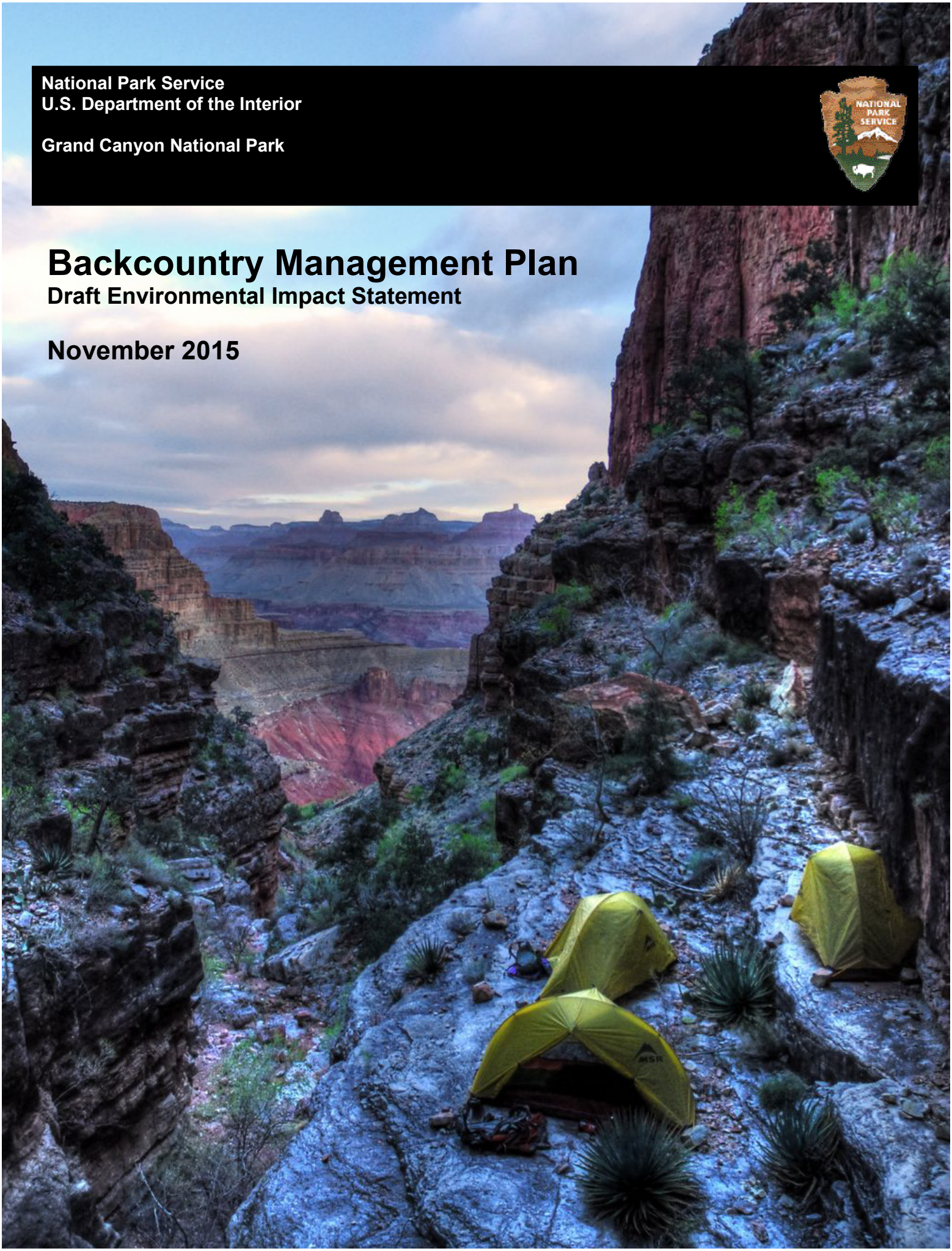
National Park Service
U.S. Department of the Interior

Grand Canyon National Park

Backcountry Management Plan

Draft Environmental Impact Statement

November 2015



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UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK
BACKCOUNTRY MANAGEMENT PLAN / DRAFT ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: National Park Service (NPS), U.S. Department of the Interior

This Grand Canyon National Park Backcountry Management Plan / Draft Environmental Impact Statement (plan/DEIS) evaulates the impacts of a range of alternatives for managing backcountry use in Grand Canyon National Park in a manner that protects and preserves natural and cultural resources and natural processes and provides a variety of visitor experiences while minimizing conflicts among various users.

This plan/DEIS evaluates the impacts of the no-action alternative (Alternative A) and three action alternatives (Alternatives B, C, and D). Alternative A would allow backcountry use levels to remain similar to current, commercial use would not be capped and would continue to be managed under commercial use authorizations, and emerging uses such as canyoneering and extended day hiking and running (rim-to-rim) would not be managed. Under all action alternatives (B, C, and D) an adaptive management process would be used to manage climbing, canyoneering, extended day hiking and running, Tuweep day use, Use Area management and human waste management, and commercial overnight backpacking would be managed through concession contracts instead of commercial use authorizations. Alternative B, the NPS preferred alternative, would reduce group size for overnight backpacking in the two most remote backcountry zones, manage river-assisted backcountry travel using 31 route-based river sections, and limit commercially guided services; overnight use in the backcountry is expected to decrease by 1%. Alternative C would manage river-assisted backcountry travel using 11 river sections, allow greater access to the backcountry through retention of large groups and development of campsites in the Corridor, and limit commercially guided services; overall, overnight use in the backcountry is expected to increase by 5%. Alternative D, the environmentally preferable alternative, would concentrate backcountry use in non-wilderness areas, reduce group size for overnight backpacking in all zones outside of the Corridor, and limit commercial use and only allow it in non-wilderness areas; overall, overnight use in the backcountry is expected to decrease by 3%.

The review period for this document will end 90 days after publication of the U.S. Environmental Protection Agency Notice of Availability in the Federal Register. During the 90-day comment period, comments will be accepted electronically through the NPS Planning, Environment and Public Comment (PEPC) website and in hard copy delivered by the U.S. Postal Service or other mail delivery service or hand-delivered to the address below. Comments will also be accepted during public meetings on the plan/DEIS. Comments will not be accepted by fax, email, or in any format other than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will also not be accepted.

For further information, visit http://parkplanning.nps.gov/grcabmp or contact:
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Backcountry Management Plan/DEIS
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NOVEMBER 2015

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EXECUTIVE SUMMARY

This Draft Environmental Impact Statement (plan/DEIS) for the Backcountry Management Plan (BCMP) at Grand Canyon National Park (Grand Canyon or the park) analyzes a range of alternatives for management of the park's backcountry. The plan/DEIS assesses the impacts that could result from implementation of any of the three action alternatives, and assesses the impacts that would occur if the park were to take no action at all (no-action alternative).

Upon conclusion of the plan/DEIS and EIS process, the alternative selected for implementation will become the Backcountry Management Plan, which will specifically address types and levels of use appropriate for the backcountry, most of which is proposed for Wilderness designation under the Wilderness Act.

Background

Grand Canyon's backcountry encompasses over 1.1 million acres, most of which are proposed for Wilderness designation. The backcountry is currently managed under the 1988 Backcountry Management Plan. Since that time, National Park Service (NPS) Wilderness regulations and policies have been updated, visitors are participating in new recreation activities in the park, and site specific issues and concerns have been identified. There is a need to revise the 1988 Backcountry Management Plan.

Purpose of the Plan

The purpose of this plan/DEIS is to analyze and determine the appropriate type, extent, and location of backcountry use in Grand Canyon. The plan/DEIS will establish an up-to-date adaptive management framework that allows the public to experience the park's unique backcountry and Wilderness resources and values while preserving them for the enjoyment of future generations.

Need for Action

The primary need for a revised BCMP is to address issues concerning visitor experience and resource protection in the park's backcountry including

- Current 1988 Backcountry Management Plan is not consistent with the park's 1995 General Management Plan (GMP) or NPS Wilderness Policy
- Commercial backcountry services have not been analyzed to determine if they are necessary and appropriate
- Some Use Areas in Wilderness have degraded resources and wilderness character which need to be addressed
- Cottonwood Campground capacity limits cross-canyon overnight opportunities
- Emerging recreational uses put demands on park resources un-envisioned in the 1988 Plan
    - Rim-to-rim and rim-to-river day use (hiking and running) has become popular and resulted in issues which need to be addressed including human waste and trash along trails, overused toilets, complaints from other Corridor users, trail etiquette problems, declining opportunities for solitude, and crowding at trailheads and Phantom Ranch
    - Impacts to resources from river-assisted backcountry travel, canyoneering, and climbing are not well understood and need to be addressed
- An adaptive management process has not been developed to guide decision-making for ongoing and emerging issues and concerns
- Increased visitation to the Tuweep area has exceeded the capacity established in the 1995 GMP and needs to be addressed
- Tribes have expressed concerns related to culturally significant places and access across tribal lands

Goals and Objectives in Taking Action

GOALS

- Protect and preserve the park's natural and cultural resources and values and integrity of wilderness character
- Provide a framework and programmatic guidance for consistent decision making in managing backcountry
- Provide a variety of visitor opportunities and experiences for public enjoyment in a manner consistent with park purposes and preservation of park resources and values
- Provide for public understanding and support of preserving fundamental resources and values for which Grand Canyon was established

OBJECTIVES

Visitor Use and Experience

- Provide opportunities for visitors to experience and be inspired by Grand Canyon's backcountry and Wilderness resources and values while ensuring resource protection
- Establish levels and types of visitor opportunities, non-commercial and commercial, to enhance visitor experience and minimize crowding, conflicts, and resource impacts

Resources

- Manage backcountry use to protect wildlife populations and habitat by minimizing human-caused disturbances and habitat alteration
- Manage backcountry use to minimize impacts to native vegetation, reduce exotic plant species spread, and preserve fundamental biological and physical processes
- Manage use to enhance wilderness character and values
- Develop and implement an adaptive management process that includes monitoring natural, cultural, and experiential resource conditions and responding when resource degradation has resulted from use levels
- Preserve and protect natural soil conditions by minimizing impacts to soils from backcountry recreational activities
- Manage recreational use to minimize adverse chemical, physical, and biological changes to water quality in tributaries, seeps, and springs
- Manage recreational use to preserve cultural resource integrity and condition

Coordination and Cooperation

- Work with park neighbors including tribes, federal land managers, park partners, gateway communities, and other stakeholders to improve coordination and communication regarding backcountry use
- Work with adjacent tribal land managers to improve access to the park's backcountry

Park Management and Operations

- Establish recreational use levels sustainable for both resource protection and park operations
- Comply with all laws, regulations and policies related to backcountry management

Purpose and Significance of Grand Canyon National Park

National park system units are established by Congress to fulfill specified purposes. A park's purpose provides the foundation for decision-making as it related to the conservation of park resources and

providing for the enjoyment of future generations. As stated in the 2010 Grand Canyon National Park Foundation Statement (NPS 2010)

As a place of national and global importance, the park will be managed to

- preserve and protect Grand Canyon's unique geologic, paleontologic, and other natural and cultural features for the benefit and enjoyment of the visiting public
- provide the public opportunity to experience Grand Canyon's outstanding natural and cultural features, including natural quiet and exceptional scenic vistas
- protect and interpret Grand Canyon's extraordinary scientific and natural values

Grand Canyon is one of the planet's most iconic geologic landscapes. During the last six million years, the Colorado River carved Grand Canyon; these same erosional and tectonic processes continually shape the canyon today. Grand Canyon's exposed layers span more than one third of Earth's history, and record tectonic and depositional environments ranging from mountain-building to quiet seas. Taken as a whole, Grand Canyon, with its immense size, dramatic and colorful geologic record exposures, and complex geologic history, is one of our most scenic and scientifically valued landscapes.

The force and flow of the Colorado River along with its numerous and remarkably unaltered tributaries, springs, and seeps provide plants and animals opportunity to flourish in this otherwise arid environment. These vital resources represent transmission of local aquatic recharge from high-elevation rims to the arid inner canyon. There are hundreds of known seeps and springs throughout the park, and probably more to be discovered.

Wilderness landscapes are an important current resource and future preserve. Park boundaries extend beyond canyon walls to include 1,904 square miles (1,218,376 acres), of which 94% is managed as Wilderness. When combined with additional contiguous public and tribal lands, this area comprises one of the largest undeveloped areas in the United States. Grand Canyon offers outstanding opportunities for visitor experiences including extended solitude, natural quiet, clean air, dark skies, and a sense of freedom from the mechanized world's rigors.

Grand Canyon contains a superlative array of natural resources. Much of this diversity can be attributed to the park's dramatic topographic spectrum. This elevational variety provides microhabitats for natural processes supporting rare and endemic plant and wildlife species. These diverse habitats serve as a living laboratory for scientific research in numerous fields that contribute greatly to our understanding of the relationship between biotic communities and abiotic environments.

The human-Grand Canyon relationship has existed for at least 12,000 years. The canyon is an important homeland for native people and a place of historic Euro-American exploration and discovery. Today that relationship continues, both for ongoing American Indian associations and millions of visitors who visit the canyon and its surrounding landscapes.

Grand Canyon's immense and richly colored scenic vistas, enhanced by a natural setting, inspire a variety of emotional, intellectual, artistic, and spiritual impressions. Its unsurpassed natural beauty is a source of profound inspiration for people worldwide.

Issues and Impact Topics

Issues associated with implementing a Backcountry Management Plan at Grand Canyon were initially identified by the Grand Canyon Backcountry Management Plan EIS Planning Team (consisting of park

staff) along with other park staff during internal scoping and were further refined through public scoping and consultation with cooperating agencies.

This plan/DEIS analyzes the following impact topics which are discussed in more detail in Chapters 1 and 3.

• Natural Resources ○ Soils ○ Water Resources ○ Soundscape ○ Cave Resources ○ Vegetation ○ Wildlife ○ Special Status Plant Species ○ Special Status Wildlife Species	• Cultural Resources ○ Archaeological Resources ○ Historic Structures ○ Traditional Cultural Properties and Ethnographic Resources ○ Cultural Landscapes	• Visitor Use and Experience • Socioeconomic Environment • Park Management and Operations • Adjacent Lands • Wilderness Character

ALTERNATIVES

The National Environmental Policy Act (NEPA) requires federal agencies to explore a range of reasonable alternatives that address the purpose of and need for the action. Action alternatives may originate from the agency proposing the action, local government officials, or members of the public at public meetings or during the early stages of project development. Alternatives may also be developed in response to comments from coordinating or cooperating agencies. Action alternatives analyzed in this document were developed based on the results of internal and public scoping, workshops with park staff, and meetings with tribes other federal agencies. These alternatives meet the management objectives of the park, while also meeting the overall purpose of and need for the plan/DEIS. Dismissed from further analysis were alternative elements that were considered but were not technically or economically feasible, did not meet the purpose of and need for the project, created unnecessary or excessive adverse impacts to resources, and/or conflicted with the overall management of the park or its resources. A complete list of the alternatives considered, as well as those considered but dismissed from further analysis, is provided in Chapter 2 of the plan/DEIS. The elements of all four alternatives are detailed in Table ES.1a, b, and c. How each of these alternatives meets the objectives of the plan/DEIS is detailed in Table ES.2 at the end of this summary.

NO-ACTION ALTERNATIVE

Alternative A

Alternative A would continue existing management practices, resulting in a continuation of current trends in resource conditions and visitor opportunities. Analysis of a no-action alternative is required by Council on Environmental Quality (CEQ) regulations.

ACTION ALTERNATIVES

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

Action alternatives (B, C, and D) propose changes to current backcountry management.

Some proposed changes to existing backcountry management practices apply to all action alternatives and include

- Two additional management zones to improve resource management of backcountry roads and areas along the Colorado River
- Determination of necessary and appropriate backcountry commercial services
- Administrative use guidelines
- Commercial filming guidelines
- Arizona Trail use
- Bicycling
- Tribal lands and interests
- Adaptive management process for addressing increasing demand for recreational access and uncertainty of how different recreational uses impact park resources. The adaptive management process would be applied to
    - Climbing
    - Canyoneering
    - Extended day hiking and running
    - Tuweep day use
    - Use area management
    - Human waste management

Specific to Individual Alternatives (A, B, C, and D)

Topics covered under all action alternatives include

- Maximum group size limits for overnight backpacking
- RABT management
- Commercial services including overnight backpacking, day hiking, and backcountry vehicle tours at Tuweep
- Backcountry roads, trails, and routes
- Tuweep facilities
- Corridor zone camping
- Deer Creek/Tapeats Creek Complex
- Deer Creek Narrows
- Hance Creek, Cottonwood Creek, and Cremation Use Areas

Alternative B NPS Preferred

Alternative B focuses on providing a variety of recreational activities and a high level of protection for natural and cultural resources and wilderness character. This alternative would place limits on currently unlimited activities to protect resources and enhance visitor experience. Guided services would be allowed in certain backcountry areas while other areas would remain free of guided services. This alternative increases the number of Primitive Zone Use Areas where visitors can expect increased opportunities for solitude and minimal infrastructure and maintenance activities.

Alternative C

Alternative C focuses on recreational activities and expanded opportunities for these activities. This alternative would increase opportunities for primitive and unconfined recreation through less management restrictions. Guided services would be allowed in more Use Areas throughout the backcountry when

compared with other action alternatives. Alternative C would result in increased overall use due to additional Threshold Zone Use Areas and Corridor Zone campsites.

Alternative D

Alternative D focuses on resource protection and opportunities for solitude. This alternative would allow for recreational use, but would prioritize preservation of natural and cultural resources and wilderness character. Recreational use would be concentrated in non-wilderness areas with limited facility improvement. Similarly, guided services would be limited to two non-wilderness zones: Corridor and a proposed Road Natural. For overnight backpacking, large groups would be allowed in the Corridor Zone, but not in zones in Wilderness (Threshold, Primitive, and Wild). These actions would allow for self-exploration and increased opportunities for solitude in Wilderness. Overall, this alternative would result in decreased use due to increased Primitive Use Areas, minimal increase in Corridor Zone campground capacity, and decreased group size limits.

Environmental Consequences

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

For each impact topic, methods were identified for measuring potential changes to the park's resources in each proposed action alternative. Intensity definitions were established for each impact topic to help in understanding the severity and magnitude of changes in resource conditions, both adverse and beneficial. A detailed description of how these impacts were analyzed across proposed action alternatives can be found in Chapter 4. Table ES.3, at this end of this summary, summarizes the results of the impact analysis for the impact topics that were assessed.

Table ES.1a Elements of Alternatives Common to All Action Alternatives (B, C, and D)

	Alternative A	Common to All Action Alternatives (B, C, and D)
Management Zones		
	• Corridor Zone • Threshold Zone • Primitive Zone • Wild Zone	Same as A and add • Road Natural Zone • River Zone
Recreational Use		
Arizona Trail	• No flexible permitting available to Arizona Trail through-hikers • South Rim camping at Mather Campground or outside park boundary on USFS land • No bicycle use on Arizona Trail's North Rim segment	• Flexible permit system allows through-hikers to obtain Corridor Zone backcountry permits • NPS considers designating walk-in Arizona Trail camping possibly near South Kaibab Trailhead • Bicycles allowed on Arizona Trail's North Rim segment
Bicycling	• Non-commercial bicycling allowed in backcountry on park roads open to private vehicles • No bicycle use allowed on Arizona Trail's North Rim segment	• Roads currently open to bicycling become part of proposed Road Natural Zone (see Map 2.4a-d) • Arizona Trail's North Rim segment open to bicycle use

RABT	• Day use not allowed • RABT not identified on overnight backcountry permits • PFDs (Type III or V) required to be worn while on the river • 5-mile limit	• Limited day use by permit • Activity identified on overnight backcountry permits • PFDs (Type III or V) required to be worn while on the river • RABT watercraft carried in and out by user during the permitted itinerary • Maximum RABT group size six persons • Identifies river sections closed to RABT • Allowable mileage varies by individual action alternative B, C, D
Tribal Lands and Interests		
	• NPS works with traditionally associated tribes to educate visitors about access to the park's backcountry through tribal lands, and consults with tribes regarding protection and treatment of archaeological and ethnographic resources	Same as A and • NPS works with backcountry users to insure awareness regarding backcountry access across tribal lands requires permits from appropriate tribal offices • NPS works with Havasupai Tribe re: access across Great Thumb on pilot program to permit ten small groups (1-6 people) across Great Thumb to the park's backcountry March-May. Permit conditions include: tribal escort, two vehicle maximum, four-wheel drive/high-clearance, assigned parking • Hematite Mine (adjacent to the Colorado River) closed to visitation • NPS works with Traditionally Associated Tribes to determine appropriate protection including access and use of culturally significant sites
Administrative Use		
	• Backcountry administrative users (resource management, maintenance, interpretation) generally obtain overnight backcountry permits. NPS and outside researchers must also obtain research permits. Wilderness activities evaluated through minimum requirement analysis (MRA)	
Guided Services Non-commercial		
NPS	• NPS backcountry interpretive day hikes to Cedar Ridge and North Rim locations; Environmental Educational Program overnight trips (1-3 times/year)	Same as A or may increase (subject to further analysis)
Cooperating Association Programs	• NPS Cooperating Association[1]: Grand Canyon Field Institute (GCFI) programs reviewed annually by NPS managers to assure course material appropriate and in keeping with NPS mission and trips require backcountry permits	• Continue annual review and GCFI subject to Requirements For Permitted Backcountry Operators outlined in Appendix F and require backcountry permits
Guided Services Commercial		
Overnight Backpacking	• Allowed in all existing backcountry zones • Authorized by commercial use authorization (CUA) • No caps	• Not allowed in Wild Zone • Majority managed by contract and limited opportunity for CUA • Proposed caps on groups/night/Zone vary by action alternative B, C, D • Other elements of Commercial Overnight Backpacking Services vary by individual Alternative B, C, D • Subject to Requirements For Permitted

[1] Cooperating associations are mission-driven nonprofit organizations incorporated under state law. They operate under a signed standard agreement with the NPS to provide program and financial assistance for interpretation, education, and research in national parks through production and sale of educational media to the public

		Backcountry Operators outlined in Appendix F
Day Hiking	• Unlimited number of CUAs issued • Day hiking locations and distances limited	• Not permitted in Wild Zone • Other elements of Commercial Day Hiking Services vary by individual Alternative B, C, D
Bicycling	• Allowed to Tuweep and Point Sublime • Maximum group size of 14 includes guides. All groups maintain ratio of no less than 1 guide for 1 to 6 clients, and 2 guides for 7 to 12 clients	Same as A and • Arizona Trail North Rim segment open to commercial bicycle tours
Backcountry Vehicle Tours	• Group size limited to 15 people and one vehicle • 22-foot-vehicle length maximum • Commercial Vehicle Tours only at Tuweep • Up to two trips per day per operator	Same as A and • Trip number per day vary by individual action alternative B, C, D
Commercial Filming		
	• Park policy does not specifically address commercial filming in backcountry	• Filming purpose must meet necessary and appropriate Wilderness test • No commercial activity in Wild Zone • Wilderness commercial filming requests evaluated under MRA

Table ES.1b Summary of Elements Common to Action Alternatives (B, C, and D) Subject to Adaptive Management

	Alternative A Current Conditions (No Adaptive Management)	Adaptive Management	
		Implement on BCMP Adoption	Implement as Needed Through Adaptive Management
Climbing	• No current park anchor policy • Climbing not identified on permits • No power drills in Wilderness	• Decision framework for new anchor placement • Overnight backcountry permit identifies activity • Monitor use and resource impacts through backcountry permitting process and field surveys • Decision framework for new anchor placement • No power drills in Wilderness • Minimum impact climbing education	• Day use permit required and identifies climbing route • Use limits for specific locations ○ restrict number of groups by day or season (overnight and day use) ○ change maximum overnight group size (decrease or increase) ○ seasonal or permanent restrictions for natural and/or cultural resource protection • Climbing Management Plan developed
Canyoneering	• No current park anchor policy • Canyoneering not identified on permits • Limited educational information • No power drills in Wilderness	• Decision framework for new anchor placement • Overnight backcountry permit identifies activity • Monitor through backcountry permitting process and field surveys • No power drills in Wilderness • Maximum group size 6 • Minimum impact canyoneering education	• Day use permit required and identifies canyoneering route • Use limits for specific locations ○ restrict number of groups by day or season (overnight and day use) ○ change maximum overnight group size (decrease or increase) ○ seasonal or permanent restrictions for natural and/or cultural resource protection • Canyoneering Management Plan developed
Extended Day Hiking and Running	• No current park policy • No day use permits	• Day use permits required seasonally for area in Table 2.5 and Map 2.6 • Minimum cost $5/person/day	• Limit group size (e.g., 30) • Daily use limits (e.g., 250) ○ designated days for groups or individuals ○ policy for other trails • Day use permits required year-round
Tuweep Day Use	• GMP set goal to *provide uncrowded and primitive experience*, and day use capacity at 85 people or 30 vehicles at one time	• Develop Tuweep day use visitor information. May include road signs and existing local and regional visitor centers • No more than one commercial stock trip/day	• Tuweep day use permit or reservation system • Limits for vehicle number per party • Designated days for group events
Use Area Management	• Hermit (BM7): illegal camping outside designated camp area • Granite Rapids (BL8): impact levels exceeded • Deer Creek/Tapeats Creek Complex: use limits commonly exceeded due	• Hermit (BM7): designate new campsite along Hermit Trail • Granite Rapids (BL8): group limit decreased from 3 to 2 • Deer Creek/Tapeats Creek Complex: redefine Use Areas (Table 2.8a/Map 2.7)	• Decrease or increase Use Area limits and/or designate sites • Variable seasonal use limits (e.g., higher in winter, lower in spring) • Change camping designations: at-large to

	Alternative A Current Conditions (No Adaptive Management)	Adaptive Management	
		Implement on BCMP Adoption	Implement as Needed Through Adaptive Management
	to off-itinerary hiking		designated sites or designated to at-large • Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes like Deer/Tapeats Creeks, Hermit/Monument) • Seasonal or permanent closures at specific locations
Human Waste Management	• Facilities located at designated campsites • Bury excrement, carry out toilet paper in areas without facilities	• Human waste carry-out required at River Zone backcountry sites by all users (RABT, hikers, etc.) • Commercially guided backpacking trips required to carry out human waste in Use Areas without toilets	• Replace existing toilets • Remove toilets • Install toilets at other sites • Specific zones or Use Areas require year-round or seasonal human waste carry-out • All Use Areas require seasonal or year-round human waste carry-out

Table ES.1c Summary of Elements Specific to Action Alternative B, C, or D

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Backcountry User Nights (Commercial and Non-Commercial)		**Percent Change from Current by Zone[2]**		
Corridor	53,821	55,531 (+3%)	59,421 (+10%)	54,846 (+2%)
Threshold	17,078	14,332 (-16%)	19,328 (+13%)	13,426 (-21%)
Primitive	20,698	20,770 (0.3%)	17,844 (-14%)	20,650 (-0.2%)
Wild	2,463	2,266 (-8%)	2,463 (0%)	2,266 (-8%)
Other	217	217	217	217
Total	94,277	93,116 (-1%)	99,273 (+5%)	91,405 (-3%)
Maximum Group Size for Overnight Backpacking by Zone (Commercial and Non-Commercial) (large/small)				
Corridor	11/6			
Threshold	11/6			6
Primitive	11/6	6	11/6	
Wild				
Commercial Overnight Backpacking				
Zone Allowed	All	Corridor, Threshold, limited Primitive	Corridor, Threshold, Primitive	Corridor
Authorization	Unlimited CUAs	Majority managed by contracts and limited opportunity for CUAs		
Permitting	*Commercial trips currently*	Percent of trips available to concessioners one year in advance:		
		100%	50%	75%
		CUA holders would	*Remaining percent available to concessioners and CUA holders to*	
	make reservations through public backcountry reservation system up to four months in advance (same as non-commercial users)			
		•CUAs limited to one permit/week and no more than 100 group nights/year • CUA use allowed up to 3 trips/year per operator • CUA holders could charter additional trips with contract holders		
Caps	**No Caps**	**Proposed Caps**		
Corridor Zone	Current Use (2012) Number of Groups/Night			
Bright Angel	Up to 5/night	2/night; 4/month can be large		3/night; 6/month can be large
Indian Garden	Up to 4/night	1.5/night (max 2/night 2 nights of 4); 3/month can be large	1/night; 3/month can be large	2/night; 3/month can be large
Cottonwood	Up to 4/night			
Threshold Zone	Up to 6/night	2 small/night; 6 nights max in any Use Area/month 3 nights/month can be large	3 small/night; 9 nights max in any Use Area/month 3 nights/month can be large	0
Primitive Zone	Up to 7/night	1 small/night with max 3 nights in any Use Area/month	2 small/night with max 6 nights in any Use Area/month	0
Wild Zone	Up to 18/year (no more than 1/night)	0	0	0

[2] Projected user nights were calculated using specific Use Area changes proposed in alternatives (i.e., Granite, Deer Creek Complex, Hance, Cottonwood, additional Corridor Zone campsites, etc.) and with the assumption that if group sizes are reduced from 11 maximum to 6 maximum (as in Alternatives B and D for some zones), groups formerly 7-11 people would become 6. Projections are based on calendar year 2012 data for each night in each Use Area.

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Commercial User Nights[3]	**Current (2012) User Nights**	**Projected**[4]		
Corridor	5011 (9.3%)*	6593 (11.9%)	5938 (10.0%)	9371 (17.1%)
Threshold	1572 (9.2%)	1572 (11.0%)	2359 (12.2%)	0
Primitive	1861 (9.0%)	786 (3.8%)	1572 (8.8%)	0
Wild	94 (3.8%)	0	0	0
Total	8538 (9.1%)	8952 (9.6%)	9869 (9.9%)	9371 (10.3%)
*Commercial user nights (percent of overall use)				
Commercial Day Hiking				
Group Size	11, minimum of 1 guide to 7 clients (2 guides with 9 clients)			
Allowed to	Recommended Limits	Limited To		
	• Bright Angel Trail to Three-Mile Resthouse • South Kaibab Trail to Cedar Ridge • North Kaibab Trail to Supai Tunnel • Hermit Trail to Santa Maria or Dripping Springs • Grandview Trail to designated turnaround at Coconino Saddle • Tanner Trail to Escalante Saddle (75-Mile Canyon Overlook)		• Same as Alternatives A and B **AND** • Bright Angel Trail to Indian Garden • South Kaibab Trail to Skeleton Point	• Bright Angel Trail to Three-Mile Resthouse • South Kaibab Trail to Cedar Ridge • North Kaibab Trail to Supai Tunnel
Commercial Backcountry Vehicle Tours (Tuweep)				
Maximum Trips/Day	• Up to 2 trips/ operator/day M-F • Up to 1 trip/ operator/day Sa-Su	• Up to 2 trips/day all operators combined	• Up to 3 trips/day M-F; 2 trips/day Sa-Su all operators combined	• Up to 1 trip/day all operators combined
Non-commercial River-assisted Backcountry Travel (RABT)				
River Travel	5-mile limit	31 river sections	9 river sections	11-mile limit
Day Use	Not permitted	Allowed with day use permit		
Backcountry Roads, Trails, and Routes				
South Rim Trails and Routes (Map 2.1)				
Eremita Mesa (1.8 miles)	Unmaintained hiking route	Same as A	Class 1 Wilderness Trail[5]	Same as A
Cape Solitude (12.4 miles)		Class 1 Wilderness Trail		
Boundary Road (14 miles)		Same as A	Boundary Road open to vehicles, stock, bicycles and hikers	Same as A
Roads (Map 2.4a)				
Pasture Wash Vehicle Access	Roads across USFS, and Havasupai lands with access fee		Same as A and Boundary Road open (see above)	Same as A

[3] User night: one hiker in the backcountry for one night.
[4] Projected user nights assumes maximum booking in prime season and same booking as 2012 off-season.
[5] See Appendix D, Trail Class Standards.

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
North Rim Trails and Routes (Map 2.1)				
Tiyo Point (6.3 miles)	• Unmaintained hiking routes • No stock use	• Class 1 Wilderness Trail • No stock use	• Class 4 Wilderness Trail • Day stock use	Same as A
Francois Matthes Point (4.7 miles)		Class 1 Wilderness Trail		
Walhalla Glades (7.3 miles)		Class 1 Wilderness Trail		
Komo Point (5.2 miles)		Same as A	Class 1 Wilderness Trail	
Roads (Map 2.4b)				
Basin Road, Kanabownits Swamp and Fire Point Roads	Open to vehicles, stock, bicycles, and hikers	Open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone		
Kanab Plateau Roads (Map 2.4c)	Road access to Kanab and SB Points, 150 Mile Canyon, and Schmutz	Road access to Kanab and SB Points, 150 Mile Canyon, and Schmutz as part of Road Natural Zone	Same as B, and convert 12 miles of former Kanab Plateau ranch roads to Class 1 Wilderness Trail	Same as B
Tuweep Road (Map 2.4d)	Open to vehicles, stock, bicycles, and hikers	Open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone		
Tuweep Facilities (Map 2.2 and Map 2.8)				
Vulcans Throne Road	Open to vehicles to rim	Convert to Class I trail; use road junction as parking/turnaround	Same as A	Same as B
Overlook Parking	Adjacent to Toroweap Overlook	Move close to campground as recommended in GMP		
Corridor Zone Camping (Groups/Night)				
Indian Garden	15 small/1 large campsites		15 small/2 large	Same as A
Bright Angel	30 small/2 large			
Cottonwood	11 small/1 large	up to 15 small/1 large	15 small/2 large	up to 13 small/1 large
Roaring Springs	Day use only		2 campsites	Same as A
Deer Creek/Tapeats Complex (Groups/Night)				
Esplanade (AY9)	2 small/1 large	3 small	2 small/1 large	2 small
Surprise Valley (AM9)	1 small/1 large	Use area split between Deer Creek, Upper Tapeats, and Bonita Creek		
Deer Creek (AX7)	2 small or 1 large	2 small	Same as A	2 small
Upper Tapeats (AW7)	2 small/1 large	3 small	3 small/1 large	3 small
Lower Tapeats (AW8)	1 small/1 large	Use area combined with Bonita Creek		

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Bonita Creek (AW9)	Doesn't exist	2 small	1 small/1 large	1 small
Total Groups in Complex	12	10	11	8
Deer Creek Narrows				
Narrows Closure	As in Compendium, reviewed annually	Permanent restriction	Unrestricted access	Same as B **AND** restrict patio to one river trip at a time
Hance Creek/Cottonwood Creek/Cremation (Groups/Night)				
Hance Creek BE9/Primitive	2 small/1 large	3 small	Same as A	Same as B
Cottonwood Creek BG9/Primitive	2 small/1 large	3 small	Same as A	
Cremation BJ9/Primitive	2 small/1 large	3 small	1 small/1 large plus 1 small or large group at new designated site	
Hance Creek/Cottonwood Creek/Cremation Use Area Changes				
Hance Creek BE9/Primitive	None	None	Convert Primitive to Threshold Zone; as Threshold, consider adding toilets, change at-large to designated camping	None
Cottonwood Creek BG9/Primitive				
Cremation BJ9/Primitive			Portion to designated campsite	

Table ES.2 How Alternatives Meet Objectives

Objective	Alternative A: No-Action	Alternative B: NPS Preferred	Alternative C	Alternative D
Visitor Use and Experience				
Provide opportunities for visitors to experience and be inspired by Grand Canyon's backcountry and Wilderness resources and values while ensuring resource protection.	Meets objective to a moderate degree because there is a variety of recreational opportunities in the park's backcountry.	Meets objective to a moderate degree because it allows additional opportunities to camp in the Corridor Zone and participate in RABT trips.	Meets objective to a moderate degree because it allows for private stock use on the Tiyo Point Trail, additional opportunities to camp in the Corridor Zone, and increased flexibility with RABT trips.	Meets objective to some degree because it allows additional opportunities to camp in the Corridor Zone and participate in RABT trips. However, group sizes are less outside the Corridor Zone, decreasing the number of opportunities for overnight backpacking in other zones.
Establish levels and types of visitor opportunities, non-commercial and commercial, to enhance visitor experience and minimize crowding, conflicts, and resource impacts.	Meets objective to some degree because levels of overnight use have been established, but not separately for commercial and non-commercial. Crowding, conflicts, and resource impacts would continue.	Meets objective to a large degree because a commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite, number of groups in the Deer Creek/Tapeats Creek Complex, and group size in Primitive and Wild Zones.	Meets objective to a large degree because a commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite and number of groups in the Deer Creek/Tapeats Creek Complex.	Meets objective to some degree because conflicts would likely still exist in the Corridor Zone between commercial and non-commercial groups. Similar to B and C, the commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite, number of groups in the Deer Creek/Tapeats Creek Complex, and group size in Threshold, Primitive and Wild Zones.
Resources				
Manage backcountry use to protect wildlife populations	Meets objective to some degree; backcountry use	Meets objective to some degree, greater than	Meets objective to some degree, less than A, because	Meets objective to some degree, greater than

and habitat by minimizing human-caused disturbances and habitat alteration.	does impact wildlife through noise and vegetation disturbance.	Alternative A and C, because there would be smaller groups in Primitive and Wild Zones and adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.	group sizes for overnight backpacking would remain the same as current, private stock use would be allowed to Tiyo Point, and the Boundary Road would be developed. Adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.	Alternative A and C, because there would be smaller groups in Threshold, Primitive and Wild Zones and adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.
Manage backcountry use to minimize impacts to native vegetation, reduce exotic plant species spread, and preserve fundamental biological and physical processes.	Meets objective to some degree, backcountry use does impact native vegetation through direct vegetation modification and also increases spread of exotic plant species.	Meets objective to a moderate degree because group size for overnight use would be reduced, the Road Natural Zone prescribes a maximum number of vehicles by location, and there are reduced numbers of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to some degree because large groups would still be allowed in all zones, private stock use would be allowed on Tiyo Point trail, and the Boundary Road would be developed, all of which would increase impacts to native plant species and encourage exotic plant species to spread.	Meets objective to a moderate degree because there would be smaller groups in Threshold, Primitive, and Wild Zones, and decreased numbers of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.
Manage use to enhance wilderness character and values.	Meets objective to some degree, but not fully because toilets are located in Wilderness, helicopters are used for toilet maintenance and emergency services, and there is not a specific park plan that implements NPS Wilderness Policy.	Meets objective to a large degree because of the reduced group size in the Primitive and Wild Zones, converts two Use Areas from Threshold to Primitive, and this plan would implement NPS Wilderness Policy.	Meets objective to a moderate degree because this plan would implement NPS Wilderness Policy, but also would convert two Use Areas from Primitive to Threshold which could result in the addition of designated campsites and toilets in Wilderness.	Meets objective to a large degree because of the reduced group size in the Threshold, Primitive, and Wild Zones, converts two Use Areas from Threshold to Primitive, converts the fewest miles of old road bed to trail, and this plan would implement NPS Wilderness Policy.
Develop and implement an adaptive management process that includes monitoring natural, cultural, and experiential resource conditions and responding when resource degradation has resulted from use levels.	Does not meet objective because there is not an adaptive management process is in place.	Meets objective to a large degree because an adaptive management process is outlined.	Meets objective to a large degree because an adaptive management process is outlined.	Meets objective to a large degree because an adaptive management process is outlined.

Preserve and protect natural soil conditions by minimizing impacts to soils from backcountry recreational activities.	Meets objective to some degree, backcountry use does impact soils through soil compaction at campsites, social trailing, and erosion.	Meets objective to moderate degree because of the reduced group size in Primitive and Wild Zones and restoration of old road beds.	Meets objective to some degree, soils would be impacted through the development of the Boundary Road.	Meets objective to moderate degree because of the reduced group size in Threshold, Primitive, and Wild Zones and restoration of old road beds.
Manage recreational use to minimize adverse chemical, physical, and biological changes to water quality in tributaries, seeps, and springs.	Meets objective to some degree, backcountry use does impact water resources through direct contamination of water sources (bathing, washing dishes, etc.), increased sediment, and social trailing.	Meets objective to moderate degree because of the reduced group size in Primitive and Wild Zones, and human waste carry out in the River Zone and by commercial groups in areas where toilets are not available, and decreased number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to some degree, greater than Alternative A because although group sizes would remain the same throughout all zones, human waste carry out would be required in the River Zone and by commercial groups in areas where toilets are not available, and there would be a decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to moderate degree because of the reduced group size in Threshold, Primitive, and Wild Zones, and human waste carry out in the River Zone and by commercial groups in areas where toilets are not available, and decreased number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.
Manage recreational use to preserve cultural resource integrity and condition.	Meets objective to some degree, backcountry use does impact cultural resources through camping impacts in and near archaeological sites, social trailing through sites, vandalism, and collection piles.	Meets objective to some degree, greater than Alternative A because although impacts would continue to cultural resources these impacts would be reduced from the decrease in group size in Primitive and Wild Zones, decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for commercial guides.	Meets objective to some degree, similar to A because group size would remain the same throughout the backcountry, the Boundary Road would be developed and impact cultural resources, and at the same time there would be a decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for commercial guides.	Meets objective to some degree, greater than Alternative A because although impacts would continue to cultural resources these impacts would be reduced from the decrease in group size in Threshold, Primitive and Wild Zones, decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for commercial guides.
Coordination and Cooperation				
Work with park neighbors including tribal entities, federal land managers, park partners, gateway communities, and other stakeholders to improve	Meets objective to some degree because NPS does work with park neighbors.	Meets objective to a moderate degree because communication and coordination would be improved, specifically with	Meets objective to a moderate degree because communication and coordination would be improved, specifically with	Meets objective to a moderate degree because communication and coordination would be improved, specifically with

coordination and communication regarding backcountry use.		tribes.	tribes.	tribes.
Work with adjacent tribal land managers to improve access to the park's backcountry.	Does not meet objective because under Alternative A, there would be no access across Great Thumb to the park's backcountry.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.
Park Management and Operations				
Establish recreational use levels sustainable for both resource protection and park operations.	Meets object to a minimal degree because the current levels of use can overtask park staff, specifically the inner canyon rangers and emergency services personnel.	Meets objective to some degree because overnight use would decrease a small amount (1%) and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.	Meets object to a minimal degree because overnight use would increase by 5%, an additional camp area would be established in the Corridor at Roaring Springs and require staff, and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.	Meets objective to some degree because overnight use would decrease a small amount (3%) and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.

Table ES.3 Impact Summary

	Alternative A	Alternative B	Alternative C	Alternative D
Soils	Under Alternative A, minor to moderate, adverse, localized, short and long-term impacts to soils would result from recreational use in areas from climbers, canyoneers, and RABT users; campsite expansion by large groups in all Use Areas; continued inappropriate human waste disposal in high use areas; damage related to Corridor Zone trail congestion associated with extended day hiking and running; and visitor impacts at Tuweep. Minor to moderate, beneficial, localized, short and long-term impacts would result from continuation of passive and active restoration of closed roads, and management activities such as trail maintenance and social trail obliteration. Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative A would contribute a small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, moderate, adverse, localized, short and long-term impacts to soils would result from increased use and more users with time to explore at Cottonwood Campground, and new soil disturbance from relocation of the Toroweap overlook parking area. Moderate, beneficial, localized, short to long-term impacts would result from continuation of closed road passive and active restoration, exclusion of large groups in Primitive and Wild Zones, reductions in group size and number in the Deer Creek/Tapeats Complex and Hermit and Granite Rapids Use Areas, River Zone waste carry-out, and recovery of former road and overlook parking at Tuweep. Beneficial impacts would also come from increased education in trail etiquette and Leave No Trace from commercial backpacking and day hiking guides, and monitoring and education of climbers, canyoneers, and RABT users through the permitting process. Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative B would contribute a small amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, major, adverse, localized, short to long-term impacts to soils would result from increased users with time to explore at new campsites at Cottonwood, Roaring Springs and Indian Garden Campsites, stock use on the Tiyo Point Trail, construction impacts and traffic on the Boundary Road, return of users to Deer Creek Narrows, and potential camp and toilet construction activities at Hermit, Granite and Cremation Use Areas. Minor, beneficial, localized, short to long-term impacts would result from continued passive and active closed road restoration; group size and number reduction in the Deer Creek/ Tapeats Creek Complex; focus of impacts on designated sites in Hermit, Cremation, and Granite Rapids Use Areas; River Zone waste carry-out; increased education in trail etiquette and Leave No Trace techniques from commercial backpacking and day hiking guides; and monitoring and education of climbers, canyoneers and RABT users through the permitting process. Minor to major beneficial, localized, long-term impacts would result from adding toilets to Hance and Cottonwood Use Areas which would be managed in the Threshold Zone. Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative C would contribute a small amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized, short and long-term impacts to soils would result from trailing in new areas associated with climbing, RABT, and canyoneering; trail construction and maintenance; and impacted area expansion in the Corridor Zone and at Tuweep. Moderate, beneficial, localized, short and long-term impacts to soils would occur from continuation of passive and active closed road restoration, creation of single trails from Wilderness routes, restriction of commercial day hikes to three segments, exclusion of large groups outside the Corridor Zone, group size and number reductions in the Deer Creek/Tapeats Creek Complex and Hermit, Granite Rapids, and Cremation Use Areas, River Zone waste carry-out; recovery of former road and Overlook parking at Tuweep; increased education in trail etiquette and LNT techniques from commercial backpacking and day hiking guides, and education of climbers, canyoneers, and RABT users. Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative D would contribute a very small amount.
Water Resources	Under Alternative A, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses and would include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor, beneficial, local to regional, short and long-term impacts would result from educating visitors on minimum impact practices and the passive restoration or recovery of old roadbeds. Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative A would contribute a very small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses would be perceptible and measurable including the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor to moderate, beneficial, localized and regional, short and long-term impacts would result from smaller group sizes, closing Deer Creek narrows, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would include the addition of up to eight Corridor Zone campsites, large and small group camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons including Deer Creek Narrows. Impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor, beneficial, short and long-term, localized and regional impacts would result from converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices. Cumulative impacts to water resources would be	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, short and long-term, localized and regional impacts to water resources would result from recreational uses include the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor to moderate, beneficial, short and long-term, localized and regional impacts would result from smaller group sizes in Wilderness Zones, closing and limiting visitation at Deer Creek narrows area, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact.

	Alternative A	Alternative B	Alternative C	Alternative D
		Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative B would contribute a very small amount.	major, adverse, localized to regional, long-term and year-round of which Alternative C would contribute a small amount.	Cumulative impacts to water quality would be major, adverse, localized to regional, and long-term of which Alternative D would contribute a very small amount.
Soundscape	Under Alternative A, minor to moderate, adverse, localized and short-term impacts would result from continued administrative use of aircraft for backcountry toilet servicing, resource management, and boundary patrols; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for trails and roads maintenance. While some of these noise sources are louder and more intense during the time they are present, they are present for short times, and are infrequent. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative A would contribute a small amount.	Under Alternative B and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 trails and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative B would contribute a small amount.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; the development of the Boundary Road and recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 and 4 trails and road maintenance. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, separation of day use parking near the overlook, and potential for establishing vehicle limits at Tuweep. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative C would contribute a small amount.	Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for such activities as trail and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep, and increased number of unmaintained trails and routes in Wilderness. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative D would contribute a small amount.
Cave Resources	Under Alternative A, minor to major, adverse, local, short and long-term effects to cave resources would result from users who enter caves while on backcountry itineraries or day hikes and degrade the resources through direct contact (e.g., breakage or removal) or through indirect means such as reducing the quality of water in caves and disturbing cave-dwelling bats. Minor to major, beneficial, localized, short and long-term impacts would result from administrative actions for mitigation and restoration (e.g., trail obliteration), or those which limit unauthorized access to caves. Cumulative impacts would be major, adverse, regional, and short to long-term of which Alternative A would contribute a large amount because backcountry users are the source of most impacts to cave resources.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized and both short and long-term impacts to cave resources would result from the increased number of canyoneering routes accessed using RABT under Alternative B, and the likely increase in users in proximity to cave resources with equipment necessary to explore them. Minor, beneficial, localized, short to long-term impacts would result from reduced group size in Primitive and Wild Zones, a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts. Cumulative impacts would be major, adverse, short and long-term, and localized of which Alternative B would contribute a medium amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, local short and long-term impacts to cave resources would result from the increase in visitors near known cave resources near Roaring Springs with the creation of campsites in the area. Minor to major adverse short and long-term impacts would also result from the potential introduction of human waste into karst systems from toilets in the Hance, Cottonwood, and Cremation Use Areas. Negligible to minor, beneficial, localized, short to long-term impacts would result from a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts. Cumulative impacts would be major adverse, short and long-term, and localized to regional of which Alternative C would contribute a large amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized, short to long-term impacts to cave resources would result from the increase in RABT segment length to a maximum of 11 miles. This increase would allow exploration of more routes to caves. Minor, beneficial, localized impacts to cave resources would occur because of the decrease in numbers and group size allowed outside the Corridor Zone, the Deer Creek/Tapeats Creek complex, and the Hance, Cottonwood, and Cremation Use Areas; minimum impact education provided to climbing, canyoneering, and RABT users and the monitoring of their numbers and distribution to inform management via the permitting process. Implementation of adaptive management would contribute to these beneficial impacts. Cumulative impacts would be major, adverse, short and long-term, and localized to regional of which Alternative D would contribute a medium amount.
Vegetation	Under Alternative A, moderate, adverse, regional, short to long-term impacts to vegetation would result	Under Alternative B, including actions described under Impacts of Elements Common to All Action	Under Alternative C, including actions described under Impacts of Elements Common to All Action	Under Alternative D, including actions described under Impacts of Elements Common to All Action

	Alternative A	Alternative B	Alternative C	Alternative D
	from general recreational use and include: vegetation trampling, soil compaction, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Beneficial impacts from vegetation recovery on closed roads and other administrative actions would be negligible. Cumulative impacts to vegetation would be adverse, major, localized to regional, long-term, and year-round of which Alternative A would contribute a small amount.	Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, regional long-term impacts would result from decreases in group size in Primitive and Wild Zones, decrease in number of groups in Granite and Deer Creek/Tapeats Creek Complex, vegetation recovery on closed roads, and active site restoration. Cumulative impacts to vegetation would be major, adverse, localized to regional, long-term, and year-round of which Alternative B would contribute a small amount.	Alternatives, moderate, adverse, regional, long-term impacts to vegetation would result from general recreational use and include vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs and Indian Garden, use of stock on the Tiyo Point trail, creation and maintenance of the Boundary Road, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, regional, long-term impacts would result from vegetation recovery on closed roads and active site restoration. Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative C would contribute a small amount.	Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor beneficial, regional long-term impacts would result from decreases in group size, some Use Area changes, vegetation recovery on closed roads, invasive plant management, vegetation inventory, and active site restoration. Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative D would contribute a small amount.
Wildlife	Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts would result from the majority of backcountry use by visitors continuing to occur in the spring, summer and fall and from current patterns of the administrative use of helicopters in the backcountry. Under some conditions impacts from habitat modification at campsites, and disturbance or displacement from camping would be observable and measurable. Conversely, campsites, rest houses, and high use trails could also attract and habituate certain species of wildlife. In addition, disturbance and displacement along high use trails would be observable. Minor, beneficial, localized, short and long-term impacts would result from administrative restoration activities, continued closure and restoration of former roads, and educational programs from NPS and partner organizations. Cumulative impacts would moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.	Under Alternative B, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from administrative use helicopter flights, continued high visitor use in the Corridor Zone, construction activities associated with increased campsite numbers in the Corridor Zone, and an approximate increase of 3% in overnight users in the Corridor Zone. Minor, beneficial, localized, short and long-term impacts would come from conversion, closure and restoration of former backcountry roads and the Toroweap Overlook road, reductions in group sizes in the Deer Creek/Tapeats Creek Complex and other Use Areas, reductions in group sizes for Primitive and Wild Zones and for all climbing, canyoneering and RABT use, overall slight decrease (1%) in overnight backcountry users, training requirements for commercial guides, and Leave No Trace education for hikers, canyoneers, and day users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have minor, beneficial local and long-term impacts on wildlife. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative B would contribute a small amount.	Under Alternative C, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance from administrative use helicopter flights, interactions between stock and wildlife on the Tiyo Point trail, construction of large campsites and increased numbers of users in the Corridor Zone, and construction activities and increased traffic on the Boundary Road. An overall increase of 5% for overnight use in the backcountry would occur under this alternative, with impacts described in the Potential Day and Overnight Use Impacts to Wildlife section. Minor, beneficial, localized, short and long-term impacts would come from closures of some backcountry roads and restoration in those areas, Leave No Trace and etiquette education for climbers, canyoneers, RABT users, extended day hikers and clients of the NPS, its cooperators and commercial guides. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative C would contribute a medium amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance caused by administrative use helicopter flights, continued use of some backcountry roads, construction associated with increasing campsite numbers in the Corridor Zone and increased numbers of overnight users in those areas. The impacts of overnight use are described in the Potential Day and Overnight Use Impacts to Wildlife Section. Minor, beneficial, localized, short and long-term impacts would occur due to the prohibition of large groups outside the Corridor Zone, including the Deer Creek/Tapeats Creek Complex, the lack of vehicles on the Vulcans Throne Road, and Minimum Impact and etiquette education for extended day hikers, canyoneers, climbers and RABT users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative D would contribute a small amount.
Special Status Plant Species	Under Alternative A, minor to moderate, adverse, regional, short-to long-term impacts to special status plant species would result from general recreational use and include vegetation trampling, soil compaction, campsite expansion, trail creation, and	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational

	Alternative A	Alternative B	Alternative C	Alternative D
	direct damage to special status plants. Negligible to minor, beneficial, localized, long-term impacts would result from passive restoration on closed roads. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative A would contribute a small amount.	use including vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, trail creation, and direct damage to vegetation. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative B would contribute a small amount.	use and include: vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs, and Indian Garden, trail creation, and direct damage to vegetation. Negligible, beneficial impacts would result from a decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative C would contribute a small amount.	use and include: vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.
Special Status Wildlife Species	Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from the majority of backcountry use continuing to occur in the spring, summer and fall. Impacts from habitat modification at campsites, and disturbance or displacement from camping would occur. Campsites, rest houses, and high use trails could also attract and habituate certain species of special status wildlife and disturbance and displacement along high use trails would occur. Cumulative effects would be moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification and disturbance from the addition of up to four campsites at Cottonwood. Impacts would be somewhat reduced when compared to Alternative A from decreased group size in Primitive and Wild Zones, decrease in group number and size in Deer Creek/Tapeats Creek Complex, and reduced number groups in the Granite Use Area. Adaptive management under all action alternatives would also benefit special status wildlife. Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative B would contribute a small amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification an disturbance from the addition and use of up to eight campsites in the Corridor Zone. A reduction of adverse impacts would occur in the Deer Creek/Tapeats Creek Complex and Granite Use Area where number of groups would be decreased compared to Alternative A. Adaptive management under all action alternatives would also benefit wildlife. Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative C would contribute a small amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status wildlife species would result from general recreational use and include: vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.
Archaeological Resources	Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would result from use of the backcountry and resultant human disturbances including trailing through archaeological sites, camping on sites, displacement of artifacts and modification of structures, theft of artifacts, graffiti, campfires, inappropriate campsite creation and management within and adjacent to archaeological sites, and improper human waste management. Continued use of the backcountry under Alternative A has the potential for continued and increasing impacts from visitor use, improper waste management and other unpermitted activities. Cumulative impacts would be major, adverse, regional, and long-term of which Alternative A would contribute a medium amount. Under Section 106	Including impacts from elements Common to All Action Alternatives, moderate to major, adverse, regional, short-term impacts to archaeological resources would result from implementation of Alternative B, as a result of road and trail use and maintenance activities, at-large and designated camps located in, or adjacent to, archaeological site boundaries. Minor, beneficial, regional, short and long-term impacts would result from reductions in group size in Primitive and Wild Zone, closures of culturally-sensitive areas, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of	Including impacts from elements common to all action alternatives, moderate to major adverse, regional, short and long-term impacts to archaeological resources would result from implementation of Alternative C as a result of road and trail use, toilet construction, and maintenance activities and at-large or designed camps located in, or adjacent to, archaeological site boundaries. Minor to moderate, beneficial, regional, long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of archaeological site National Register eligibility.	Under Alternative D and common to all action alternative elements, moderate to major, adverse, regional, short-term impacts would result from continued disturbances to archaeological resources as a result of road and trail use and maintenance activities and at-large or designated camps located in, or adjacent to, archaeological site boundaries. These effects may be reduced by small group sizes in Threshold, Primitive, and Wild use zones. Minor to moderate, beneficial, regional, short and long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that

	Alternative A	Alternative B	Alternative C	Alternative D
	there would be an adverse effect to archaeological resources.	archaeological site National Register eligibility. Cumulative impacts would be major, adverse, long-term, and regional of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.	Cumulative impacts would be major, adverse, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to archaeological resources.	promote preservation of archaeological site National Register eligibility. Cumulative impacts would be major, adverse, regional, and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.
Historic Structures	Under Alternative A, minor to moderate, adverse, localized and regional, short and long-term impacts to the historic structures would result from would result from visitor use disturbances including vandalism (graffiti and structural damage), human waste disposal, littering, and campfires. Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a small amount. Under Section 106, there would be an adverse effect to historic structures.	Under Alternative B and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from smaller group size in Primitive and Wild zones and guide requirements would have minor, localized, and long-term effects on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from guide requirements would have a minor, localized, and long-term impact on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.	Under Alternative D and elements common to all action alternatives, minor, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), and improper human waste disposal. Beneficial effects from smaller group size in Threshold, Primitive and Wild zones, guide requirements, and management of unmaintained routes would have minor, localized and regional, short and long-term impacts on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a very small amount. Under Section 106, there would be an adverse effect to the historic structures.
Traditional Cultural Properties and Ethnographic Resources	Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would occur from continued use of the backcountry and visitor use disturbances including crowding from large groups, reduced access to resources by the Traditionally Associated Tribes from overuse, trailing, camping on sites and within resource areas, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, vegetation disturbances, disturbances to animals, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects result from restrictions at Deer Creek Narrows and ongoing visitor education on trail etiquette and leave no trace camping practices. These impacts are minor to moderate, localized and regional, short and long-term. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative A would contribute a medium amount to the adverse impact. Under Section 106, there would be an adverse effect to ethnographic resources.	Under Alternative B and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size in the Primitive and Wild Zone, closures of culturally sensitive areas, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.	Under Alternative C and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, road maintenance, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size for canyoneering groups, establishment of campsites outside of boundaries of ethnographic resources and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative C would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.	Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size in the Threshold, Primitive and Wild Zone, closures of culturally sensitive areas, retaining unmaintained routes and allowing old roadbeds to naturally recover, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to major, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.

	Alternative A	Alternative B	Alternative C	Alternative D
Cultural Landscapes	Under Alternative A, minor to moderate, adverse, localized and regional, short and long-terms impacts to the Cross-canyon Corridor Cultural Landscape would result from visitor use disturbances including crowding, reduced access to park resources from overuse, trailing, and improper waste management. Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a medium amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.	Under Alternative B and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape at a lower intensity than Alternative A.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.	Under Alternative D and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.
Visitor Use and Experience	Under Alternative A, minor, adverse, localized, short to long-term impacts to visitor use and experience would result from increasing levels of day use and associated crowding, dissatisfaction with management of RABT, and restrictions in access to the Deer Creek Narrows. Major, beneficial, long-term, regional, impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict (with the exception of day use in some areas), general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character (with the exception of human waste management and roads and trails management in some areas). Cumulative impacts would be minor, adverse localized to regional, and short to long-term and Alternative A would contribute a very small amount.	Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor use and experience would result from a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access to the Deer Creek Narrows. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative B would contribute a very small amount.	Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor and climbing, canyoneering and packrafting activity designations on overnight permits on overnight permits. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional, beneficial impacts under Alternative C would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative C would contribute a very small amount.	Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access at a site specific location. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional, impacts under Alternative D would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative effects would be minor, adverse, localized to regional, and short to long-term and Alternative D would contribute a very small amount.
Socioeconomic Environment	Under Alternative A, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry, at approximately 9% for commercial backpacking, and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Cumulative impacts would be beneficial, regional, short to long-term and moderate.	Under Alternative B and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.6% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience minor, adverse, short	Under Alternative C and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.9% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse,	Under Alternative D and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 10.3% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse,

	Alternative A	Alternative B	Alternative C	Alternative D
	Alternative A would have a small contribution to this overall adverse effect.	and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative B would have a small contribution to this overall adverse effect.	short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative C would have a small contribution to this overall adverse effect.	short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative D would have a small contribution to this overall adverse effect.
Park Management and Operations	Under Alternative A, moderate, adverse, long-term and major, adverse, short-term, localized to regional impacts would result from larger group size management in all zones, the lack of policy for managing extended day hiking and running, management of Tuweep day use, maintenance of backcountry toilets and roads and trails, and illegal use of old road beds, and the need to address direct impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education. Cumulative impacts would be moderate adverse, regional, short to long-term of which Alternative A would contribute a small amount.	Under Alternative B, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails, and maintenance of these trails, day use permits for RABT and Extended Day hiking, day and overnight use at Tuweep, and the need to address direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in Primitive and Wild Zones, authorizing commercial backpacking trips through concessions contracts and establishing caps for these trips in Corridor, Threshold and Primitive Zones. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a small amount.	Under Alternative C, and moderate to major, adverse, localized and regional, short to long-term impacts would result from larger group size management in all zones, management of extended day hiking and running, backcountry toilets installation and maintenance, conversion of old roadbeds to trails, development or upgrade and maintenance of Class 4 Tiyo Point trail and Boundary Road, day use permits for RABT and extended day hiking and running, Tuweep area management, and the need to address direct impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a medium amount.	Under Alternative D, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails and maintenance of these trails, day use permits for RABT and extended day hiking and running, Tuweep facilities changes, and the need to address direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in all zones, and limiting commercial backpacking and day hiking to the Corridor Zone, and limits on commercial vehicle and stock use trips at Tuweep. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.
Adjacent Lands	Under Alternative A, moderate, adverse, regional, long-term impacts would result from access across adjacent lands, associated campsite and staging impacts, trespass on tribal lands, and direct impacts to natural and cultural resources. Minor, beneficial, long-term, regional impacts would result from conversion of roads in Wilderness. Cumulative impacts would be moderate, adverse, short to long-term, regional of which Alternative A would contribute a small amount.	Under Alternative B and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in some zones, and limits on number of people and vehicles for organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a very small amount.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, and limits set for people and vehicles in organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a small amount.	Under Alternative D and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts to adjacent lands would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in all zones bordering adjacent lands, and limits on number of people and vehicles for organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.
Wilderness Character	Under Alternative A, moderate, adverse, regional, short to long-term impacts to wilderness character would result from large groups in Primitive and Wild Zones, presence of toilet facilities and the effects of toilet maintenance, the absence of an anchor policy, presence and illegal use of old road beds, and direct	Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from large groups in Threshold Zone Use Areas, presence of toilet facilities and the effects of toilet maintenance, and	Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts from larger groups in all use areas, additional designated campsites, presence of toilet facilities and the effects of toilet maintenance, and	Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from presence of toilet facilities and the effects of toilet maintenance, and direct impacts to natural and cultural resources.

	Alternative A	Alternative B	Alternative C	Alternative D
	impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from conversion of roads in proposed Wilderness. Cumulative impacts would be moderate, adverse, short to long-term, localized to regional of which Alternative A would contribute a small amount.	direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, and short to long-term. Alternative B would contribute a very small amount.	direct impacts to natural and cultural resources. Minor, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative C would contribute a small amount to this adverse effect.	Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Threshold, Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and natural restoration of old roadbeds. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative D would contribute a very small amount.

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CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

Chapter 1 describes why the National Park Service (NPS) is taking action at this time regarding backcountry management at Grand Canyon National Park (Grand Canyon or the park). This Draft Environmental Impact Statement (plan/DEIS) presents three action alternatives for managing backcountry use, and assesses impacts that could result if the park were to take no action (no-action alternative) or implement any of the three action alternatives.

Chapter 1 includes

- Statements of purpose and need for taking action
  - objectives in taking action developed during internal and public scoping
- Descriptions of the
  - project's study area
  - park's purpose and significance
  - backcountry and Wilderness history and management
  - related laws, policies, plans, and other constraints
- Discussions of issues and impact topics
  - identified during the scoping process and either
    - dismissed from further analysis or
    - analyzed in this plan/DEIS

Purpose of the Plan

The purpose of this plan/DEIS is to analyze and determine the appropriate type, extent, and location of backcountry use in Grand Canyon National Park. The plan/DEIS will establish an up-to-date adaptive management framework that allows the public to experience the park's unique backcountry and Wilderness resources and values while preserving them for the enjoyment of future generations.

Need for Action

A new Backcountry Management Plan is needed because

- Current 1988 Backcountry Management Plan is not consistent with the park's 1995 General Management Plan (GMP) or NPS Wilderness Policy
- Commercial backcountry services have not been analyzed to determine if they are necessary and appropriate
- Some Use Areas in Wilderness have degraded resources and wilderness character which need to be addressed
- Cottonwood Campground capacity limits cross-canyon overnight opportunities
- Emerging recreational uses put demands on park resources un-envisioned in the 1988 Plan
  - Rim-to-rim and rim-to-river day use (hiking and running) has become popular and resulted in issues which need to be addressed including human waste and trash along trails, overused toilets, complaints from other Corridor users, trail etiquette problems, declining opportunities for solitude, and crowding at trailheads and Phantom Ranch
  - Impacts to resources from river-assisted backcountry travel, canyoneering, and climbing are not well understood and need to be addressed
- An adaptive management process has not been developed to guide decision-making for ongoing and emerging issues and concerns

- Increased visitation to the Tuweep area has exceeded the capacity established in the 1995 GMP and needs to be addressed
- Tribes have expressed concerns related to culturally significant places and access across tribal lands

Goals and Objectives in Taking Action

Pursuant to NPS Director's Order 12 (DO 12), Conservation Planning, Environmental Impact Analysis, and Decision Making, goals and objectives are what must be achieved to a large degree for the action to be considered a success. All alternatives carried forward for detailed analysis in this plan/DEIS meet the park's goals and objectives to a large degree and resolve the purpose of and need for action. Goals and objectives for managing backcountry use are grounded in the park's enabling legislation, purpose, significance, and as stated in planning documents.

Goals and objectives are also compatible with direction and guidance provided by the park's GMP and other management guidance. Goals and objectives for managing the park's backcountry use include

GOALS

- Protect and preserve the park's natural and cultural resources and values and integrity of wilderness character
- Provide a framework and programmatic guidance for consistent decision making in managing backcountry, including Wilderness
- Provide a variety of visitor opportunities and experiences for public enjoyment in a manner consistent with park purposes and preservation of park resources and values
- Provide for public understanding and support of preserving fundamental resources and values for which Grand Canyon National Park was established

OBJECTIVES

Visitor Use and Experience

- Provide opportunities for visitors to experience and be inspired by Grand Canyon's backcountry resources and values while ensuring resource protection
- Establish levels and types of visitor opportunities, non-commercial and commercial, to enhance visitor experience and minimize crowding, conflicts, and resource impacts

Resources

- Manage backcountry use to protect wildlife populations and habitat by minimizing human-caused disturbances and habitat alteration
- Manage backcountry use to minimize impacts to native vegetation, reduce exotic plant species spread, and preserve fundamental biological and physical processes
- Manage use to enhance wilderness character and values
- Develop and implement an adaptive management process that includes monitoring natural, cultural, and experiential resource conditions and responding when resource degradation has resulted from use levels
- Preserve and protect natural soil conditions by minimizing impacts to soils from backcountry recreational activities
- Manage recreational use to minimize adverse chemical, physical, and biological changes to water quality in tributaries, seeps, and springs
- Manage recreational use to preserve cultural resource integrity and condition

Coordination and Cooperation

- Work with park neighbors including tribal entities, federal land managers, park partners, gateway communities, and other stakeholders to improve coordination and communication regarding backcountry use
- Work with adjacent tribal land managers to improve access to the park's backcountry

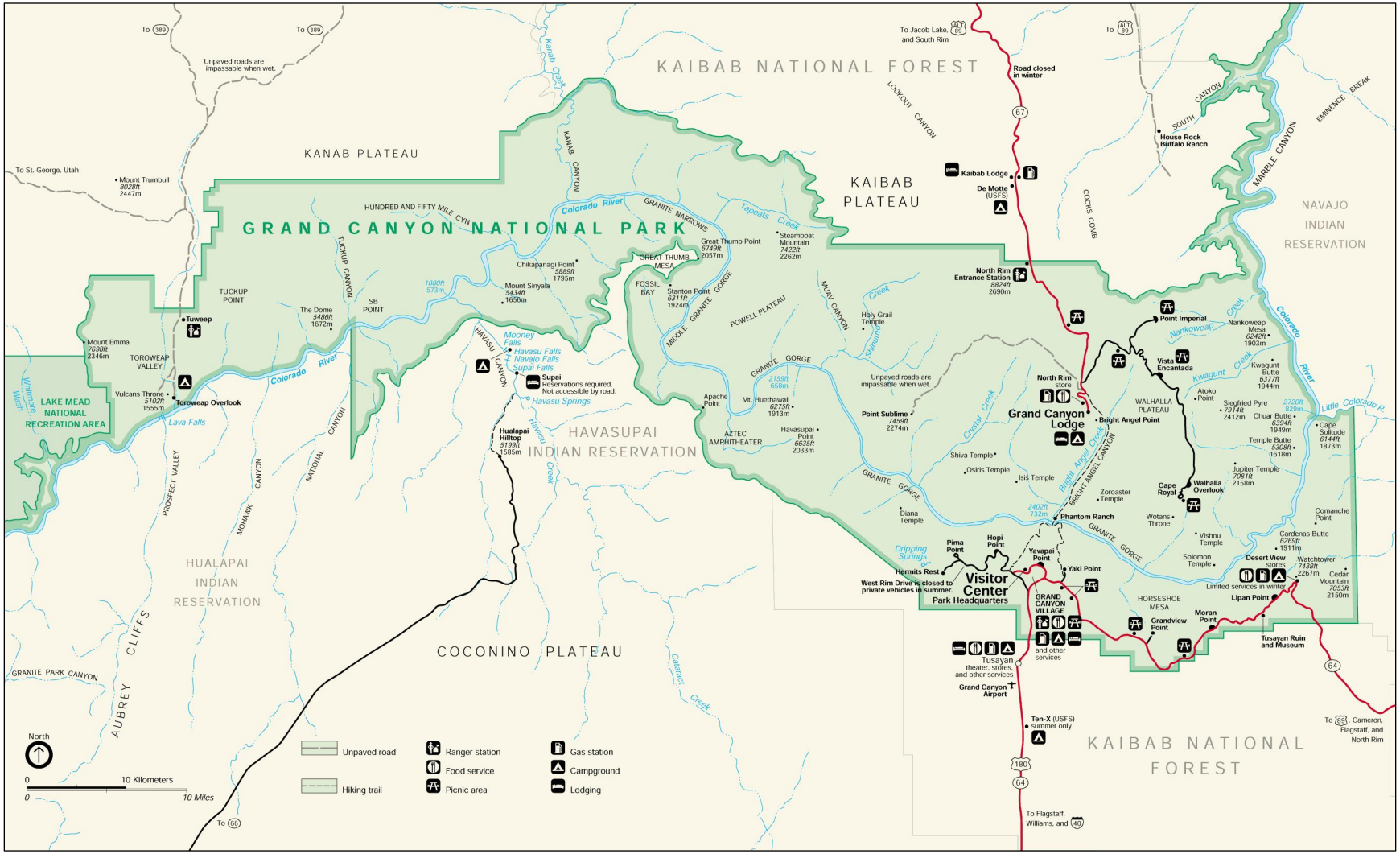
Park Management and Operations

- Establish recreational use levels sustainable for both resource protection and park operations
- Comply with all laws, regulations and policies related to backcountry management

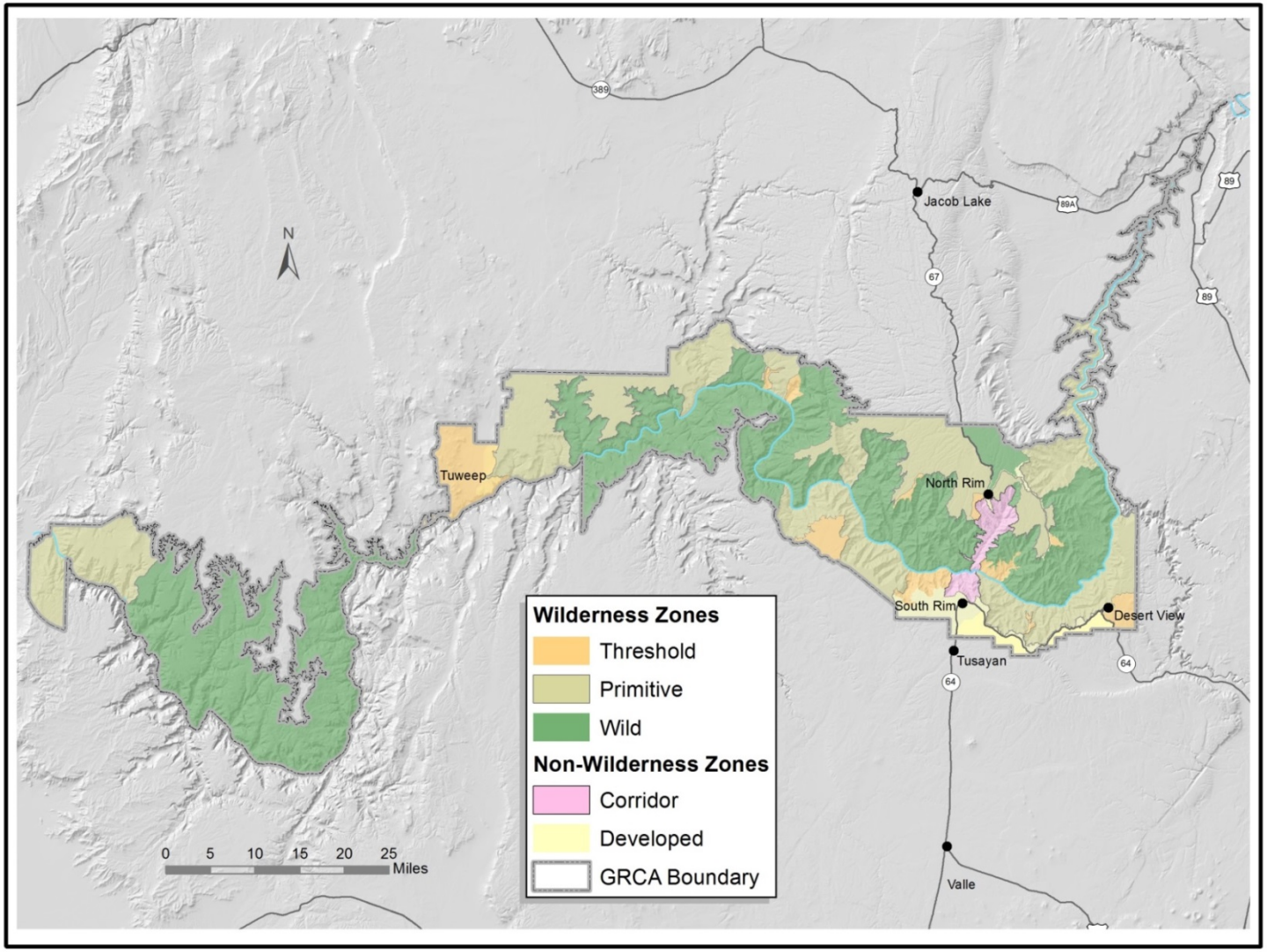
Project Study Area

The study area (Map 1.1) for this plan/DEIS includes the park boundary. This plan/DEIS focuses primarily on the park's backcountry in describing Affected Environment (Chapter 3) and analyzing impacts of alternatives (Chapter 4).

Map 1.1 Grand Canyon National Park and Vicinity



Map 1.2 Grand Canyon Wilderness



Purpose and Significance of Grand Canyon National Park

Theodore Roosevelt created the Grand Canyon Game Preserve by proclamation in 1906, and Grand Canyon National Monument in 1908. The park, first established in 1919, has grown to encompass approximately 1,216,000 acres of public land on the Colorado Plateau's southern end, and is a globally significant natural resource containing scenic vistas known throughout the world. In recognition of its significant values, Grand Canyon National Park was designated a World Heritage Site on October 26, 1979.

National park system units are established by Congress to fulfill specified purposes. A park's purpose provides the foundation for decision-making as it related to the conservation of park resources and providing for the enjoyment of future generations. As stated in the 2010 Grand Canyon National Park Foundation Statement (NPS 2010)

As a place of national and global importance, the park will be managed to

- preserve and protect Grand Canyon's unique geologic, paleontologic, and other natural and cultural features for the benefit and enjoyment of the visiting public
- provide the public opportunity to experience Grand Canyon's outstanding natural and cultural features, including natural quiet and exceptional scenic vistas
- protect and interpret Grand Canyon's extraordinary scientific and natural values

Grand Canyon is one of the planet's most iconic geologic landscapes. During the last six million years, the Colorado River carved Grand Canyon; these same erosional and tectonic processes continually shape the canyon today. Grand Canyon's exposed layers span more than one third of Earth's history, and record tectonic and depositional environments ranging from mountain-building to quiet seas. Taken as a whole, Grand Canyon, with its immense size, dramatic and colorful geologic record exposures, and complex geologic history, is one of our most scenic and scientifically valued landscapes.

The force and flow of the Colorado River along with its numerous and remarkably unaltered tributaries, springs, and seeps provide plants and animals opportunity to flourish in this otherwise arid environment. These vital resources represent transmission of local aquatic recharge from high-elevation rims to the arid inner canyon. There are hundreds of known seeps and springs throughout the park, and probably more to be discovered.

Wilderness landscapes are an important current resource and future preserve. Park boundaries extend beyond canyon walls to include 1,904 square miles (1,218,376 acres) of which 94% are managed as wilderness. When combined with additional contiguous public and tribal lands, this area comprises one of the largest U.S. undeveloped areas. Grand Canyon offers outstanding opportunities for visitor experiences including extended solitude, natural quiet, clean air, dark skies, and a sense of freedom from the mechanized world's rigors.

Grand Canyon National Park contains a superlative array of natural resources. Much of this diversity can be attributed to the park's dramatic topographic spectrum. This elevational variety provides microhabitats for natural processes supporting rare and endemic plant and wildlife species. These diverse habitats serve as a living laboratory for scientific research in numerous fields that contribute greatly to our understanding of the relationship between biotic communities and abiotic environments.

The human-Grand Canyon relationship has existed for at least 12,000 years. The canyon is an important homeland for native people and a place of historic Euro-American exploration and discovery. Today that relationship continues, both for ongoing Native American associations and millions of visitors who visit the canyon and its surrounding landscapes.

Grand Canyon's immense and richly colored scenic vistas, enhanced by a natural setting, inspire a variety of emotional, intellectual, artistic, and spiritual impressions. Its unsurpassed natural beauty is a source of profound inspiration for people worldwide.[6]

History of Backcountry Planning and Management

1970 – 800 individuals camped at Phantom Ranch's Bright Angel Campground Easter weekend. The resulting overcrowding, unsanitary conditions, clogged toilets, vegetation damage, and litter led to use limits in 1971.

1974 – A Backcountry Use and Operations Plan (NPS 1974) was developed and established trailhead use limits for Corridor Trails.

1981 – A new Backcountry Use Plan was drafted to include management policies, address backcountry management concerns, and guide management decisions for the ensuing five years. For the first time, Special Use Permits were required for all backcountry commercial guiding.

1983 – An Environmental Assessment (EA) was completed and a new Backcountry Management Plan (NPS 1983) was adopted. Major changes included the use of four management zones (Developed, Threshold, Primitive, and Undeveloped) and 72 Use Areas with prescribed use limits; this replaced the trailhead quota system. Sociological and environmental research and monitoring programs were initiated.

1985 – The 1983 plan was revised to include an after-hours permit pickup system, mail-out permit procedures, creation of five additional Use Areas, and reduction of party limits from three to two in Boucher Use Area in response to adverse environmental impacts. Sociological research was used to identify backcountry user needs and concerns and determine how well the existing backcountry management program met those needs.

Do Backcountry and Wilderness Differ?

According to NPS Management Policies (2006), Chapter 8.2.2.4, the term ***backcountry*** generally refers to "*primitive and undeveloped portions of parks. Usually these areas limit development to trails, unpaved roads, and administrative facilities*."

Wilderness is a Federal designation granted by congress and the president. Wilderness character is defined in the 1964 Wilderness Act as *"…an area of undeveloped Federal land retaining its primeval character and influence…"*

One **difference** between *Wilderness* and *backcountry* is that motorized equipment and mechanized transport is generally prohibited in Wilderness, whereas both may be present in backcountry if such uses are deemed necessary and appropriate.

The Wilderness Act specifically prohibits permanent structures and roads in Wilderness.

Permanent structures such as shelters and cabins may be allowed in backcountry areas for public safety and resource protection purposes. Land managers have defined Wilderness' primeval character as untrammeled, natural, and undeveloped land.

[6] Grand Canyon 2010 Foundation Statement.

1988 – The 1988 Backcountry Management Plan (NPS 1988) was implemented[7]. Changes from the previous plan included backcountry commercial use policy, private stock use, trail and backcountry road standards, management objectives, and a backcountry reservation and permit system. Additional research contributed to some reallocation and distribution of use (the number of Use Areas increased from 77 to 87, and the plan identified overnight use levels and day use areas). The 1988 BCMP also set use limits for Corridor and Wilderness Use Areas; set management objectives for signs, structures, stock use, and primitive roads; described trail classifications and maintenance standards; and set standards for visitor experience and campsite condition.

Although the 1988 Plan was intended for review after three years, it is still in use today.

1995 – The General Management Plan was completed which directed the park to update the 1988 Backcountry Management Plan to be consistent with direction provided in the GMP's management objectives

1998 – A Draft Wilderness Management Plan (DWMP) and accompanying Environmental Assessment (NPS 1998) were issued to be consistent with then-existing NPS Wilderness policies. The same year, the public process for updating the 1989 Colorado River Management Plan (CRMP) began (NPS 1989). This lead to public confusion regarding how the DWMP impacted the CRMP and how the park's Wilderness Plan affected its Wilderness Recommendation. The NPS initially attempted to integrate Wilderness and river plans, but ultimately suspended efforts in early 2000.

Beginning in 2002, the park conducted the following activities to prepare for the backcountry planning process

- Backcountry Task Group: parkwide interdisciplinary planning team (canyon rangers, resource specialists, planners, trail specialists, interpreters, and permits staff) 2002-2011. Identified information needs, identified and remedied immediate backcountry issues, coordinated campsite monitoring and visitor experience research, conducted fieldwork to mitigate campsite impacts in three Use Areas, and coordinated parkwide workshops on Wilderness and research programs. The group was reinitiated in 2013 to assist with this plan/EIS
- Archaeological Clearance, Hermit Trail 2003[8]
- Backcountry Day Hiker Visitor Study under cooperative agreement with the University of Illinois 2003 and 2004[9]
- Parkwide Partial Inventory Archaeological Resources 2004-07[10]
- Mule Rider and Phantom Ranch Visitor Study under a cooperative agreement with the University of Illinois in 2004[11]
- Overnight Backcountry Visitor Study under cooperative agreement with the University of Illinois 2004 and 2005[12]
- Rapid Site Inventory of Backcountry Campsites under cooperative agreement with Northern Arizona University 2004 to 2006[13]
- Stakeholder Analysis of Grand Canyon's Backcountry 2008[14]

[7] 1988 BCMP accessed at http://www.nps.gov/grca/learn/management/bmp.htm
[8] NPS 2003.
[9] Backlund et al. 2008.
[10] Neff et al. 2004.
[11] McDonald and Stewart 2006.
[12] Backlund et al. 2008.
[13] Foti et al. 2006.
[14] Barkley and Stewart 2008.

- NPS and Museum of Northern Arizona Assessment of Archaeological Sites along the Corridor Trails, Phase 1 and 2, 2009 and 2010[15]
- BCMP internal scoping 2007
- Grand Canyon's Foundation Statement 2010
- Ethnographic Resources in the Backcountry of Grand Canyon National Park: Final Report 2012[16]
- South Boundary Road Archaeological Survey 2012[17]

Many of the documents listed above are available at http://www.nps.gov/grca/learn/management/bmp.htm

In 2011, NPS published a Notice of Intent (Volume 76, Issue 81 April 27, 2011) to prepare this plan/DEIS, and initiated public scoping. See Chapter 5 for scoping details.

History of Wilderness Planning and Management

1964 – Passage of the Wilderness Act, Public Law 88-577, Section 3(c), instructed the Secretary of the Interior to review all roadless areas of at least 5,000 acres in the National Park System, and submit a report regarding suitability of these areas for Wilderness classification. The Act provided a ten-year review period and timetable.

1970 –NPS released for public review its Preliminary Wilderness Study for Grand Canyon National Park, Marble Canyon National Monument, and Grand Canyon National Monument. The study recommended phasing out motorized use on the Colorado River, and closing the network of North Rim fire and ranch roads to qualify these areas for Wilderness. The total Wilderness Recommendation was 569,200 acres, or approximately 63% of the then 900,000-acre park. Absent from the study were any South Rim lands except the Palisades below the Desert View rim area (NPS 1970).

1971 –NPS issued a Wilderness Recommendation of 508,500 acres, approximately 60,000 acres less than the earlier study (NPS 1971). Deleted from the Recommendation were the river corridor and North Rim. The river corridor was excluded due to planned continued use of motors on the river. Fire road requirements and projected mechanical equipment use excluded North Rim lands from Wilderness consideration until completion of a fire-hazard reduction program

1972 – NPS released another Wilderness Recommendation consisting of 512,870 acres due to environmental concerns, and which resulted in the Potential Wilderness addition of Grand Canyon National Monument and North Rim based on the projected elimination of grazing in the former and of fuel buildup in the latter

1973 – The park released its Final Environmental Statement for the Proposed Wilderness Classification of 1972 (NPS 1973). Passage of the Grand Canyon National Park Enlargement Act of 1975, Public Law 93-620, (amended PL 94-31), Section 11, required the Secretary of the Interior submit within two years a new Wilderness Recommendation accommodating an enlarged Grand Canyon National Park.

1976 – The 1976 Preliminary Wilderness Proposal called for 992,046 acres as suitable for Wilderness. An additional 120,965 acres, including the river corridor, was recommended as Potential Wilderness (NPS 1976). The total proposal was 1,113,011 acres. A Draft Environmental Statement was also prepared in 1976 (NPS 1976a). In August 1976, NPS conducted public hearings and received letters and written

[15] Collette et al. 2011, Collette et al. 2012.
[16] Hedquist and Ferguson 2012.
[17] Brown, Blayne In preparation.

statements from 23 federal agencies, 17 state agencies, three American Indian Tribes, 39 organizations, 24 companies, and 501 individuals (NPS 1976a).

1977 – The Final Wilderness Recommendation signed by the Director recommended 1,004,066 acres (including the river corridor and most of North Rim) for immediate Wilderness designation with an additional 108,945 recommended as potential Wilderness (NPS 1977). The total proposal was 1,113,001 acres. NPS sent this recommendation to Legislative Counsel in 1977, where it was held in abeyance pending completion of the Colorado River Management Plan (NPS 1977a, NPS 1979).

1980 – On completion of the Colorado River Management Plan (NPS 1979a), a memorandum from the Director to the Assistant Secretary for Fish, Wildlife, and Parks recommended 980,088 acres for immediate Wilderness designation and an additional 131,814 acres as Potential Wilderness (NPS 1980). The total proposal was 1,111,902 acres. The revised Recommendation eliminated the 1,109-acre area between the Kaibab and Bright Angel Trails (NPS 1980a). The river corridor was also recommended as Potential Wilderness until the planned phase-out of motors in 1985. The Hatch Amendment to the 1981 Department of the Interior Appropriations Bill resulted in abandonment of the 1980 Colorado River Management Plan and its Wilderness emphasis. In 1981, a new river plan was written, and motor use on the river continued (NPS 1981).

1993 – The park conducted an internal review and update of the 1980 Wilderness Recommendation (NPS 1993). Revisions were made based on acquisition of mining, grazing, and other leases; the 1969 Field Solicitor's Opinion regarding the western boundary of the Navajo Reservation; and GIS acreage refinements. Modifications were consistent with the letter or intent of the 1980 Recommendation. On August 3, 1993, Grand Canyon's Superintendent transmitted this Recommendation to the Director (NPS 1993a).

2010 – Grand Canyon prepared a Draft Update (NPS 2010b) to the park's 1980 Final Wilderness Recommendation[18]. Because the 1980 Recommendation was never forwarded to the President and Congress for legislative action, the park prepared the 2010 Draft Update to reconcile facts on the ground and incorporate modern mapping tools (GIS). The 2010 Draft Update did not alter the substance of the original Recommendation. The official Wilderness Recommendation map retained Map #113-40, 047B, submitted to the Department of Interior in 1980. The total proposal includes 1,143,918 acres, 94% of the park's total area. Of this total, 1,117,457 acres are recommended for immediate Wilderness designation; 26,461 are recommended for

Grand Canyon Wilderness 2014

Recommended
1,117,457 acres

+

Potential
26,461 acres

=

1,143,918 total acres or 94% of the park

For purposes of this EIS, all Grand Canyon *Proposed* and/or *Potential Wilderness will be referred to as *Wilderness***

***for Wilderness definitions, see** Glossary

[18] Draft Final Wilderness Recommendation, 2010 Update, http://www.nps.gov/grca/learn/management/upload/Draft_2010_Final_Wilderness_Rec.pdf.

designation as Potential Wilderness pending resolution of boundary and motorized riverboat issues.

As of this writing, the park's Wilderness Recommendation has not been forwarded to Congress, but the park is prohibited by NPS Management Policies from taking any action that would diminish Wilderness eligibility. Management decisions which affect Wilderness will be made in expectation of eventual designation. NPS Management Policies also apply to potential Wilderness to the extent existing nonconforming conditions allow. Map 1.2 shows Grand Canyon Wilderness.

Changes to Backcountry Management Since the 1998 BCMP

Backcountry activities are generally managed according to the 1988 BCMP; however, some changes since that time have occurred and are noted in this section.

Use Areas
In the 1988 Plan, 87 Use Areas were defined. Since that time, several Use Areas have been split for reasons noted in Table 1.1. There are currently 96 Use Areas identified in the park's backcountry.

Permit System
In February 2010, Grand Canyon changed the backcountry permit system to help ensure all requests received equal consideration regardless of the method used to submit the request. Previously, applications made in person received an immediate answer while written requests received answers as time allowed. For more information visit http://www.nps.gov/grca/planyourvisit/permit_change.htm

Fees
In 1997, Grand Canyon backcountry fees began with a charge of $20 per permit plus $4 per person per night and an option of a $50 Frequent Hiker Membership (waived $20 per permit fee for one year).

In 2000, a non-refundable fee of $10 per permit plus $5 per person per night camped below the rim and $5 per group per night camped above the rim is charged. Frequent users may purchase a one-year Frequent Hiker Membership for $25 that waives the initial $10 fee for each permit obtained by the trip leader for twelve months from date of purchase.

Starting October 2015, a non-refundable cost recovery charge of $10 per permit plus $8 per person per night camped below the rim and $8 per group per night camped above the rim will be charged. The Frequent Hiker Membership program will be terminated.

Group Size
The 1988 BCMP prescribed a maximum group size of 16 persons for large groups, and a maximum of eight for small groups. The results of early monitoring programs established an adverse relationship between group size and resource impacts at campsites. To address this issue, in 1993 NPS changed maximum large group size to 11, and maximum small group size to six.

Toilets
Since 1988, toilets have been added in both Corridor (Pipe Creek, Cedar Ridge, Tip-Off, Three-mile Resthouse and Mile-and-a-half Resthouse) and non-Corridor (Clear Creek, Deer Creek, Tanner, Uncle Jim Trail, and Point Sublime) areas. These toilets were placed to address resource impacts.

Roads
Since 1993, former fire and ranch roads have been closed in Wilderness to comply with the 1993 Final Wilderness Recommendation (updated 2010). Visitors use many of these former roads as unmaintained hiking routes and, while some have become overgrown and are no longer detectable, all are managed in accordance with the Superintendent's Compendium (NPS 2013g) wherein unmaintained routes for hiker access would continue to be managed as untrailed areas to allow former roadbeds to recover.

Table 1.1 Summary of Use Area Changes Since 1988

Use Area Name and Code	Change	Reason	Year
Rider (AB9)	Split into Rider and Soap Creek	Rider extended to include 19-mile Canyon. Soap Creek split off to improve access and distribution of overnight use in Soap Creek and Nine Mile Canyon	1999*
Soap Creek (AB0)	Split from Rider		
Walhalla Plateau (NA0)	Split into Walhalla Plateau, Cape Final, and Ken Patrick	Boundaries redefined to improve access and distribution of overnight use. Cape Final campsite designation for endangered plant protection	1999
Ken Patrick (NC9)	Split from Walhalla		
Cape Final (NA1)			
Swamp Ridge (NJ0)	Create designated camping at Swamp and Fire Points	Provide rim camping opportunities at designated sites	1999
Swamp Point (NJ2)	Split from Swamp Ridge		
Fire Point (NJ1)			
Robbers Roost (ND9)	Split into Robbers Roost and Point Sublime	Create designated camping opportunities at Point Sublime	1999
Point Sublime (NH1)	Split from Robbers Roost		
Deer Creek (AX9)	Split into Indian Hollow (AN9) and Deer Creek (AX7)	Create designated camping upstream in Deer Creek to protect archaeological sites and separate camping from day use activities at Deer Creek Narrows (Map 2.7)	1999
Indian Hollow (AN9)	Split from expansive AX9; does not include Deer Creek Narrows		
Deer Creek (AX7)	AX9 code changed to AX7		
Pasture Wash (SE9)	Split into SE0, SE1, SE2, SE3 and Eremita Mesa	SE1, SE2, and SE3 split from Pasture Wash to provide rim camping at designated sites. SE9 code changed to SE0 Eremita Mesa split off from Pasture Wash to provide hiker camping along administrative access road	1999
Pasture Wash (SE1, SE2, SE3)	Split from Pasture Wash; campsites designated at South Bass Trailhead and along Havasupai Point Road		
Eremita Mesa (SC9)			
Other Use Area Changes			
Cremation (BJ9)	Use area boundary adjustment	Archaeological site damage from campsite proliferation and use	2014**
Tuweep (TUW)	Implement overnight permit system and prohibit campfires	Manage consistent with all backcountry areas	August 2014

*Categorical Exclusion. 1999.Grand Canyon National Park. Signed J.T. Reynolds
**Categorical Exclusion. 2014 Grand Canyon National Park. Signed D. Uberuaga

Issues and Impact Topics

NEPA regulations require an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Issues are

problems, opportunities, and concerns regarding backcountry use management, impacts of backcountry use, and backcountry opportunities in Grand Canyon. Issues were identified by the NPS, cooperating agencies, other agencies, tribes, and the public through the scoping process. Information obtained from the public scoping period is included in this document. Information about public outreach for the 2011 scoping process is provided in Chapter 5, Consultation and Coordination.

Impact topics described below were derived from scoping issues. An impact topic represents a resource, such as water resources, that may be impacted by backcountry use. Each impact topic is described in its current condition in Chapter 3, Affected Environment. In Chapter 4, Environmental Consequences, changes to impact topics that would result from implementation of each alternative are disclosed.

Public scoping for this plan/DEIS began on April 27, 2011, with publication of A Notice of Intent to Prepare an Environmental Impact Statement (EIS) for the Backcountry Management Plan, Grand Canyon National Park, was published in the Federal Register Volume 76, Issue 81 (April 27, 2011)[19]. Comments were solicited during a series of public meetings, through mailings, websites, and planning newsletters. The public scoping period closed June 27, 2011; the NPS received 581 separate comments on the scope of this plan/DEIS. An account of the public scoping process is provided in Chapter 5. Comments focused on a variety of topics including

- Overall access to the park's backcountry
- Access to the park's backcountry across tribal lands
- Protection of park natural and cultural resources and Wilderness values
- Permits
- Visitor experience
- Roads and trails maintenance
- Visitor safety
- Recreation activities
- Commercial services
- Use Areas and zoning

An important part of planning is seeking to understand consequences of making one decision over another. EISs identify anticipated impacts of possible actions on resources, park visitors, and neighbors. Impacts are organized by topic, such as "impacts on the visitor experience" or "impacts on vegetation and soils." Impact topics focus environmental analysis and ensure relevance of impact evaluation. Impact topics identified for analysis are described in this section; they were identified based on federal laws and other legal requirements, Council on Environmental Quality regulations, NPS policies and guidelines, staff subject-matter expertise, and issues and concerns expressed by the public, tribes, and other agencies early in the planning process. Also included is a discussion of impact topics considered but dismissed for the reasons given.

Impact Topics Retained for Analysis

Impact topics or components of the human environment affected by alternatives and analyzed in detail in this plan/DEIS include

[19]Available at http://www.gpo.gov/fdsys/granule/FR-2011-04-27/2011-10118/content-detail.html.

NATURAL RESOURCES

SOILS
Proposed alternatives could result in new ground disturbance or possibly change soil erosion, the area's productivity, drainage patterns, or damage fragile soil crusts. Alternatives under consideration could result in impacts to backcountry soils and therefore it is retained as an impact topic to be analyzed.

WATER RESOURCES
Proposed alternatives could result in water pollution or a change in other hydrological conditions. Alternatives under consideration could result in impacts to water resources in the backcountry and therefore it is retained as an impact topic to be analyzed.

SOUNDSCAPE
Noise can adversely affect, directly and indirectly, natural soundscape, wildlife, and other park resources. Noise can also adversely impact visitor experience. Visitors have opportunities to experience tranquility in an environment of natural sounds in many park areas. Some actions in alternatives under consideration could result in adverse or beneficial noise-related impacts to Soundscape, other resources, and visitor experience. Soundscape is retained as an impact topic to be analyzed.

CAVE RESOURCES
Proposed alternatives could affect caves, including impacts to hydrology, cave formation, mineral formation, paleontology, or wildlife habitat. Alternatives under consideration could result in impacts to cave resources therefore this impact topic is retained to be analyzed.

VEGETATION
Alternatives being considered could result in developments, actions, or uses that would result in new ground disturbance, fires, social trails development, vegetation trampling, or non-native or invasive species spread, all of which could affect plant populations and distributions. Alternatives under consideration could result in impacts to vegetation and therefore it is retained as an impact topic to be analyzed.

WILDLIFE
Grand Canyon supports a diverse wildlife population, including insects, birds, reptiles, amphibians, and mammals. The park's wildlife populations are an important resource and one of the attractions that add to the quality of visitor experience. Some of the park's birds and mammals are susceptible to disturbance. Potential impacts of concern would be modification of animal behavior and alteration of feeding, breeding, and socializing habits. Indirect effects of concern could include accidental injury, energy loss, and impacts to offspring survival. Alternatives under consideration could result in impacts to wildlife and therefore it is retained as an impact topic to be analyzed.

SPECIAL STATUS PLANT SPECIES
The Endangered Species Act of 1973, as amended, requires examination of impacts on all federally listed threatened or endangered species. NPS Management Policies 2006 repeats this requirement and adds the stipulation that analysis examine impacts on state-listed species and federal species proposed for listing. Grand Canyon is home to nine endemic plant species (known only from the park) one of which, sentry milk-vetch (*Astragalus cremnophylax cremnophylax*), is a federally listed plant species. Alternatives under consideration could result in impacts to special status plant species and therefore it is retained as an impact topic to be analyzed.

SPECIAL STATUS WILDLIFE SPECIES

Special status wildlife species are species that may be state, tribal, or federally listed (including proposed for federal listing and candidate for federal listing). The Endangered Species Act of 1973, as amended, requires examination of impacts on all federally listed threatened or endangered species. Alternatives under consideration could result in impacts to special status wildlife species and therefore it is retained as an impact topic to be analyzed.

CULTURAL RESOURCES

ARCHAEOLOGICAL RESOURCES

According to NPS 28, archaeological resources are any material remains or physical evidence of past human life or activities of archaeological interest, including the record of effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research. Alternatives under consideration could result in impacts to archaeological resources and therefore it is retained as an impact topic to be analyzed.

HISTORIC STRUCTURES

Historic structures include any constructed work consciously created to serve some human activity. Historic structures are usually immovable, and include buildings and monuments, dams, canals, bridges, tunnels and roads, trails, fences, defensive works, kivas, ruins of all structural types, phone lines, and other structure types (NPS 1998a). Alternatives under consideration could result in impacts to historic structures and therefore it is retained as an impact topic to be analyzed.

TRADITIONAL CULTURAL PROPERTIES AND ETHNOGRAPHIC RESOURCES

Traditional cultural properties (TCPs) are eligible for inclusion in the National Register because of their association with a living community’s cultural practices or beliefs rooted in that community's history and important in maintaining the community’s continuing cultural identity. Ethnographic resources include sites, structures, objects, landscapes, or natural resource features assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it (NPS 1998a). Alternatives under consideration could result in impacts to TCPs and ethnographic resources and therefore are retained as an impact topic to be analyzed.

CULTURAL LANDSCAPES

Cultural landscapes are a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values (NPS 1998a). Alternatives under consideration could result in impacts to cultural landscapes and therefore it is retained as an impact topic to be analyzed.

VISITOR USE AND EXPERIENCE

One of the purposes of national parks is to provide for public enjoyment, education, and inspiration. Grand Canyon’s high-quality visitor experiences attract visitors from around the world. Backpacking, day hiking, sightseeing, camping, and wildlife viewing are some of the many opportunities available. Alternatives under consideration could result in impacts to visitor use and experience including commercially guided opportunities and visitor safety and therefore it is retained as an impact topic to be analyzed.

SOCIOECONOMIC ENVIRONMENT

As part of its complete analysis of potential impacts on the human environment, NEPA requires examination of social and economic impacts caused by federal actions, including potential impacts on commercial opportunities in the park’s backcountry. Consideration will be given to potential economic effects on local and regional economies affected by these actions. Issues for consideration include income

from tourism, fuel consumption, employment, intrinsic value, and logistical costs. Alternatives under consideration could result in impacts to socioeconomic environment and therefore it is retained as an impact topic to be analyzed.

PARK MANAGEMENT AND OPERATIONS
NPS DO 12, Conservation Planning, Environmental Impact Analysis, and Decision-making, provides guidance to national parks on inclusion of Park Management and Operations as an Impact Topic. Although NPS Management Policies 2006 does not specifically address Park Management and Operations, virtually every action or proposal evaluated in the NEPA process has either a direct or indirect effect on Park Management and Operations. Management of backcountry operations may have varying degrees of impact on personnel, funding, and time. In addition, NPS backcountry management includes planning, coordination with other agencies and stakeholders, monitoring, stewardship activities, visitor safety, and fee collection. Alternatives under consideration could result in impacts to park management and operations and therefore it is retained as an impact topic to be analyzed.

ADJACENT LANDS
NPS DO 12, Conservation Planning, Environmental Impact Analysis, and Decision-making, provides guidance on inclusion of adjacent lands as an impact topic. Alternatives under consideration could result in impacts to adjacent lands and therefore it is retained as an impact topic to be analyzed.

WILDERNESS CHARACTER
Wilderness character is defined in NPS Director's Order 41: Wilderness Stewardship as, "The combination of biophysical, experiential, and symbolic ideals that distinguishes wilderness from other lands. The five qualities of wilderness character are 1) Untrammeled, 2) Undeveloped, 3) Natural, 4) Solitude or a Primitive and Unconfined Type of Recreation, and 5) Other Features of Value." Wilderness character, including opportunities for solitude and/or primitive, unconfined recreation, and apparent naturalness, are key to many visitors' experiences and to park management. Alternatives under consideration could result in impacts to wilderness character and therefore it is retained as an impact topic to be analyzed.

Impact Topics Considered but Dismissed from Further Analysis

Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 Code of Federal Regulations (CFR) Part 1500-1508), and NPS DO 12 require an EIS to identify and focus on significant environmental issues and de-emphasize and eliminate from detailed review insignificant or non-applicable issues. Accordingly, the following issues are not analyzed in this plan/DEIS.

AIR QUALITY
Grand Canyon National Park is classified as a mandatory Class I area under the Clean Air Act (42 USC 7401 et seq.). Under this most stringent air quality classification, it is mandated to be protected against degradation of air quality and an increase in air pollution. Furthermore, the Clean Air Act sets the goal of natural visibility conditions, free of human-caused haze. NPS Management Policies 2006 provide guidance for protection of air quality under both the 1916 NPS Organic Act and the Clean Air Act to ensure the best possible air quality in parks and actively promote and pursue measures to protect air-quality-related values. Current park air quality is generally good, with pollution levels generally below those established by the U.S. Environmental Protection Agency (EPA) to protect human health.

Visibility is usually worse than natural levels due to regional haze originating outside park boundaries and smoke from local and regional wildland fires. In-park air pollutant emissions are dominated by wildland

fire and motor vehicles including visitor vehicles, commercial tour buses, and park-operated shuttle buses, with lesser contributions from watercraft, aircraft, boilers, generators, campfires, woodstoves, and other sources (NPS 2002).

Alternatives considered in this plan/DEIS would not make an appreciable difference in park haze or ozone levels in the study area. Consequently, air quality is not a determining factor in selecting among the alternatives, and is dismissed from further analysis.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL AND NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

None of the alternatives being considered would appreciably increase energy consumption. Therefore, this topic was dismissed from further analysis.

ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low-income populations. Guidelines for implementing this executive order under NEPA are provided by the Council on Environmental Quality, Environmental Justice, Guidance under the National Environmental Policy Act (1997). According to EPA, "Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (http://www.epa.gov/compliance/environmentaljustice/basics/index.html). Because alternatives in this plan/DEIS would not affect environmental justice, the topic was dismissed from further analysis.

NATURAL LIGHTSCAPE RESOURCES

Natural lightscape has only recently been recognized as an important cultural, natural, and scientific resource by the NPS and the nation. At the turn of the century, two-thirds of the U.S. population lived where they could not see the Milky Way (Cinzano 2001). As starry skies become rare, park visitor interest in stargazing is increasing sharply along with corresponding economic benefits. Natural darkness is additionally critical to many wildlife species, especially in desert ecosystems (Rich and Longcore 2006). An increasing number of national parks containing areas of exceptional night sky quality have taken steps to protect this valuable resource. Recommended indicators for monitoring natural lightscape would be considered in the adaptive management process. Grand Canyon recently began monitoring the quality of its nighttime natural lightscape and the impact of light pollution within park boundaries and is actively working toward Dark Sky Park status from the International Dark Sky Association. Grand Canyon will consider creating a Lightscape Management Plan for long-term natural lightscape protection. Because alternatives in this plan/DEIS would not affect natural lightscape, the topic was dismissed from further analysis.

WETLAND RESOURCES AND FLOODPLAINS

Although wetlands and floodplains occur in the study area, no new developments, actions, or uses are proposed in the alternatives that would result in loss or disturbance of wetlands or floodplains. Likewise, no changes are proposed that would affect or change NPS-management of wetlands or floodplains. Because none of the alternatives would affect these resources, they were dismissed from further analysis.

WILD, SCENIC, AND RECREATIONAL RIVERS

Although the Colorado River and tributaries have been studied for Wild and Scenic River eligibility, the NPS has not undertaken the process to determine suitability of river segments for designation. Backcountry activities were taken into account during the study process, and many tributary and river segments were identified as eligible under a range of values including cultural, recreational, geological,

and biological diversity. Because none of the alternatives would alter Wild and Scenic River eligibility, the topic was dismissed from further analysis.

CLIMATE CHANGE
Although alternatives considered in this plan/DEIS would not make appreciable differences in emissions or other factors contributing to climate change, backcountry use and management will likely be affected by climate change. Shifts in mean conditions (e.g., increasing mean annual temperature), changes in climate variability (e.g., more intense storms and droughts), and uncertainty of future conditions create a scenario for the park to consider climate change through adaptive management and recognize it will impact park resources and visitors.

Based on historical climate trends and future projections, examples of climate change impacts that would affect Grand Canyon backcountry use and management include

- Increased temperatures for all seasons, with the greatest increase in summer
- All perennial water sources except the mainstem Colorado River are spring-dependent and flows in most springs respond to local snowpack levels (Rice 2012)
- Increases in extreme runoff and flooding will increase magnitude and frequency of flooding in fall and winter
- Extreme events such as flash floods are expected to increase from combined effects of warming and increasingly intense winter storms
- Fire frequency and intensity could increase due to higher temperatures, increased drought, and decreased snow pack
- Increase in fire season length, fire severity, and number of acres burned

Related Laws, Policies, Plans, and Constraints

Guiding Laws and Policies

Laws and policies, as well as plans by the NPS, state governments, or agencies with neighboring land or relevant management authority, are derived in this section to show the framework and constraints under which this plan/DEIS will need to operate and the goals and policies that will be considered. These related laws, policies, plans, and constraints will guide the development and implementation of this backcountry management plan.

NPS Organic Act
The NPS Organic Act (54 USC 100101(a)) directs the Secretary of the Interior and the NPS "to conserve the scenery, natural and historic objects, and wild life in the [units of the National Park System] and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." NPS must conduct its actions in a manner ensuring no "derogation of the values and purposes for which the System units have been established, except as directly and specifically provided by Congress" (54 U.S.C. 100101(b)).

Grand Canyon National Park Act and Grand Canyon Enlargement Act
On February 26, 1919, Congress dedicated and set apart Grand Canyon National Park "as a public park for the benefit and enjoyment of the people" (16 USC 221). Over the years the park has been enlarged and its boundaries revised, most recently on January 3, 1975, when Congress recognized "that the entire Grand Canyon, from the mouth of the Paria River to the Grand Wash Cliffs, including tributary side canyons and surrounding plateaus, is a natural feature of national and international significance" (Grand

Canyon Enlargement Act, Public Law 93-620). In this act, Congress also recognized the need for "further protection and interpretation of the Grand Canyon in accordance with its true significance."

NPS Management Policies 2006 sets policy for topics addressed in this plan/DEIS including public participation, environmental analysis, Wilderness, natural, cultural, and experiential resource management, and visitor use of national parks.

National Environmental Policy Act (NEPA) Regulations and Procedures
NEPA is implemented through regulation of the CEQ (40 CFR 1500-1508). The NPS has in turn adopted procedures to comply with NEPA and the CEQ regulations, including the Department of the Interior NEPA Regulations (43 CFR 46), and Director's Order 12: Conservation Planning, Environmental Impact Analysis (NPS 2011b), and Decision-making and its accompanying handbook (NPS 2015).

Wilderness Act of 1964 and Director's Order 41: Wilderness Stewardship
Under the Wilderness Act of 1964, (Section 4(b)) "Except as otherwise provided in this act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." By policy, any action taken by the park must comply with this act.

In addition, the park must apply the "minimum requirement" concept to all management activities that affect the wilderness resource. This concept is intended to minimize impacts on wilderness values and resources. Managers may authorize (using a documented process) the generally prohibited activities or uses listed in Section 4(c) of the Wilderness Act if deemed necessary to meet the minimum requirements for the administration of the area as wilderness and where those methods are determined to be the "minimum tool" for the project.

The purpose of Director's Order 41 is to provide accountability, consistency, and continuity to the NPS wilderness stewardship program, and to otherwise guide servicewide efforts in meeting the letter and spirit of the 1964 Wilderness Act.

Section 106 of the **National Historic Preservation Act (NHPA) of 1966** requires federal agencies take into account effects of their undertakings on historic properties, including traditional cultural properties, either listed in, or eligible to be listed in, the National Register of Historic Places.

NPS Director's Order 28, NPS Cultural Resource Management Guideline provides basic guidance and procedures for NPS managers, planners, and cultural resource specialists to effectively carry out cultural resources research, planning, and stewardship. DO 28 provides specific guidance for management of archaeological resources, historic/ prehistoric structures, cultural landscapes, ethnographic resources, and museum collections.

Concessions Management Improvement Act of 1998 requires the Secretary to administer NPS units to preserve and conserve resources and values, and requires that such public accommodations, facilities, and services as have to be provided should be provided only under carefully controlled safeguards against unregulated and indiscriminate use, so that visitation will not unduly impair these resources and values. Furthermore, any development of public accommodations, facilities, and services within such units must be limited to those that are necessary and appropriate for public use and enjoyment, as well as limited to locations that are consistent to the highest practicable degree with the preservation and conservation of the resources and values of the park unit in which they are developed.

Section 7 of the **Endangered Species Act (ESA) of 1973** charges all federal agencies aid in conservation of listed species, and requires federal agencies ensure their activities are not likely to jeopardize continued existence of listed species or adversely modify designated critical habitats.

NPS-75, Natural Resources Inventory and Monitoring Guideline summarizes reasons for inventory and monitoring of natural resources, describes a process for conducting inventorying and monitoring studies at the park level, identifies major ecosystem components useful for resources inventory and long-term monitoring; and provides data administration and reporting guidelines.

NPS Reference Manual 77, Natural Resource Management offers comprehensive guidance for managing, conserving, and protecting natural resources in NPS units. This RM guides natural resource management, replacing NPS-77, Natural Resource Management Guideline, issued in 1991 under the previous NPS guideline series.

Americans with Disabilities Act of 1990 (ADA) prohibits discrimination against people with disabilities in employment, transportation, public accommodation, communications, and governmental activities. Specific direction is provided in NPS Director's Order 42, Accessibility for Park Visitors.

Court-Mandated Direction

Review and revision of the 1988 Backcountry Management Plan is also mandated by a settlement agreement (Grand Canyon Private Boaters Ass'n v. Alston, CV-00-1277-PCT-PGR-TSZ)[20]. The settlement committed the NPS to restarting the backcountry management planning process subsequent to completion of the Colorado River Management Plan.

Special Mandates and Administrative Commitments

Special mandates are legal requirements and administrative commitments that apply specifically to Grand Canyon, and are mandated by Congress or signed agreements with other entities.

World Heritage Site
Grand Canyon National Park was designated a World Heritage Site on October 26, 1979. The Secretary of the Interior, through the NPS, is responsible for identifying and nominating U.S. sites to the World Heritage List.

Arizona National Scenic Trail
The National Trails System is the network of scenic, historic, and recreation trails created by the National Trails System Act of 1968. These trails provide for outdoor recreation needs; promote enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources; and encourage public access and citizen involvement.

The Arizona Trail was designated a National Scenic Trail as part of the Omnibus Public Lands Management Act of 2009. The Arizona National Scenic Trail extends 807 miles across the state of Arizona from the U.S.–Mexico international border to the Arizona–Utah border. The trail passes through Grand Canyon National Park, entering near South Entrance Station, crossing South Rim, following South and North Kaibab Trails, then crossing North Rim, and exiting near North Entrance Station.

[20] Settlement agreement accessed at http://www.usbr.gov/uc/rm/amp/amwg/mtgs/02jan17/Attach_15.pdf.

Individual Agreements with Tribes
Havasupai Traditional Use Lands. Under the Grand Canyon Enlargement Act, the Havasupai Tribe is allowed to use lands within the park as traditional use lands for grazing and other traditional purposes. The traditional use lands are located below South Rim adjacent to the Havasupai Reservation. Within Grand Canyon, grazing is permitted on these lands only.

Research Natural Areas
NPS-77 defines Research Natural Areas (RNA) as part of a national network of sites designed to facilitate research and preserve natural features. RNAs are usually established in a typical example of an ecological community type, preferably one having been little disturbed in the past and where natural processes are not unduly impeded. The tract is set aside permanently and managed exclusively for approved non-manipulative research; i.e., research that measures but does not alter existing conditions. A park RNA is designated by the NPS. Federal agencies are required to consider potential impacts of their actions on RNAs.

Grand Canyon's RNAs are listed below.[21] The GMP states six research natural areas totaling 8,845 acres were officially designated in Grand Canyon in the 1970s. Although not formally designated by the Regional Director, a seventh RNA, Fishtail Mesa, was set aside by a Categorical Exclusion signed by the Superintendent in 2000 (Table 1.2).

The NPS is responsible for approving activities conducted in RNAs, and assigns park staff to coordinate park research, issue collecting permits, and maintain RNA research data files.

Table 1.2 Research Natural Areas

Name	Acres	Primary Type	Other Important Types	Elevation	Topography
Great Thumb	960	Pinyon-juniper	Sedimentary (Paleozoic)	6,100-6,185	Level
Neal Spring	15	Aspen	Caves and caverns (limestone sink-karst) topography Sedimentary (Paleozoic)	7,400-7,650	Mountainous steep
Powell Plateau	5,120	Interior Ponderosa Pine	Sedimentary (Paleozoic)	6,750-7,650	Level Plateau
Swamp Point	1,120	Interior Ponderosa Pine	Sedimentary (Paleozoic)	7,750-7,847	Rolling
Wayside-Tusayan	480	Pinyon-juniper	Sedimentary (Paleozoic)	6,800-7,250	Rolling
Mt Emma	1,150	Interior Ponderosa Pine	Volcanoes and Associated Works (Quaternary)	6,750-7,500	Mountainous steep
Fishtail Mesa*	1,098	Old growth pinyon and juniper, sagebrush and muttongrass steppe, and a small grassland		5,837-6,161	Rolling

*Fishtail Mesa Research Natural Area Categorical Exclusion, GRCA-01-0009, November 2000

Related Plans, Policies, and Actions for Grand Canyon National Park

General Management Plan (1995)
Grand Canyon's 1995 General Management Plan (GMP) provides management objectives and park vision. The GMP also designated park management zones and recognized the importance of park natural quiet and scenic resources. It specifically described and set forth objects for Tuweep, the corridor trails, and undeveloped areas located in the park's backcountry.

[21] A Directory of Research Natural Areas on Federal Lands of the United States of America. 1968. Compiled by the Federal Committee on Research Natural Areas, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

For Tuweep, the GMP set day use limits at 30 vehicles or 85 visitors at one time and also stated that "commercial uses at Tuweep will be tightly controlled, and requests for such activity will be evaluated on a case-by-case basis (p. 52)."

Foundation Statement (2010)
The Grand Canyon National Park Foundation Statement for Planning and Management provides a base for future planning to help guide park management. By identifying what is most important according to Grand Canyon's establishing legislation, purpose and significance statements, primary interpretive themes, and special mandates, this document sets parameters for future planning and provides managers information necessary to make informed decisions critical to park operations, management, and the future.

Although not a decision document or additional plan, the Foundation Statement summarizes fundamental resources and values critical to maintaining Grand Canyon's natural, cultural, and experiential value into the future.

Cave Management Plan
The park's now-outdated 1980 Cave Management Plan (NPS 1980b) was updated in draft in 1997, but never released to the public for NEPA review. Grand Canyon will be updating the plan through a public NEPA process.

Colorado River Management Plan
The 2006 Colorado River Management Plan (NPS 2006a) is a visitor use management plan that specifies actions to conserve park resources and visitor experience while enhancing river running recreational opportunities on the Colorado River through Grand Canyon National Park.

Compendium of Designations, Closures, Use and Activity Restrictions, Permit Requirements and Other Regulations
The Superintendent's Compendium (NPS 2013g) is a compilation of designations, closures, permit requirements, and other restrictions made by the Superintendent *in addition to* what is contained in Title 36 of the Code of Federal Regulations (Chapter 1, Parts 1 through 7 and 34) and other applicable federal statutes and regulations. Grand Canyon's Compendium includes regulations regarding such topics as camping activities, human waste, stock use, bicycles, fires, areas restricted to public presence, use and access by permit only, and unmanned aircraft use.

The Compendium is available at http://www.nps.gov/grca/learn/management/publications.htm Temporary regulations currently covered by the Compendium regarding Deer Creek use and backcountry roads will be permanently addressed by this plan/DEIS.

Desired Conditions
Beginning in April 2012, Grand Canyon worked with stakeholders to describe resource desired conditions that characterize the preferred state of a park resource and what that resource should be like after implementing management actions. Management actions analyzed in this plan/DEIS and those proposed in other park plans and projects, should be consistent with natural, cultural, and experiential resource (visitor experience) desired conditions (see Appendix B).

Exotic Plant Management Plan
Grand Canyon's 2009 Exotic Plant Management Plan (NPS 2009) includes integrated pest management techniques to control and contain exotic plant species; increased education, prevention, and collaboration; and increased manual, mechanical, cultural, and chemical controls.

Fire Management Plan
The Fire Management Plan (NPS 2012) is a detailed action plan for all wildland fire activities, including preparedness, initial response, suppression, wildfire management, fire prevention, fire monitoring, and fuels management activities including prescribed fire.

Greater Grand Canyon Landscape Assessment
In July 2012, in partnership with Northern Arizona University (NAU), Grand Canyon initiated the Greater Grand Canyon Landscape Assessment (GGCLA) to assess natural and cultural resource conditions in the park and adjacent lands. This collaborative process will identify priority natural and cultural resources and appropriate condition indicators, synthesize information on current status and trends, and evaluate potential threats. Information will come from existing data, reports, and scientific publications, along with input from subject-matter experts and stakeholders. Data derived will be analyzed within an ecosystem-based, spatially-explicit modeling framework.

Project outcomes include a report with GIS maps providing an interdisciplinary and landscape-scale overview of resource conditions. It will also identify priority sub-watersheds that contain high-value resources and those at greatest risk from internal and external threats. GGCLA's intention is to 1) provide a sound scientific foundation and ecosystem-based framework for future decision making, 2) help focus future stewardship activities in high-priority areas, 3) provide opportunity for ongoing communication and collaboration with neighbors in addressing shared resource-management issues, and 4) identify critical information gaps to help guide future monitoring and research.

Internal Aviation Management Plan
The plan, updated in 2011 (NPS 2011c), documents accepted procedures and practices for official use, reduces and minimizes NPS flight number, and establishes a safe operation while minimizing impacts to the park's natural quiet and experience. This plan establishes general guidelines for official aircraft use on park business including facility construction and maintenance, basic transportation of persons and cargo for managerial and administrative purposes, search and rescue (SAR) efforts, medical response and evacuation, cultural and natural resources management, law enforcement, and wildland fire detection/suppression and/or management.

Long-term Experimental and Management Plan for Operation of Glen Canyon Dam
The Department of the Interior, through the Bureau of Reclamation and NPS, is preparing an EIS for a Long-Term Experimental and Management Plan (LTEMP) for Glen Canyon Dam Operations. The EIS will fully evaluate dam operations and provide a framework for adaptively managing Glen Canyon Dam over 15 to 20 years.

Mule Operations and Stock Use
The NPS approved a Mule Operations and Stock Use Plan in 2011 (NPS 2011a) that allows commercial mule rides to continue, but limits rides on some Inner Canyon and rim trails damaged by mule use. Private stock use limits remain unchanged. The Mule Operations and Stock Use Plan addressed impacts of heavy and continuous stock use and limited trail maintenance funds on 42 miles of rim and Corridor trails.

Resource Management Plan (RMP)
The RMP (NPS 1997) provides long-term guidance and direction for stewardship of Grand Canyon's natural, cultural, and recreational resources. Primary stewardship functions include: management, interpretation, education, research, inventory, monitoring, mitigation, law enforcement, and maintenance. These functions are required to perpetuate natural processes, and natural and cultural resources, to achieve park purposes and management objectives, and regulate park use. On completion of the Backcountry

Management Plan and the Greater Grand Canyon Landscape Assessment, Grand Canyon plans to develop a Resource Stewardship Strategy as a revision to the RMP.

Other Federal Agency Plans, Policies, and Actions

Grand Canyon—Parashant National Monument Management Plan and EIS (BLM and NPS)
The 2007 Resource Management Plan and EIS for the Arizona Strip Field Office, the Vermilion Cliffs National Monument and the Bureau of Land Management (BLM) portion of Grand Canyon–Parashant National Monument, and GMP and EIS for the NPS portion of Grand Canyon–Parashant National Monument addresses land-use desired conditions on bordering Bureau of Land Management public domain, as well as within the national monument.

Proposed Withdrawal from New Mining Claims near Grand Canyon FEIS (BLM)
The FEIS analyzes potential effects of withdrawing federal lands near Grand Canyon from location and entry under the 1872 Mining Law and temporarily withdraws about one million acres, subject to valid existing rights. A withdrawal would prevent individuals and companies from staking new mining claims; however, currently approved operations could continue and new operations could be approved on valid existing mining claims.

Coconino National Forest Land and Resources Management Plan (USFS)
The U.S. Forest Service manages lands on the Coconino National Forest near Grand Canyon. The USFS accepted public comment on the Draft Coconino National Forest Land and Resources Management Plan and DEIS in 2014 to provide guidance for forest resource management, recreation, and other activities.

Kaibab National Forest Land and Resources Management Plan (USFS)
The USFS manages lands on the Kaibab National Forest near and adjacent to Grand Canyon on both North and South Rims including Ten X Campground, Coconino Rim Primitive Non-motorized Use Area, Kanab Creek Wilderness, and Saddle Mountain Wilderness. The 2014 Land and Resources Management Plan provides guidance for forest resource management, recreation, and other activities.

Kaibab National Forest Travel Management (USFS)
The Kaibab National Forest is implementing the **Travel Management Rule**, which requires all national forests designate a system of roads, trails, and areas for motorized use, and prohibit all motor vehicle use off the designated system.

Four Forest Restoration Initiative (USFS)
The USFS has developed a DEIS for the Four Forest Restoration Initiative (4FRI). Four national forests (the Kaibab, Coconino, Apache-Sitgreaves and Tonto) are actively engaged in a collaborative, landscape-scale initiative designed to restore fire-adapted ecosystems. With a diverse group of stakeholders, the four forests are working to collaboratively plan and carry out landscape-scale restoration of ponderosa pine forests in northern Arizona.

Items Outside the Scope of Analysis

This plan/DEIS focuses primarily on managing human use of the backcountry and the effects of such use on backcountry resources and wilderness character. This plan/DEIS does not analyze items beyond the scope defined in Chapter 1 including

- Colorado River Management
- Aircraft Overflights Management

- Wilderness Designation
- Wildlife Reintroductions, Removal, or Management
- Wild and Scenic River Designation
- Stock Use
- Cave and Karst Management

CHAPTER 2: ALTERNATIVES

Introduction

NEPA requires that an EIS consider a range of reasonable alternatives including a no-action alternative, even if a no-action alternative may not be implemented due to legal, regulatory, or other considerations, including a legislative command to act.

As required in CEQ regulations (40 CFR 1502.14), agencies must "rigorously explore and objectively evaluate all reasonable alternatives" in an EIS. CEQ defines reasonable alternatives as those technically and economically feasible. CEQ is also clear agencies should not pare alternatives to only those that are cheap, easy, or the agency's favorite. Rather, feasibility is an initial measure of whether the alternative makes sense and is achievable (DO 12).

Through the planning process, four alternatives were carried forward for analysis in this plan/DEIS: the no-action (A) and three action alternatives (B, C, and D). In 2013, NPS identified the preferred alternative. During that process other actions were explored but dismissed from further consideration; see Chapter 2, Actions Considered and Dismissed from Further Consideration.

Summary of Alternatives

NO-ACTION ALTERNATIVE

Alternative A
Alternative A would continue existing management practices, resulting in a continuation of current trends in resource conditions and visitor opportunities. Analysis of a no-action alternative is required by Council on Environmental Quality (CEQ) regulations.

ACTION ALTERNATIVES

Common to All Action Alternatives
Action alternatives (B, C, and D) propose changes to current backcountry management.

Some proposed changes to existing backcountry management practices apply to all action alternatives and include

- Two additional management zones to improve resource management of backcountry roads and areas along the Colorado River
- Determination of appropriate commercial services and the extent necessary in Wilderness and backcountry
- Administrative use guidelines
- Commercial filming guidelines
- Arizona Trail use
- Bicycling
- Tribal lands and interests

- Adaptive management process for addressing increasing demand for recreational access and uncertainty of how different recreational uses impact park resources. The adaptive management process would be applied to
    - Climbing management
    - Canyoneering management
    - Extended day hiking and running management
    - Tuweep day use management
    - Use area management
    - Human waste management

Specific to Individual Action Alternatives (B, C, and D)
Topics covered under action alternatives include

- Maximum group size limits for overnight backpacking
- RABT management
- Commercial services including overnight backpacking, day hiking, and backcountry vehicle tours at Tuweep
- Backcountry roads, trails, and routes
- Tuweep facilities
- Corridor zone camping
- Deer Creek/Tapeats Creek Complex
- Deer Creek Narrows
- Hance Creek, Cottonwood Creek, and Cremation Use Area

Alternative B NPS Preferred
Alternative B focuses on providing a variety of recreational activities and a high level of protection for natural and cultural resources and wilderness character. This alternative would place limits on currently unlimited activities to protect resources and enhance visitor experience. Guided services would be allowed in certain backcountry areas while other areas would remain free of guided services. This alternative increases the number of Primitive Zone Use Areas where visitors can expect increased opportunities for solitude and minimal infrastructure and maintenance activities.

Alternative C
Alternative C focuses on recreational activities and expanded opportunities for these activities. This alternative would increase opportunities for primitive and unconfined recreation through fewer management restrictions. Guided services would be allowed in more Use Areas throughout the backcountry when compared with other action alternatives. Alternative C would result in increased overall use due to additional Threshold Zone Use Areas and Corridor Zone campsites.

Alternative D
Alternative D focuses on resource protection and opportunities for solitude. This alternative would allow for recreational use, but would prioritize preservation of natural and cultural resources and wilderness character. Recreational use would be concentrated in non-wilderness areas with limited facility improvement. Similarly, guided services would be limited to two non-wilderness zones: Corridor and a proposed Road Natural. For overnight backpacking, large groups would be allowed in the Corridor Zone, but not in zones in Wilderness (Threshold, Primitive, and Wild). These actions would allow for self-exploration and increased opportunities for solitude in Wilderness. Overall, this alternative would result in decreased use due to increased Primitive Use Areas, minimal increase in Corridor Zone campground capacity, and decreased group size limits.

Formulation of Alternatives

Alternatives for managing Grand Canyon's backcountry were developed to meet plan/DEIS objectives. Alternatives carried forward for analysis must meet project objectives to a large degree, although not necessarily completely or equally.

The range of alternatives was developed with input from the public, agencies, and tribes. After developing a range of preliminary alternatives, the Grand Canyon EIS Planning Team met with Grand Canyon's Leadership Team and other park staff to refine alternatives into those analyzed in this plan/DEIS. The EIS Planning Team applied its best professional judgment in developing these alternatives to meet plan/DEIS objectives.

Alternative A: No-Action

Concept

Alternative A continues existing management practices, resulting in continuing current trends in resource conditions and visitor opportunities.

Current backcountry management is guided by the 1988 Backcountry Management Plan (NPS 1988)**;** subsequent administrative updates; and the Compendium of Designations, Closures, Use and Activity Restrictions, Permit Requirements and Other Regulations (also known as the Superintendent's Compendium) which is updated yearly (NPS 2013g). A summary of current backcountry use and management can be found in Chapter 1, Current Backcountry Use and Management. Alternative A would include

Backcountry Management Zones

The park's 1988 Backcountry Management Plan defined four management zones (Corridor, Threshold, Primitive, and Wild) to better guide backcountry management actions and to provide opportunities for a wide variety of backcountry experiences: Corridor, Threshold, Primitive, and Wild. The Corridor Zone is non-wilderness, while Threshold, Primitive and Wild Zones are in Wilderness.

Management zones were divided into Use Areas based on established use patterns and resource management considerations. Most Use Area boundaries are defined according to identifiable topographic features such as ridge tops and drainages. Each Use Area was given overnight capacity based on area size, number of suitable and available campsites in the area and management zoning.

The following descriptions provide overviews for general resource, social, and managerial conditions for existing zones. Under Alternative A, no changes would occur to backcountry management zones.

Corridor Zone
The Corridor Zone would continue to include Bright Angel Trail, North and South Kaibab Trails, developed campgrounds, Phantom Ranch tourist lodging, ranger stations, and sewage and water treatment facilities. The Corridor Zone would continue to provide a transition from developed rim areas to Inner Canyon backcountry. Corridor Zone trails would continue to receive high day use levels including hikers, mules, horses, and long-distance hikers and runners.

Trails and facilities would continue to be managed to accommodate high visitation levels. Smallest of backcountry management zones, the Corridor Zone supports approximately 57% (2012 data) of total overnight backcountry use (at Indian Garden, Bright Angel, and Cottonwood Campgrounds).

Threshold Zone
The Threshold Zone would continue to include Use Areas managed for moderate to high use and provide opportunity to transition from a developed backcountry experience (Corridor Zone or rim) to Wilderness. The landscape would be largely undisturbed except in destination areas where use would be concentrated. Camping would be limited to designated areas, many with composting toilets. Trail encounter rate[22] would be moderate, and there would be high probability of camping within sight or sound of other groups. Trails into Threshold Use Areas would generally be in close proximity to rim and Inner Canyon developed areas, and several Inner Canyon trails would provide access to this Zone including Hermit, Tonto, Grandview, and Clear Creek. Popular day hiking destinations include Santa Maria Springs, Drippings Springs, Horseshoe Mesa, Widforss Point, and Cape Final.

Approximately 18% (2012 data) of total overnight backcountry use occurs in the Threshold Zone.

Primitive Zone
The Primitive Zone would continue to be managed for low to moderate use and would continue to provide opportunities for experiencing wild lands and solitude. The landscape would be largely undisturbed, and human-use impacts would be most evident near water sources, attraction sites, and along trails. Camping would be at-large, although camp areas could be defined to address resource impacts, and composting toilets would be placed as a last-resort measure to address human waste problems. Trail encounter rate would be low-to-moderate, and there would be low probability of camping within sight or sound of others in some Use Areas. Compared to the Corridor and Threshold Zone Use Areas, trails into Primitive Zone Use Areas would be more distant from developed areas including Tanner, Nankoweap, and Bass.

Approximately 22% (2012 data) of total overnight backcountry use occurs in the Primitive Zone.

Wild Zone
The Wild Zone would continue to provide outstanding opportunities for solitude and would require the highest level of self-reliance. The landscape is largely undisturbed and natural processes dominate. Wild Zone Use Areas would remain very large and remote. Camping would be at-large and hikers would rarely encounter other groups. Trails would be unimproved, and route-finding would be required often. Access to Wild Zones would typically be through Threshold and Primitive Zones; remote trailheads may be located on other federal and tribal lands.

Approximately 3% (2012 data) of total overnight backcountry use occurs in the Wild Zone.

Climbing Management

Director's Order 41: Wilderness Stewardship, defines climbing to include rock climbing, snow and ice climbing, mountaineering, and caving where climbing equipment, such as ropes and fixed or removable anchors, is generally used to support an ascent or descent. The policy states, "Any climbing use or related activity must be restricted or prohibited when its occurrence, continuation or expansion would result in unacceptable impacts to park resources or wilderness character, or interfere significantly with the experience of other park visitors," and "Establishment of bolt-intensive face climbs, commonly known as sport climbs, is considered incompatible with Wilderness due to concentrated human activity, and the

[22] Trail Encounter Standards are defined in Appendix B

types and levels of impacts that may be associated with climbing routes." Motorized drills are prohibited in Wilderness.

While it is known that climbing occurs during overnight and day use backcountry trips in the park, the exact number is unknown because there are no limits on climbing, day use permits are not required, it is not identified on backpacking permits, and no other monitoring framework exists. The NPS promotes clean climbing practices (see Glossary) including use of temporary equipment and anchors (removable without altering the environment); however, Grand Canyon does not currently have a park-specific climbing policy. Under Alternative A, no changes would occur.

Canyoneering Management

Canyoneering is traveling in canyons, typically narrow canyons, using a variety of techniques that may include walking, wading, scrambling, climbing, jumping, rappelling, and swimming. Non-technical canyoneering is travel through a canyon using non-technical methods, such as walking or scrambling, without the use of ropes and harnesses. In a general sense, non-technical canyoneering is most similar to a typical overnight backpacking trip or day hike in the park's backcountry.

For purposes of this plan/DEIS, canyoneering is considered technical canyoneering and is defined as descent or ascent of a canyon by rappelling, building anchors, or other rope work like technical climbing or down-climbing (placing protection or using rope for belay) while wearing a harness. Similar to climbing, the NPS recognizes canyoneering is a legitimate and appropriate Wilderness use. However, any canyoneering or related activity must be restricted or prohibited when its occurrence, continuation, or expansion would result in unacceptable impacts to park resources or wilderness character, or interfere significantly with the experience of other park visitors. Establishment of bolt-intensive routes is considered incompatible with Wilderness due to concentrated human activity and types and levels of impacts that may be associated with these routes. Motorized drills are prohibited in Wilderness.

While it is known that technical canyoneering occurs during overnight and day trips in the park's backcountry, the exact number is unknown because canyoneering is not identified on backpacking permits, and day use permits are not required. The NPS promotes clean climbing practices (see Glossary) including use of temporary equipment and anchors (removable without altering the environment); however, Grand Canyon does not currently have a park-specific canyoneering policy. Under Alternative A, no changes would occur.

Extended Day Hiking and Running Management

Extended day hiking and running, such as rim-to-river and rim-to-rim, occur primarily on Bright Angel, South Kaibab, and North Kaibab Trails, but also on other backcountry trails. Both individuals and groups partake in rim-to-rim hiking and running year-round. Use substantially increases spring and fall, and organized events often coincide with North Rim's opening (May 15) and closing (October 15). Permits are not required and no restrictions apply to individuals participating in this activity.

An interim policy is in place that requires organized groups participating in rim-to-rim or extended day hiking and running to obtain special use permits. This policy became effective September 15, 2014 (see http://www.nps.gov/grca/learn/news/interim-permits-r2r.htm). Group size is limited to 30 people and only one permit per day will be issued per organization or group. However, the overall number of special use permits being issued is not limited. Under Alternative A no changes would occur.

Tuweep Day Use Management

Tuweep Use Area is a unique, road-accessible primitive area on western Grand Canyon's north side and, with the exception of overnight campground use, is day use only (i.e., sunrise to 30 minutes after sunset). The 1995 GMP established Tuweep day use limits at a maximum of 30 vehicles or 85 visitors at one time to meet the goal of providing an "uncrowded and primitive experience" at Tuweep. This day use limit includes visitors at Toroweap Overlook and Campground, in the Vulcans Throne area, and on local trails. Currently the NPS lacks data to determine how often these limits are exceeded. Under Alternative A, no changes would occur.

Use Area Management

The park's backcountry is divided into 96 distinct Use Areas defined according to identifiable topographic features such as ridge tops and drainages that allocate use by geographic area. The majority of camping is at-large; the remainder managed as designated campsites or campgrounds. Each Use Area is classified in one of four management zones: Corridor, Threshold, Primitive, or Wild (Map 1.2). Classification of Use Areas into management zones is associated with how the park manages resources given the level of visitor use and types of activities. Overnight use limits and group number and size are defined for each Use Area (see Table 2.14d). If designated Use Areas, use limits, or group sizes prove inappropriate, no formal process exists to amend these elements. Under Alternative A, no changes would occur.

Human Waste Management

Grand Canyon facilities for disposal of human waste (excrement and urine) vary by management zone. Corridor Zone facilities include composting and flush toilets. Dehydrating or composting toilets occur in six Threshold Zone Use Areas with designated campsites, and in one Primitive Zone Use Area (Tanner). Grand Canyon policy for disposal in other areas requires excrement burial and toilet paper carry-out. All Colorado River trips are required to carry-out solid human waste in airtight containers. Backcountry personal waste carry-out systems are occasionally used; however, there are no specific policies or requirements for these methods. Under Alternative A, no changes would occur.

Arizona Trail

The Arizona National Scenic Trail is a continuous 800-mile trail from Utah to Mexico open to hiking, bicycling, and stock use. Approximately 41 miles run through Grand Canyon divided into three segments (South Rim, Inner Canyon, North Rim) based on unique settings and allowable uses. Currently, bicycles are not officially allowed on the North Rim segment or on Inner Canyon trails. Under Alternative A, no changes would occur.

Overnight use in Grand Canyon's backcountry requires a permit for a specified night in the Inner Canyon segment or along the North Rim Arizona Trail segment. Through-hikers[23] often have difficulty obtaining backcountry permits in Grand Canyon for their Arizona Trail itinerary. Overnight use on the South Rim Arizona Trail segment is available by reservation at Mather Campground in South Rim Village (2.5 miles away). Under Alternative A, no changes would occur.

[23] Through-hikers are those hiking the entire 800-mile Arizona Trail across the state and crossing Grand Canyon as a portion of their longer hike.

Bicycling

Backcountry bicycling would continue to be allowed on park roads open to private vehicles, and prohibited in Wilderness and on Inner Canyon trails. The South Rim segment of the Arizona Trail is open to bicycle use. Under Alternative A, no changes would occur

River-assisted Backcountry Travel (RABT)

RABT is transient travel on the Colorado River using a portable, personal watercraft to cross the river to access a route or trail on the other side or travel a limited distance to gain access to an exit route or trail. This activity is commonly referred to as packrafting.

RABT associated with backpacking or overnight canyoneering requires a backcountry permit and no day use permitted. Personal flotation devices (PFDs) (Type III or V) would continue to be required to be worn on the river. Currently, the Superintendent's Compendium (NPS 2013g) imposes a five-mile RABT river travel restriction which is reviewed annually. Under Alternative A, no changes would occur

Tribal Lands and Interests

Three Traditionally Associated Tribes including the Navajo Nation, Hualapai Tribe, and Havasupai Tribe share a boundary with Grand Canyon National Park. NPS works to educate visitors about access to the park's backcountry across tribal lands. Each tribe has established rules and regulations regarding hiking and other recreational activities on reservation lands. The Navajo Nation Department of Parks and Recreation administers a permit system for day and overnight use on the reservation. The Hualapai Tribe does not currently permit day or overnight hiking on the reservation. The Havasupai Tribe administers a permit system for day and overnight hiking in Havasu Canyon, but currently does not allow access across Great Thumb Mesa (Havasupai Reservation) to Grand Canyon backcountry users. There are no current restrictions on use of the Hematite Mine. NPS consults with tribes regarding protection and treatment of archaeological and ethnographic resources. Under Alternative A, no changes would occur.

Administrative Use

Backcountry administrative use includes resource management, maintenance, visitor protection, visitor education, and research activities. Administrative users obtain overnight backcountry permits. NPS and outside researchers must obtain appropriate research permits. All administrative use in Wilderness including flights is evaluated through MRA (Appendix E). Under Alternative A, no changes would occur.

Guided Services

The NPS authorizes three basic types of backcountry guided services: NPS Programs, cooperating association programs, and commercial services. Special use permits (SUPs) for guided activities are generally not issued, but requests for SUPs are considered on a case-by-case basis. All authorized services are subject to stipulations including use limits, permit requirements, group size limits, trip itineraries, and safety and environmental regulations.

Non-commercial Services

The National Park Service and its official cooperating association, the Grand Canyon Association and its field institute, provide public guided services.

National Park Service
NPS-led backcountry interpretive services include day hikes to Cedar Ridge and various North Rim locations. Overnight trips led by the Environmental Educational Program occur on a limited basis (one to three times annually). These NPS backcountry interpretive programs would continue under Alternative A.

Cooperating Association Programs
Grand Canyon Field Institute (GCFI) is a program of the Grand Canyon Association, the park's official cooperating association. Cooperating associations are mission-driven nonprofit organizations, incorporated under state law. They operate under a signed standard agreement with the NPS to provide program and financial assistance for interpretation, education, and research in national parks through production and sale of educational media to the public (details at http://www.nps.gov/hfc/cfm/coop-assn.cfm). In 2012, GCFI led 17 backcountry overnight trips in the Corridor, Threshold, and Primitive Zones. Under Alternative A, GCFI programs would continue and be reviewed annually by NPS managers to assure course material is appropriate and in keeping with the NPS mission.

Commercial Services

Commercially guided backcountry services include overnight backpacking, day hiking, bicycling, and vehicle tours permitted by commercial use authorizations (CUAs). CUAs are granted for one year and stipulations include guide-to-client ratios, guide qualifications, and other regulations that apply to all backcountry users. Commercial stock use also occurs in the backcountry. Stock use is managed by concessions contract and specifically addressed in the 2010 Mule Operations and Stock Use EA; therefore, commercial stock use is not addressed in this plan/DEIS.

Commercial Overnight Backpacking
Commercially guided backpacking trips are allowed in all management zones granted through a CUA that allows overnight backcountry trips. Group size is limited to 11 with a minimum of one guide to seven clients or two guides to nine clients. Commercial use is included in use limits set for backcountry Use Areas including Corridor Zone campgrounds (see Table 2.14d). There are no caps on commercial use, and CUA holders obtain backcountry permits through the public backcountry reservation system (http://www.nps.gov/grca/planyourvisit/backcountry-permit.htm) in the same manner as other backcountry visitors up to four months in advance. Commercial trips account for approximately 9% of total overnight backpacking use; current (2012) use numbers are summarized in Summary Table 2.14d by user night and groups/zone. Under Alternative A, no changes would occur.

Commercial Day Hiking
Commercially guided day hiking trips are granted through a CUA. Group size is limited to 11 with a minimum of one guide to seven clients or two guides to nine clients. CUAs specify recommended locations and hike destinations on Bright Angel, South Kaibab, North Kaibab, Hermit, Grandview, and Tanner Trails (Summary Table 2.14c). Under Alternative A, there are no limits on number of hikes allowed per day per trail, and no limit on number of day-hiking CUAs. Under Alternative A, no changes would occur.

Commercial Bicycling
Commercially guided bicycling trips are granted through a CUA. Group size is limited to 14 with a minimum of one guide to six clients. The majority of commercial bicycling occurs on paved roads in developed areas outside backcountry. Some commercial bicycling does occur in backcountry including the road to Point Sublime. Under Alternative A, no changes would occur.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial backcountry vehicle tours are currently allowed only at Tuweep and are granted through a CUA. Up to six CUAs exist, and each holder is allowed to conduct two trips per day, Monday through Friday, and one trip per day Saturday and Sunday. Each trip is limited to one vehicle with no overlap trips from the same company. The vehicle used is limited to 15 passengers or less, and 22-feet in length or less. Under Alternative A, no changes would occur.

Commercial Filming

NPS Management Policies (2006) include guidance on commercial filming in national parks, and Grand Canyon has a general policy (http://www.nps.gov/grca/learn/management/upload/grca_filming_guidelines.pdf). However, the park does not have a policy that focuses on backcountry commercial filming. Under Alternative A, no changes would occur.

Maximum Group Size Overnight Backpacking by Zone

Maximum overnight backpacking group size limit for Corridor, Threshold, Primitive, and Wild Zones is 11 persons (private or commercial). Use limits are described in terms of small groups (1-6 persons) or large groups (7-11 persons) for each Use Area. The number of small and large groups for each Use Area is based on management zone objectives and destination camp capacity (see Table 2.14d). Under Alternative A, no changes would occur.

Backcountry Roads, Trails, and Routes

Currently, Grand Canyon's Inner Canyon and rim classified backcountry trails total approximately 358 miles (Appendix C). Since 1993, former fire and ranch roads have been closed in the park's Wilderness to comply with the 1993 Final Wilderness Recommendation. Visitors use many of these former roads as unmaintained hiking routes and, while some have become overgrown and are no longer detectable, all are managed in accordance with the Superintendent's Compendium (NPS 2013g). Under Alternative A, no changes would occur and unmaintained routes for hiker access would continue to be managed as untrailed areas to allow former roadbeds to recover.

South Rim

- Routes (Map 2.1)
  - Eremita Mesa (1.8 miles): would remain unmaintained hiking route in Wilderness
  - Cape Solitude (12.4 miles): would remain unmaintained hiking route in Wilderness
  - Boundary Road (14.1 miles): would remain unmaintained hiking route open to occasional emergency vehicle access. Boundary Road is outside Wilderness and extends from Waldron Trailhead to Pasture Wash
- Roads (Map 2.4a)
  - Pasture Wash Access: Visitors currently access Pasture Wash (South Bass Trailhead Road, Havasupai Point Road, and rim campsites) on roads through USFS and Havasupai Tribal lands. The Havasupai Tribe charges fees for access through the reservation. In Alternative A, Pasture Wash access would remain unchanged

North Rim

- Routes (Map 2.1)
  - Walhalla Glades, and Tiyo, Francois Matthes, Komo Points: would remain unmaintained hiking routes in Wilderness

- Roads (Map 2.4b)
  - The Basin Road (Point Sublime), Kanabownits, and Swamp and Fire Points Roads: would remain open to vehicles, stock, bicycles, and hikers

Kanab Plateau

- Roads (Map 2.4c)
  - Kanab, SB Point, 150 Mile Canyon, and Schmutz Roads: would remain open to vehicles, stock, bicycles, and hikers

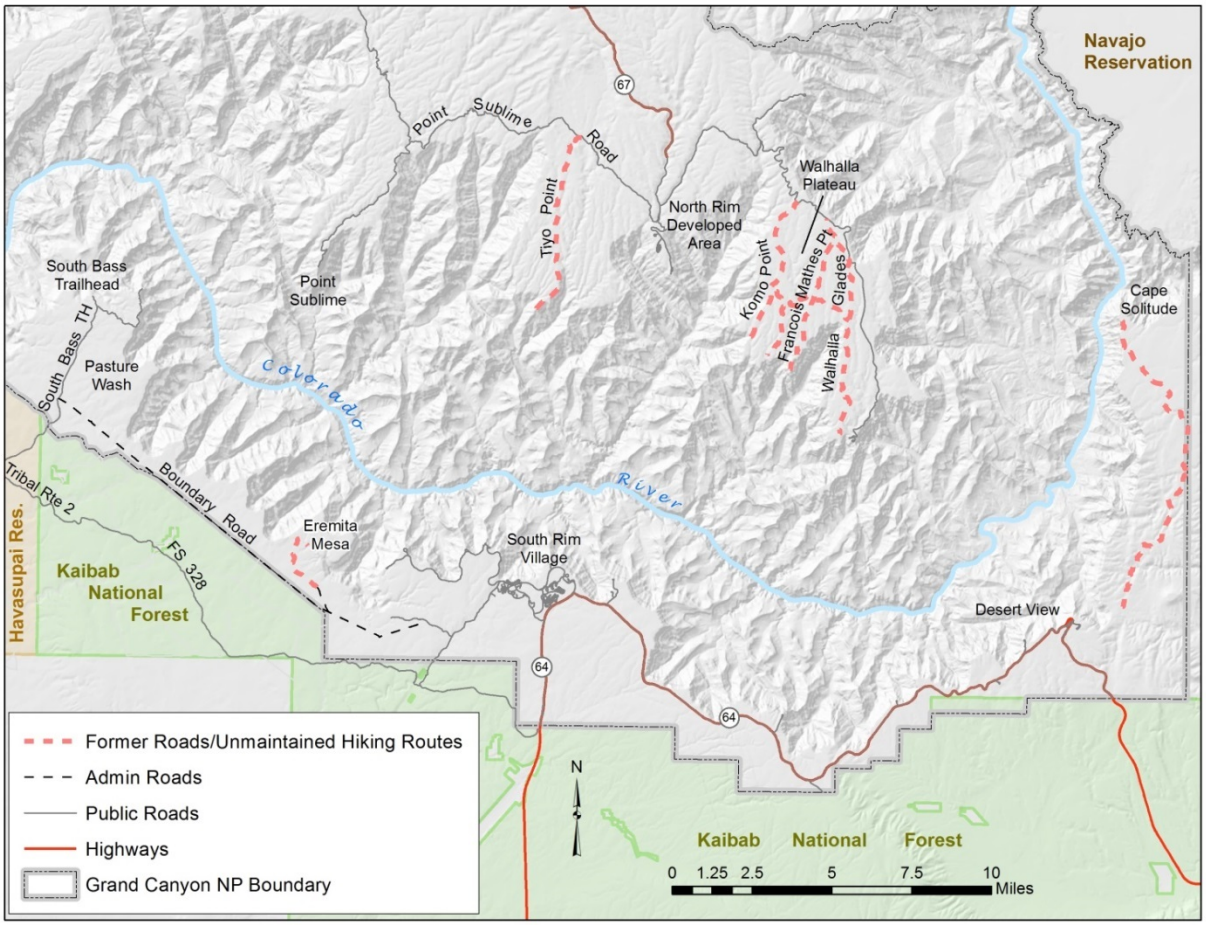
Tuweep

- Roads (Map 2.2)
  - Toroweap and Vulcans Throne Roads would remain open to vehicles, bicycles, and hikers

Inner Canyon

- Trails
  - Would continue to be maintained to differing standards based on use level and classification (see Appendix C)

Map 2.1 Backcountry Roads, Trails, and Routes addressed in Alternatives

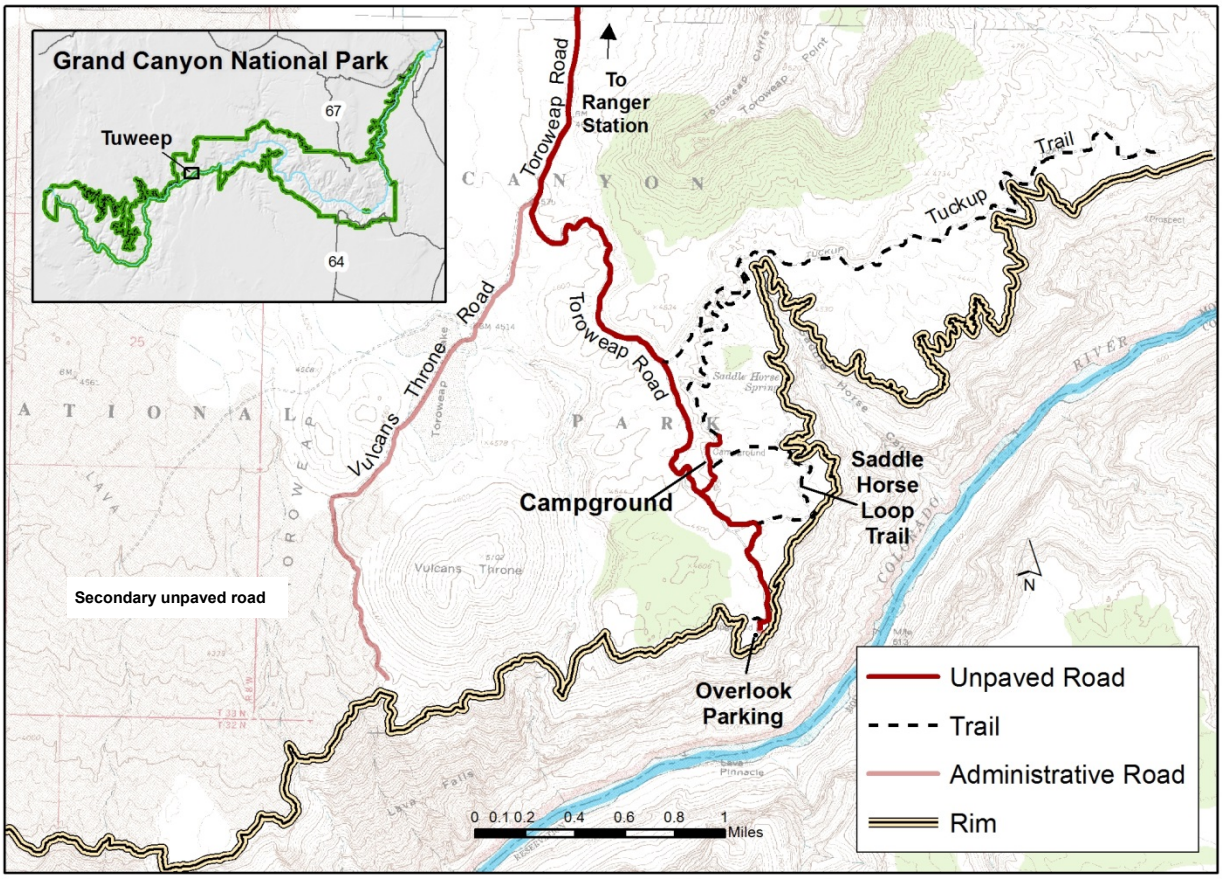


Tuweep Facilities

Tuweep is a road-accessible primitive area with a large day use area and small campground (Map 2.2). Tuweep Campground is limited to ten groups: 9 small groups (maximum 6 people and 2 vehicles) and 1 large group (maximum 11 people and 4 vehicles).

Although the 1995 GMP called for removal and relocation of parking and a composting toilet from the Overlook to the campground, the actions were never implemented. Under Alternative A, Tuweep facilities and overnight use limits would remain unchanged.

Map 2.2 Current Tuweep Facilities



Corridor Zone Camping

Corridor Zone camping is available in three campgrounds

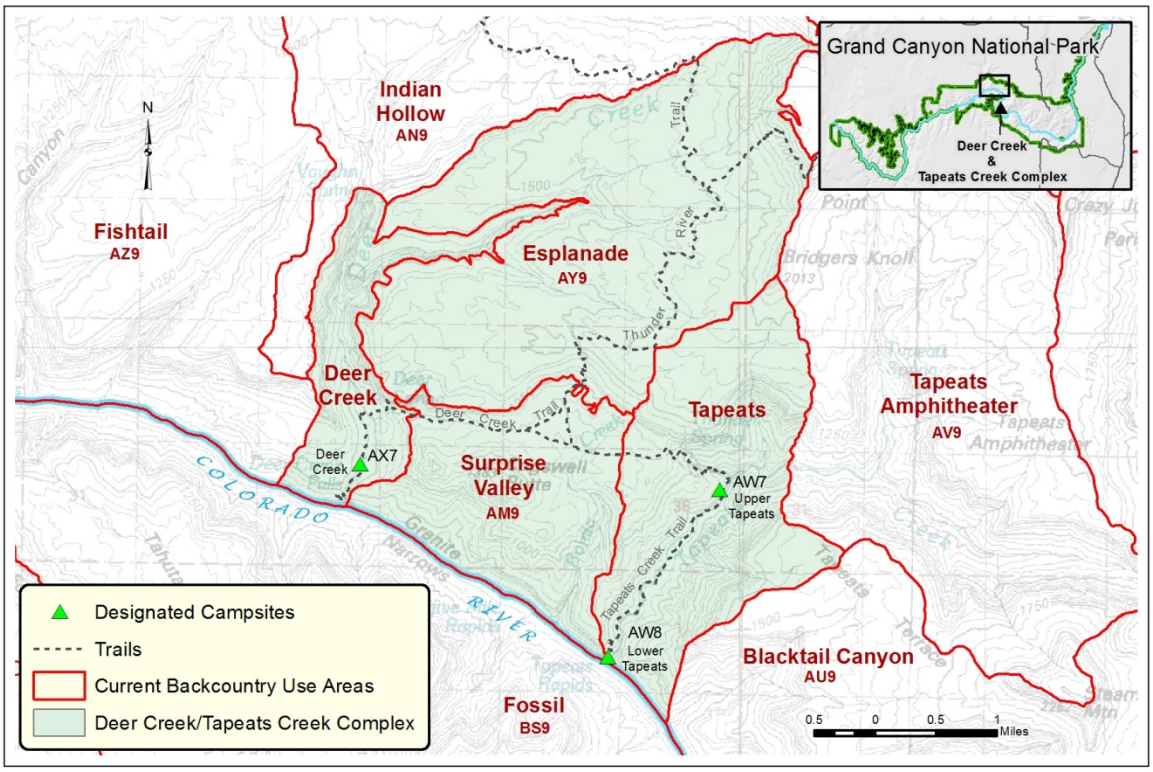
- Indian Garden along Bright Angel Trail has l large and 15 small campsites
- Bright Angel Campground at Phantom Ranch has 2 large and 31 small campsites
- Cottonwood Campground along North Kaibab Trail has 1 large and 11 small campsites

Corridor Zone campground locations and limits would remain as current. Day use only (no camping) at Roaring Springs along North Kaibab Trail. Under Alternative A, no changes would occur.

Deer Creek/Tapeats Creek Complex

Deer Creek/Tapeats Creek Complex (Map 2.3), approximately 33 miles northwest of Grand Canyon Village on the north side of the Colorado River, includes Esplanade (AY9), Surprise Valley (AM9), Deer Creek (AX7), and Tapeats (AW9) Use Areas. Total number of groups per night allowed in the complex is 12. Deer Creek/Tapeats Creek Complex Use Areas would remain unchanged.

Map 2.3 Current Deer Creek/Tapeats Creek Complex



Deer Creek Narrows

In accordance with the Superintendent's Compendium (NPS 2013g), "climbing or rappelling (ascending or descending) in Deer Creek Narrows, with or without the use of ropes or other technical equipment, is prohibited." This restriction extends from the southeast end of the ledges known as the Patio to the base of Deer Creek Falls. This closure was implemented for cultural resource protection in Deer Creek drainage. Under Alternative A, the closure would continue to be reviewed annually as part of the Superintendent's Compendium.

Hance Creek, Cottonwood Creek, and Cremation Use Areas

Hance Creek Use Area (BE9) (Primitive Zone) has use limits of two small and one large group per night. Camping is at-large; however, most campsites are concentrated near Hance Creek. Cottonwood Creek Use Area (BG9) (Primitive Zone) has use limits of two small and one large group per night. Camping is at-large, and most campsites are adjacent to Cottonwood Creek. Hance and Cottonwood Use Areas surround Horseshoe Mesa Use Area (BF9) (Threshold Zone), accessible by Grandview Trail (3 miles). From Horseshoe Mesa, backpackers may access Hance Creek to the east in an additional 1.9 miles or Cottonwood Creek to the west in an additional 1.5 miles. Hance Creek and Cottonwood Creek Use Areas

adjoin along Tonto Trail. Backpackers often create itineraries that include travel through these Use Areas and beyond.

Cremation Use Area (BJ9) (Primitive Zone) allows two small and one large group per night. Cremation is adjacent to the Corridor Zone and accessible along Tonto Trail to the west of Tipoff on South Kaibab Trail. Camping is at-large and many Corridor Zone hikes include this Use Area in the trip itinerary. Under Alternative A, no changes would occur

Common to All Action Alternatives

Backcountry Management Zones

Existing management zones (Corridor, Threshold, Primitive, and Wild) described in Alternative A would be retained under all action alternatives.

This plan/DEIS proposes two new backcountry management zones in addition to those covered in Alternative A: the Road Natural Zone and River Zone. Each proposed zone recognizes unique recreation opportunities (e.g., rim camping, river running) and actions required to protect resources and manage visitor use.

Three of the four backcountry management zones implemented by the 1988 BCMP (Threshold, Primitive, and Wild) are within Wilderness; the Corridor Zone is in non-wilderness (Table 2.1). A large portion of the Colorado River corridor is also included in Wilderness.

Table 2.1 Backcountry Management Zones and Wilderness

Zone		Implemented
Corridor	Non-wilderness Backcountry	1988 BCMP
Proposed Road Natural	Non-wilderness Backcountry	Proposed by this plan/DEIS
Threshold	Wilderness Backcountry	1988 BCMP
Primitive		
Wild		
Proposed River	Wilderness Backcountry	Proposed by this plan/DEIS

Proposed Road Natural Zone

The proposed Road Natural Zone would apply to approximately 75 miles of primitive road in 300-foot-wide non-wilderness corridors that provide access to remote trailheads, rim campsites, and scenic overlooks on North and South Rim (Map 2.4). The proposed Road Natural Zone would recognize road-accessible backcountry as an experience different from trail-accessible (Inner Canyon) backcountry. Resource management in the proposed Road Natural Zone would also differ from other backcountry management zones.

The proposed Road Natural Zone would prescribe vehicle numbers and size (22-foot combined limit) to protect resources adjacent to roads and at destination areas. Prescribed maximum overnight group size and vehicle numbers would be as shown in Table 2.2. Day use groups traveling together would be limited to 11 people and four vehicles (cars, jeeps, motorcycles, etc.) ***except*** as prescribed in Table 2.2. All overnight use requires a backcountry permit.

Table 2.2 lists designated campsites by Use Area in the proposed Road Natural Zone.

Table 2.2 Proposed Road Natural Zone Designated Campsite Limits by Use Area Common to All Action Alternatives (B, C, and D)

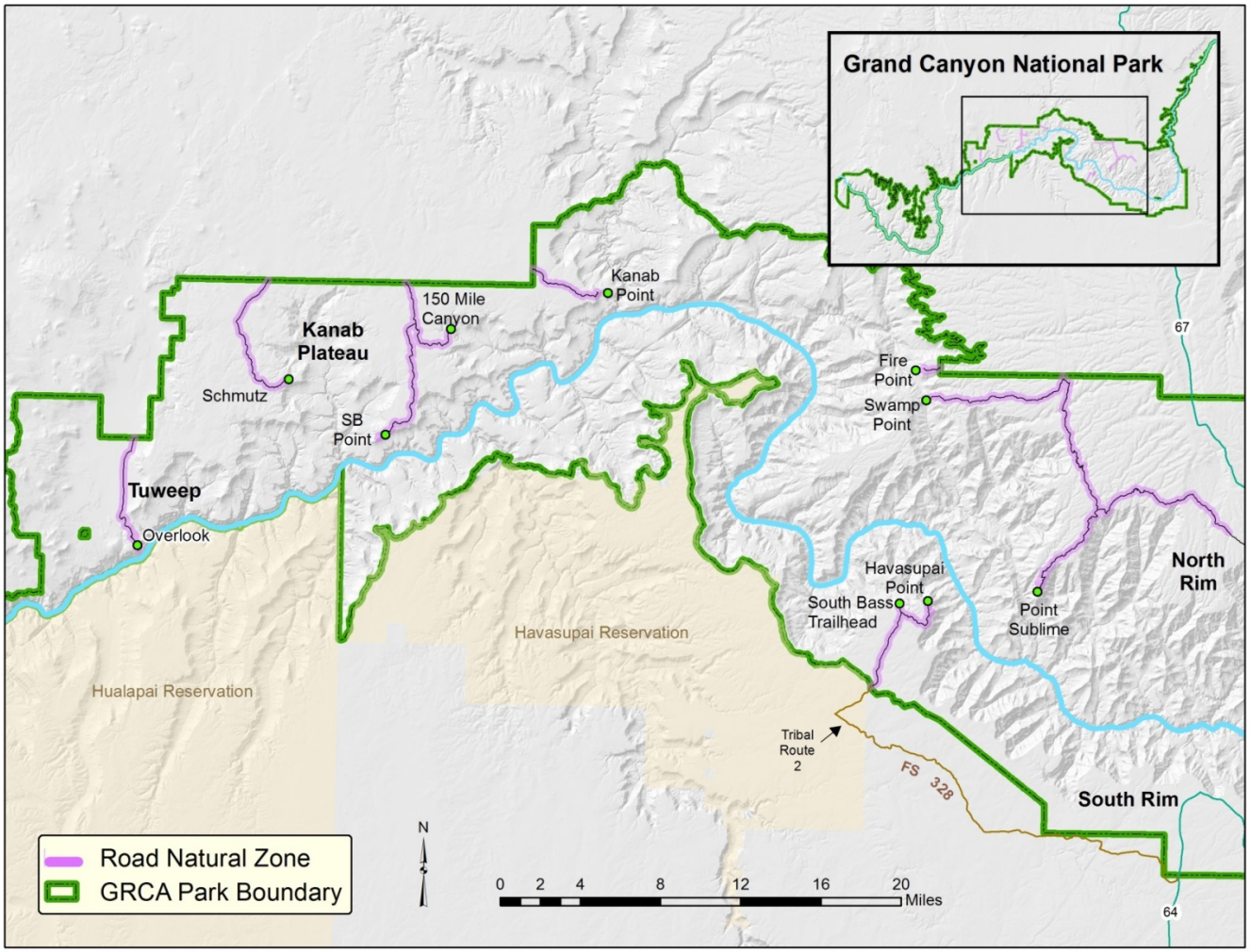
Use Area and Designated Campsite		Maximum Number*	
		People Overnight (Site)	Vehicle Capacity**
South Rim (Map 2.4a)			
SE1	Signal Hill	6 (1 small)	2
SE2	Ruby Point	6 (1 small)	1
--	Havasupai Point (day use only)	n/a	3
SE3	South Bass Trailhead	12 (2 small)	6
North Rim (Map 2.4b)			
NH1	Point Sublime	12 (2 small)	6
NJ1	Fire Point	12 (2 small)	6
NJ2	Swamp Point	12 (2 small)	6
Kanab Plateau (Map 2.4c)			
NK1	Kanab Point	12 (2 small)	6
NK2	SB Point	6 (1 small)	2
NK3	150 Mile Canyon	6 (1 small)	2
NL1	Schmutz	6 (1 small)	4
Tuweep (Map 2.4d)			
Tuweep Campground***		65 (1 large site + 9 small sites)	22 (4/large site + 2/small site)

* numbers are based on the area's capacity to accommodate people and vehicles without causing damage to resources

** maximum vehicle number the site can accommodate at one time, including day use

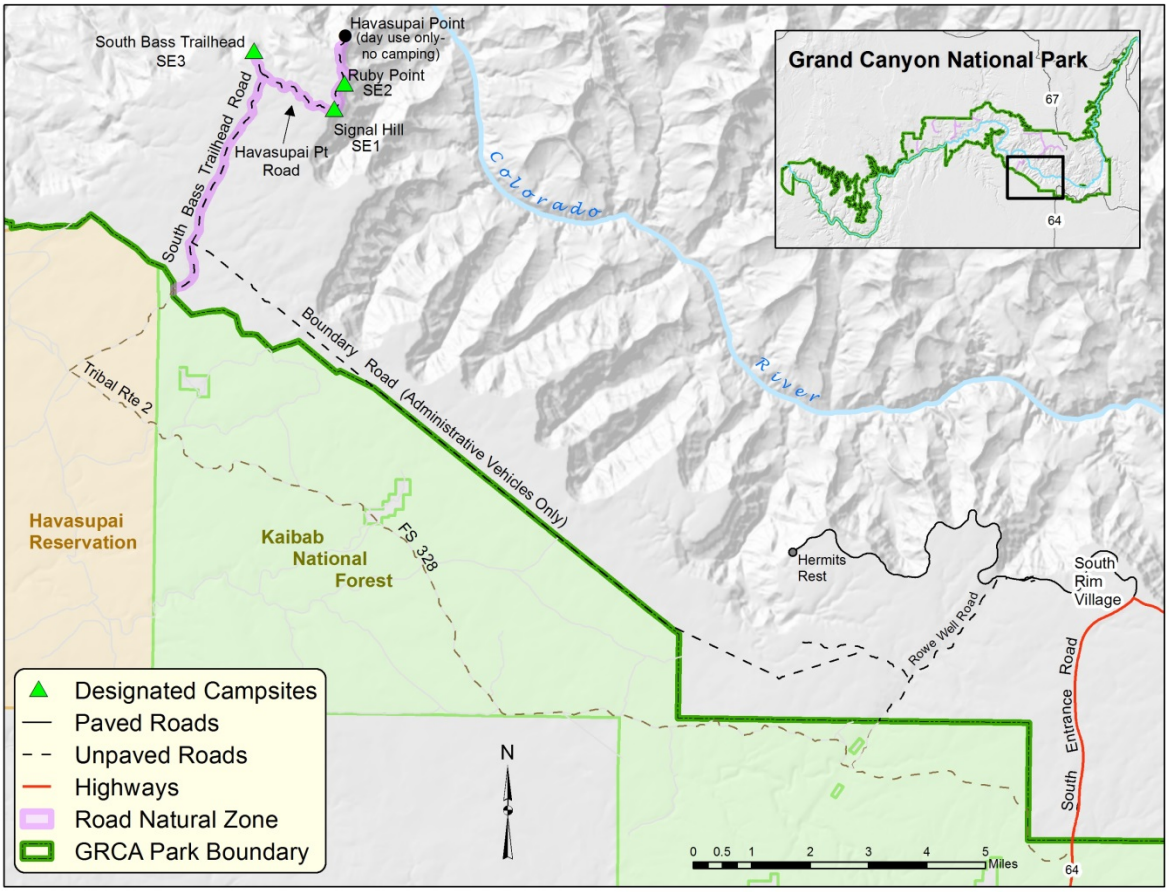
*** same as current

Map 2.4 Proposed Road Natural Zones



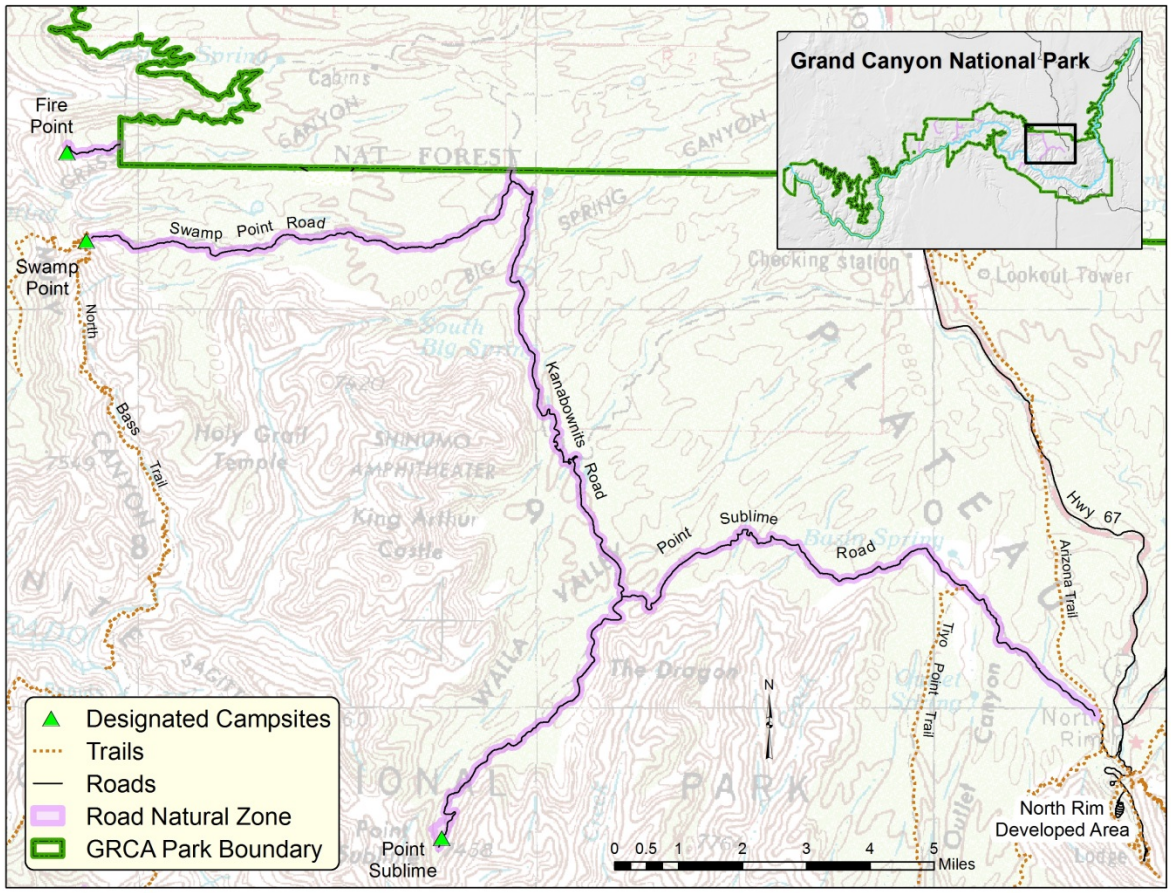
Proposed Road Natural Zone South Rim (Map 2.4a) would include roads and designated campsites in the Pasture Wash area including South Bass Trailhead and Havasupai Point. Access to South Bass Trailhead Road differs by action alternative (Summary Table 2.14c). The proposed Road Natural Zone (shown in pink) would prescribe vehicle length (22-feet overall), maximum overnight group size, and vehicle numbers as in Table 2.2.

Map 2.4a Proposed Road Natural Zone – South Rim



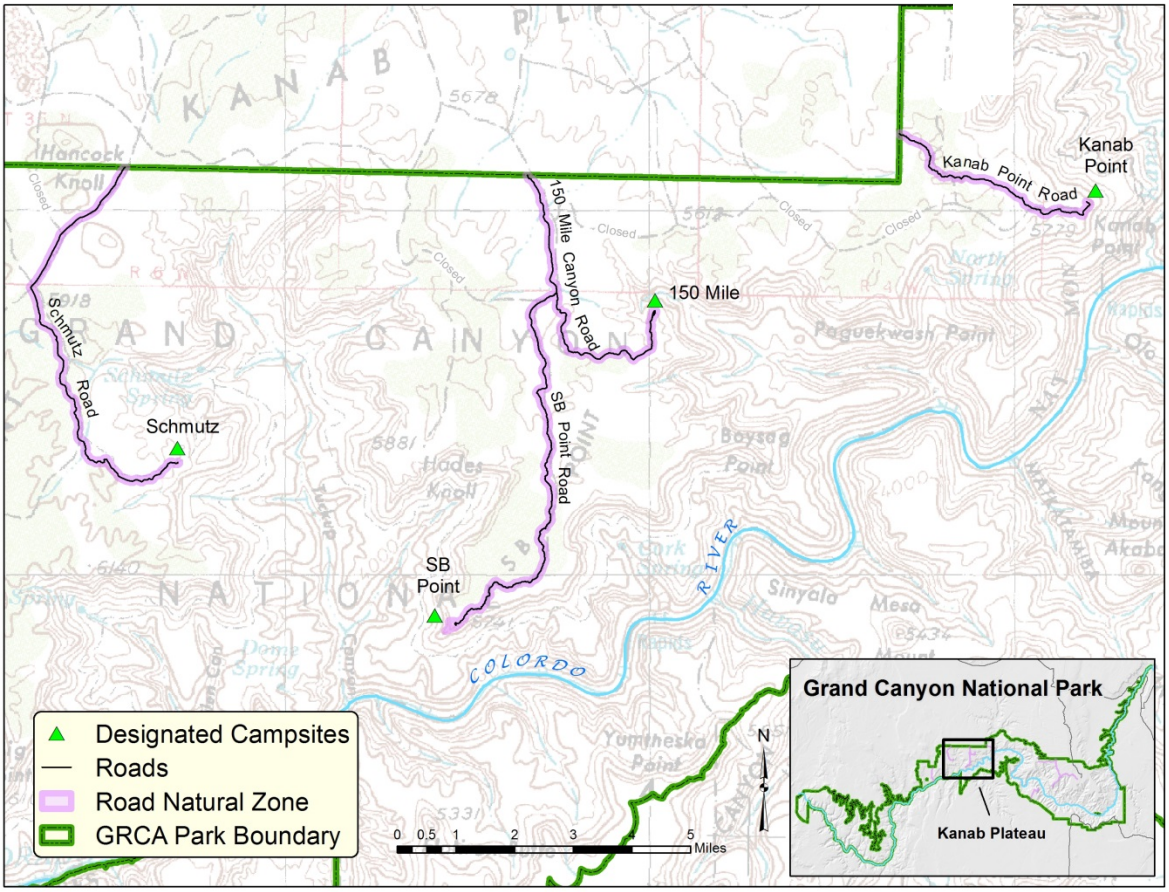
Proposed Road Natural Zone North Rim (Map 2.4b) would include primitive roads to Swamp Point/North Bass Trailhead, Fire Point, and Point Sublime that provide access to at-large Wilderness Use Areas in North Rim's forest. The proposed Road Natural Zone (shown in pink) would prescribe vehicle length (22-feet overall), maximum overnight group size, and vehicle numbers as in Table 2.2.

Map 2.4b Proposed Road Natural Zone – North Rim



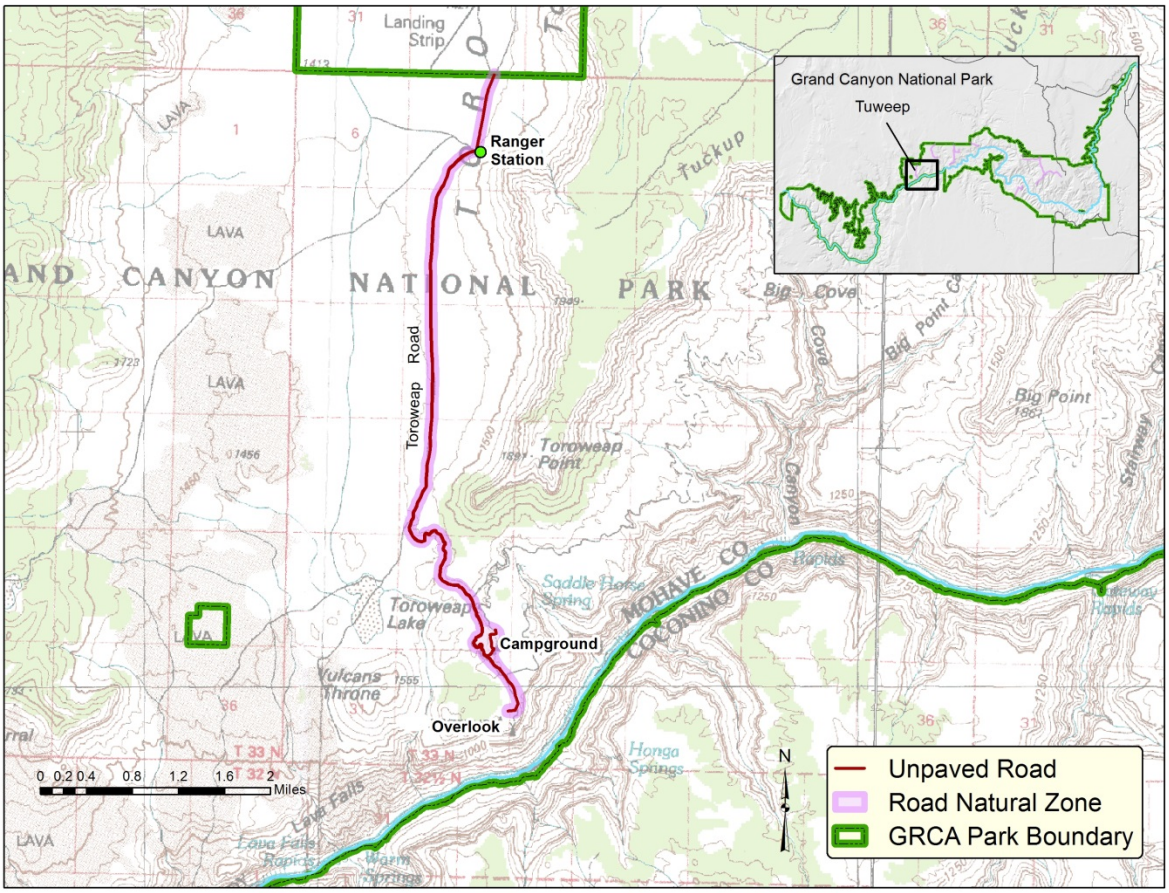
Proposed Road Natural Zone Kanab Plateau (Map 2.4c) would include unmaintained dirt roads to Kanab Point, 150 Mile Canyon, SB Point, and Schmutz. The proposed Road Natural Zone (shown in pink) would prescribe vehicle length (22-feet overall), maximum overnight group size, and vehicle numbers as in Table 2.2.

Map 2.4c Proposed Road Natural Zone – Kanab Plateau



Proposed Road Natural Zone Tuweep (Map 2.4d) would include roads and designated campsites in the Tuweep road-accessible primitive area including Toroweap Road. As of August 2014, under a Categorical Exclusion (2014), Tuweep area management will be made consistent with all backcountry areas; thus, backcountry permits will be required for campground stays, and campfires will be prohibited (Table 1.1). The proposed Road Natural Zone (shown in pink) would prescribe maximum overnight group size, vehicle numbers as in Table 2.2, and would continue to prescribe vehicle length (22-feet overall).

Map 2.4d Proposed Road Natural Zone – Tuweep

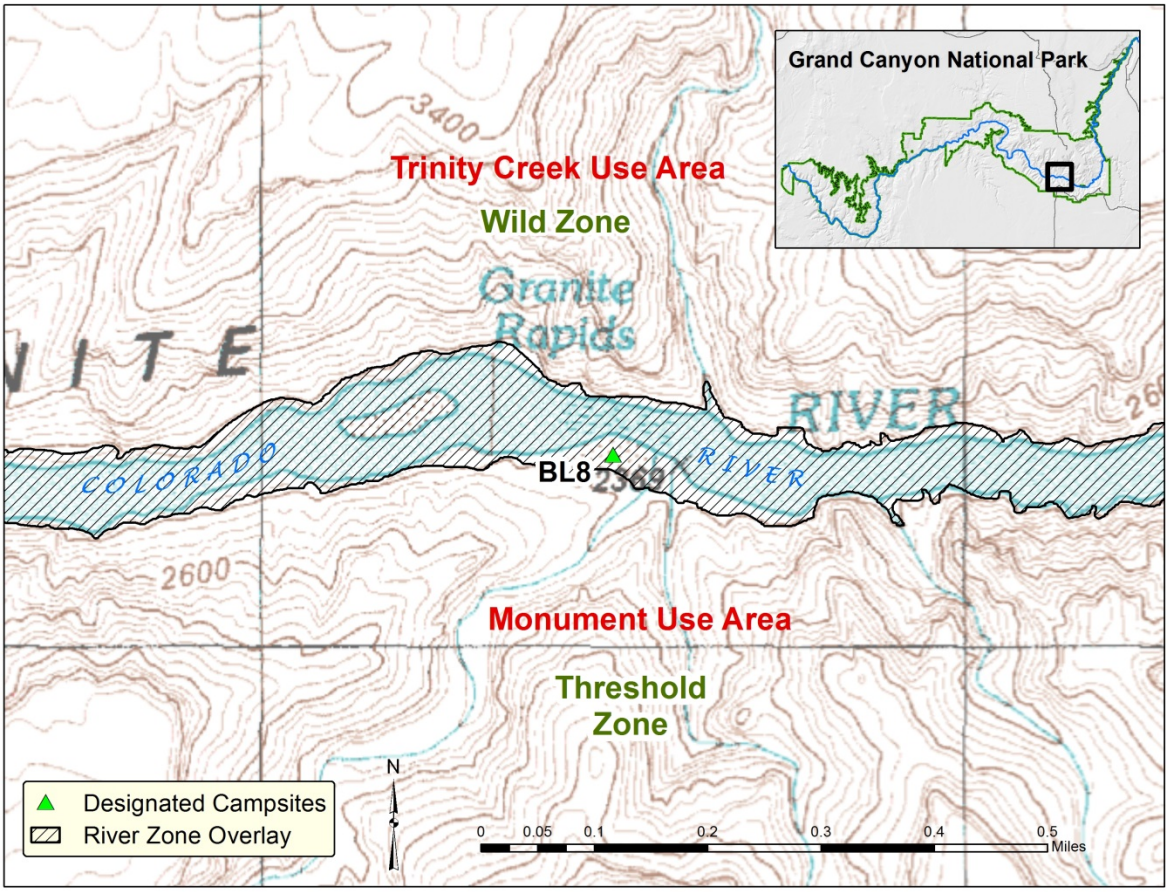


Proposed River Zone

Along the Colorado River, Grand Canyon's backcountry, Wilderness, and river policies overlap. The 2006 Colorado River Management Plan identified a River Zone along the river corridor from Lees Ferry (RM 0) to Lake Mead, and includes the pre-dam high water zone. This plan/DEIS proposes to adopt the CRMP River Zone as an element of backcountry management. The proposed River Zone would retain existing Wilderness and non-wilderness areas; Corridor, Threshold, Primitive, and Wild Zones; and Use Areas along the Colorado River corridor for its 270-mile length within the park. The proposed River Zone recognizes and acknowledges resources and visitor use differ from other remote backcountry areas: for example, users who hike many miles in undeveloped areas with low encounter rates could, when entering the still-remote River Zone, be confronted with more developed conditions and high encounter rates. Proposed River Zone resource management standards also differ from other remote backcountry management zones due to the upstream presence and influence of Glen Canyon Dam 15 miles upstream of the park's boundary.

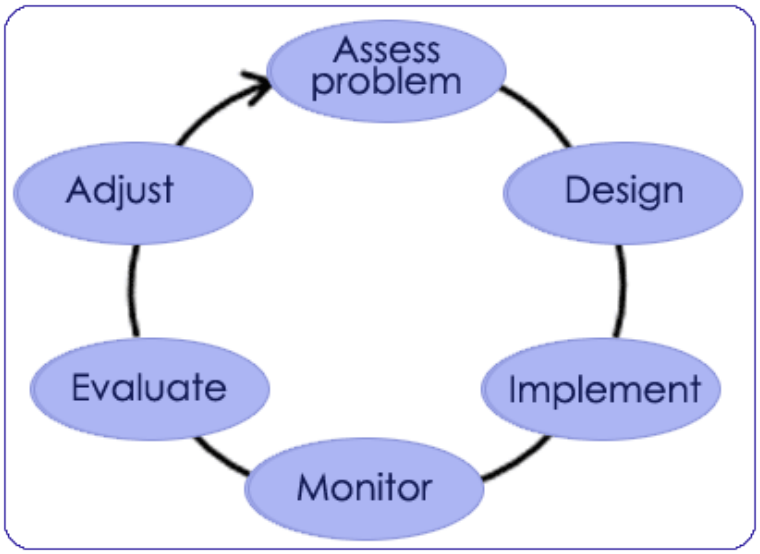
Because showing the proposed River Zone in its entirety on a single map would be difficult, a section is shown on Map 2.5 *as an example*.

Map 2.5 Proposed River Zone



Adaptive Management

Figure 2.1 Adaptive Management



From: *Adaptive Management: The U.S. Department of the Interior Technical Guide*. 2009. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Adaptive management is a decision process that promotes flexible decision making in the face of uncertainties as management outcomes from actions and other events become better understood. Careful monitoring of outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management does not represent an end in itself, but is rather a means to more effective decisions and enhanced benefits for park resources and visitor experiences (USDOI 2009).

In recognizing increasing demand for recreational access and uncertainty of how different recreational uses impact park resources, the BCMP proposes to implement an adaptive management process (Figure 2.1) that provides management flexibility to achieve desired resource conditions while providing opportunities for a range of visitor experiences. The adaptive management process requires a commitment to monitoring resources and visitor use levels to determine how conditions change as a result of management actions. Climate change would also be considered in adaptive management when evaluating resource conditions to guide adaptive management actions.

The adaptive management process would be guided by desired conditions, management objectives, indicators, and standards for resource protection and visitor experience. Appendix B outlines how the changes in resource conditions or visitor use would trigger additional actions under the adaptive management process. In Appendix B, tables provide guidance on how decisions will be made using adaptive management for Extended Day Hiking and Running (Table B.1), Canyoneering and Climbing (Table B.2), Tuweep Day Use (Table B.3), Use Area Management (Table B.4), and Human Waste Management (Table B.5). Each table includes management objectives for resource conditions and each of these objectives can be measured using an indicator and standard. If standards are exceeded, for example with water quality if there is an accumulation of litter or food waste in a water source, the park may take action to educate visitors of backcountry and Leave No Trace etiquette. If the standard continues to be exceeded (litter and food waste continues to accumulate), the park may take another action to reduce the number of users in the area where the water source is being impacted.

Adaptive management actions identified in the following section describe activities that would be implemented on approval of the Backcountry Management Plan and management actions that would be implemented if existing management actions do not adequately address resource impacts, visitor conflicts, or other issues (Management Actions Potentially Implemented through Adaptive Management). Additional management actions may be implemented, but may require additional NEPA compliance and public communication. Those actions that would definitely require additional NEPA are identified throughout the chapter.

Climbing Management

Director's Order 41 defines climbing to include rock climbing, snow and ice climbing, mountaineering, canyoneering, and caving where climbing equipment, such as ropes and fixed or removable anchors, is generally used to support an ascent or descent.

DO 41 states, "The NPS recognizes that climbing is a legitimate and appropriate use of wilderness. However, any climbing use or related activity must be restricted or prohibited when its occurrence, continuation or expansion would result in unacceptable impacts to park resources or wilderness character, or interfere significantly with the experience of other park visitors. The establishment of bolt-intensive face climbs, commonly known as sport climbs, is considered incompatible with Wilderness due to concentrated human activity, and the types and levels of impacts that may be associated with climbing routes." Grand Canyon does not currently have a park-specific climbing management plan or anchor policy. Climbing is not identified on backcountry permits. Under all action alternatives (B, C, and D), climbing management actions in Table 2.3 would occur as described.

Table 2.3 Climbing Management Actions

Implemented on BCMP Adoption
• authorization required for placement of new fixed anchors or equipment, and replacement or removal of existing fixed anchors or equipment • activity and route identified on overnight backcountry permits for information purposes • monitor climbing use and resource impacts through backcountry permit process and field surveys • no motorized drills in Wilderness • minimum impact climbing education including implementation of Clean Climbing techniques involving removable equipment and anchors, such as slings, that can be placed and removed without altering environment
Potential Adaptive Management

• climbing day use permit identifies route
• use limits for specific locations such as or including
  ▪ restrict number of groups by day or season (overnight and day use)
  ▪ change maximum group size (decrease or increase)
  ▪ seasonal or permanent restrictions for natural and/or cultural resource protection at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
• develop Climbing Management Plan (additional NEPA would be needed)

Canyoneering Management

Canyoneering is defined as traveling in canyons, using a variety of techniques that may include walking, wading, scrambling, climbing, jumping, rappelling, and swimming. Non-technical canyoneering is travel through a canyon using non-technical methods, such as walking or scrambling, without use of ropes and harnesses.

For purposes of this plan/DEIS, canyoneering is considered technical canyoneering and is defined as descent or ascent of a canyon by climbing, rappelling, building anchors, or other rope work like technical climbing or down-climbing (placing protection or using rope for belay) while wearing a harness. Similar to climbing, the NPS recognizes canyoneering is a legitimate and appropriate Wilderness use. However, any canyoneering or related activity must be restricted or prohibited when its occurrence, continuation, or expansion would result in unacceptable impacts to park resources or wilderness character, or interfere significantly with the experience of other park visitors. Establishment of bolt-intensive routes is considered incompatible with Wilderness due to concentrated human activity and the types and levels of impacts that may be associated with these routes. Grand Canyon does not currently have a park-specific canyoneering policy, nor is canyoneering identified on overnight backcountry permits. Under all action alternatives (B, C, and D), management actions in Table 2.4 would occur as described.

Table 2.4 Canyoneering Management Actions

Implemented on BCMP Adoption
• authorization required for placement of new fixed anchors or equipment, and replacement or removal of existing fixed anchors or equipment • activity and canyoneering route identified on overnight backcountry permits (for information purposes) • monitor canyoneering use and resource impacts through overnight backcountry permit process and field surveys • no motorized drills in Wilderness • maximum group size: six • implementation of minimum impact canyoneering education, clean canyoneering techniques, and removable equipment and anchors such as slings that can be placed and removed without altering the environment
Potential Adaptive Management

• canyoneering day use permit identifying route
• use limits for specific locations such as or including
  ▪ restrict number of groups by day or season (overnight and day use)
  ▪ change maximum group size (decrease or increase)
  ▪ seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites
• develop Canyoneering Management Plan (additional NEPA would be needed)

Extended Day Hiking and Running Management

Under all action alternatives, day use permits would be required seasonally for areas shown in Table 2.5 and Map 2.6. The expected cost of the day use permit is at least $5 per person per day. The initial actions proposed in this plan/DEIS also include increased outreach and user education, and user monitoring and data gathering. Under all action alternatives, management actions in Table 2.6 would occur as described.

Table 2.5 Extended Day Hiking and Running Permit Area [‡]

Leaving from	On	Traveling Beyond
South Rim	Bright Angel Trail	Tonto East Trail Junction (Mile 5.0)
South Rim	South Kaibab Trail	Tip-Off (Tonto Platform) (Mile 4.5)
North Rim	North Kaibab Trail	Manzanita Resthouse (Mile 5.4)

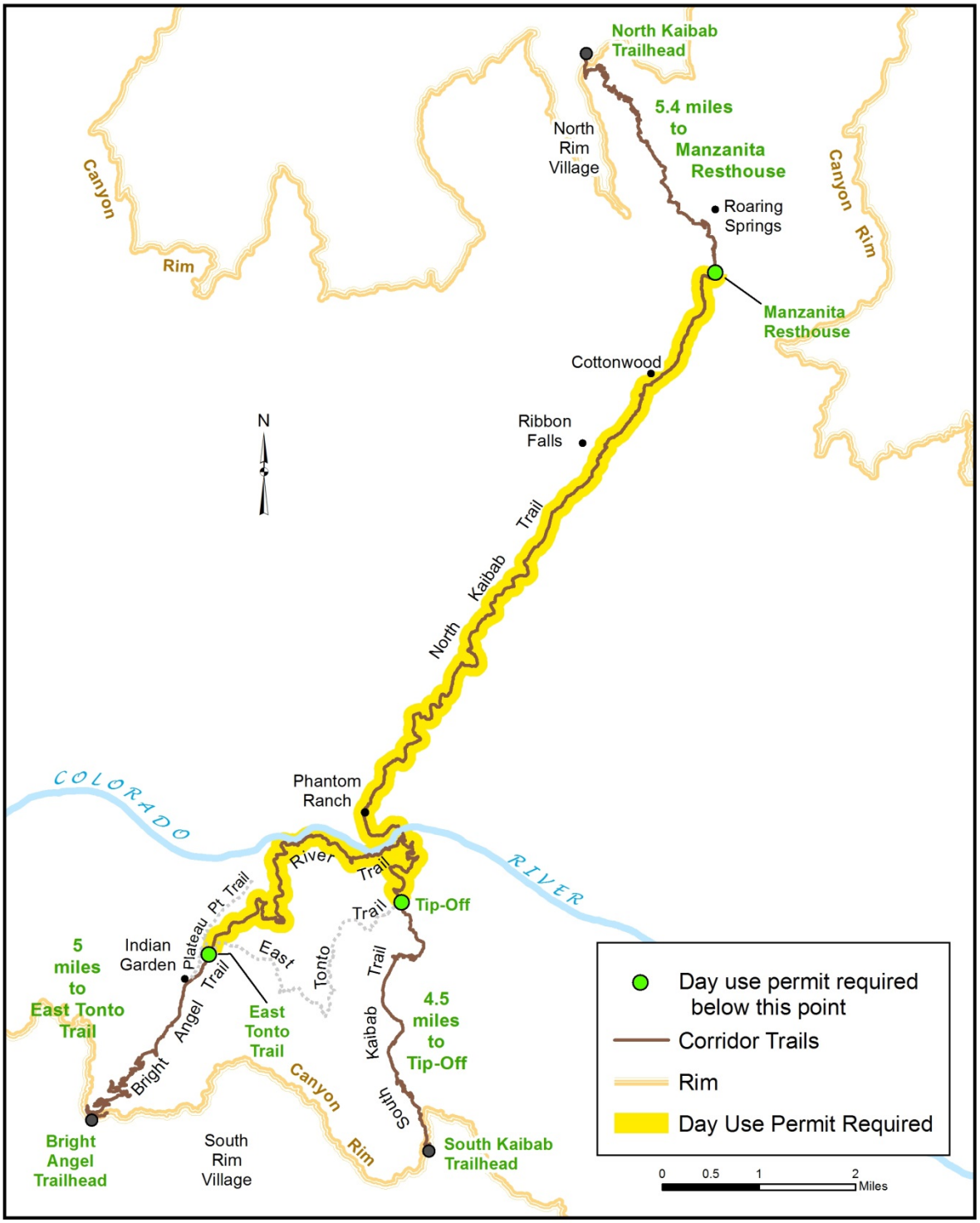
[‡]See Map 2.6

Table 2.6 Extended Day Hiking and Running Management Actions

Implemented on BCMP Adoption
• Day use permits required seasonally for areas shown in Table 2.5 and Map 2.6 • Expected cost of day use permit at least $5 per person per day • Outreach and user education • User monitoring and data gathering • Protocols for Special Use Permits
Potential Adaptive Management

• For area in Table 2.5 and Map 2.6
  ▪ Implement group size limits (e.g., 30); adjust limits as research determines
  ▪ Daily use limits (e.g., 250); adjust limits as research determines
  ▪ Designated days for group or individual events
  ▪ Day use permits required year-round
• Policy for other trails

Map 2.6 Extended Day Hiking and Running Permit Area



Tuweep Day Use Management

Tuweep is a unique, road-accessible primitive area on western Grand Canyon's north side and, with the exception of overnight campground use by backcountry reservation, is day use only (i.e., sunrise to 30 minutes after sunset). Grand Canyon's 1995 GMP established Tuweep day use limits at a maximum 30 vehicles or 85 visitors at one time to meet the GMP goal of providing an "uncrowded and primitive experience" at Tuweep. This day use limit includes visitors at Toroweap Overlook and Campground, in the Vulcans Throne area, and on local trails. Regardless of the alternative chosen, NPS plans to implement data collection efforts to document visitor use in the Tuweep and Kanab Plateau area and implement the GMP management goal.

Under all action alternatives (B, C, and D), management actions in Table 2.7 would occur as described.

Table 2.7 Tuweep Day Use Management Actions

Implemented on BCMP Adoption

• limits on commercial services
  ▪ no more than one stock trip per day
  ▪ vehicle tours limited by individual action alternative
• Tuweep visitor day use information and education
  ▪ information sources may include roadside signs and local and existing regional visitor centers

Potential Adaptive Management
• Tuweep day use permit or reservation system • limits for vehicle number per party • designated days for group events

Use Area Management

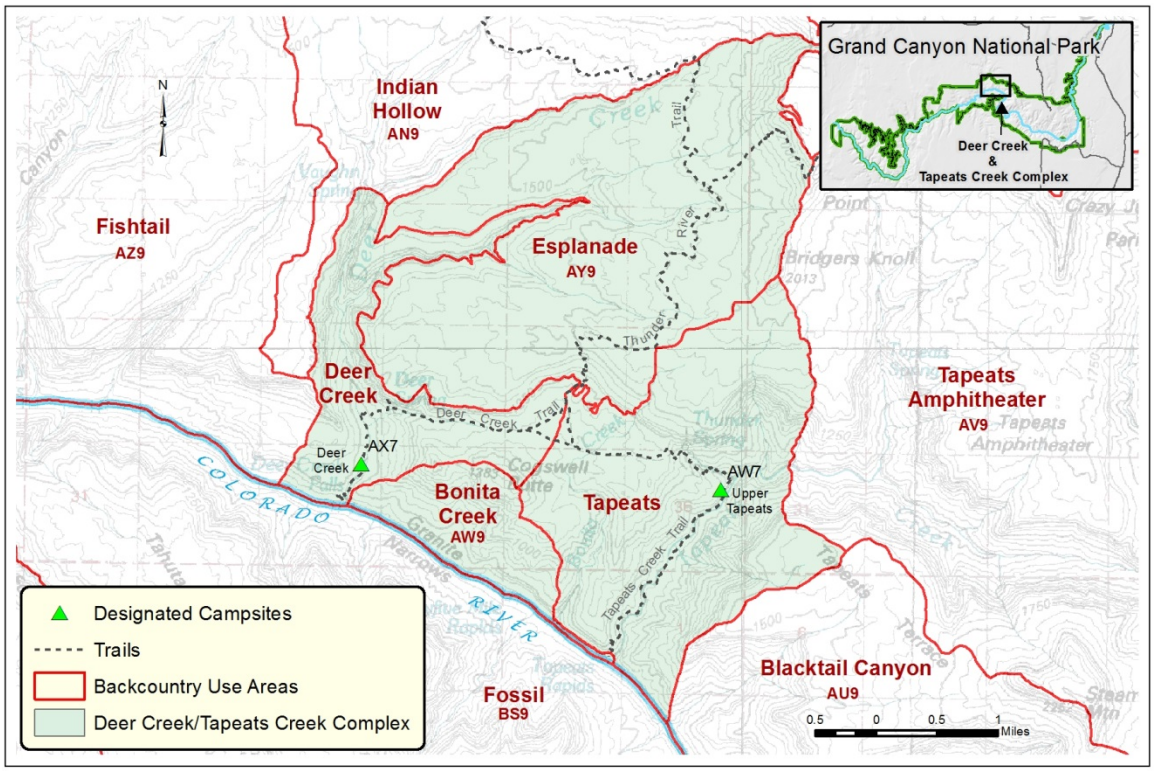
The NPS has identified specific Use Areas where additional management actions are needed to improve resource health while allowing continued backcountry use. Examples include Hermit Use Area (BM7) where illegal camping occurs outside the designated camping area, Granite Rapids Use Area (BL8) where resource impact levels are exceeded, and Deer Creek/Tapeats Creek Complex where use limits and an resource impact levels are commonly exceeded due to off-itinerary camping.

Current Use Area boundaries in the Deer Creek/Tapeats Creek Complex (Map 2.3) would be redefined to address crowding at designated campsites and associated impacts to cultural and natural resources (Map 2.7). These Use Areas have become popular due in part to reliable water sources in Deer Creek and Tapeats. The Complex would include the current Esplanade (AY9) Use Area, modified Deer Creek (AX7) and Tapeats (AW7) Use Areas, and the newly created Bonita Creek (AW9) Use Area (Table 2.8a). Surprise Valley (AM9) Use Area would be eliminated, and its northern half split between Deer Creek and Tapeats Use Areas to disperse use between Deer and Tapeats Creeks. Camping in designated campsites would continue to be required along Deer (AX7) and Tapeats Creeks (AW7), and at-large camping would be allowed in the former Surprise Valley area of both Use Areas. The southern half of Surprise Valley Use Area would become Bonita Creek Use Area, an at-large Use Area which would also encompass Tapeats Creek delta and routes along the Colorado River to disperse use along routes between Tapeats and Deer Creeks.

This plan/DEIS proposes specific management actions to address resource impacts and analyzes potential management actions to allow NPS managers flexibility in addressing resource and visitor experience impacts that may arise. Examples of resource impacts include trampling archaeological sites, soil compaction, cutting or crushing vegetation, high density of human waste and associated catholes, disturbing wildlife during breeding season or at watering holes, etc. Managers may institute changes in

Use Area boundaries, use limits, camping designations, and permanent or seasonal closures to prevent resource degradation. Under all action alternatives (B, C, and D), management actions described in Table 2.8 would occur as described.

Map 2.7 Proposed Deer Creek/Tapeats Creek Complex*



*For current condition, see Map 2.3

Table 2.8a Proposed Deer Creek/Tapeats Creek Complex Use Area Changes

Use Area Name and Code	Camping	Change	Reason
Deer Creek (AX7)	Designated and at-large	East boundary moved to encompass west side Surprise Valley (AM9)	Current use levels combined with off-itinerary hikes results in crowding at Deer and Tapeats Creek campsites; use limits are exceeded at designated sites resulting in undesirable resource impacts. Proposed changes will reduce crowding and improve resource conditions
Tapeats (AW7)	Designated and at-large	West boundary moved to encompass Surprise Valley's (AM9) east side	
Surprise Valley (AM9)	Eliminated	Split into proposed Deer Creek (AX7), Tapeats (AW9), and Bonita Creek (AW9) Use Areas. Surprise Valley Use Area (AM9) eliminated	
Bonita Creek (AW9)	At-large	Split from Surprise Valley (AM9) and includes the former AW8 Lower Tapeats Camp	
Lower Tapeats (AX8)	Eliminated	Incorporated into Bonita Creek Use Area	
Esplanade (AY9)	At-large	None	

Table 2.8 Use Area Management Actions

Implemented on BCMP Adoption
• designate a campsite along Hermit Trail. Hermit Use Area (BM7) overall use limits would not increase. The new campsite would provide an option for hikers permitted for Hermit (BM7) and Monument Creek (BL7) Use Areas • decrease Granite Rapids (BL8) use limits from three to two groups per night. This campsite is commonly shared with river groups. Changes to the riverine environment have impacted site capacity • redefine Deer Creek/Tapeats Creek Complex as shown in Map 2.7 and Table 2.8a
Potential Adaptive Management (site specific NEPA would be needed)
• decrease or increase Use Area group number and/or designated sites • variable seasonal use limits (e.g., higher in winter, lower in spring) • change camping designations: at-large to designated or designated to at-large • redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument, etc.) • seasonal or permanent closures at specific locations

Human Waste Management

A variety of methods for dealing with solid human waste in Grand Canyon have been applied in different backcountry areas including human waste carry-out systems used by river runners. Toilet facilities in Wilderness and non-wilderness backcountry areas have addressed impacts to some degree; however, facilities in remote areas present concerns related to maintenance and effects on wilderness character. Under all action alternatives (B, C, and D), management actions described in Table 2.9 would occur as described.

Table 2.9 Human Waste Management Actions

Implemented on BCMP Adoption
• solid human waste carry-out required at River Zone backcountry sites (e.g., Granite, Hermit, and Hance Rapids; South Canyon, etc.) by all users (RABT, commercial and non-commercial backcountry hikers, etc.) • commercially guided backpacking trips required to carry out solid human waste in Use Areas without toilets
Potential Adaptive Management
• replace existing toilets at existing sites (additional NEPA would be needed) • remove toilets (additional NEPA would be needed) • install toilets at other sites (additional NEPA would be needed) • seasonal or year-round solid human waste carry-out requirement for specific Use Areas or Zones • seasonal or year-round solid human waste carry-out requirement for all Use Areas or Zones

Arizona Trail

The Arizona National Scenic Trail is a continuous 800-mile trail from Mexico to Utah. Approximately 41 miles of the trail is in the park, and is identified by three segments based on unique settings and allowable uses (Table 2.10).

Table 2.10 Arizona Trail in Grand Canyon National Park

Segment		Miles	Setting	Allowable Use
South Rim	South Kaibab Trailhead to Park boundary	6.9	Developed frontcountry	Foot, stock, bicycle
Inner Canyon	North and South Kaibab Trails	21.4	Inner Canyon backcountry	Foot, stock
North Rim	Park boundary to North Kaibab Trailhead	12.6	Forest backcountry	Foot, stock, bicycle[‡]

[‡]North Rim Arizona Trail bicycle use is the only proposed change

A flexible permit system proposed under all action alternatives would allow through-hikers to obtain overnight backcountry permits in the Corridor Zone: Arizona Trail through-hikers would verify Arizona Trail itinerary with the Backcountry Information Center. On completion of this plan/DEIS, NPS would consider designating a walk-in/Arizona Trail campsite possibly near the South Kaibab Trailhead/Arizona Trail in a site-specific analysis and separate NEPA process and is not included in this plan/DEIS. See also Common to All Action Alternatives, Bicycling.

Bicycling

Non-commercial bicycling would continue to be allowed on backcountry roads open to private vehicles. Under all action alternatives, these roads would be in the proposed Road Natural Zone (see Map 2.4a-c). As in Alternative A, bicycles would be still be prohibited in Grand Canyon's Wilderness and on Inner Canyon trails.

Under all action alternatives, a segment of the Arizona Trail in the park outside Wilderness would be opened to bicycle use: the Arizona Trail section from the park's northern boundary to the North Kaibab Trailhead. Permits would be required for overnight use in the park and overnight group size limits would apply.

River-assisted Backcountry Travel

Under all action alternatives

- portable, personal watercraft used on the river for RABT would be carried in and out by the user on the itinerary where RABT takes place
- a limited number of permits would be issued for day hikes involving river travel, excluding areas closed to RABT (see Alternatives B, C, D)
- maximum RABT group size would be six
- resource and visitor use impact monitoring would occur and adjustments made (e.g., increase/decrease group size, change trip length) if needed. Future RABT actions or adjustments would be reviewed by an Interdisciplinary Team and may require additional NEPA

RABT trip length varies by individual Alternatives B, C, and D.

Tribal Lands and Interests

NPS would continue to work closely with Traditionally Associated Tribes to educate visitors about strong historical and cultural ties tribes maintain to Grand Canyon, and increase knowledge about current tribal interests related to the Grand Canyon region. In addition to A, under action alternatives

- NPS would work with all Grand Canyon backcountry users to increase awareness that access to Grand Canyon backcountry across Navajo, Havasupai, and Hualapai tribal lands requires permits from appropriate tribal offices
- NPS would work with the Havasupai Tribal Council to determine appropriate level of access across Great Thumb on the Havasupai Reservation. The Havasupai Tribe does not currently permit access across Great Thumb Mesa (Havasupai Reservation) to backcountry users
    - A pilot program is being developed by Grand Canyon and the Havasupai Tribe to permit ten small groups (1-6 people per group) access across Great Thumb Mesa to backcountry areas in the park from March through May. Some permit conditions being considered to protect tribal natural and cultural resources include requirements for tribal escort on

reservation lands, two vehicle maximum per group, four-wheel drive and high clearance vehicles, and assigned parking

- Hematite Mine (adjacent to the Colorado River) would be closed to general visitation. NPS would work with tribes to determine appropriate tribal access and use of this culturally important site
- NPS would work with Traditionally Associated Tribes to determine appropriate protection, access, and use of culturally significant canyon sites

Administrative Use

As described in Alternative A, backcountry administrative use (resource management, maintenance, visitor protection, education, and research activities) would not displace public backcountry access. In general, administrative users obtain overnight backcountry permits, with the exception of law enforcement patrols and resource management activities for conditions that need immediate attention (such as trail repair, etc.).

The NPS and outside researchers must also obtain appropriate research permits. In Wilderness, all administrative activities must adhere to MRA (Appendix E). MRA is a two-step process that 1) determines if the proposed action is appropriate or necessary for administration of the area as Wilderness and does not cause significant impact to Wilderness resources, and 2) determines techniques and types of equipment needed to ensure impacts on Wilderness resources are minimized. These administrative use policies would continue.

Guided Services

The NPS authorizes three basic types of guided services in the park's backcountry: Non-commercial Services including NPS and cooperating association programs and commercial services. SUPs for guided activities are generally not issued, but SUP requests would continue to be considered on a case-by-case basis. All authorized services are subject to stipulations including use limits, permit requirements, group size, trip itineraries, and safety and environmental regulations.

Non-commercial Services

The National Park Service and its official cooperating association, the Grand Canyon Association and its field institute, provide public guided services.

National Park Service

NPS-led backcountry interpretive services include day hikes to Cedar Ridge and changeable North Rim locations. Backcountry overnight trips led by Grand Canyon's Environmental Educational Program occur on a limited basis (one to three times annually). These NPS backcountry interpretive programs would continue, and may increase, under action alternatives.

Cooperating Association[24] Programs

Grand Canyon Field Institute (GCFI) is a program of the Grand Canyon Association, the park's official cooperating association. Cooperating associations help connect individuals to the nation's parks by creating and distributing educational and interpretive materials, providing information services, conducting educational programs and field institutes, and raising contributions to support the interpretive and educational mission of the parks. Under Alternative A and action alternatives, GCFI programs would continue and be reviewed annually by NPS managers to

[24]Cooperating Associations are mission-driven nonprofit organizations incorporated under state law. They operate under a signed standard agreement with the NPS to provide program and financial assistance for interpretation, education, and research in national parks through production and sale of educational media to the public.

assure course material is appropriate and in keeping with the NPS mission. Under all action alternatives, GCFI would be subject to the Requirements for Permitted Backcountry Operators, see Appendix F.

Commercial Services

Commercial services must be consistent to the highest degree practicable with preservation and conservation of park resources and values. In 2012 Grand Canyon evaluated backcountry commercial visitor services to determine whether they are appropriate and necessary using NPS laws, policies, and park management objectives and desired conditions. Appendix G details this commercial backcountry services analysis that incorporates the extent necessary determination for commercial services in Wilderness.

Authorizations for commercially guided services would include requirements for guide qualifications and visitor use reporting.

Commercial overnight backpacking, day hiking, bicycling, and backcountry vehicle tours at Tuweep were determined appropriate and necessary services in the park's backcountry (see Appendix , Commercial Backcountry Services Analysis) and would apply to action alternatives.

As outlined in Appendix G, the NPS determined in 2012 the following activities often associated with commercial overnight backpacking or day hiking services are not appropriate or necessary as commercial services at this time

- Climbing
- Canyoneering
- Extended Day Hiking and Running from the rim to river or rim-to-rim
- River-assisted backcountry travel

Commercial Overnight Backpacking

The majority of commercially guided backpacking trips would be granted through a limited number of concession contracts—a change from current authorization by CUA. Contracts are generally issued for a ten-year period, allow a greater level of NPS oversight, and insure higher quality visitor services. CUAs would continue to be authorized for companies doing a small number of trips per year. CUAs are issued for up to one year.

- Commercial overnight backpacking would be authorized by a limited number of contracts. It is estimated the number of contracts would be approximately three to five; the final number would be based on analysis of business opportunities presented by this activity
- CUA holders would be allowed up to three trips per year per operator
- Caps would be placed on commercial groups/night/zone (caps vary by action alternative, see Summary Table 2.14c)
- No commercial services would be permitted in the Wild Zone

Other elements of commercial overnight backpacking services vary by individual Alternatives B, C, and D.

Commercial Day Hiking

- Permitting would be by CUA
- Maximum group size of 11 would include guides. All groups would maintain a ratio of no less than one guide for one to seven clients or two guides for eight to nine clients
- No commercial services would be permitted in the Wild Zone

Other elements of commercial day hiking services vary by individual Alternatives B, C, and D.

Commercial Bicycling

- Commercial bicycling would continue in the park's backcountry to Tuweep and Point Sublime and would be permitted by CUA
- Commercial bicycling would be allowed on the Arizona Trail's North Rim segment
- Maximum group size would continue to be 14 people (including guides) and groups would maintain a ratio of no less than one guide for one to six clients and two guides for seven to twelve clients
- No commercial services would be permitted in the Wild Zone

Commercial Backcountry Vehicle Tours (Tuweep)

Action alternatives would continue elements of Alternative A including

- Commercial vehicle tours would be allowed at Tuweep only
- Vehicles would continue to be limited to 22-foot length maximum (including towed vehicles)
- Maximum group size would continue to be 15 people (including guides)
- Trips would be limited to one vehicle

Number of trips per day varies by individual action alternative B, C, and D.

Commercial Filming

The NPS requires that commercial filming activities obtain a permit. Commercial filming means filming that involves digital or film recording of a visual image or sound by a person, business, or other entity for a market audience (NPS Management Policies 2006, 8.6.2.2). The filming permits and review process would assure filming activities are appropriate for the area and do not cause undesirable impacts to park resources or visitor experience. Commercial filming would not be allowed in the Wild Zone. Filming requests in Wilderness would be evaluated under a MRA.

Elements Common to All Action Alternatives are summarized in Table 2.14a.

Alternative B

Concept

Alternative B focuses on providing a variety of recreational activities and a high level of protection for natural and cultural resources and Wilderness values. This alternative would place limits on currently unlimited activities to protect resources and enhance visitor experience. Guided services would be allowed in certain backcountry areas while other areas would remain free of guided services. This alternative increases the number of Primitive Zone Use Areas where visitors can expect increased opportunities for solitude, and minimal infrastructure and maintenance activities.

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative B, maximum group size limit for Corridor and Threshold Zones would be 11 persons, and both large and small groups would continue to be allowed.

In Primitive and Wild Zones where visitors can expect increased opportunities for solitude, group size would change from a maximum of 11 to a maximum 6 persons, or small groups only, where visitors could expect increased opportunities for solitude. Total number of permits per night for each Use Area would remain unchanged (i.e., same as Alternative A) with exception of Use Areas in Deer Creek/Tapeats Creek Complex and Granite Rapids (as described above in Common to All Action Alternatives, Use Area Management).

River-assisted Backcountry Travel

In addition to actions described in Common to All Action Alternatives, River-assisted Backcountry Travel, under Alternative B, RABT would be managed by river section to allow users more flexibility in trip planning.

Alternative B proposes 31 river sections delineated by river mile (RM) (see Table 2.11). Each section is based on RABT entry and exit points, and the average river section is 9.4 miles long. Because RABT is primarily a means of accessing backcountry routes across the river, downstream, or upstream, and not a whitewater rafting trip, RABT trips would be limited to one river section per permitted trip or two river sections if on different days. Multiple river crossings within the same river section may be approved if the permitted itinerary so requires. Under Alternative B, four river sections would be closed to RABT as shown in Table 2.11.

A limited number of permits would be issued for day hikes involving river travel, excluding areas closed to RABT.

Table 2.11 RABT Sections and Closures by River Mile (RM)[25] (Alternative B)

River Section	RM	From	RM	To	Total Miles	
1	0	Lees Ferry	4.8	5 Mile Draw	4.8	CLOSED
Adequate hiking access available in area						
2	4.8	5 Mile Draw	8.0	Badger Rapids	3.2	
3	8.0	Badger Rapid	11.4	Soap Creek Rapid	3.4	
4	11.4	Soap Creek Rapid	17.1	House Rock Rapid	5.6	
5	17.1	House Rock Rapid	31.8	South Canyon	14.5	
6	31.8	South Canyon	45.1	Eminence Break/Willie Taylor Camp	13.4	
7	45.1	Eminence Break/Willie Taylor Camp	52.4	Nankoweap Rapid	7.4	
8	52.4	Nankoweap Rapid	61.7	LCR	9.3	
9	61.7	LCR	69.0	Tanner	7.3	
10	69.0	Tanner	77.2	Hance	8.1	
11	77.2	Hance	82.1	Grapevine	4.7	
12	82.1	Grapevine	88.1	Boat Beach	6.0	
13	88.1	Boat Beach	90.8	Horn	2.6	CLOSED
Adequate hiking access; RABT not needed to facilitate backcountry itinerary						
14	90.8	Horn	93.9	Granite	3.1	
15	93.9	Granite	97.2	Boucher Rapid	3.3	CLOSED
Adequate hiking access; RABT not needed to facilitate backcountry itinerary						
16	97.2	Boucher Rapid	109.3	Shinumo Rapid	12.1	

[25] Using the GCMRC river mileage system.

River Section	RM	From	RM	To	Total Miles	
17	109.3	Shinumo Rapid	134.4	Tapeats	25.0	
18	134.4	Tapeats	139.1	Fishtail	4.7	CLOSED
Adequate hiking access; RABT not needed to facilitate backcountry itinerary						
19	139.1	Fishtail	144.0	Kanab	5.0	
20	144.0	Kanab Creek	157.3	Havasu Canyon	13.3	
21	157.3	Havasu Canyon	165.0	Tuckup Canyon	7.7	
22	165.0	Tuckup Canyon	179.7	Lava Falls Rapid	14.7	
23	179.7	Lava Falls Rapid	188.3	Whitmore	8.6	
24	188.3	Whitmore Rapid	198.9	Parashant Canyon	10.6	
25	198.9	Parashant Canyon	204.7	Spring Canyon	5.8	
26	204.7	Spring Canyon	219.6	Trail Canyon	14.9	
27	219.6	Trail Canyon	225.9	Diamond Creek Take out	6.3	
28*	225.9	Diamond Creek Take out	235.3	Bridge Canyon Rapid	9.4	
29*	235.3	Bridge Canyon Camp	246.3	Spencer Canyon	9.4	
30*	246.3	Spencer Canyon	260.0	Burnt Spring Canyon	11.0	
31*	260.0	Burnt Spring Canyon	277.6	Park Boundary	13.7	

*Hualapai Tribal Permit required for access across the Hualapai Reservation

Commercial Overnight Backpacking

Under all action alternatives, the majority of commercially guided backpacking trips would be granted through a limited number of concession contracts (e.g., 3-5) for a ten-year period. CUAs would continue to be authorized for companies doing a small number of trips per year (up to three).

Specifically, under Alternative B

- Commercial use caps would be established for Corridor Zone campgrounds, and Threshold and Primitive Zone Use Areas (see Summary Table 2.14c)
- For concessioners, 100% of commercial trips described in Summary Table 2.14c would be available for permitting one year in advance
- CUA holders would obtain permits in the same manner as non-commercial users by making reservations up to four months in advance
- CUA holders could charter additional trips with contract holders

Total projected commercial overnight use would be 9.1% of all overnight backcountry use.

Commercial Day Hiking

Commercially guided day hiking trips would continue to be granted through a CUA. Guided day hikes would have a maximum 11 persons including guides. CUAs would specify allowable locations and hike destinations on Bright Angel, South Kaibab, North Kaibab, Hermit, Grandview, and Tanner Trails (see Summary Table 2.14c).

Commercial Backcountry Vehicle Tours (Tuweep)

Commercial backcountry vehicle tours at Tuweep, including jeeps and vans, would be granted through a limited number of CUAs. Maximum number of trips per day would be two. If a stock use trip were

conducted on the same day, only one vehicle tour would be allowed. Each trip would be limited to 15 persons (one vehicle), and the vehicle used would need to be 22 feet or less.

Backcountry Roads, Trails, and Routes

Alternative B would convert approximately 30 miles of former roads in Grand Canyon Wilderness to Class 1 (Minimally Developed) Wilderness Trail. Existing primitive roads outside Wilderness would continue to provide vehicle access to trailheads, campsites, and overlooks in accordance with Grand Canyon's Final Wilderness Recommendation (1980, updated in 2010) as part of the proposed Road Natural Zone.

South Rim

- Routes and Trails (Map 2.1)
  - Eremita Mesa: would remain an unmaintained hiking route in Wilderness
  - Cape Solitude (12.4 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail[26]
  - Boundary Road: would remain an unmaintained hiking route open to occasional emergency vehicle access. Boundary Road is outside Wilderness and extends from Waldron Trailhead to Pasture Wash
- Roads (Map 2.4a)
  - Pasture Wash Access: visitors currently access Pasture Wash (South Bass Trailhead Road, Havasupai Point Road, and rim campsites) on roads through USFS and Havasupai Tribal lands. The Havasupai Tribe charges fees for access through the reservation. In Alternative B, Pasture Wash access would remain unchanged

North Rim

- Routes and Trails (Map 2.1)
  - Tiyo Point (6.3 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Francois Matthes (4.7 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Walhalla Glades (7.3 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Komo Point: would remain unmaintained hiking route in Wilderness
- Roads (Map 2.4b)
  - The Basin Road (Point Sublime), Kanabownits, and Swamp and Fire Point Roads: would remain open to vehicles, stock, bicycles, and hikers as part of the proposed Road Natural Zone

Kanab Plateau

- Roads (Map 2.4c)
  - Kanab and SB Points, 150 Mile Canyon and Schmutz: would remain open to vehicles, stock, bicycles, and hikers as part of the proposed Road Natural Zone.

Tuweep

- Roads (Map 2.4d)
  - Toroweap Road would remain a day use area (unless user has backcountry permit for campground) and be included in the proposed Road Natural Zone; Vulcans Throne Road would be converted to a Class 1 (Minimally Developed) Trail

[26] See Appendix D, Trail Class Standards.

- Trails (Map 2.8)
  - Vulcans Throne Road would be converted to a Class 1 (Minimally Developed) Trail

Inner Canyon

- Trails
  - Would continue to be maintained to differing standards depending on use level and type (see Appendix D)

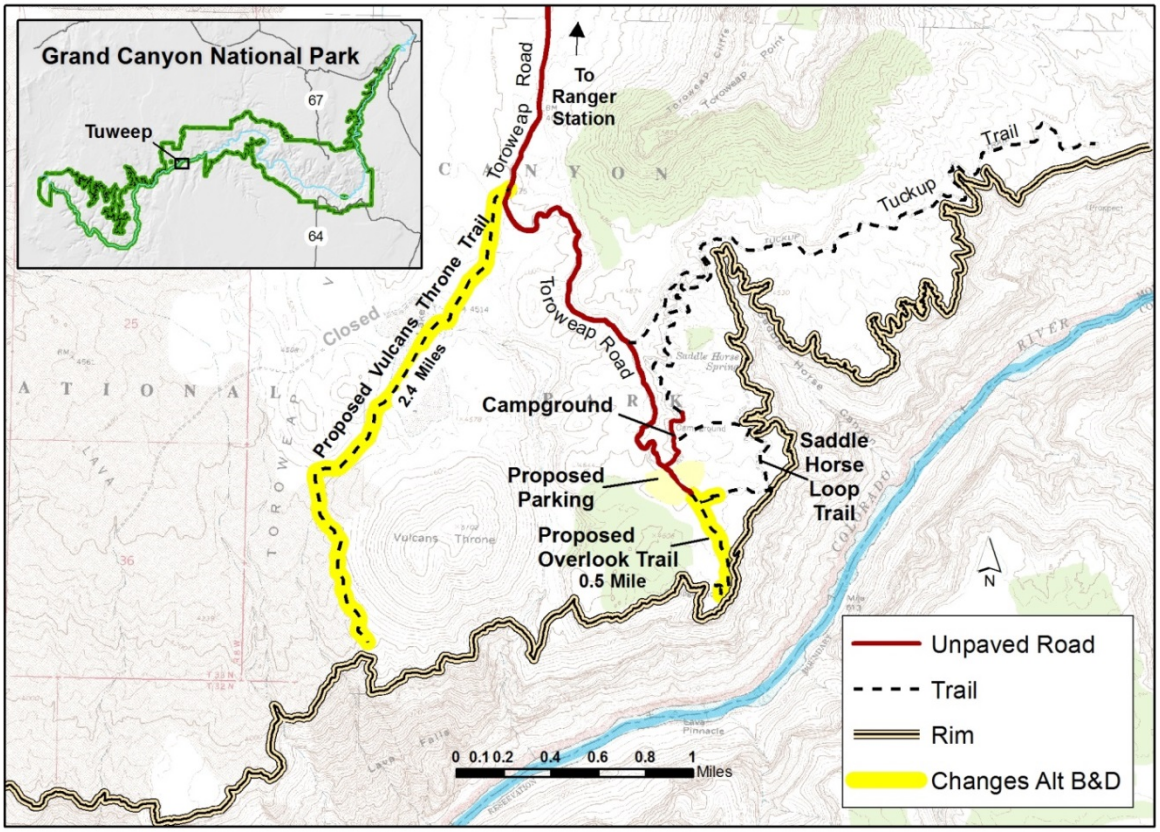
Tuweep Facilities

Tuweep would continue to be managed as a road-accessible primitive area as in Alternative A.

Facilities: Under Alternative B, and as described in the park's 1995 GMP, the existing Toroweap Overlook parking lot (Map 2.2) would be removed and re-established along the existing road near the campground. The section of road from the proposed parking area to Toroweap Overlook would be converted to the Toroweap Overlook Trail (pedestrian), although service vehicles and visitors with disabilities would be allowed to drive to the rim (Map 2.8).

In Alternative B, the existing Vulcans Throne Road (2.4 miles) would be converted to the Vulcans Throne Trail (hiking), and a parking area in a previously disturbed area would be established at the Vulcans Throne Trail and Toroweap Road junction (Map 2.8).

Map 2.8 Tuweep Facilities*



*See Map 2.2 for current conditions.

Corridor Zone Camping

Corridor Zone camping would continue in three campgrounds, and limits would remain as in Alternative A in Indian Garden and Bright Angel Campgrounds. Four small campsites would be added at Cottonwood Campground. Roaring Springs would remain as in Alternative A, day use only (no camping).

- Indian Garden: Same as Alternative A, 15 small and 1 large campsite
- Bright Angel Campground: Same as Alternative A, 31 small and 2 large campsites
- Cottonwood Campground: from 11 small and 1 large campsite, up to 15 small and 1 large campsites

Deer Creek/Tapeats Creek Complex

Current Use Area boundaries in the Deer Creek/Tapeats Creek Complex would be redefined under all action alternatives to address crowding at designated campsites and associated impacts to cultural and natural resources (Map 2.7). The complex would include the current Esplanade (AY9) Use Area, modified Deer Creek (AX7) and Tapeats (AW7) Use Areas, and the newly created Bonita Creek (AW9) Use Area (Table 2.8a). Surprise Valley (AM9) Use Area would be eliminated, and the northern half split between Deer Creek and Tapeats Use Areas to disperse use between Deer and Tapeats Creeks. The southern half of Surprise Valley Use Area would become Bonita Creek Use Area, an at-large Use Area which would also encompass Tapeats Creek delta and routes along the Colorado River to disperse use along routes between Tapeats and Deer Creeks.

In Alternative B, total number of groups per night in the Complex would be ten and be distributed as follows:

- Esplanade (AY9): 3 small groups
- Deer Creek (AX7): 2 small groups
- Upper Tapeats Creek (AW7): 3 small groups
- Bonita Creek (AW9): 2 small groups

Deer Creek Narrows

In Alternative B, the Deer Creek Narrows closure described in Alternative A would become permanent. Climbing or rappelling (ascending or descending with or without ropes or other technical equipment) would be prohibited. This restriction would extend within the creek from the southeast end of the ledges known as the Patio to the base of Deer Creek Falls.

Hance Creek, Cottonwood Creek, and Cremation Use Area

As in Alternative A, Hance Creek (BE9) and Cottonwood Creek (BG9) Use Areas would continue to be managed as Primitive Zone Use Areas. In Alternative B, the maximum group size would be 6 (small groups only) and number of groups per night would change from two small and one large in Alternative A, to three small for each Use Area.

As in Alternative A, Cremation (BJ9) Use Area would continue to be managed as a Primitive Zone Use Area. Under Alternative B, the maximum group size would be 6 (small groups only) with 3 small groups per night (from maximum group size of 11 with 1 large and two small).

Alternative C

Concept

Alternative C
Alternative C focuses on recreational activities and expanded opportunities for these activities. This alternative would increase opportunities for primitive and unconfined recreation through less management restrictions. Guided services would be allowed in more Use Areas throughout the backcountry when compared with other action alternatives. Alternative C would result in increased overall use due to additional Threshold Zone Use Areas and Corridor Zone campsites.

Maximum Group Size for Overnight Backpacking by Zone

Maximum group size limit for Corridor, Threshold, Primitive, and Wild Zones would remain 11 persons, and both small and large groups would continue to be allowed.

River-assisted Backcountry Travel

In addition to elements described in Common to All Action Alternatives, under Alternative C, RABT would be managed by river sections designed to allow users the most flexibility among alternatives in trip planning. Alternative C proposes 11 river sections delineated by river mile (see Table 2.12). Each river section is based on RABT entry and exit points, and average river sections are 29.5 miles long. These river sections generally extend beyond the current five-mile limit (Alternative A) and encompass more river miles per section than Alternative B. Because RABT is primarily a means of accessing backcountry routes across the river or further downstream and not a whitewater rafting trip, RABT trips would be limited to one river section per permitted trip or two river sections if on different days. Multiple river crossings within the same river section may be approved if the permitted itinerary so required. Under Alternative C, three RABT river sections would be closed to RABT as shown in Table 2.12.

A limited number of permits would be issued for day hikes involving river travel, excluding areas closed to RABT.

Table 2.12 RABT Sections and Closures by River Mile (RM) (Alternative C)

River Section	RM	From	RM	To	Total Miles	
1	0	Lees Ferry	4.8	5 Mile Draw	4.8	CLOSED
Adequate hiking access available in area						
2	4.8	5 Mile Draw	31.8	South Canyon	27	
3	31.8	South Canyon	61.7	LCR	29.9	
4	88.1	Boat Beach	90.8	Horn	2.7	CLOSED
Adequate hiking access; RABT not needed to facilitate backcountry itinerary						
5	90.8	Horn	109.3	Shinumo Rapid	18.5	
6	109.3	Shinumo Rapid	134.4	Tapeats	25.1	
7	134.4	Tapeats	139.1	Fishtail	4.7	CLOSED
Adequate hiking access; RABT not needed to facilitate backcountry itinerary						
8	139.1	Fishtail	157.3	Havasu Canyon	18.2	
9	157.3	Havasu Canyon	188.3	Whitmore Rapid	31.0	
10	188.3	Whitmore Rapid	225.9	Diamond Creek Take out	37.6	

River Section	RM	From	RM	To	Total Miles	
11*	225.9	Diamond Creek Takeout	277.6	Park Boundary	51.7	River Permit Required

*Hualapai Tribal Permit required for access across the Hualapai Reservation

Commercial Overnight Backpacking

Under all action alternatives, the majority of commercially guided backpacking trips would be granted through a limited number of concession contracts (e.g., 3-5) for a ten-year period. CUAs would continue to be authorized for companies doing a small number of trips (up to three) per year for a maximum two years.

In Alternative C

- Commercial use caps for Corridor Zone campgrounds would be lower than Alternatives B and D; and caps in Threshold and Primitive Zone Use Areas would be higher than Alternative B (see Summary Table 2.14c)
- For concessioners, 50% of commercial trips described in Summary Table 2.14c would be available for permitting one year in advance. The remaining 50% would be available to CUA holders and concessioners four months in advance which is the same time the non-commercial public would be able to apply for permits

Total projected commercial use would be 9.6% of all overnight backcountry use.

Commercial Day Hiking

Alternative C would allow commercial day hiking in locations described in Alternatives A and B, and would add two additional hikes that allow longer distances: Bright Angel Trail to Indian Garden, and South Kaibab Trail to Skeleton Point.

Commercial Backcountry Vehicle Tours

Under Alternative C, Backcountry Commercial Vehicle Tours at Tuweep including jeeps and vans are granted through a limited number of CUAs. The maximum number of trips per day would be three Monday through Friday, and two Saturday and Sunday. If a stock use trip were conducted on the same day, one less vehicle tour would be allowed. Each trip is limited to 15 persons, and vehicle used must be 22 feet or less.

Backcountry Roads, Trails, and Routes

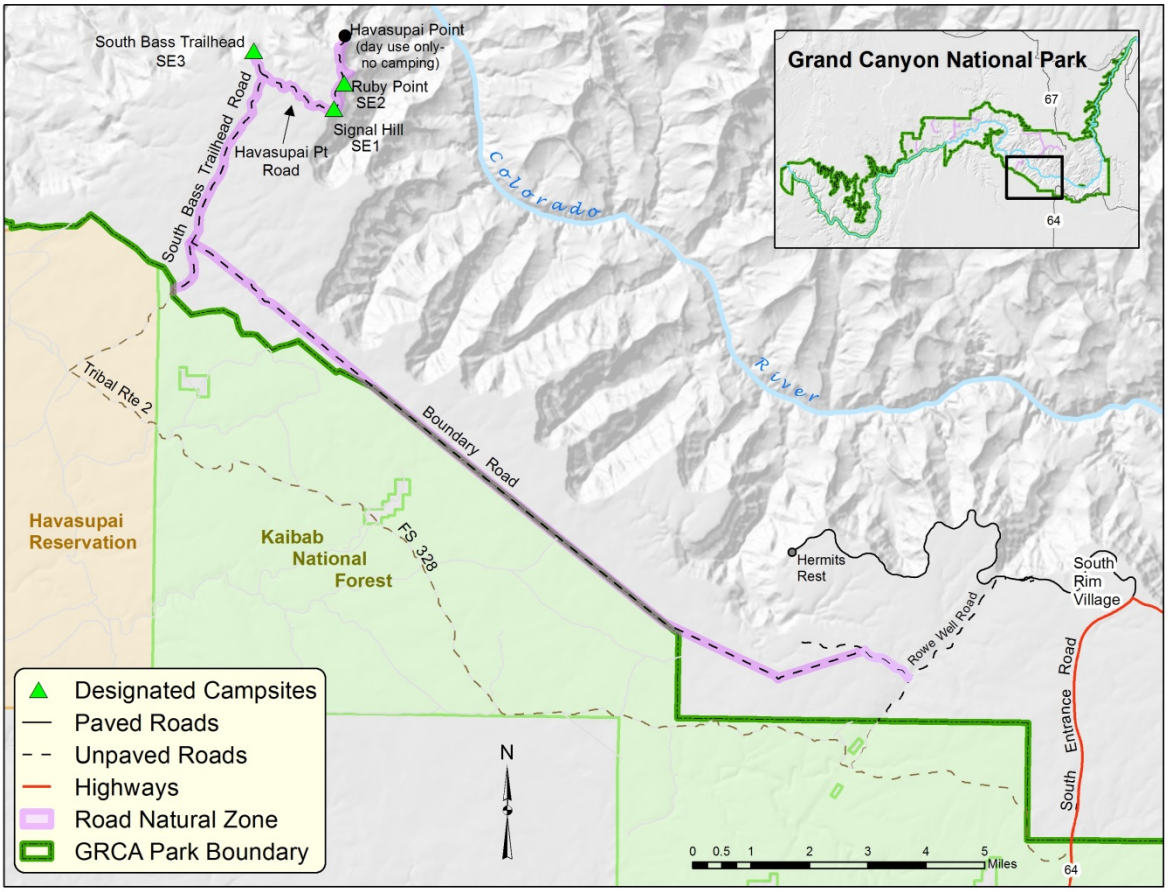
Alternative C would convert approximately 50 miles of former roads in Grand Canyon Wilderness to Class 1 (Minimally Developed) Wilderness Trail, and Tiyo Point to Class 4 (Highly Developed) Wilderness Trail open to stock use for day use only.

Under Alternative C, primitive roads outside Grand Canyon Wilderness would continue to provide vehicle access to trailheads, campsites, and overlooks in accordance with the Final Wilderness Recommendation (1980, updated in 2010) as part of the Road Natural Zone. The non-wilderness Boundary Road would be converted to a road open to the public.

South Rim

- Routes and Trails (Map 2.1)
  - Eremita Mesa (1.8 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail[27]
  - Cape Solitude (12.4 miles): from unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Boundary Road (14.1 miles): from unmaintained hiking route to backcountry road (see Roads below)
- Roads (Map 2.9)
  - Pasture Wash Access (14.1 miles): convert Boundary Road from unmaintained hiking route to a primitive backcountry road and, unlike other Alternatives, open to public vehicle, bicycle, and stock access to Pasture Wash (South Bass Trailhead Road, Havasupai Point Road, and rim campsites), and include road in Road Natural Zone

Map 2.9 Pasture Wash Access (Alternative C)



North Rim

- Trails (Map 2.1)
  - Tiyo Point (6.3 miles): from unmaintained hiking route in Wilderness to Class 4 (Highly Developed) Wilderness Trail and, unlike other Alternatives, open to day stock use

[27] See Appendix D, Trail Class Standards.

  - Francois Matthes (4.7 miles): from unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Walhalla Glades (7.3 miles): from unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
  - Komo Point (5.2 miles): from unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail
- Roads (Map 2.4b)
  - The Basin Road (Point Sublime), Kanabownits, Swamp and Fire Points: open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone

Kanab Plateau

- Roads (Map 2.4c)
  - Kanab and SB Points, 150 Mile Canyon and Schmutz: include in proposed Road Natural Zone (Map 2.4c) and
  - convert 12 miles of former ranch roads (K-29 to Boysag Point and various old road segments from K-5 to Toroweap Point) to Class 1 (Minimally Developed) Wilderness Trail

Tuweep

- Roads (Map 2.4d)
  - Toroweap and Vulcans Throne Roads would continue to be in a day use area (unless user has a backcountry permit for campground) as part of the proposed Road Natural Zone

Inner Canyon

- Trails
  - Would continue to be maintained to differing standards based on use levels and type (see Appendix D)

Tuweep Facilities

As in Alternative A, Tuweep would continue to be managed as a road-accessible primitive area. However, Alternative C would not implement management actions described in Grand Canyon's 1995 GMP. The Toroweap Overlook parking lot would remain in its current location. Vulcans Throne Road (Map 2.2) would continue to provide vehicle access to the rim (2.4 miles).

Corridor Zone Camping

Corridor Zone camping would increase from Alternatives A and B by adding one large campsite at Indian Garden, four small and one large campsite at Cottonwood, and establishing two small campsites at Roaring Springs.

- Indian Garden: from 15 small and 1 large to 15 small and 2 large campsites
- Bright Angel Campground: Same as Alternative A, 31 small and 2 large campsites
- Cottonwood Campground: from 11 small and 1 large to 15 small and 2 large campsites
- Roaring Springs: from day use only to 2 small campsites

Deer Creek/Tapeats Creek Complex

Current Use Area boundaries in the Deer Creek/Tapeats Creek Complex would be redefined under all action alternatives to address crowding at designated campsites and associated impacts to cultural and natural resources (Map 2.7). The Complex would include the current Esplanade (AY9) Use Area, modified Deer Creek (AX7) and Tapeats (AW7) Use Areas, and the newly created Bonita Creek (AW9)

Use Area (Table 2.8a). Surprise Valley (AM9) Use Area would be eliminated, and the northern half split between Deer Creek and Tapeats Use Areas to disperse use between Deer and Tapeats Creeks. The southern half of Surprise Valley Use Area would become Bonita Creek Use Area, an at-large Use Area which would also encompass Tapeats Creek delta and routes along the Colorado River to disperse use along routes between Tapeats and Deer Creeks.

In Alternative C, the total number of groups per night in the complex would be 11 and distributed as follows:

- Esplanade (AY9): 2 small and 1 large groups
- Deer Creek (AX7): 2 small groups or 1 large group
- Upper Tapeats Creek (AW7): 3 small groups and 1 large group
- Bonita Creek (AW9): 1 small and 1 large group

Deer Creek Narrows

Under Alternative C, climbing or rappelling (ascending or descending) in Deer Creek Narrows, with or without the use of ropes or other technical equipment, would be allowed.

Hance Creek, Cottonwood Creek, and Cremation Use Area

In Alternative C, Hance Creek (BE9) and Cottonwood Creek (BG9) Use Areas would be converted from their current designation as Primitive to Threshold Zone, whereby designated campsites may be established, and installation of a toilet considered based on site-specific resource needs. Each Use Area would then allow three small and one large group.

As in Alternative A, Cremation (BJ9) Use Area would continue to be managed within the Primitive Zone allowing one small and one large group. However, under Alternative C, Cremation Use Area's western boundary would be modified, and a designated campsite, Cremation West Use Area (BJ1) would be established to provide an additional camping opportunity for one group (large or small) immediately adjacent to the Corridor Zone.

Alternative D

Concept

Alternative D focuses on resource protection and opportunities for solitude. This alternative would allow for recreational use, but would prioritize preservation of natural and cultural resources and wilderness character. Recreational use would be concentrated in non-wilderness areas with limited facility improvement. Similarly, guided services would be limited to two non-wilderness zones: Corridor and a proposed Road Natural. For overnight backpacking, large groups would be allowed in the Corridor Zone, but not in zones in Wilderness (Threshold, Primitive, and Wild). These actions would allow for self-exploration and increased opportunities for solitude in Wilderness. Overall, this alternative would result in decreased use due to increased Primitive Use Areas, minimal increase in Corridor Zone campground capacity, and decreased group size limits.

Maximum Group Size for Overnight Backpacking

Corridor Zone maximum group size limit would continue at 11, and both large and small groups would be allowed. To expand the areas where visitors can expect increased opportunities for solitude, Alternative D

would change Threshold, Primitive, and Wild Zone large group size to a maximum 6 persons, or what is currently a small group.

River-assisted Backcountry Travel

In addition to actions described in Common to All Action Alternatives, in Alternative D RABT would be managed by an 11-mile travel limit to allow users more flexibility than Alternative A in trip planning. The 11-mile limit would more than double the current (Alternative A) restriction. Multiple crossings may be approved if the permitted itinerary so required. Cumulative river miles must be 11 miles or less per itinerary. Three river sections would be closed to RABT under this alternative (see Table 2.13).

A limited number of permits would be issued for day hikes involving river travel, excluding areas closed to RABT.

Table 2.13 RABT Closures* by River Mile (RM) (Alternative D)

River Section	RM	From	RM	To	Total Miles	
1	0	Lees Ferry	4.8	5 Mile Draw	4.8	CLOSED
2	88.1	Boat Beach	90.7	Horn	2.6	CLOSED
3	134.4	Tapeats	139.1	Fishtail	4.7	CLOSED
4	225.9	Diamond Creek	277.6	Park Boundary	51.7	River Permit Required

*Lees Ferry to 5 Mile Draw closed due to availability of adequate hiking access in area
River Sections 2, 3, and 4 in Table 2.13 closed to RABT due to availability of adequate hiking access in those areas

Commercial Overnight Backpacking

Under all action alternatives, the majority of commercially guided backpacking trips would be granted through a limited number of concession contracts for a ten-year period. CUAs would continue to be authorized for companies doing a small number of trips (up to three) per year for a maximum two years.

Under Alternative D

- Commercial use would be permitted in the Corridor Zone only, and commercial use in Corridor Zone campgrounds would be higher than Alternative B and Alternative C
- For concessioners, 75% of commercial trips would be available for permitting one year in advance. The remaining 25% would be available to CUA holders and concessioners four months in advance which is the same time the non-commercial public would be able to apply for permits

Total projected commercial use would be 10.2% of the total overnight backcountry use.

Commercial Day Hiking

Commercially guided day hiking trips would be granted through a CUA. Guided day hikes have a maximum 11 persons including guides. The commercial hiking trips would be limited to the Corridor Zone: Bright Angel Trail to 3-Mile Resthouse, South Kaibab Trail to Cedar Ridge, and on the North Kaibab Trail to Supai Tunnel.

Commercial Backcountry Vehicle Tours

Backcountry commercial vehicle tours at Tuweep including jeeps and vans would be granted through a limited number of CUAs. One trip per day would be allowed if a stock use trip was not being conducted. Each trip is limited to 15 persons and one vehicle 22 feet or less.

Backcountry Roads, Trails, and Routes

Alternative D is most similar to Alternative A wherein unmaintained routes for hiker access would continue to be managed as untrailed areas to allow former roadbeds to recover. Similar to Alternatives B and C, primitive roads would continue to provide access to trailheads, campsites, and overlooks in accordance with the Final Wilderness Recommendation (1980, updated 2010) as part of the proposed Road Natural Zone.

South Rim

- Routes and Trails (Map 2.1)
  - Eremita Mesa (1.8 miles): would remain unmaintained hiking route in Wilderness
  - Cape Solitude (12.4 miles): unmaintained hiking route in Wilderness to Class 1 (Minimally Developed) Wilderness Trail[28]
  - Boundary Trail (14.1 miles): would remain unmaintained hiking route open to occasional emergency vehicle access. Boundary Road is outside Wilderness and extends from Waldron Trailhead to Pasture Wash area
- Roads (Map 2.4a)
  - Pasture Wash Access: In Alternative D, Pasture Wash access would remain unchanged. Visitors currently access Pasture Wash (South Bass Trailhead Road, Havasupai Point Road, and rim campsites) on roads through USFS and Havasupai Tribal lands. The Havasupai Tribe charges fees for access through the reservation

North Rim

- Routes (Map 2.1)
  - Walhalla Glades, and Tiyo, Francois Matthes, and Komo Points: would remain unmaintained hiking routes in Wilderness
- Roads (Map 2.4b)
  - The Basin Road (Point Sublime), Kanabownits, and Swamp and Fire Points Roads: would remain open to vehicles, stock, bicycles, and hikers as part of the proposed Road Natural Zone

Kanab Plateau

- Roads (Map 2.4c)
  - Kanab and SB Points, 150 Mile Canyon and Schmutz: would remain open to vehicles, stock, bicycles, and hikers as part of the proposed Road Natural Zone

Tuweep

- Roads (Map 2.4d)
  - Toroweap Road would remain a day use area (unless user had backcountry permit for campground). Toroweap road would be included in the proposed Road Natural Zone; Vulcans Throne Road would be converted to a Class 1 (Minimally Developed) Trail
- Trails (Map 2.8)

[28] Appendix , Trail Class Standards.

- Vulcans Throne Road would be converted to a trail

Inner Canyon

- Trails
  - Would continue to be maintained to differing standards depending on use level and type (see Appendix D)

Tuweep Facilities

In all alternatives, Tuweep would continue to be managed as a road-accessible primitive area.

Under Alternative D (and B), and as prescribed in the 1995 GMP, the existing Toroweap Overlook parking lot would be removed and re-established along the existing road near the existing campground and/or Saddle Horse Canyon Trail. The section of road from the proposed parking area to Toroweap Overlook would be converted to the Toroweap Overlook Trail (pedestrian), although service vehicles and visitors with disabilities would be allowed to drive to the rim (Map 2.8).

In Alternative D (and B), the existing Vulcans Throne Road (2.4 miles) would be converted to the Vulcans Throne Trail (hiking), and a parking area would be established at the junction of Vulcans Throne Trail and Toroweap Road (Map 2.8).

Corridor Zone Camping

Corridor Zone camping would continue to be available in three campgrounds. Alternative D would add two small campsites at Cottonwood Campground.

- Indian Garden: Same as Alternative A, 15 small and 1 large campsite
- Bright Angel Campground: Same as Alternative A, 31 small and 2 large campsites
- Cottonwood Campground: from 11 small and 1 large to up to 13 small and 1 large campsites

Roaring Springs: day use only (no camping).

Deer Creek/Tapeats Creek Complex

Under all action alternatives, current Use Area boundaries in the Deer Creek/Tapeats Creek Complex would be redefined to address crowding at designated campsites and associated impacts to cultural and natural resources (Map 2.7). The Complex would include the current Esplanade (AY9) Use Area, modified Deer Creek (AX7) and Tapeats (AW7) Use Areas, and the newly created Bonita Creek (AW9) Use Area (Table 2.8a). Surprise Valley (AM9) Use Area would be eliminated, and the northern half split between Deer Creek and Tapeats Use Areas to disperse use between Deer and Tapeats Creeks. The southern half of Surprise Valley Use Area would become Bonita Creek Use Area, an at-large Use Area which would also encompass Tapeats Creek delta and routes along the Colorado River to disperse use along routes between Tapeats and Deer Creeks.

Under Alternative D, total number of groups per night in the Complex would be eight and distributed

- Esplanade (AY9): 2 small groups
- Deer Creek (AX7): 2 small groups
- Upper Tapeats Creek (AW7): 3 small groups
- Bonita Creek (AW9): 1 small group

Deer Creek Narrows

Alternative D would implement a permanent closure as in Alternative B, and add an additional restriction to limit patio visitation to one river trip at one time.

Hance Creek, Cottonwood Creek, and Cremation Use Area

Hance Creek (BE9) and Cottonwood Creek (BG9) would be managed as Primitive Zones as described in Alternative B. Number of groups per night would be three small for each Use Area.

Cremation (BJ9) Use Area would be managed as a Primitive Zone with a maximum group size of six with three groups per night.

Mitigation Measures

The following mitigation measures were developed to minimize the degree of adverse effects that would result from the four proposed alternatives, and would be implemented during execution of the selected alternative, as needed.

Previous mitigation efforts indicate that specific measures can be effective in reducing impacts if adequate funding, staffing, monitoring, and implementation of the measures are maintained.

A list of mitigation measures to be considered singly or in combination include

Soils

- Revegetate impacted areas, restore native plant associations, and remove noxious weeds

Water Resources

- Improve education on catholing and promote use of personal-size carry out bags for human waste
- Educate visitors about the impacts from streambed modification such as dam building, creation on pools for cooling, etc.
- Improve education on urination in river in the River Zone and at an appropriate distance from tributary streams (200 feet per park regulations)

Soundscape

- Develop a Minimum Requirement Analysis for each type of non-emergency activity.
- Use NPS “quiet technology” helicopter for missions in support of maintenance, resource management and other non-emergency and emergency functions.
- Minimize use of helicopters to service backcountry toilets. Conduct work during low use periods.
- Require the use of best available technology for all motorized vehicles, rafts and tools used by the NPS and for other administrative uses. As improvements become commercially available, update the standard for “best available”.
- Monitor and model aircraft and motorized vehicle/tool use and conduct sound monitoring to ensure the accuracy of model predictions, and to better characterize the natural soundscape.

Caves

- Increase patrols and enforcement of site closures.

Vegetation

- Actively revegetate impacted areas, restore biological and physical components, and accelerate the recovery of the biological community's structure and function.
- Remove invasive exotic plant species and monitor removal efforts. Actively manage native and non-native vegetation to impede encroachment into historically used campsites and help preserve campsite capacities.

Cultural Resources

- Conduct preservation maintenance of popular sites that are open for visitation, including creation of formal trails to avoid trampling cultural deposits, creation of hardened areas for camping, and vegetation rehabilitation.
- Placement of erosion control structures (e.g., check dams) where trailing has channelized water runoff which disturbs archeological sites and historic structures
- Increased education of site disclosure practices (what sites can be visited) and site etiquette standards (e.g., Leave No Trace principles)
- Stabilization or repair of damaged features
- Graffiti Removal
- Data recovery to mitigate existing adverse effects from improper toilet, road, trail, and campsite placement, and impacts to historic structures and ethnographic resources
- Rehabilitation of trails and closed roads passing through archaeological sites including revegetation and other restoration activities
- Removal of vegetation impacting archaeological sites, historic structures, and landscape features
- Revegetation of barren core areas within archaeological sites, shrines and other culturally sensitive locations
- Minor trail re-routing and campsite rehabilitation to avoid ethnographic resources and archeological sites
- Closing archaeological sites to visitation (visitor or administrative use) when other mitigation methods do not resolve adverse effects
- Temporary, seasonal, or permanent restrictions to culturally sensitive locations
- Placement of new toilet facilities outside of archaeological site boundaries and other sensitive locations
- Implement maintenance activities for historic structures of all types that maintain their character-defining elements.
- Prepare determinations of eligibility for the NRHP for properties lacking such documentation
- Temporary or permanent closure of other exceptionally vulnerable historic structures as necessary to preserve their NRHP integrity
- Implement Pest management activities to protect historic structures
- Rehabilitate trails in the Cross-canyon Corridor Cultural Landscape including revegetation and other restoration activities
- Remove invasive vegetation impacting landscape character
- Add native vegetation to obscure the view of any new campsites so they are not visible from the North Kaibab Trail

Visitor Use and Experience

- Provide information regarding high and low use times of visitation at specific sites and along specific trails
- Provide maps of delineated campsites in some areas to encourage minimum impacts
- Increase NPS presence to improve visitor education and resource protection

- Increase educational efforts about backcountry areas affected by commercial overflight tours, including locations, general numbers, timing of flights, etc.

Park Operations

- Increase staff and funding to support visitor and employee safety through education and enforcement of resource protection regulations
- Increase staff and funding to support resource inventory and monitoring programs
- Increase staff and funding to support resource restoration activities, including campsite and trail maintenance and rehabilitation, native and non-native vegetation management, sensitive and endangered species protections, and archaeological site preservation
- Increase staff and funding to support overnight and day use permitting for commercial and non-commercial recreational activities and commercial filming

Adjacent Lands

- Work with adjacent land owners and managers to address natural and cultural resource concerns such as wildlife poaching, domestic animals trespass of and looting of cultural resource sites

Wilderness Character

- Implement Minimum Requirement Analysis for all NPS and administrative activities to ensure that impacts to Wilderness resources and values are minimized
- Increase education on wilderness character and defining qualities (Untrammeled, Naturalness, Undeveloped, Outstanding Opportunities for Solitude or Unconfined Recreation, and Other Features of Value (e.g., Cultural and Paleontological resources)

Alternatives and Actions Considered and Dismissed from Further Consideration

Some alternatives or actions were initially considered but later eliminated from further study. Alternatives and actions dismissed did not meet the definition of a reasonable alternative. CEQ states, “Reasonable Alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant.” In addition, reasonable alternatives also meet project objectives, resolve need, and alleviate potentially significant impacts to important resources. An alternative is not automatically rendered unreasonable if it requires amending of a park plan or policy; causes potential conflict with local, state, or federal law; or lies outside congressionally approved or funded scope or NPS legal jurisdiction. Dismissal rationales are presented below.

These dismissed actions, when combined with alternatives fully evaluated, constitute the full range of alternatives NPS is required to consider under NEPA.

Create New Management Zones for Havasupai Traditional Use Lands and Research Natural Areas

The 1988 Backcountry Management Plan defined four management zones to guide backcountry management actions and provide opportunities for a variety of backcountry experiences. These zones correspond to desired resource and visitor experience conditions. Development of a new zone for Havasupai Traditional Use Lands was not carried forward in analysis because no conflicts have been identified with the way these lands are managed under the current zoning framework.

Grand Canyon's six research natural areas (RNA) are not actively managed. If RNAs are impacted by visitation in the future, the park may place restrictions on camping or visitor use in these areas and complete additional NEPA as necessary.

Management of these areas is not an issue within the context of zoning and therefore creating new management zones would not resolve the purpose and need for action.

Create New Management Zones under Flight Corridors

Backcountry activities directly under or near aircraft flight corridors are impacted by aircraft noise. Expectations and experiences under these corridors are different than other backcountry areas. For example, Boucher Use Area (BN9) is underneath a flight corridor and zoned Primitive; whereas Grapevine Use Area (BH9) also zoned Primitive, is not below a flight corridor. Visitors in Boucher would generally experience more aircraft noise than visitors in Grapevine and have a different experience. Zones prescribe use level including group number and size, camping opportunity (at-large vs. designated), infrastructure (toilets), and distance from developed areas, but are not necessarily a reflection of outside impacts (noise sources, light sources, etc.). Development of new management zones under flight corridors would not necessarily change Zone management, but could possibly address visitor expectations. The creation of zones under flight corridors is not technically feasible due to the variable extent of noise impacts from flights such as topography, vegetation and proximity to river rapids.

Increase Large Group Size for Overnight Backpacking

Several ideas were raised through internal and public scoping related to increased group size for overnight backpacking. One option was to allow an extra-large group of 14-16 people to camp at Bright Angel Campground. Another was to allow larger groups for guided activities (for example: do not count guides in group size to allow more participants).

The 1988 Backcountry Management Plan prescribed a maximum group size of 16 people for large groups. Results of early monitoring programs established a negative relationship between group size and resource conditions at campsites. To reduce backcountry resource impacts NPS, in 1993, lowered the maximum group size to 11. To again accommodate an increased group size of 16 in Corridor Zone campgrounds would come at the expense of at least one small campsite. Group size limits take into account camp capacity, encounter rates with other backcountry users, and desired resource and social conditions. Group size applies to the entire party, including guides, because each person has an impact on human waste management, number of encounters with other groups, and camp space needed. Larger groups would result in too great of an environmental impact, as determined by resource studies between 1988 and 1993, and therefore was not carried forward in analysis.

Add Camping Opportunities along South Kaibab and/or Bright Angel Trails

The high demand for overnight use in the Corridor Zone pressed NPS to consider additional camping opportunities along South Kaibab and/or Bright Angel Trail. South Kaibab Trail does not have available water, and adding a pipeline or water tank would be extremely expensive. Camping without a water source, particularly in warmer months could result in safety concerns and increased medical emergencies. Bright Angel Trail's Indian Garden campground has limited room to increase capacity. Any increase would require additional park staff which at current funding levels is not feasible. This plan/DEIS does analyze increasing camping opportunities along North Kaibab Trail to address a bottleneck for overnight users. This alternative was not carried forward because of safety issues from camping without water and

NPS staff presence. Constructing a water line for additional camping areas and hiring additional NPS staff would not be feasible.

Require Day Hiking Permits Regardless of Distance

Requiring Grand Canyon visitors get a day hike permit regardless of distance is not needed, practical nor feasible at this time. With over 1,500 visitors day hiking on backcountry trails during busy times, requiring permits for all day hiking would be a burden on both visitors and park staff. Additionally, a need has not been identified to monitor or restrict short day hikes or hikes in remote locations. Staff would be needed to check permit and implement this system. This plan/DEIS does propose day hiking permits for long day hikes on Corridor Zone trails where conflicts currently exist. With current and foreseeable funding and staffing levels, it is not feasible to implement day hiking permits regardless of distance.

In the future, additional trails may be identified for day hiking permits, and additional NEPA analysis and documentation would be required.

Do Not Allow Backcountry Commercial Service

A Commercial Services Analysis (Appendix G) was conducted. A number of commercial services were determined to be both necessary and appropriate including overnight backpacking, day hiking, vehicle tours, and bicycling. This plan/DEIS evaluates varying levels and locations for commercial services. All action alternatives leave the Wild Zone free of backcountry commercial services. Part of the purpose and need for this plan/DEIS is to determine the appropriate type, extent and location for backcountry use. As noted above, the NPS determined some commercial use to be appropriate; therefore an alternative to ban all commercial services in the backcountry was not carried forward for analysis.

Do Not Allow Corridor Zone Commercial Backpacking

Commercially guided backpacking provides an opportunity for visitors to be guided into the Grand Canyon and learn about basic backpacking techniques and etiquette. The Corridor Zone offers potable water, toilets, ranger stations, interpretive programs, and is therefore an excellent place for first-time backpackers that seek to transition into backcountry travel via a guided experience in a less remote and rugged area. For many backcountry visitors, hiking in the Corridor Zone is a wilderness experience and may be the most remote hiking they have encountered. By not allowing commercial backpacking in this zone, visitors seeking guided experiences would be required to hike into more remote locations, without potable water sources and toilets. Commercial services including guided stock trips and Phantom Ranch visitor lodging already exist in the Corridor Zone. Because this commercial service was determined necessary and appropriate, an alternative to not allow Corridor Zone commercial backpacking was considered but dismissed from detailed analysis.

Commercial RABT, Canyoneering, Climbing, Extended Day Hiking

RABT, canyoneering, climbing, and extended day hiking did not meet the necessary and appropriate criteria (Appendix G). Resource and visitor impacts from these activities are not well understood and data is needed to make future management decisions. Allowing these as commercial services would not resolve the purpose and need, including the objective to comply with all laws, regulations and policies related to backcountry management.

It is possible one or more of these could be authorized as commercial services in the future; additional NEPA analysis and documentation would be required.

No River-assisted Backcountry Travel

NPS considered not allowing RABT for day and/or overnight trips. Use of personal floatation devices has occurred for many years, and backcountry hiking and canyoneering itineraries exist that cannot be completed without RABT or river trip assistance (e.g., South to North Bass). RABT allows visitors to experience backcountry areas otherwise unavailable. Although RABT is not currently allowed for day trips, park staff knows visitors participate in this activity. By actively managing use, NPS can collect information and better understand use locations, levels, and resource impacts. Under Alternative A, day use RABT would not be allowed. RABT associated with an overnight backcountry trip would be allowed under all alternatives. Banning this activity would not meet the purpose and need for action because RABT is an appropriate use.

Allow Bicycling in Proposed Wilderness

Public and internal scoping included requests to open Cape Solitude, Tiyo Point, and Walhalla Plateau to bicycling. These areas occur in Proposed Wilderness where use of mechanized equipment is prohibited. Allowing bicycling in Proposed Wilderness would require NPS to reopen and alter the 1980 Wilderness Recommendation which would require additional public hearings and a specific process to amend the Recommendation. Allowing bicycling in proposed Wilderness would not resolve the purpose and need, including the objective to comply with all laws, regulations and policies related to backcountry management.

Environmentally Preferable Alternative

According to DOI NEPA regulations, the Environmentally Preferable Alternative is the Alternative "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The Environmentally Preferable Alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

For the following reasons, the Environmentally Preferable Alternative is Alternative D

- Alternative D would cause fewer impacts to natural and cultural resources including social trailing, soil compaction, and wildlife and archaeological site disturbances due to a reduced number of people staying overnight in backcountry areas outside the Corridor Zone compared to Alternatives A, B and C
- Alternative D would cause less soil and vegetation disturbance as it does not include two additional Cottonwood Campground campsites proposed in Alternatives B and C
- Alternative D would cause less ground disturbance and would likely result in less visitation as it does not include almost 20 miles of additional Walhalla Plateau minimally maintained Wilderness trails proposed in Alternatives B and C
- Alternative D would cause fewer resource impacts in the Deer Creek/Tapeats Complex due to a reduced number of people permitted to camp in that area compared to Alternatives A, B and C

For these reasons, Alternative D would cause the least damage to the biological and physical environment and best protect, preserve, and enhance cultural and natural resources, thereby making it the Environmentally Preferable Alternative.

NPS Preferred Alternative

CEQ defines the Agency's Preferred Alternative as the alternative "the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors."[29]

To identify the Preferred Alternative, discussions were held among NPS managers, scientists, and environmental specialists regarding alternatives analyzed in the plan/DEIS. Deliberations considered NPS and Grand Canyon statutory missions, plan/DEIS impact analysis, how well each Alternative met the plan/DEIS purpose, need and objectives, and public and agency comments received during public scoping.

Alternative B was identified as the Preferred Alternative due to its emphasis on both resource protection and improved visitor experience. This alternative would maintain both large and small groups in two of the four backcountry management zones—a change from current management which allows large and small groups throughout the backcountry. Allowing only small groups (up to six people per group) in Primitive and Wild Zones would better protect resources and wilderness character in these Zones. Overall, overnight backcountry use is expected to decrease by approximately 1% (from 94,277 to 93,116 user nights) with some increase in the Corridor Zone (3% increase from current).

The level of commercial overnight backpacking proposed under Alternative B would remain similar to current, approximately 9%. Under all action alternatives, commercial backpacking would be authorized primarily through contracts which would allow the park additional oversight, better resource protection, and consistent visitor service through standardized guide requirements, longer term agreements (generally ten-year contracts compared to current two-year Commercial Use Authorizations), and a competitive selection process to choose the most qualified operators.

Alternative B would implement the 1980 Wilderness Recommendation through identification of open Kanab Plateau roads for access to Kanab and SB Points, 150 Mile Canyon, and Schmutz. In addition, several fire roads on Walhalla Plateau in Wilderness would be managed as Wilderness trails. The NPS will consider comments on this plan/DEIS and may modify or adjust the Preferred Alternative accordingly. Any modifications or adjustments will be disclosed in the published FEIS. A Record of Decision will follow the FEIS and be made available to the public.

[29] *CEQ Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations.* Question 4a. http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf.

Summary Tables

Table 2.14a Elements of Alternatives Common to All Action Alternatives (B, C, and D)

	Alternative A	Common to All Action Alternatives (B, C, and D)
Management Zones		
	• Corridor Zone • Threshold Zone • Primitive Zone • Wild Zone	Same as A and add • Road Natural Zone • River Zone
Recreational Use		
Arizona Trail	• No flexible permitting available to Arizona Trail through-hikers • South Rim camping at Mather Campground or outside park boundary on USFS land • No bicycle use on Arizona Trail's North Rim segment	• Flexible permit system allows through-hikers to obtain Corridor Zone backcountry permits • NPS considers designating walk-in Arizona Trail camping possibly near South Kaibab Trailhead • Bicycles allowed on Arizona Trail's North Rim segment
Bicycling	• Non-commercial bicycling allowed in backcountry on park roads open to private vehicles • No bicycle use allowed on Arizona Trail's North Rim segment	• Roads currently open to bicycling become part of proposed Road Natural Zone (see Map 2.4a-d) • Arizona Trail's North Rim segment open to bicycle use
RABT	• Day use not allowed • RABT not identified on overnight backcountry permits • PFDs (Type III or V) required to be worn while on the river • 5-mile limit	• Limited day use by permit • Activity identified on overnight backcountry permits • PFDs (Type III or V) required to be worn while on the river • RABT watercraft carried in and out by user during the permitted itinerary • Maximum RABT group size six persons • Identifies river sections closed to RABT • Allowable mileage varies by individual action alternative B, C, D
Tribal Lands and Interests		
	• NPS works with traditionally associated tribes to educate visitors about access to the park's backcountry through tribal lands, and consults with tribes regarding protection and treatment of archaeological and ethnographic resources	Same as A and • NPS works with backcountry users to insure awareness regarding backcountry access across tribal lands requires permits from appropriate tribal offices • NPS works with Havasupai Tribe re: access across Great Thumb on pilot program to permit ten small groups (1-6 people) across Great Thumb to the park's backcountry March-May. Permit conditions include: tribal escort, two vehicle maximum, four-wheel drive/high-clearance, assigned parking • Hematite Mine (adjacent to the Colorado River) closed to visitation • NPS works with Traditionally Associated Tribes to determine appropriate protection including access and use of culturally significant sites

	Alternative A	Common to All Action Alternatives (B, C, and D)
Administrative Use		
	• Backcountry administrative users (resource management, maintenance, interpretation) generally obtain overnight backcountry permits. NPS and outside researchers must also obtain research permits. Wilderness activities evaluated through minimum requirement analysis (MRA)	
Guided Services Non-commercial		
NPS	• NPS backcountry interpretive day hikes to Cedar Ridge and North Rim locations; Environmental Educational Program overnight trips (1-3 times/year)	Same as A or may increase (subject to further analysis)
Cooperating Association Programs	• NPS Cooperating Association[30]: Grand Canyon Field Institute (GCFI) programs reviewed annually by NPS managers to assure course material appropriate and in keeping with NPS mission and trips require backcountry permits	• Continue annual review and GCFI subject to Requirements For Permitted Backcountry Operators outlined in Appendix F and require backcountry permits
Guided Services Commercial		
Overnight Backpacking	• Allowed in all existing backcountry zones • Authorized by commercial use authorization (CUA) • No caps	• Not allowed in Wild Zone • Majority managed by contract and limited opportunity for CUA • Proposed caps on groups/night/Zone vary by action alternative B, C, D • Other elements of Commercial Overnight Backpacking Services vary by individual Alternative B, C, D • Subject to Requirements For Permitted Backcountry Operators outlined in Appendix F
Day Hiking	• Unlimited number of CUAs issued • Day hiking locations and distances limited	• Not permitted in Wild Zone • Other elements of Commercial Day Hiking Services vary by individual Alternative B, C, D
Bicycling	• Allowed to Tuweep and Point Sublime • Maximum group size of 14 includes guides. All groups maintain ratio of no less than 1 guide for 1 to 6 clients, and 2 guides for 7 to 12 clients	Same as A and • Arizona Trail North Rim segment open to commercial bicycle tours
Backcountry Vehicle Tours	• Group size limited to 15 people and one vehicle • 22-foot-vehicle length maximum • Commercial Vehicle Tours only at Tuweep • Up to two trips per day per operator	Same as A and • Trip number per day vary by individual action alternative B, C, D
Commercial Filming		
	• Park policy does not specifically address commercial filming in backcountry	• Filming purpose must meet necessary and appropriate Wilderness test • No commercial activity in Wild Zone • Wilderness commercial filming requests evaluated under MRA

[30] Cooperating associations are mission-driven nonprofit organizations incorporated under state law. They operate under a signed standard agreement with the NPS to provide program and financial assistance for interpretation, education, and research in national parks through production and sale of educational media to the public

Table 2.14b Summary of Elements Common to Action Alternatives (B, C, and D) Subject to Adaptive Management

	Alternative A Current Conditions (No Adaptive Management)	Adaptive Management	
		Implement on BCMP Adoption	Implement as Needed Through Adaptive Management
Climbing	• No current park anchor policy • Climbing not identified on permits • No power drills in Wilderness	• Decision framework for new anchor placement • Overnight backcountry permit identifies activity • Monitor use and resource impacts through backcountry permitting process and field surveys • Decision framework for new anchor placement • No power drills in Wilderness • Minimum impact climbing education	• Day use permit required and identifies climbing route • Use limits for specific locations ○ restrict number of groups by day or season (overnight and day use) ○ change maximum overnight group size (decrease or increase) ○ seasonal or permanent restrictions for natural and/or cultural resource protection • Climbing Management Plan developed
Canyoneering	• No current park anchor policy • Canyoneering not identified on permits • Limited educational information • No power drills in Wilderness	• Decision framework for new anchor placement • Overnight backcountry permit identifies activity • Monitor through backcountry permitting process and field surveys • No power drills in Wilderness • Maximum group size 6 • Minimum impact canyoneering education	• Day use permit required and identifies canyoneering route • Use limits for specific locations ○ restrict number of groups by day or season (overnight and day use) ○ change maximum overnight group size (decrease or increase) ○ seasonal or permanent restrictions for natural and/or cultural resource protection • Canyoneering Management Plan developed
Extended Day Hiking and Running	• No current park policy • No day use permits	• Day use permits required seasonally for area in Table 2.5 and Map 2.6 • Minimum cost $5/person/day	• Limit group size (e.g., 30) • Daily use limits (e.g., 250) ○ designated days for groups or individuals ○ policy for other trails • Day use permits required year-round
Tuweep Day Use	• GMP set goal to *provide uncrowded and primitive experience*, and day use capacity at 85 people or 30 vehicles at one time	• Develop Tuweep day use visitor information. May include road signs and existing local and regional visitor centers • No more than one commercial stock trip/day	• Tuweep day use permit or reservation system • Limits for vehicle number per party • Designated days for group events
Use Area Management	• Hermit (BM7): illegal camping outside designated camp area • Granite Rapids (BL8): impact levels exceeded • Deer Creek/Tapeats Creek Complex: use limits commonly exceeded due	• Hermit (BM7): designate new campsite along Hermit Trail • Granite Rapids (BL8): group limit decreased from 3 to 2 • Deer Creek/Tapeats Creek Complex: redefine Use Areas (Table 2.8a/Map 2.7)	• Decrease or increase Use Area limits and/or designate sites • Variable seasonal use limits (e.g., higher in winter, lower in spring) • Change camping designations: at-large to

	Alternative A Current Conditions (No Adaptive Management)	Adaptive Management	
		Implement on BCMP Adoption	Implement as Needed Through Adaptive Management
	to off-itinerary hiking		designated sites or designated to at-large • Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes like Deer/Tapeats Creeks, Hermit/Monument) • Seasonal or permanent closures at specific locations
Human Waste Management	• Facilities located at designated campsites • Bury excrement, carry out toilet paper in areas without facilities	• Human waste carry-out required at River Zone backcountry sites by all users (RABT, hikers, etc.) • Commercially guided backpacking trips required to carry out human waste in Use Areas without toilets	• Replace existing toilets • Remove toilets • Install toilets at other sites • Specific zones or Use Areas require year-round or seasonal human waste carry-out • All Use Areas require seasonal or year-round human waste carry-out

Table 2.14c Summary of Elements Specific to Action Alternative B, C, or D

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Backcountry User Nights (Commercial and Non-Commercial)		**Percent Change from Current by Zone[31]**		
Corridor	53,821	55,531 (+3%)	59,421 (+10%)	54,846 (+2%)
Threshold	17,078	14,332 (-16%)	19,328 (+13%)	13,426 (-21%)
Primitive	20,698	20,770 (0.3%)	17,844 (-14%)	20,650 (-0.2%)
Wild	2,463	2,266 (-8%)	2,463 (0%)	2,266 (-8%)
Other	217	217	217	217
Total	94,277	93,116 (-1%)	99,273 (+5%)	91,405 (-3%)
Maximum Group Size for Overnight Backpacking by Zone (Commercial and Non-Commercial) (large/small)				
Corridor	11/6			
Threshold	11/6			6
Primitive	11/6	6	11/6	
Wild				
Commercial Overnight Backpacking				
Zone Allowed	All	Corridor, Threshold, limited Primitive	Corridor, Threshold, Primitive	Corridor
Authorization	Unlimited CUAs	Majority managed by contracts and limited opportunity for CUAs		
Permitting	*Commercial trips currently*	Percent of trips available to concessioners one year in advance:		
		100%	50%	75%
		CUA holders would	*Remaining percent available to concessioners and CUA holders to*	
	make reservations through public backcountry reservation system up to four months in advance (same as non-commercial users)			
		•CUAs limited to one permit/week and no more than 100 group nights/year • CUA use allowed up to 3 trips/year per operator • CUA holders could charter additional trips with contract holders		
Caps	**No Caps**	**Proposed Caps**		
Corridor Zone	Current Use (2012) Number of Groups/Night			
Bright Angel	Up to 5/night	2/night; 4/month can be large		3/night; 6/month can be large
Indian Garden	Up to 4/night	1.5/night (max 2/night 2 nights of 4); 3/month can be large	1/night; 3/month can be large	2/night; 3/month can be large
Cottonwood	Up to 4/night			
Threshold Zone	Up to 6/night	2 small/night; 6 nights max in any Use Area/month 3 nights/month can be large	3 small/night; 9 nights max in any Use Area/month 3 nights/month can be large	0
Primitive Zone	Up to 7/night	1 small/night with max 3 nights in any Use Area/month	2 small/night with max 6 nights in any Use Area/month	0
Wild Zone	Up to 18/year (no more than 1/night)	0	0	0

[31] Projected user nights were calculated using specific Use Area changes proposed in alternatives (i.e., Granite, Deer Creek Complex, Hance, Cottonwood, additional Corridor Zone campsites, etc.) and with the assumption that if group sizes are reduced from 11 maximum to 6 maximum (as in Alternatives B and D for some zones), groups formerly 7-11 people would become 6. Projections are based on calendar year 2012 data for each night in each Use Area.

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Commercial User Nights[32]	**Current (2012) User Nights**	**Projected**[33]		
Corridor	5011 (9.3%)*	6593 (11.9%)	5938 (10.0%)	9371 (17.1%)
Threshold	1572 (9.2%)	1572 (11.0%)	2359 (12.2%)	0
Primitive	1861 (9.0%)	786 (3.8%)	1572 (8.8%)	0
Wild	94 (3.8%)	0	0	0
Total	8538 (9.1%)	8952 (9.6%)	9869 (9.9%)	9371 (10.3%)
*Commercial user nights (percent of overall use)				
Commercial Day Hiking				
Group Size	11, minimum of 1 guide to 7 clients (2 guides with 9 clients)			
Allowed to	Recommended Limits	Limited To		
	• Bright Angel Trail to Three-Mile Resthouse • South Kaibab Trail to Cedar Ridge • North Kaibab Trail to Supai Tunnel • Hermit Trail to Santa Maria or Dripping Springs • Grandview Trail to designated turnaround at Coconino Saddle • Tanner Trail to Escalante Saddle (75-Mile Canyon Overlook)		• Same as Alternatives A and B **AND** • Bright Angel Trail to Indian Garden • South Kaibab Trail to Skeleton Point	• Bright Angel Trail to Three-Mile Resthouse • South Kaibab Trail to Cedar Ridge • North Kaibab Trail to Supai Tunnel
Commercial Backcountry Vehicle Tours (Tuweep)				
Maximum Trips/Day	• Up to 2 trips/ operator/day M-F • Up to 1 trip/ operator/day Sa-Su	• Up to 2 trips/day all operators combined	• Up to 3 trips/day M-F; 2 trips/day Sa-Su all operators combined	• Up to 1 trip/day all operators combined
Non-commercial River-assisted Backcountry Travel (RABT)				
River Travel	5-mile limit	31 river sections	9 river sections	11-mile limit
Day Use	Not permitted	Allowed with day use permit		
Backcountry Roads, Trails, and Routes				
South Rim Trails and Routes (Map 2.1)				
Eremita Mesa (1.8 miles)	Unmaintained hiking route	Same as A	Class 1 Wilderness Trail[34]	Same as A
Cape Solitude (12.4 miles)		Class 1 Wilderness Trail		
Boundary Road (14 miles)		Same as A	Boundary Road open to vehicles, stock, bicycles and hikers	Same as A
Roads (Map 2.4a)				
Pasture Wash Vehicle Access	Roads across USFS, and Havasupai lands with access fee		Same as A and Boundary Road open (see above)	Same as A

[32] User night: one hiker in the backcountry for one night.
[33] Projected user nights assumes maximum booking in prime season and same booking as 2012 off-season.
[34] See Appendix D, Trail Class Standards.

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
North Rim Trails and Routes (Map 2.1)				
Tiyo Point (6.3 miles)	• Unmaintained hiking routes • No stock use	• Class 1 Wilderness Trail • No stock use	• Class 4 Wilderness Trail • Day stock use	Same as A
Francois Matthes Point (4.7 miles)		Class 1 Wilderness Trail		
Walhalla Glades (7.3 miles)		Class 1 Wilderness Trail		
Komo Point (5.2 miles)		Same as A	Class 1 Wilderness Trail	
Roads (Map 2.4b)				
Basin Road, Kanabownits Swamp and Fire Point Roads	Open to vehicles, stock, bicycles, and hikers	Open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone		
Kanab Plateau Roads (Map 2.4c)	Road access to Kanab and SB Points, 150 Mile Canyon, and Schmutz	Road access to Kanab and SB Points, 150 Mile Canyon, and Schmutz as part of Road Natural Zone	Same as B, and convert 12 miles of former Kanab Plateau ranch roads to Class 1 Wilderness Trail	Same as B
Tuweep Road (Map 2.4d)	Open to vehicles, stock, bicycles, and hikers	Open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone		
Tuweep Facilities (Map 2.2 and Map 2.8)				
Vulcans Throne Road	Open to vehicles to rim	Convert to Class I trail; use road junction as parking/turnaround	Same as A	Same as B
Overlook Parking	Adjacent to Toroweap Overlook	Move close to campground as recommended in GMP		
Corridor Zone Camping (Groups/Night)				
Indian Garden	15 small/1 large campsites		15 small/2 large	Same as A
Bright Angel	30 small/2 large			
Cottonwood	11 small/1 large	up to 15 small/1 large	15 small/2 large	up to 13 small/1 large
Roaring Springs	Day use only		2 campsites	Same as A
Deer Creek/Tapeats Complex (Groups/Night)				
Esplanade (AY9)	2 small/1 large	3 small	2 small/1 large	2 small
Surprise Valley (AM9)	1 small/1 large	Use area split between Deer Creek, Upper Tapeats, and Bonita Creek		
Deer Creek (AX7)	2 small or 1 large	2 small	Same as A	2 small
Upper Tapeats (AW7)	2 small/1 large	3 small	3 small/1 large	3 small
Lower Tapeats (AW8)	1 small/1 large	Use area combined with Bonita Creek		

Element	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Bonita Creek (AW9)	Doesn't exist	2 small	1 small/1 large	1 small
Total Groups in Complex	12	10	11	8
Deer Creek Narrows				
Narrows Closure	As in Compendium, reviewed annually	Permanent restriction	Unrestricted access	Same as B **AND** restrict patio to one river trip at a time
Hance Creek/Cottonwood Creek/Cremation (Groups/Night)				
Hance Creek BE9/Primitive	2 small/1 large	3 small	Same as A	Same as B
Cottonwood Creek BG9/Primitive	2 small/1 large	3 small	Same as A	
Cremation BJ9/Primitive	2 small/1 large	3 small	1 small/1 large plus 1 small or large group at new designated site	
Hance Creek/Cottonwood Creek/Cremation Use Area Changes				
Hance Creek BE9/Primitive	None	None	Convert Primitive to Threshold Zone; as Threshold, consider adding toilets, change at-large to designated camping	None
Cottonwood Creek BG9/Primitive				
Cremation BJ9/Primitive			Portion to designated campsite	

Table 2.14d Overnight Use Limits, Group Number, and Group Size by Use Area and Zone

Table 2.14d illustrates Use Area maximum use levels for Alternative A (no-action/current conditions) and *proposed changes* by under action alternatives (B, C, and D).

Numbers in Table 2.14d were calculated based on proposals in each action alternative including changing some Use Area boundaries, maximum group size, and Corridor Campgrounds. Estimated number of people allowed to camp in each Use Area assumes group size is the maximum for each permit. Corridor Zone overnight use limits (Bright Angel, Cottonwood, and Indian Garden Campgrounds) are based on campground facility capacity rather than campsites available as explained in Chapter 3, Visitor Use and Experience, and Park Management and Operations. Projected user nights were calculated using specific Use Area changes (e.g., Granite, Deer Creek Complex, Hance, Cottonwood, etc.), additional Corridor Zone campsites, and with the assumption that if group sizes are reduced from 11 maximum to 6 maximum (as in Alternative B and D for some Zones), those groups that would have totaled 7-11 people would total six.

For more information on items in Table 2.14d, see Chapter 2, Alternatives and elements Common to All Action Alternatives, including sections: Backcountry Management Zones; Use Area Management (including Granite Rapids, Deer Creek/Tapeats Creek Complex and Hance Creek, Cottonwood Creek, and Cremation Use Areas); Maximum Group Size for Overnight Backpacking by Zone; Corridor Zone Camping.

Table 2.14d Summary of Use Area Limit and Management Zone Changes by Alternative
(Changes from Alternative A are shown in red italics)

Use Area Name, Code, Current Camp Type (D=Designated/ A=At-large)			Alternative															
			A (Current)				B				C				D			
			Number			Zone	Number			Zone	Number			Zone	Number			Zone
			Small Groups	Large Groups	People		Small Groups	Large Groups	People		Small Groups	Large Groups	People		Small Groups	Large Groups	People	
Corridor Management Zone																		
Bright Angel	CBG	D	31	2	90	C	31	2	90	C	31	2	90	C	31	2	90	C
Cottonwood	CCG	D	11	1	40	C	*15*	1	*50*	C	*15*	*2*	*60*	C	*13*	1	*50*	C
Indian Garden	CIG	D	15	1	50	C	15	1	50	C	15	*2*	*60*	C	15	1	50	C
Roaring Springs	*CRG*		Day use only				Day use only				*2*	*0*	*12*		Day use only			
											Designated							
Threshold Management Zone																		
Cape Final	NA1	D	1	0	6	T	1	0	6	T	1	0	6	T	1	0	6	T
Cedar Mountain	SB9	A	2	2	34	T	2	2	34	T	2	2	34	T	*4*	*0*	*24*	T
Cedar Springs	BL6	D	1	0	6	T	1	0	6	T	1	0	6	T	1	0	6	T
Clear Creek	AK9	A	3	1	29	T	3	1	29	T	3	1	29	T	*4*	*0*	*24*	T
Deer Creek	AX7	D	1	1	17	T	*2*	*0*	*12*	*P*	1	1	17	T	*2*	*0*	*12*	*P*
Eremita Mesa	SC9	A	1 sm or 1 lg		11	T	1 sm or 1 lg		11	T	1 sm or 1 lg		11	T	*1*	*0*	*6*	T
Granite Rapids	BL8	A	2	1	23	T	*1*	1	*17*	T	*1*	1	*17*	T	2	*0*	*12*	T
							Changes to the riverine environment have impacted Granite Rapids site capacity											

Use Area Name, Code, Current Camp Type (D=Designated/ A=At-large)			Alternative															
			A (Current)				B				C				D			
			Number				Number				Number				Number			
			Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone
Hermit Creek	BM7	D	3	1	29	T	3	1	29	T	3	1	29	T	*4*	*0*	*24*	T
Hermit Rapid	BM8	D	1	1	17	T	1	1	17	T	1	1	17	T	*2*	*0*	*12*	T
Horn Creek	BL4	D	1	0	6	T	1	0	6	T	1	0	6	T	1	0	6	T
Horseshoe Mesa	BF5	D	3	1	29	T	3	1	29	T	3	1	29	T	*4*	*0*	*24*	T
Lava	NN9	A	1	1	17	T	1	1	17	T	1	1	17	T	*2*	*0*	*12*	T
Lower Tapeats	*AW8*	D	1	1	17	T	*Lower Tapeats becomes part of at-large Bonita Creek Use Area*											
Monument	BL7	D	3	1	29	T	3	1	29	T	3	1	29	T	*4*	*0*	*24*	T
Pasture Wash	SE0	A	1	1	17	T	1	1	17	T	1	1	17	T	*2*	*0*	*12*	T
Point Sublime	NH1	D	1	1	17	T	*2*	*0*	*12*	*RN*	*2*	*0*	*12*	*RN*	*2*	*0*	*12*	*RN*
Ruby Point	SE2	D	1	0	6	T	1	0	6	*RN*	1	0	6	*RN*	1	0	6	*RN*
Salt Creek	BL5	D	1	0	6	T	1	0	6	T	1	0	6	T	1	0	6	T
Signal Hill	SE1	D	1	0	6	T	1	0	6	*RN*	1	0	6	*RN*	1	0	6	*RN*
South Bass Trailhead	SE3	D	2 sm or 1 lg		12	T	*2*	*0*	12	*RN*	*2*	*0*	12	*RN*	*2*	*0*	12	*RN*
Toroweap	NM9	A	2	1	23	T	2	1	23	T	2	1	23	T	*3*	*0*	*18*	T
Upper Tapeats	AW7	D	2	1	23	T	*3*	*0*	*18*	*P*[35]	*3*	1	*29*	*P*	*3*	*0*	*18*	*P*
Whitmore	LI9	A	1	1	17	T	1	1	17	T	1	1	17	T	*2*	*0*	*12*	T
Widforss	NF9	A	2	1	23	T	2	1	23	T	2	1	23	T	*3*	*0*	*18*	T
Primitive Management Zone																		
150 Mile Trailhead	*NK3*	*D*	Use Area does not currently exist				*1*	*0*	*6*	*RN*	*1*	*0*	*6*	*RN*	*1*	0	*6*	*RN*
Badger	AA9	A	1	1	17	P	*2*	*0*	*12*	P	1	1	17	P	*2*	*0*	*12*	P
Bonita Creek	*AW9*	*A*	Use Area does not currently exist				*2*	*0*	*12*	*P*	*1*	*1*	*17*	*P*	*1*	*0*	*6*	*P*
							Bonita Creek created from part of Surprise Valley and Lower Tapeats Use Areas											
Boucher	BN9	A	2	1	23	P	*3*	*0*	*18*	P	2	1	23	P	*3*	*0*	*18*	P
Cape Solitude	SA9	A	2	1	23	P	*3*	*0*	*18*	P	2	1	23	P	*3*	*0*	*18*	P
Cardenas	BC9	A	2	1	23	P	*3*	*0*	*18*	P	2	1	23	P	*3*	*0*	*18*	P
Cottonwood Ck	BG9	A	3	1	29	P	*4*	*0*	*24*	P	3	1	29	*T*	*4*	*0*	*24*	P
											Designated camping							
Cremation *East*	BJ9	A	2	1	23	P	*3*	*0*	*18*	P	*1*	1	*17*	P	*3*	*0*	*18*	P
Cremation West	*BJ1*	-	Use Area does not currently exist								*1 sm or 1 lg*		*11*	T				
											Designated							
Eminence Break	SF9	A	1	1	17	P	*2*	*0*	*12*	P	1	1	17	P	*2*	*0*	*12*	P

[35] Backcountry Management Zone Abbreviations: P=Primitive; T=Threshold; W=Wild; RN=Proposed Road Natural; R=Proposed River.

Use Area Name, Code, Current Camp Type (D=Designated/ A=At-large)			Alternative															
			A (Current)				B				C				D			
			Number				Number				Number				Number			
			Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone
Esplanade	AY9	A	2	1	23	P	3	0	18	P	2	1	23	P	2	0	12	P
Fire Point	NJ1	D	1 sm or 1 lg		11	P	1	0	6	RN	1	0	6	RN	1	0	6	RN
Garnet	BR9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Grand Wash Cliffs	LM9	A	2 sm or 1 lg		12	P	2	0	12	P	2 sm or 1 lg		12	P	2	0	12	P
Grapevine	BH9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Hance Creek	BE9	A	2	1	23	P	3	0	18	P	2	1	23	T	3	0	18	P
											Designated camping							
Indian Hollow	AN9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Jackass	SI9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Kanab	NK9	A	3	1	29	P	1	0	6	P	1 sm or 1 lg		11	P	1	0	6	P
							Sites designated at Kanab, SB, 150 Mile Points											
Kanab Creek	LA9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Kanab Point	NK1	D	Use Area does not currently exist				2	0	12	RN	2	0	12	RN	2	0	12	RN
Ken Patrick	NC9	A	2 sm or 1 lg		12	P	2	0	12	P	2	0	12	P	2	0	12	P
Nankoweap	AE9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
North Bass	AS9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Outlet	NG9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Palisades	BA9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Powell Plateau	AT9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Red Canyon	BD9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Rider	AB9	A	1 sm or 1 lg		11	P	1	0	6	P	1 sm or 1 lg		11	P	1	0	6	P
Robbers Roost	ND9	A	3	1	29	P	4	0	24	P	3	1	29	P	4	0	24	P
Ruby	BP9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Saddle Canyon	AD9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Saltwater Wash	SH9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
SB Point	NK2	D	Use Area does not currently exist				1	0	6	RN	1	0	6	RN	1	0	6	RN
Schmutz Trailhead	NL1	D	Use Area does not currently exist				1	0	6	RN	1	0	6	RN	1	0	6	RN
Shinumo Wash	SG9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Slate	BO9	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Snap Point	LL9	A	2 sm or 1 lg		12	P	2	0	12	P	2 sm or 1 lg		12	P	2	0	12	P
Soap Creek	AB0	A	2 sm or 1 lg		12	P	2	0	12	P	2 sm or 1 lg		12	P	2	0	12	P
South Canyon	AC9	A	1	1	17	P	2	0	12	P	1	1	17	P	2	0	12	P
Surprise Valley	AM9	A	1	1	17	P	Surprise Valley becomes part of Deer Creek, Tapeats, and Bonita Creek Use Areas											
Swamp Point	NJ2	D	2 sm or 2 lg		22	P	2	0	12	RN	2	0	12	RN	2	0	12	RN

Use Area Name, Code, Current Camp Type (D=Designated/ A=At-large)			Alternative															
			A (Current)				B				C				D			
			Number				Number				Number				Number			
			Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone
Swamp Ridge	NJ0	A	1	1	17	P	2	0	12	P	2	0	12	P	2	0	12	P
South Bass	BQ9	A	1	1	17	P	2	0	12	P	2	0	12	P	2	0	12	P
Tanner	BB9	A	3	1	29	P	4	0	24	P	3	1	29	P	4	0	24	P
The Dome	LC9	A	2 sm or 1 lg		12	P	2	0	12	P	2 sm or 1 lg		12	P	2	0	12	P
Thompson Canyon	NB9	A	2 sm or 1 lg		29	P	4	0	24	P	3	1	29	P	4	0	24	P
Tuckup Point	NL9	A	3	1	29	P	3	0	18	P	2	1	23	P	3	0	18	P
							Sites designated at Tuckup Point and Schmutz Trailhead											
Walhalla	NA0	A	2	1	23	P	3	0	18	P	2	1	23	P	3	0	18	P
Wild Management Zone																		
Blacktail	AU9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Boysag	LB9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Burnt Point	LK9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Cheyava	AJ9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Chuar	AF9	A	2 sm or 1 lg		12	w	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Diamond Creek	LG9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Fishtail	AZ9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Fossil	BS9	A	1 sm or 1 lg		11	W	1	0	6	W	1 sm or 1 lg		11	W	1	0	6	W
Greenland Springs	AL9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
National	BU9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Olo	BT9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Parashant	LE9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Phantom Creek	AP9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Scorpion Ridge	AR9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Separation	LH9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Surprise	LJ9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Tapeats Amphitheater	AV9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Trail Canyon	LF9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Trinity Creek	AQ9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Unkar	AG9	A	2 sm or 1 lg		12	W	2	0	12	W	2 sm or 1 lg		12	W	2	0	12	W
Vishnu	AH9	A	1 sm or 1 lg		11	W	1	0	6	W	1 sm or 1 lg		11	W	1	0	6	W
Other Use Areas (not categorized in Backcountry Zones)																		
North Rim Horse Camp	NRH	D	1	1	8	O	1	1	8	O	1	1	8	O	1	1	8	O
North Rim Roads (winter)	NRR		5	2	52	O	5	2	42	O	5	2	52	O	5	2	42	O

Use Area Name, Code, Current Camp Type (D=Designated/ A=At-large)			Alternative															
			A (Current)				B				C				D			
			Number				Number				Number				Number			
			Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone	Small Groups	Large Groups	People	Zone
North Rim Winter Camp	NCG	D	5	2	52	O	5	2	42	O	5	2	42	O	5	2	42	O
North Rim Yurt	YUR	D	1	0	6	O	1	0	6	O	1	0	6	O	1	0	6	O
Tuweep Campground	TCG		9	1	65	O	9	1	65	*RN*	9	1	65	*RN*	9	1	65	*RN*
Proposed River Zone																		
The proposed River Zone overlays the Colorado River and adjacent Management Zones and Use Areas as a tool to address river-related resource issues. Use levels prescribed by individual Use Areas listed above do not change																		
Proposed Road Natural Zone																		

The proposed Road Natural Zone does not currently exist. Use Areas and overnight numbers shown in the table to the right are also shown in the table above, but are summarized here for the Road Natural Zone

Use Area and Designated Campsite		Maximum Number People Overnight (Site)*	Maximum Number Vehicle Capacity*
South Rim (Map 2.4a)			
SE1	Signal Hill	6 (1 small)	2
SE2	Ruby Point	6 (1 small)	1
--	Havasupai Point (day use only)	n/a	3
SE3	South Bass Trailhead	12 (2 small)	6
North Rim (Map 2.4b)			
NH1	Point Sublime	12 (2 small)	6
NJ1	Fire Point	12 (2 small)	6
NJ2	Swamp Point	12 (2 small)	6
Kanab Plateau (Map 2.4c)			
NK1	Kanab Point	12 (2 small)	6
NK2	SB Point	6 (1 small)	2
NK3	150 Mile Canyon Trailhead	6 (1 small)	2
NL1	Schmutz Spring Trailhead	6 (1 small)	6
Tuweep (Map 2.4d)			
Tuweep Campground‡		65 (1 large site + 9 small sites)	22 (4/large site + 2/small site)

*maximum vehicle number the site can accommodate at one time, including day use
*Numbers are based on the area's capacity to accommodate people and vehicles without causing damage to resources
‡ same as current

Table 2.15 How Alternatives Meet Objectives

Objective	Alternative A: No-Action	Alternative B: NPS Preferred	Alternative C	Alternative D
Visitor Use and Experience				
Provide opportunities for visitors to experience and be inspired by Grand Canyon's backcountry resources and values while ensuring resource protection.	Meets objective to a moderate degree because there is a variety of recreational opportunities in the park's backcountry.	Meets objective to a moderate degree because it allows additional opportunities to camp in the Corridor Zone and participate in RABT trips.	Meets objective to a moderate degree because it allows for private stock use on the Tiyo Point Trail, additional opportunities to camp in the Corridor Zone, and increased flexibility with RABT trips.	Meets objective to some degree because it allows additional opportunities to camp in the Corridor Zone and participate in RABT trips. However, group sizes are less outside the Corridor Zone, decreasing the number of opportunities for overnight backpacking in other zones.
Establish levels and types of visitor opportunities, non-commercial and commercial, to enhance visitor experience and minimize crowding, conflicts, and resource impacts.	Meets objective to some degree because levels of overnight use have been established, but not separately for commercial and non-commercial. Crowding, conflicts, and resource impacts would continue.	Meets objective to a large degree because a commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite, number of groups in the Deer Creek/Tapeats Creek Complex, and group size in Primitive and Wild Zones.	Meets objective to a large degree because a commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite and number of groups in the Deer Creek/Tapeats Creek Complex.	Meets objective to some degree because conflicts would likely still exist in the Corridor Zone between commercial and non-commercial groups. Similar to B and C, the commercial services analysis would determine the necessary and appropriate types and levels of commercially guided services; conflicts and crowding from extended day hiking and running would be addressed through adaptive management; and resource impacts would be reduced from the decrease in number of groups at Granite, number of groups in the Deer Creek/Tapeats Creek Complex, and group size in Threshold, Primitive and Wild Zones.

Objective	Alternative A: No-Action	Alternative B: NPS Preferred	Alternative C	Alternative D
Resources				
Manage backcountry use to protect wildlife populations and habitat by minimizing human-caused disturbances and habitat alteration.	Meets objective to some degree; backcountry use does impact wildlife through noise and vegetation disturbance.	Meets objective to some degree, greater than Alternative A and C, because there would be smaller groups in Primitive and Wild Zones and adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.	Meets objective to some degree, less than A, because group sizes for overnight backpacking would remain the same as current, private stock use would be allowed to Tiyo Point, and the Boundary Road would be developed. Adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.	Meets objective to some degree, greater than Alternative A and C, because there would be smaller groups in Threshold, Primitive and Wild Zones and adaptive management would consider impacts to wildlife and implement actions such as seasonal restrictions to canyoneering and other activities in sensitive wildlife habitats.
Manage backcountry use to minimize impacts to native vegetation, reduce exotic plant species spread, and preserve fundamental biological and physical processes.	Meets objective to some degree, backcountry use does impact native vegetation through direct vegetation modification and also increases spread of exotic plant species.	Meets objective to a moderate degree because group size for overnight use would be reduced, the Road Natural Zone prescribes a maximum number of vehicles by location, and there are reduced numbers of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to some degree because large groups would still be allowed in all zones, private stock use would be allowed on Tiyo Point trail, and the Boundary Road would be developed, all of which would increase impacts to native plant species and encourage exotic plant species to spread.	Meets objective to a moderate degree because there would be smaller groups in Threshold, Primitive, and Wild Zones, and decreased numbers of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.
Manage use to enhance wilderness character and values.	Meets objective to some degree, but not fully because toilets are located in Wilderness, helicopters are used for toilet maintenance and emergency services, and there is not a specific park plan that implements NPS Wilderness Policy.	Meets objective to a large degree because of the reduced group size in the Primitive and Wild Zones, converts two Use Areas from Threshold to Primitive, and this plan would implement NPS Wilderness Policy.	Meets objective to a moderate degree because this plan would implement NPS Wilderness Policy, but also would convert two Use Areas from Primitive to Threshold which could result in the addition of designated campsites and toilets in Wilderness.	Meets objective to a large degree because of the reduced group size in the Threshold, Primitive, and Wild Zones, converts two Use Areas from Threshold to Primitive, converts the fewest miles of old road bed to trail, and this plan would implement NPS Wilderness Policy.
Develop and implement an adaptive management	Does not meet objective because there is not an	Meets objective to a large degree because an adaptive	Meets objective to a large degree because an adaptive	Meets objective to a large degree because an adaptive

Objective	Alternative A: No-Action	Alternative B: NPS Preferred	Alternative C	Alternative D
process that includes monitoring natural, cultural, and experiential resource conditions and responding when resource degradation has resulted from use levels.	adaptive management process is in place.	management process is outlined.	management process is outlined.	management process is outlined.
Preserve and protect natural soil conditions by minimizing impacts to soils from backcountry recreational activities.	Meets objective to some degree, backcountry use does impact soils through soil compaction at campsites, social trailing, and erosion.	Meets objective to moderate degree because of the reduced group size in Primitive and Wild Zones and restoration of old road beds.	Meets objective to some degree, soils would be impacted through the development of the Boundary Road.	Meets objective to moderate degree because of the reduced group size in Threshold, Primitive, and Wild Zones and restoration of old road beds.
Manage recreational use to minimize adverse chemical, physical, and biological changes to water quality in tributaries, seeps, and springs.	Meets objective to some degree, backcountry use does impact water resources through direct contamination of water sources (bathing, washing dishes, etc.), increased sediment, and social trailing.	Meets objective to moderate degree because of the reduced group size in Primitive and Wild Zones, and human waste carry out in the River Zone and by commercial groups in areas where toilets are not available, and decreased number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to some degree, greater than Alternative A because although group sizes would remain the same throughout all zones, human waste carry out would be required in the River Zone and by commercial groups in areas where toilets are not available, and there would be a decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.	Meets objective to moderate degree because of the reduced group size in Threshold, Primitive, and Wild Zones, and human waste carry out in the River Zone and by commercial groups in areas where toilets are not available, and decreased number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex.
Manage recreational use to preserve cultural resource integrity and condition.	Meets objective to some degree, backcountry use does impact cultural resources through camping impacts in and near archaeological sites, social trailing through sites, vandalism, and collection piles.	Meets objective to some degree, greater than Alternative A because although impacts would continue to cultural resources these impacts would be reduced from the decrease in group size in Primitive and Wild Zones, decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for	Meets objective to some degree, similar to A because group size would remain the same throughout the backcountry, the Boundary Road would be developed and impact cultural resources, and at the same time there would be a decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for	Meets objective to some degree, greater than Alternative A because although impacts would continue to cultural resources these impacts would be reduced from the decrease in group size in Threshold, Primitive and Wild Zones, decrease in number of groups in the Granite Use Area and Deer Creek/Tapeats Creek Complex, and increased education specifically for

Objective	Alternative A: No-Action	Alternative B: NPS Preferred	Alternative C	Alternative D
		commercial guides.	commercial guides.	commercial guides.
Coordination and Cooperation				
Work with park neighbors including tribal entities, federal land managers, park partners, gateway communities, and other stakeholders to improve coordination and communication regarding backcountry use.	Meets objective to some degree because NPS does work with park neighbors.	Meets objective to a moderate degree because communication and coordination would be improved, specifically with tribes.	Meets objective to a moderate degree because communication and coordination would be improved, specifically with tribes.	Meets objective to a moderate degree because communication and coordination would be improved, specifically with tribes.
Work with adjacent tribal land managers to improve access to the park's backcountry.	Does not meet objective because under Alternative A, there would be no access across Great Thumb to the park's backcountry.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.	Meets objective to a moderate degree because under all action alternatives, 10 small groups would be allowed access across Great Thumb to the park's backcountry and the park would continue to communicate with the tribe about this access.
Park Management and Operations				
Establish recreational use levels sustainable for both resource protection and park operations.	Meets object to a minimal degree because the current levels of use can overtask park staff, specifically the inner canyon rangers and emergency services personnel.	Meets objective to some degree because overnight use would decrease a small amount (1%) and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.	Meets object to a minimal degree because overnight use would increase by 5%, an additional camp area would be established in the Corridor at Roaring Springs and require staff, and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.	Meets objective to some degree because overnight use would decrease a small amount (3%) and adaptive management would be used to manage activities that currently overtask staff, such as extended day hiking and running.

Table 2.16 Impact Summary

	Alternative A	Alternative B	Alternative C	Alternative D
Soils	Under Alternative A, minor to moderate, adverse, localized, short and long-term impacts to soils would result from recreational use in areas from climbers, canyoneers, and RABT users; campsite expansion by large groups in all Use Areas; continued inappropriate human waste disposal in high use areas; damage related to Corridor Zone trail congestion associated with extended day hiking and running; and visitor impacts at Tuweep. Minor to moderate, beneficial, localized, short and long-term impacts would result from continuation of passive and active restoration of closed roads, and management activities such as trail maintenance and social trail obliteration. Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative A would contribute a small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, moderate, adverse, localized, short and long-term impacts to soils would result from increased use and more users with time to explore at Cottonwood Campground, and new soil disturbance from relocation of the Toroweap overlook parking area. Moderate, beneficial, localized, short to long-term impacts would result from continuation of closed road passive and active restoration, exclusion of large groups in Primitive and Wild Zones, reductions in group size and number in the Deer Creek/Tapeats Complex and Hermit and Granite Rapids Use Areas, River Zone waste carry-out, and recovery of former road and overlook parking at Tuweep. Beneficial impacts would also come from increased education in trail etiquette and Leave No Trace from commercial backpacking and day hiking guides, and monitoring and education of climbers, canyoneers, and RABT users through the permitting process. Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative B would contribute a small amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, major, adverse, localized, short to long-term impacts to soils would result from increased users with time to explore at new campsites at Cottonwood, Roaring Springs and Indian Garden Campsites, stock use on the Tiyo Point Trail, construction impacts and traffic on the Boundary Road, return of users to Deer Creek Narrows, and potential camp and toilet construction activities at Hermit, Granite and Cremation Use Areas. Minor, beneficial, localized, short to long-term impacts would result from continued passive and active closed road restoration; group size and number reduction in the Deer Creek/ Tapeats Creek Complex; focus of impacts on designated sites in Hermit, Cremation, and Granite Rapids Use Areas; River Zone waste carry-out; increased education in trail etiquette and Leave No Trace techniques from commercial backpacking and day hiking guides; and monitoring and education of climbers, canyoneers and RABT users through the permitting process. Minor to major beneficial, localized, long-term impacts would result from adding toilets to Hance and Cottonwood Use Areas which would be managed in the Threshold Zone. Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative C would contribute a small amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized, short and long-term impacts to soils would result from trailing in new areas associated with climbing, RABT, and canyoneering; trail construction and maintenance; and impacted area expansion in the Corridor Zone and at Tuweep. Moderate, beneficial, localized, short and long-term impacts to soils would occur from continuation of passive and active closed road restoration, creation of single trails from Wilderness routes, restriction of commercial day hikes to three segments, exclusion of large groups outside the Corridor Zone, group size and number reductions in the Deer Creek/Tapeats Creek Complex and Hermit, Granite Rapids, and Cremation Use Areas, River Zone waste carry-out; recovery of former road and Overlook parking at Tuweep; increased education in trail etiquette and LNT techniques from commercial backpacking and day hiking guides, and education of climbers, canyoneers, and RABT users. Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative D would contribute a very small amount.
Water Resources	Under Alternative A, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses and would include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor, beneficial, local to regional, short and long-term impacts would result from educating visitors on minimum impact practices and the passive restoration or recovery of old roadbeds. Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative A would contribute a very small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses would be perceptible and measurable including the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor to moderate, beneficial, localized and regional, short and long-term impacts would result from smaller group sizes, closing Deer Creek narrows, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would include the addition of up to eight Corridor Zone campsites, large and small group camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons including Deer Creek Narrows. Impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor, beneficial, short and long-term, localized and regional impacts would result from converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices. Cumulative impacts to water resources would be	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, short and long-term, localized and regional impacts to water resources would result from recreational uses include the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features. Minor to moderate, beneficial, short and long-term, localized and regional impacts would result from smaller group sizes in Wilderness Zones, closing and limiting visitation at Deer Creek narrows area, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact.

	Alternative A	Alternative B	Alternative C	Alternative D
		Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative B would contribute a very small amount.	major, adverse, localized to regional, long-term and year-round of which Alternative C would contribute a small amount.	Cumulative impacts to water quality would be major, adverse, localized to regional, and long-term of which Alternative D would contribute a very small amount.
Soundscape	Under Alternative A, minor to moderate, adverse, localized and short-term impacts would result from continued administrative use of aircraft for backcountry toilet servicing, resource management, and boundary patrols; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for trails and roads maintenance. While some of these noise sources are louder and more intense during the time they are present, they are present for short times, and are infrequent. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative A would contribute a small amount.	Under Alternative B and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 trails and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative B would contribute a small amount.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; the development of the Boundary Road and recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 and 4 trails and road maintenance. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, separation of day use parking near the overlook, and potential for establishing vehicle limits at Tuweep. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative C would contribute a small amount.	Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for such activities as trail and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground. Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep, and increased number of unmaintained trails and routes in Wilderness. Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative D would contribute a small amount.
Cave Resources	Under Alternative A, minor to major, adverse, local, short and long-term effects to cave resources would result from users who enter caves while on backcountry itineraries or day hikes and degrade the resources through direct contact (e.g., breakage or removal) or through indirect means such as reducing the quality of water in caves and disturbing cave-dwelling bats. Minor to major, beneficial, localized, short and long-term impacts would result from administrative actions for mitigation and restoration (e.g., trail obliteration), or those which limit unauthorized access to caves. Cumulative impacts would be major, adverse, regional, and short to long-term of which Alternative A would contribute a large amount because backcountry users are the source of most impacts to cave resources.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized and both short and long-term impacts to cave resources would result from the increased number of canyoneering routes accessed using RABT under Alternative B, and the likely increase in users in proximity to cave resources with equipment necessary to explore them. Minor, beneficial, localized, short to long-term impacts would result from reduced group size in Primitive and Wild Zones, a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts. Cumulative impacts would be major, adverse, short and long-term, and localized of which Alternative B would contribute a medium amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, local short and long-term impacts to cave resources would result from the increase in visitors near known cave resources near Roaring Springs with the creation of campsites in the area. Minor to major adverse short and long-term impacts would also result from the potential introduction of human waste into karst systems from toilets in the Hance, Cottonwood, and Cremation Use Areas. Negligible to minor, beneficial, localized, short to long-term impacts would result from a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts. Cumulative impacts would be major adverse, short and long-term, and localized to regional of which Alternative C would contribute a large amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized, short to long-term impacts to cave resources would result from the increase in RABT segment length to a maximum of 11 miles. This increase would allow exploration of more routes to caves. Minor, beneficial, localized impacts to cave resources would occur because of the decrease in numbers and group size allowed outside the Corridor Zone, the Deer Creek/Tapeats Creek complex, and the Hance, Cottonwood, and Cremation Use Areas; minimum impact education provided to climbing, canyoneering, and RABT users and the monitoring of their numbers and distribution to inform management via the permitting process. Implementation of adaptive management would contribute to these beneficial impacts. Cumulative impacts would be major, adverse, short and long-term, and localized to regional of which Alternative D would contribute a medium amount.
Vegetation	Under Alternative A, moderate, adverse, regional, short to long-term impacts to vegetation would result	Under Alternative B, including actions described under Impacts of Elements Common to All Action	Under Alternative C, including actions described under Impacts of Elements Common to All Action	Under Alternative D, including actions described under Impacts of Elements Common to All Action

	Alternative A	Alternative B	Alternative C	Alternative D
	from general recreational use and include: vegetation trampling, soil compaction, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Beneficial impacts from vegetation recovery on closed roads and other administrative actions would be negligible. Cumulative impacts to vegetation would be adverse, major, localized to regional, long-term, and year-round of which Alternative A would contribute a small amount.	Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, regional long-term impacts would result from decreases in group size in Primitive and Wild Zones, decrease in number of groups in Granite and Deer Creek/Tapeats Creek Complex, vegetation recovery on closed roads, and active site restoration. Cumulative impacts to vegetation would be major, adverse, localized to regional, long-term, and year-round of which Alternative B would contribute a small amount.	Alternatives, moderate, adverse, regional, long-term impacts to vegetation would result from general recreational use and include vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs and Indian Garden, use of stock on the Tiyo Point trail, creation and maintenance of the Boundary Road, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, regional, long-term impacts would result from vegetation recovery on closed roads and active site restoration. Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative C would contribute a small amount.	Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor beneficial, regional long-term impacts would result from decreases in group size, some Use Area changes, vegetation recovery on closed roads, invasive plant management, vegetation inventory, and active site restoration. Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative D would contribute a small amount.
Wildlife	Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts would result from the majority of backcountry use by visitors continuing to occur in the spring, summer and fall and from current patterns of the administrative use of helicopters in the backcountry. Under some conditions impacts from habitat modification at campsites, and disturbance or displacement from camping would be observable and measurable. Conversely, campsites, rest houses, and high use trails could also attract and habituate certain species of wildlife. In addition, disturbance and displacement along high use trails would be observable. Minor, beneficial, localized, short and long-term impacts would result from administrative restoration activities, continued closure and restoration of former roads, and educational programs from NPS and partner organizations. Cumulative impacts would moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.	Under Alternative B, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from administrative use helicopter flights, continued high visitor use in the Corridor Zone, construction activities associated with increased campsite numbers in the Corridor Zone, and an approximate increase of 3% in overnight users in the Corridor Zone. Minor, beneficial, localized, short and long-term impacts would come from conversion, closure and restoration of former backcountry roads and the Toroweap Overlook road, reductions in group sizes in the Deer Creek/Tapeats Creek Complex and other Use Areas, reductions in group sizes for Primitive and Wild Zones and for all climbing, canyoneering and RABT use, overall slight decrease (1%) in overnight backcountry users, training requirements for commercial guides, and Leave No Trace education for hikers, canyoneers, and day users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have minor, beneficial local and long-term impacts on wildlife. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative B would contribute a small amount.	Under Alternative C, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance from administrative use helicopter flights, interactions between stock and wildlife on the Tiyo Point trail, construction of large campsites and increased numbers of users in the Corridor Zone, and construction activities and increased traffic on the Boundary Road. An overall increase of 5% for overnight use in the backcountry would occur under this alternative, with impacts described in the Potential Day and Overnight Use Impacts to Wildlife section. Minor, beneficial, localized, short and long-term impacts would come from closures of some backcountry roads and restoration in those areas, Leave No Trace and etiquette education for climbers, canyoneers, RABT users, extended day hikers and clients of the NPS, its cooperators and commercial guides. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative C would contribute a medium amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance caused by administrative use helicopter flights, continued use of some backcountry roads, construction associated with increasing campsite numbers in the Corridor Zone and increased numbers of overnight users in those areas. The impacts of overnight use are described in the Potential Day and Overnight Use Impacts to Wildlife Section. Minor, beneficial, localized, short and long-term impacts would occur due to the prohibition of large groups outside the Corridor Zone, including the Deer Creek/Tapeats Creek Complex, the lack of vehicles on the Vulcans Throne Road, and Minimum Impact and etiquette education for extended day hikers, canyoneers, climbers and RABT users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well. Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative D would contribute a small amount.
Special Status Plant Species	Under Alternative A, minor to moderate, adverse, regional, short-to long-term impacts to special status plant species would result from general recreational use and include vegetation trampling, soil compaction, campsite expansion, trail creation, and	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational

	Alternative A	Alternative B	Alternative C	Alternative D
	direct damage to special status plants. Negligible to minor, beneficial, localized, long-term impacts would result from passive restoration on closed roads. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative A would contribute a small amount.	use including vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, trail creation, and direct damage to vegetation. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative B would contribute a small amount.	use and include: vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs, and Indian Garden, trail creation, and direct damage to vegetation. Negligible, beneficial impacts would result from a decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative C would contribute a small amount.	use and include: vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.
Special Status Wildlife Species	Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from the majority of backcountry use continuing to occur in the spring, summer and fall. Impacts from habitat modification at campsites, and disturbance or displacement from camping would occur. Campsites, rest houses, and high use trails could also attract and habituate certain species of special status wildlife and disturbance and displacement along high use trails would occur. Cumulative effects would be moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.	Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification and disturbance from the addition of up to four campsites at Cottonwood. Impacts would be somewhat reduced when compared to Alternative A from decreased group size in Primitive and Wild Zones, decrease in group number and size in Deer Creek/Tapeats Creek Complex, and reduced number groups in the Granite Use Area. Adaptive management under all action alternatives would also benefit special status wildlife. Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative B would contribute a small amount.	Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification an disturbance from the addition and use of up to eight campsites in the Corridor Zone. A reduction of adverse impacts would occur in the Deer Creek/Tapeats Creek Complex and Granite Use Area where number of groups would be decreased compared to Alternative A. Adaptive management under all action alternatives would also benefit wildlife. Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative C would contribute a small amount.	Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status wildlife species would result from general recreational use and include: vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area. Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.
Archaeological Resources	Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would result from use of the backcountry and resultant human disturbances including trailing through archaeological sites, camping on sites, displacement of artifacts and modification of structures, theft of artifacts, graffiti, campfires, inappropriate campsite creation and management within and adjacent to archaeological sites, and improper human waste management. Continued use of the backcountry under Alternative A has the potential for continued and increasing impacts from visitor use, improper waste management and other unpermitted activities. Cumulative impacts would be major, adverse, regional, and long-term of which Alternative A would contribute a medium amount. Under Section 106	Including impacts from elements Common to All Action Alternatives, moderate to major, adverse, regional, short-term impacts to archaeological resources would result from implementation of Alternative B, as a result of road and trail use and maintenance activities, at-large and designated camps located in, or adjacent to, archaeological site boundaries. Minor, beneficial, regional, short and long-term impacts would result from reductions in group size in Primitive and Wild Zone, closures of culturally-sensitive areas, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of	Including impacts from elements common to all action alternatives, moderate to major adverse, regional, short and long-term impacts to archaeological resources would result from implementation of Alternative C as a result of road and trail use, toilet construction, and maintenance activities and at-large or designed camps located in, or adjacent to, archaeological site boundaries. Minor to moderate, beneficial, regional, long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of archaeological site National Register eligibility.	Under Alternative D and common to all action alternative elements, moderate to major, adverse, regional, short-term impacts would result from continued disturbances to archaeological resources as a result of road and trail use and maintenance activities and at-large or designated camps located in, or adjacent to, archaeological site boundaries. These effects may be reduced by small group sizes in Threshold, Primitive, and Wild use zones. Minor to moderate, beneficial, regional, short and long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that

	Alternative A	Alternative B	Alternative C	Alternative D
	there would be an adverse effect to archaeological resources.	archaeological site National Register eligibility. Cumulative impacts would be major, adverse, long-term, and regional of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.	Cumulative impacts would be major, adverse, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to archaeological resources.	promote preservation of archaeological site National Register eligibility. Cumulative impacts would be major, adverse, regional, and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.
Historic Structures	Under Alternative A, minor to moderate, adverse, localized and regional, short and long-term impacts to the historic structures would result from would result from visitor use disturbances including vandalism (graffiti and structural damage), human waste disposal, littering, and campfires. Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a small amount. Under Section 106, there would be an adverse effect to historic structures.	Under Alternative B and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from smaller group size in Primitive and Wild zones and guide requirements would have minor, localized, and long-term effects on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from guide requirements would have a minor, localized, and long-term impact on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.	Under Alternative D and elements common to all action alternatives, minor, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), and improper human waste disposal. Beneficial effects from smaller group size in Threshold, Primitive and Wild zones, guide requirements, and management of unmaintained routes would have minor, localized and regional, short and long-term impacts on historic structures. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a very small amount. Under Section 106, there would be an adverse effect to the historic structures.
Traditional Cultural Properties and Ethnographic Resources	Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would occur from continued use of the backcountry and visitor use disturbances including crowding from large groups, reduced access to resources by the Traditionally Associated Tribes from overuse, trailing, camping on sites and within resource areas, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, vegetation disturbances, disturbances to animals, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects result from restrictions at Deer Creek Narrows and ongoing visitor education on trail etiquette and leave no trace camping practices. These impacts are minor to moderate, localized and regional, short and long-term. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative A would contribute a medium amount to the adverse impact. Under Section 106, there would be an adverse effect to ethnographic resources.	Under Alternative B and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size in the Primitive and Wild Zone, closures of culturally sensitive areas, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.	Under Alternative C and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, road maintenance, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size for canyoneering groups, establishment of campsites outside of boundaries of ethnographic resources and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative C would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.	Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects would result from reductions in group size in the Threshold, Primitive and Wild Zone, closures of culturally sensitive areas, retaining unmaintained routes and allowing old roadbeds to naturally recover, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to major, localized and regional, long-term beneficial effects to ethnographic resources. Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.

	Alternative A	Alternative B	Alternative C	Alternative D
Cultural Landscapes	Under Alternative A, minor to moderate, adverse, localized and regional, short and long-terms impacts to the Cross-canyon Corridor Cultural Landscape would result from visitor use disturbances including crowding, reduced access to park resources from overuse, trailing, and improper waste management. Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a medium amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.	Under Alternative B and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape at a lower intensity than Alternative A.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.	Under Alternative D and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas. Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.
Visitor Use and Experience	Under Alternative A, minor, adverse, localized, short to long-term impacts to visitor use and experience would result from increasing levels of day use and associated crowding, dissatisfaction with management of RABT, and restrictions in access to the Deer Creek Narrows. Major, beneficial, long-term, regional, impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict (with the exception of day use in some areas), general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character (with the exception of human waste management and roads and trails management in some areas). Cumulative impacts would be minor, adverse localized to regional, and short to long-term and Alternative A would contribute a very small amount.	Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor use and experience would result from a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access to the Deer Creek Narrows. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative B would contribute a very small amount.	Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor and climbing, canyoneering and packrafting activity designations on overnight permits on overnight permits. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional, beneficial impacts under Alternative C would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative C would contribute a very small amount.	Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access at a site specific location. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions. Major, beneficial, long-term, regional, impacts under Alternative D would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative effects would be minor, adverse, localized to regional, and short to long-term and Alternative D would contribute a very small amount.
Socioeconomic Environment	Under Alternative A, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry, at approximately 9% for commercial backpacking, and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Cumulative impacts would be beneficial, regional, short to long-term and moderate.	Under Alternative B and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.6% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience minor, adverse, short	Under Alternative C and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.9% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse,	Under Alternative D and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 10.3% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse,

	Alternative A	Alternative B	Alternative C	Alternative D
	Alternative A would have a small contribution to this overall adverse effect.	and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative B would have a small contribution to this overall adverse effect.	short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative C would have a small contribution to this overall adverse effect.	short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative D would have a small contribution to this overall adverse effect.
Park Management and Operations	Under Alternative A, moderate, adverse, long-term and major, adverse, short-term, localized to regional impacts would result from larger group size management in all zones, the lack of policy for managing extended day hiking and running, management of Tuweep day use, maintenance of backcountry toilets and roads and trails, and illegal use of old road beds, and the need to address direct impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education. Cumulative impacts would be moderate adverse, regional, short to long-term of which Alternative A would contribute a small amount.	Under Alternative B, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails, and maintenance of these trails, day use permits for RABT and Extended Day hiking, day and overnight use at Tuweep, and the need to address direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in Primitive and Wild Zones, authorizing commercial backpacking trips through concessions contracts and establishing caps for these trips in Corridor, Threshold and Primitive Zones. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a small amount.	Under Alternative C, and moderate to major, adverse, localized and regional, short to long-term impacts would result from larger group size management in all zones, management of extended day hiking and running, backcountry toilets installation and maintenance, conversion of old roadbeds to trails, development or upgrade and maintenance of Class 4 Tiyo Point trail and Boundary Road, day use permits for RABT and extended day hiking and running, Tuweep area management, and the need to address direct impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a medium amount.	Under Alternative D, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails and maintenance of these trails, day use permits for RABT and extended day hiking and running, Tuweep facilities changes, and the need to address direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in all zones, and limiting commercial backpacking and day hiking to the Corridor Zone, and limits on commercial vehicle and stock use trips at Tuweep. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.
Adjacent Lands	Under Alternative A, moderate, adverse, regional, long-term impacts would result from access across adjacent lands, associated campsite and staging impacts, trespass on tribal lands, and direct impacts to natural and cultural resources. Minor, beneficial, long-term, regional impacts would result from conversion of roads in Wilderness. Cumulative impacts would be moderate, adverse, short to long-term, regional of which Alternative A would contribute a small amount.	Under Alternative B and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in some zones, and limits on number of people and vehicles for organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a very small amount.	Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, and limits set for people and vehicles in organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a small amount.	Under Alternative D and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts to adjacent lands would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources. Moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in all zones bordering adjacent lands, and limits on number of people and vehicles for organized groups. Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.
Wilderness Character	Under Alternative A, moderate, adverse, regional, short to long-term impacts to wilderness character would result from large groups in Primitive and Wild Zones, presence of toilet facilities and the effects of toilet maintenance, the absence of an anchor policy, presence and illegal use of old road beds, and direct	Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from large groups in Threshold Zone Use Areas, presence of toilet facilities and the effects of toilet maintenance, and	Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts from larger groups in all use areas, additional designated campsites, presence of toilet facilities and the effects of toilet maintenance, and	Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from presence of toilet facilities and the effects of toilet maintenance, and direct impacts to natural and cultural resources.

	Alternative A	Alternative B	Alternative C	Alternative D
	impacts to natural and cultural resources. Minor beneficial, regional, long-term impacts would result from conversion of roads in proposed Wilderness. Cumulative impacts would be moderate, adverse, short to long-term, localized to regional of which Alternative A would contribute a small amount.	direct impacts to natural and cultural resources. Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, and short to long-term. Alternative B would contribute a very small amount.	direct impacts to natural and cultural resources. Minor, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative C would contribute a small amount to this adverse effect.	Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Threshold, Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and natural restoration of old roadbeds. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions. Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative D would contribute a very small amount.

CHAPTER 3: AFFECTED ENVIRONMENT

Introduction

Chapter 3 describes the affected environment for impact topics developed from April 2011 internal and public scoping (Chapter 5). Affected environment for this plan/DEIS includes the Study Area described in Chapter 1. Each impact topic includes an overview of information and issues relevant to management of backcountry resources. Impact topic descriptions in this chapter serve as the baseline from which to compare potential effects of management actions considered in this plan/DEIS. Topics presented in this chapter, and their organization, correspond to the impact analysis in Chapter 4, Environmental Consequences.

Natural Resources

Soils

Soils form through erosion of parent materials (bedrock), and changes to minerals, organic matter, and organisms over time. Different parent materials, depositional environments, weather patterns, organisms, and age create different soils. At least 62 soil-family complexes have been identified in Grand Canyon by the USDA Natural Resources Conservation Service (NRCS) (NRCS 2006). Soil-family complexes are soil types grouped on physical and chemical properties and other characteristics affecting management.

Grand Canyon soil family groups represent six of the twelve recognized soil orders (Figure 3.1). Entisols and inceptisols, the youngest and least developed soils, are the most common by area (ca. 43%). Aridisols, characteristic of desert environments with high levels of soluble salts, are the next most common types. Alfisols and mollisols are more well-developed soils with clay and organic material subhorizon accumulation. They tend to have greater water holding capacity and aggregate soil structure than other Grand Canyon soil types (Merrill 2006). These soils are generally more productive and support more plant growth in forest and meadow habitats. Soil stability, erosion potential, and productivity vary between different soil orders and within orders, depending on local development and slopes. Table 3.1 provides some physical characters of Grand Canyon soil orders pertinent to soil erosion potential and productivity. All of these orders include soil types with potential for very high surface runoff.

Outside developed areas such as South Rim's Grand Canyon Village, North Rim's Bright Angel Point, and along backcountry roadways, soils are not affected by human activity. Logging, grazing, and farming have not occurred in Grand Canyon in at least 75 years. Thus, current Grand Canyon soil conditions are close to natural.

Grand Canyon Soils
Park soils vary widely, reflecting differences in environmental and geomorphic conditions under which they were formed, and in parent materials. Environmental and geomorphic conditions are controlled primarily by regional topography which ranges from nearly level canyon bottoms and gently-sloping plateaus to vertical cliffs. Steep topography creates dramatic soil variation from canyon to plateau.

Figure 3.1 Soil Orders Grand Canyon

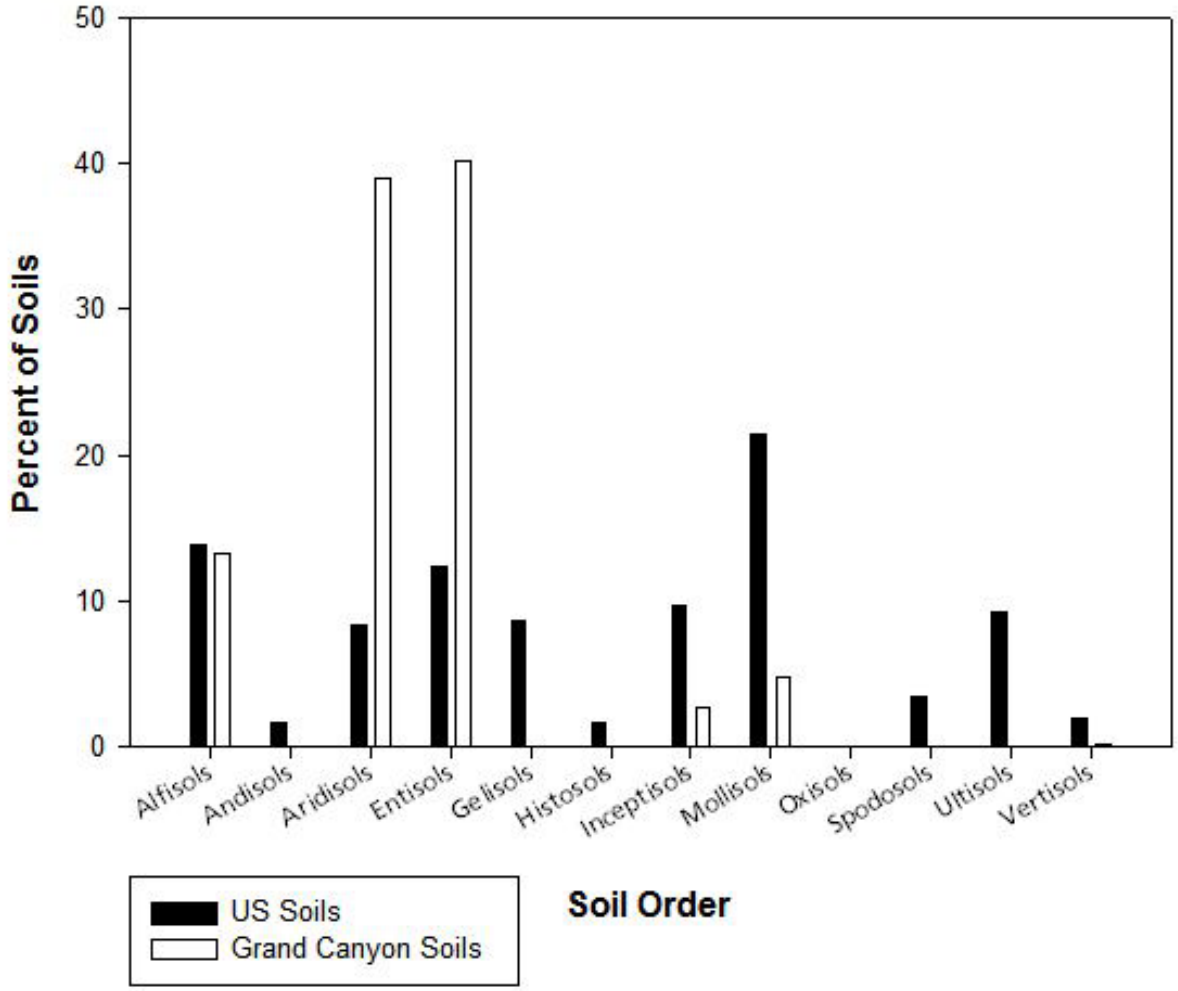


Table 3.1 Soil Order Qualities Grand Canyon

Order	Characteristic Environment	Runoff Class	Percent Organic Matter	Soil Characteristics
Alfisols	Temperate forest	Low to Very High	0.0 to 6.0	Moist part of year, usually with hard or low-permeability horizons
Aridisols	Desert environments	Very low to very high	0.1 to 3.0	Little moisture and little soil development. May contain soluble salts
Entisols	Diverse habitats often on steep slopes	Very low to very high	0.1 to 6.0	Few or no distinct soil horizons; little or no organic matter
Inceptisols	Youngest soils, very undeveloped includes river banks	Medium to very high	0.0 to 3.0	Moist at least 3 months per year with low permeability horizons; may not have distinct horizons
Mollisols	Fertile grasslands	Negligible to very high	1.0 to 5.0	Carbon-rich, darkly colored, thick soils. Moist most of year
Vertisols	Semi-arid, clay-rich	Very high	1.0 to 2.0	Strong shrink-swell cycles with moisture changes

Source: *The 12 Soil Orders*. University of Idaho, Soil and Land Resources Division. http://www.cals.uidaho.edu/soilorders/

NRCS defines Land Resource Units (LRUs) as regions where soil forming processes tend to repeat across the landscape with changes in elevation, temperature, and precipitation. The park intersects six LRU (Map 3.1): one from the Mojave Basin and Range and seven from the Colorado Plateau.

The Mojave Basin Desert Shrub Land Resource Unit occupies about 1% of the park west of Grand Wash Cliffs, situated between the Great Basin Desert to the north and the Sonoran Desert to the south. Soils in this area include the Iceberg, Helkitchen, Orrubo, and Pompeii families. All are rocky and very shallow, generally underlain by petrocalcic horizons (hardpan) and/or are hardened into fanglomerates (alluvial fans of conglomerates).

The largest Colorado Plateau LRU is the Grand Canyon Desert Shrub LRU which extends from South Canyon along both sides of the Colorado River, covering nearly 50% of the park's area. Throughout its extreme elevational range (1,200 to 4,200 feet), this LRU has an average annual precipitation of six to ten inches and a typically thermic (hot) temperature regime, although soils can be mesic (moderate) at the upper elevations on north-facing slope aspects and hyperthermic (very hot) on south-facing slopes at low elevations. Along the center of this LRU lie river corridor beaches. Formed by deposition during high-water events, these beaches are the most common example of alluvium in Grand Canyon. Just above the level of regulated river flows are silt terraces deposited by pre-dam spring flows. High above the river are alluvial deposits, possibly from the Pleistocene, which are old and stable enough to have accumulated clay and calcium carbonate horizons.

Above the river corridor, Grand Canyon Desert Shrub LRU soils lie on portions of two major Inner Canyon plateaus, the Tonto and Esplanade, where erosion is minimal due to its relative flatness. In eastern Grand Canyon, the Tonto Platform consists of exposures of Tapeats Sandstone and Bright Angel Shale. The coarse-grained Tapeats crumbles into large blocks at moderate slopes and is high in feldspars that readily form clays. These Zibate-family soils are shallow-to-bedrock and very erodible. The Bright Angel Shale weathers into the clay-rich Garr-family soils, but is erodible to the point that soil formation is minimal. In this LRU's central and western parts, the Esplanade consists of dense, compact Esplanade Sandstone exposures along broad benches that weather into large blocky boulders. The sandstone's sand particles are very small and, in absence of protective biotic crusts, susceptible to wind erosion.

Upstream of the Grand Canyon Desert Shrub LRU, in northeastern Grand Canyon is the Colorado Plateau Shrub-Grasslands LRU. It includes the first 30 miles of Marble Canyon and rims on both sides, and ranges in elevation from 3,500 to 5,500 feet. Precipitation is similar to the Grand Canyon Desert Shrub LRU, but the temperature regime is more moderate. Precipitation is mostly snow December through February which rarely lasts more than one or two days at lower elevations. Soils are derived from the Kaibab Limestone, Coconino Sandstone, and Hermit Shale. Kaibab and Coconino soils are generally very young and undeveloped, shallow, and on steep slopes. Entisols derived from the Hermit Shale are deeper, but subject to severe erosion.

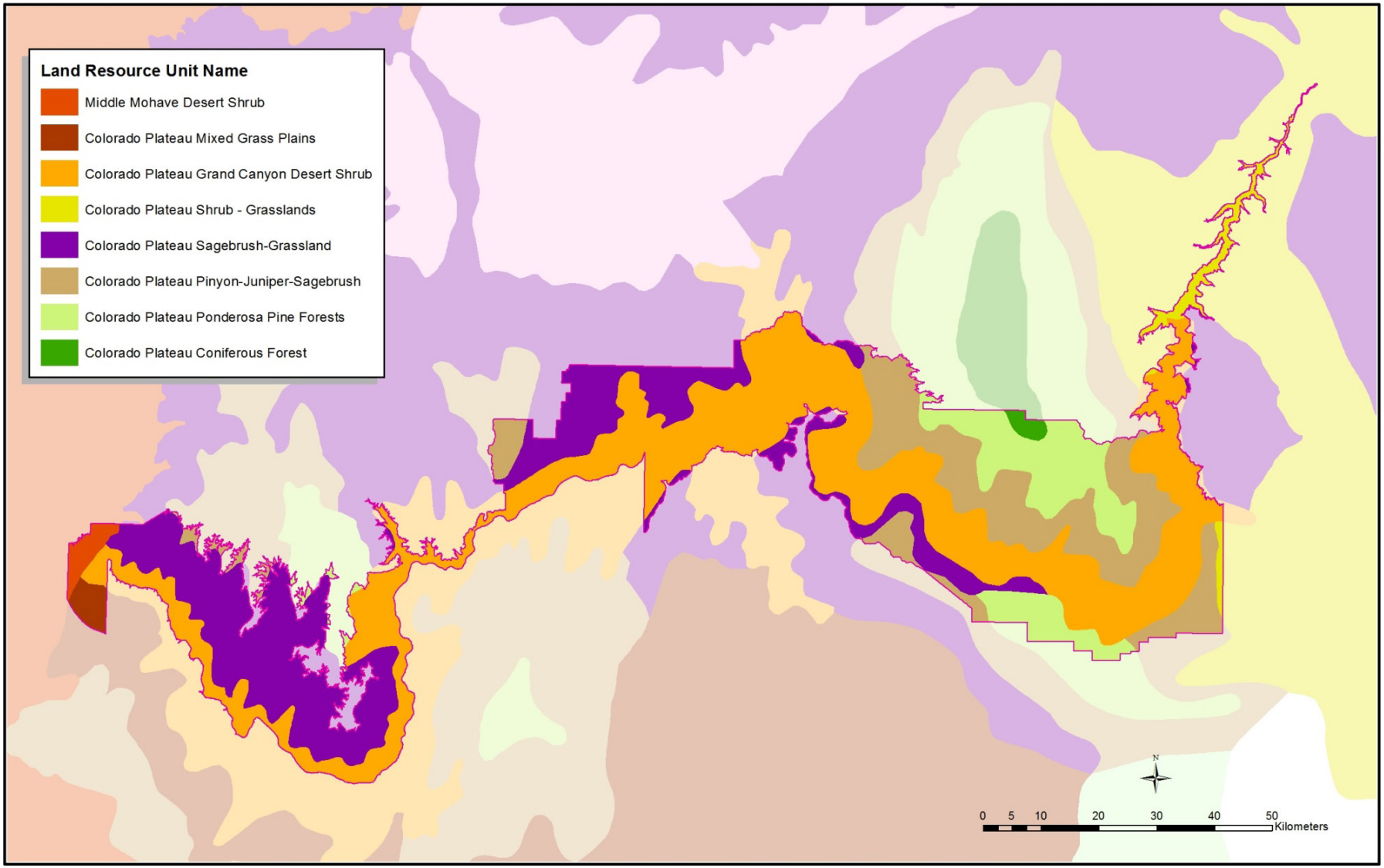
The Colorado Plateau Sagebrush-Grassland LRU covers roughly a quarter of the park, straddling the central and western parts of the Grand Canyon Desert Shrub LRU. On Grand Canyon's south side, it is found below the rim from Mather Point west around Great Thumb Mesa. On the north side, it is occurs from Kanab Canyon to Toroweap Valley, and from 209-Mile Canyon to the Grand Wash Cliffs. Compared to Sagebrush-Grassland LRU areas on the south side, elevations on the north side are higher (4,200 to 5,000 feet), leading to more moderate temperature regimes and slightly higher precipitation (10 to 14 inches). It is also influenced by sedimentary rocks from the Kaibab Limestone's Fossil Mountain Member. Around Eremita Mesa, soils are mostly young and shallow (less than 20 inches to bedrock) and on steep slopes, with some having clay accumulations. In areas between Kanab Point and Toroweap Valley, the Curhollow, Puertecito, Wodomont and Topocoba family soils contain materials cemented by

calcium carbonate creating petrocalcic horizons (hardpan) restricting soil depths to 20 to 40 inches. West of Diamond Creek, this LRU is dominated by shallow, often rocky, young and desert soils in gorges and on mesas.

The Colorado Plateau Pinyon-Juniper Sagebrush LRU extends throughout Grand Canyon on the Tonto and Marble Platforms, and parts of the Esplanade, Coconino, and Tonto Plateaus at elevations of 4,500 to 6,000 feet. Precipitation tends to occur as snow from December through February with accumulations of up to 12 inches. At the park's east end, most soils in this LRU are shallow—young entisols in steep settings where erosion is an issue. Soil depths are generally less than 20 inches and slopes often average more than 40%. West of the developed areas on the north side of the Colorado River there are exceptions, including aridisols derived from Bright Angel Shale and Tapeats Sandstones on the Tonto Platform. However, most of this area contains erodible entisols derived from sandstones and limestones on steep slopes. South of the Colorado River, this LRU occurs on the Coconino Plateau where soil depths are greater than on the north side (20 to 60 inches), slopes are less extreme, and erosion is less of an issue. At the east end, mollisols and aridisols of the Toqui, Meriwhitica and Progresso families have low or no limitations based on erosion susceptibilities. To the west, towards Eremita Mesa, the Chunkmonk, Wodomont and Toqui soils are relatively shallow alfisols and inceptisols on low gradient slopes (less than 15%).West of Toroweap, the Pinyon-Juniper LRU occurs on stony and cindery soils with significant clay components derived from basalt flow weathering.

Colorado Plateau Pinyon-Juniper-Sagebrush LRU soils are located on higher (5,500 to 7,000 feet) areas north of the Grand Canyon Desert Shrub LRU from Nankoweap and Chuar Valleys west to Tapeats Amphitheater and in a small area of Toroweap Valley. On the Coconino Plateau, the LRU is found along the canyon rim east from Grandview to Cape Solitude, and west from Hermits Rest to Eremita Mesa. Precipitation is similar in quantity and pattern to the Sagebrush-Grassland LRU, and soil temperature regimes are also moderate. In this LRU, areas along the Coconino Plateau on Eremita Mesa hold the shallow Chunkmonk, Wodomont, and Toqui soil families derived from cherty limestones. South of Cape Solitude, this LRU contains Puerticito, Meriwhitica, Progresso, and Tassi soil families derived from blocky, calcium-rich sandstones. The same soil families also appear in the Pinyon-Juniper Sagebrush LRU around the Dragon. West of Toroweap, this LRU occurs on stony and cindery soils with significant clay components derived from basalt flow weathering. At the park's far west end are Twin, Burnt Canyon, Tincanabitts, and Fort Garrett Points. In the canyons between, unusual soils including the Natank, Disterheff, Binsin, and Bilburc contain high red clay amounts, small rock fragments, and calcium carbonate. The soil surface is covered by a large quantity of gravel-sized, butterscotch-colored chert which contains abundant brachiopod and coral fossils. Residual soil material is very conducive to clay formation due to the fossils' high silica content.

Map 3.1 Land Resource Units (Soils) Grand Canyon



Colorado Plateau Ponderosa Forest LRU soils are located between 6,800 and 8,500 feet on the Kaibab Plateau and in the Coconino Rim region with a small presence on the Shivwits Plateau edge. Average annual precipitation ranges 17 to 25 inches, and soil temperature regimes are moderate. Precipitation generally occurs as snow from October into April. Soils are moderately deep and have high clay content, and are derived from the weatherable sandstone bed in the Kaibab Limestone's Harrisburg Member. These soils support stands of ponderosa pine woodlands because they are deep enough to hold sufficient water for big trees. The Pocomate, Pinntank, and Retsover family of soils are well represented in the Coconino Plateau portion of this LRU, whereas deep areas of the Kaiparowits, Kanabownits, and Kippers soils predominate in this LRU on the Kaibab Plateau.

The Colorado Plateau Coniferous Forests LRU is found only in Grand Canyon's highest 2% on the Kaibab Plateau. The higher precipitation (greater than 25 inches per year) and cool temperatures often produce snowpack up to 12 feet that can last as long as eight months. The climate fosters greater vegetation growth than elsewhere in the park which protects the soil from erosion, allowing development of consistently deep soils that support healthy tree growth. All soils are derived from residual material eroded from the Kaibab Formation. In areas like Swamp Ridge, Kaiparowits soils form on moderate slopes, Kanabownits soils occur on ridgetops, and the Plite and Canburn families are found under meadows in valley bottoms.

Biological Soil Crusts

Biological crusts, a protective soil layer formed by living organisms and their by-products, are found in Grand Canyon's semi-arid areas. Biological crusts are the expression of symbiotic relationships among cyanobacteria, algae, mosses, microfungi, and lichens. On the southern Colorado Plateau, crusts are primarily composed of cyanobacteria, but lichens and mosses can be favored in specific habitats. The filamentous growth form of cyanobacteria and algae, hyphae of fungi, and rhizoids and rhizines of lichens and mosses bind together particles in the top 0.2 inches (5 mm) of soil, stabilizing it and preventing erosion. Roughness created by pinnacled and rolling surfaces of particularly well developed crusts further protects soil from water and wind erosion. Crusts' water- and nutrient-holding capacity can increase vascular plant germination and growth and have been connected to their increased vigor in otherwise marginal habitats.

For full development, soil crusts require long periods without compressional disturbance (trampling). Damage from human or livestock trampling breaks up sheaths and filaments which hold soil together. With physical damage comes a loss of function; an area that loses as little as 10% of crust cover can increase soil losses by a factor of six in the following year. Cascading impacts on vegetation, via reductions in soil moisture and fertility, take longer to manifest.

Soil crusts are most common and best developed in unoccupied inter-plant soils of Grand Canyon's desert shrublands, but can also be found in undisturbed areas of pinyon-juniper woodlands on rims and plateaus, and in the Colorado River's pre-dam riparian zone. They consistently occupy more than 80% of the soil surface in some semi-desert badlands, and more than a third in some desertscrub types. Stands of pinyon-juniper and live oak on Inner Canyon plateaus often have greater soil crusts cover than vascular vegetation.

Water Resources

Grand Canyon contains some of the few unaltered and un-degraded water resources in the western U.S. These springs and creeks are vital to backcountry users at Grand Canyon and the ecosystems they pass through. The popularity of hiking areas such as Deer Creek, Nankoweap, and Cottonwood Canyon results from the presence of perennial water; drinking water and shade from riparian vegetation provide a respite

from desert heat and dry air. In addition, Traditionally Associated Tribes regard these sources as culturally important.

Precipitation drives the dynamics of most native waters (i.e., the springs and creeks sourced inside the park) (Sellers et al. 1986, Rice 2012, Western Regional Climate Center 2012). There are two primary periods of precipitation in the region: winter snow and rain from Pacific-based frontal systems and summer monsoon rains from storms in the Gulf of Mexico (Blasch et al. 2006). Creeks and other surface waters respond rapidly to inputs during both periods, but groundwater recharge and thus spring discharge primarily responds to winter snowmelt runoff and rarely to summer monsoons. The lack of response during monsoons is likely due to more active vegetative uptake of water as it sinks into the subsurface. Responses occur during monsoons when there are extreme precipitation events or in cases where sinkholes allow extremely fast infiltration. During seasonal snowmelt, water seeps below the reach of plants before they can utilize it primarily because photosynthesis (and thus plant water use) is not occurring as rapidly as during summer months (Chimner and Cooper 2004, Huth et al. 2004, Loik et al. 2004, Heilman et al. 2009).

Threats to Grand Canyon water resources come from both internal and external sources. Increasing demand and contamination, both biological (bacteria, viruses) and chemical (Pharmaceuticals and Personal Care Products (PPCPs)), affect water quantity and quality. Grazing, stock use, and mining in areas upstream and outside of the park negatively affect water quality for recreation and groundwater mining, while diversions and climate change currently and will likely continue to reduce park water availability (Bates et al. 2008, Saunders et al. 2008).

Grand Canyon's water resources inventory is incomplete and monitoring occurs at a very limited number of locations. Of these, the most complete data come from the Colorado River, Bright Angel Creek, and three small creeks near the South Rim (Cottonwood, Hermit, and Garden Creeks). Monitoring does not include water withdrawn from Roaring Springs for consumption in all the park's developed areas. Data gaps are most significant west of Diamond Creek where basic inventories have not been performed.

Surface Water

The major Grand Canyon surface water feature is the Colorado River. There are 23 perennial tributary streams in the park, with 13 additional perennial sub-tributaries that all ultimately flow into the Colorado River. Due to the necessity of water in the desert and Wilderness backcountry, nearly all perennial stream reaches have associated trails or routes. All streams are spring-fed, sometimes with intermittent or ephemeral drainages upstream of the perennial source springs. While many surface water features are entirely contained by the park boundary, several large surface water drainages originate outside the park (primarily Paria and Little Colorado Rivers, Kanab and Havasu Creeks).

The USGS and NPS maintain gauging stations on some of these surface waters. There are hundreds of other intermittent and ephemeral drainages and washes as well as several short perennial reaches that do not reach the Colorado River, especially along Tonto Platform below South Rim (Webb and Griffiths 2000). These locations are very important to backcountry travelers, given their remoteness from high-traffic trails and developed water sources.

Due to regional karstic topography[36], standing bodies of water are rare in Grand Canyon and are only found on canyon rims. Seasonal and perennial ponds and lakes exist in many sinkholes on North Rim. Historic stock tanks and ephemeral ponds exist in the park, largely on South Rim and the Tuweep area. Stock tanks are not maintained and are being allowed to naturally infill with sediment (NPS 2006a).

[36] Karst: limestone terrain characterized by caves, sinkholes, and the absence of surface streams and lakes.

Colorado River

Current Colorado River flow, turbidity, sediment transport, and temperature conditions are different than historic conditions due to Lake Powell impoundment by Glen Canyon Dam, and Lake Mead by Hoover Dam (Carothers et al. 1976). Colorado River flows entering Grand Canyon are controlled by Glen Canyon Dam. Because it is drawn from deep within Lake Powell, Colorado River water in Grand Canyon is cold year-round varying little with season (Wright et al. 2008). Flows are regulated seasonally and daily, eliminating the river's natural extreme high flows. Recent experimental elevated flows have been conducted mainly for sediment distribution, as sediment transport is less than a tenth of pre-dam conditions (Webb et al. 1999, Wright et al. 2008a). Main post-dam Upper Gorge (Lees Ferry to Diamond Creek) sources of Colorado River system sediment are the Paria and Little Colorado Rivers (Webb and Griffiths 2000, Rubin et al. 2001).

A major water quality concern is that in previous Colorado River sampling, correlation was found between increased total coliform bacteria levels and increased turbidity (Somerfield et al. 1976). Bacteria adhere to sediment and are found in larger concentrations in bottom sediments than in the water column. Therefore, elevated bacteria counts in water are associated with activities that entrain sediments such as storm runoff and human wading.

Several gastrointestinal illness outbreaks have occurred among river users since 1972. Outbreaks in 1994, 2000, and 2002 involved more than 300 persons (Higgins 2002). Specimens taken from those afflicted in 2002 were positive for enteric norovirus. Other potential sources of contamination include septic systems at Phantom Ranch, Cottonwood, Roaring Springs, and Lees Ferry (NPS 2006a). While indications are that norovirus outbreaks typically begin with a visitor who arrives at the park with the illness imminent, Grand Canyon backcountry water quality remains a public health concern.

Backcountry users affect water quality through inadequate human waste disposal. Human waste is a biohazard (high concentrations in water can lead to viral/bacterial diseases if consumed) and usually contains compounds such as pharmaceuticals and hormones (Kolpin et al. 2002). Additionally, topical products such as sunscreen, soaps, and insect repellants can be harmful to water quality, even in small amounts (Balmer et al. 2005, Diaz-Cruz and Barcelo 2009). The Colorado River's substantial flows generally dilute PPCPs and hormone contaminants, but areas of concern remain, especially near mainstem Colorado eddies and backwaters and confluence areas where volumes and velocities are usually smaller and water temperatures often higher.

Tributaries that originate outside park boundaries have water quality issues caused either by natural conditions (e.g., minerals) or anthropogenic activities (e.g., agriculture). The Colorado River is 303d-listed for the heavy metal selenium and radionuclide impacts from uranium mining (e.g., Horn, Salt, and Kanab Creeks). Impacts to water resources from uranium mining are addressed in the Northern Arizona Mineral Withdrawal Final EIS (BLM 2012).

While water quality issues in Lower Gorge (Diamond Creek to Pearce Ferry) are similar to those in Upper Gorge (Lees Ferry to Diamond Creek), use types and intensity (and associated facilities) increase markedly in Lower Gorge (NPS 2006a). On this river section, less monitoring occurs and fewer water quality baseline data exist. The Hualapai Tribe established a water quality monitoring program for seeps and springs, which includes Lava and Pumpkin Springs, and works in collaboration with USGS. Some Lower Gorge water quality parameters differ from those in the Upper Gorge due to rise in turbidity that results from tributaries feeding the Colorado River and erosion of bank sediments deposited when Lake Mead backfilled the canyon's far western portions. South Rim waters generally have greater water quality concerns due to greater development and/or mining activities.

Tributary Streams

Of Grand Canyon's 768 tributary canyons (Griffiths and Webb 2004), only 23 are perennial. Perennial tributaries are all sourced from regional karst groundwater systems and, in general, are popular attraction sites for backcountry and Wilderness travelers. A stark contrast to the surrounding arid landscape, they offer lush vegetation, clear freshwater pools, and waterfalls. Angling is popular at cold water tributaries like Bright Angel and Tapeats Creeks which can be accessed by backcountry hikers. Several Grand Canyon tributary streams are potentially eligible for Wild and Scenic River and/or Outstanding Natural Resource Waters designation (Barnes 2005).

Grand Canyon's largest perennial tributary streams—Little Colorado River and Havasu Creek—are sourced outside the park boundary. They are also some of the most heavily visited by backcountry visitors, especially river runners. These areas have potential water quality issues related to human use, similar to those in the Colorado River section above.

Groundwater (seeps and springs), sourced from karst aquifers, is the base flow for park perennial tributaries of the Colorado River. The perennial tributary streams off North Rim (Vaseys Paradise and Clear, Bright Angel, Shinumo, Stone, Tapeats, and Deer Creeks, among others) generally have higher discharges, lower temperatures, and better water quality than those discharging from South Rim (Hance, Cottonwood, Grapevine, Monument, and Hermit Creeks) (Rice 2008). However karst aquifer systems, due to their variety of flow paths and flow times, are highly susceptible to contamination. Impacts that occur on the surface, far from surface water features, can degrade water quality at spring mouths and the surface tributaries that these feed (Sauter 1992, Spangler 2001).

The vast majority of the park's tributaries are seasonal, intermittent, and ephemeral. Water flows on the surface only during storm- or snowmelt runoff events. However, due to occasional presence of pooled water, seeps, springs, and shade, they too are used by backcountry travelers. Many provide opportunities for increasingly popular canyoneering and route-finding activities.

Sampling at 14 tributary streams during summer 1995 and 1996 (Gerba et al. 1997) detected *E.coli* in measurable amounts at most sites sampled with six sites registering counts of over 100 organisms per 100 ml. Of these, three sites exceeded the EPA standard for *E. coli* in recreational water (235 organisms/100 ml), with one sample from Tapeats Creek reaching over 900 organisms/100 ml (Gerba et al. 1997). Three of the sites, Tapeats Creek, Nautiloid Canyon, Royal Arch Creek (Elves Chasm), are heavily visited by both backpackers and river runners. However, the report concluded concentrations of parasites are low, and tributary waters generally do not exceed health standards for bacteria.

The Southern Colorado Plateau Network (SCPN) has monitored Bright Angel, Garden, and Hermit Creeks as of 2010. Results show that *E.coli* concentrations are greater during monsoon season, most probably correlated to increased runoff. Sources of contamination include Phantom Ranch, Cottonwood, and Roaring Springs septic systems (NPS 2006a), animal feces near streams and sinkholes that either flow directly into surface streams or through rapid flow paths in the aquifers and into streams, as well as improperly maintained backcountry compost toilets (NPS 2013e, NPS 2013f). The park's 1995 GMP calls for existing toilets along trails to be replaced with water-conserving models. Though compost toilets are beneficial in that they are waterless, they require leachate pipes that currently are open, drain directly into the ground or canyon, or insert directly into the ground with no form of lined catchment.

Coliform is related to wildlife more than humans (Mazzu and Rihs 1995, Derlet and Carlson 2006). Positive accounts of *E.coli* might be associated with runoff from mule corrals into Garden, Pipe, and Bright Angel Creeks. Further, a number of stock tanks and ephemeral ponds being allowed to infill with sediments act as water attraction holes for wildlife. Bison grazing is also concentrated in water resource areas (e.g., tributaries, sinkholes). Riparian, stream, and sinkhole degradation (e.g., soil compaction, plant

eradication) due to overgrazing is a serious problem on the Colorado Plateau. North Rim sinkholes are commonly found trampled and with fecal matter. Overall, wildlife concentrations at water resources leads to an increase in fecal matter at a given point, potentially adversely impacting water quality.

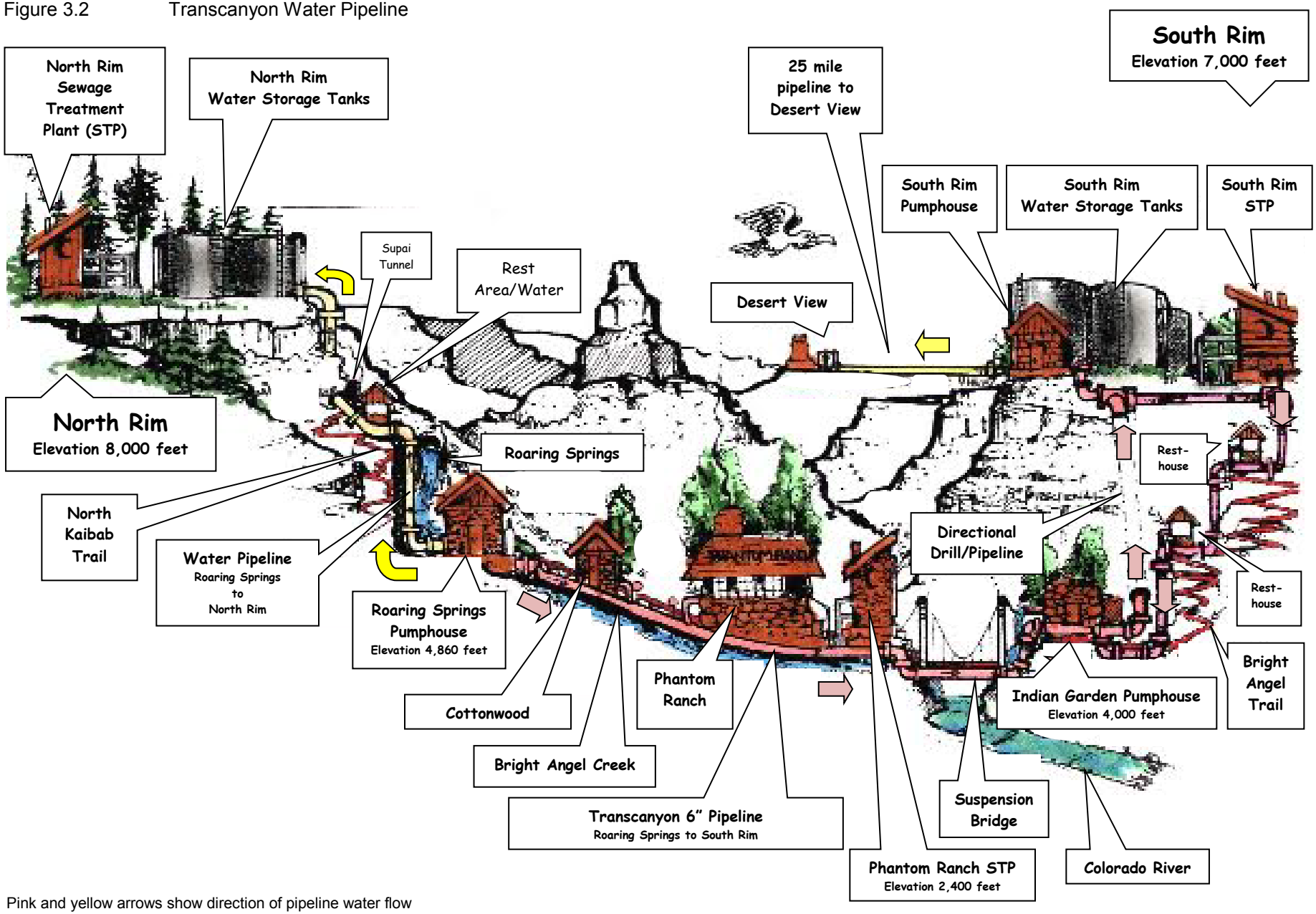
In addition to bacterial and viral water quality issues, some tributary streams have chemical contaminants that can be of serious concern for backcountry travelers. High levels of naturally-occurring dissolved minerals such as sulfate and/or phosphate are found in many tributary streams, and elevated levels of metals such as arsenic and lead have been noted in others (ADEQ 2007). Mazzu and Rihs (1995) found high levels of radioactive elements (radionuclides) in Lava/Chuar, Hermit and Kanab Creeks, and the Paria River with levels in Kanab Creek at flood stage well above health standards (Mazzu and Rihs 1995). The Paria River has also been shown to contain elevated levels of nitrogen and phosphorous (ADEQ 2007) likely associated with grazing and farming activities upstream.

Backcountry and Wilderness users can modify stream channels. Bank and channel stability are compromised by heavy backcountry traffic in and around tributary streams. These activities increase stream sediment load (e.g., trampling, artificial damming or ponding, etc.). This can be a substantial impact especially in smaller-volume tributary streams, and can affect fish, amphibian, macroinvertebrate and plant communities that rely on full stream function.

The largest human alteration to park tributary streams is the diversion from Roaring Springs and partial-channelization of Bright Angel Creek for the transcanyon pipeline and the North Kaibab Trail (Figure 3.2).

The almost 50-year-old, approximately 22-mile-long transcanyon pipeline supplies potable water for the entire park. Withdrawal from Roaring Springs (with some sections concreted to increase water diversion) is loosely estimated to be 30% at baseline conditions, and effluent flow at Indian Garden pumphouse is estimated to increase Garden Creek flow by 50% (Rihs 2008).The rest of the park's perennial tributary streams are largely unmodified and appear to be functioning within the range of historically recorded conditions, but this is based on limited measurements over a long period using varying methods and should not be used to make assumptions of trends over time.

Figure 3.2 Transcanyon Water Pipeline

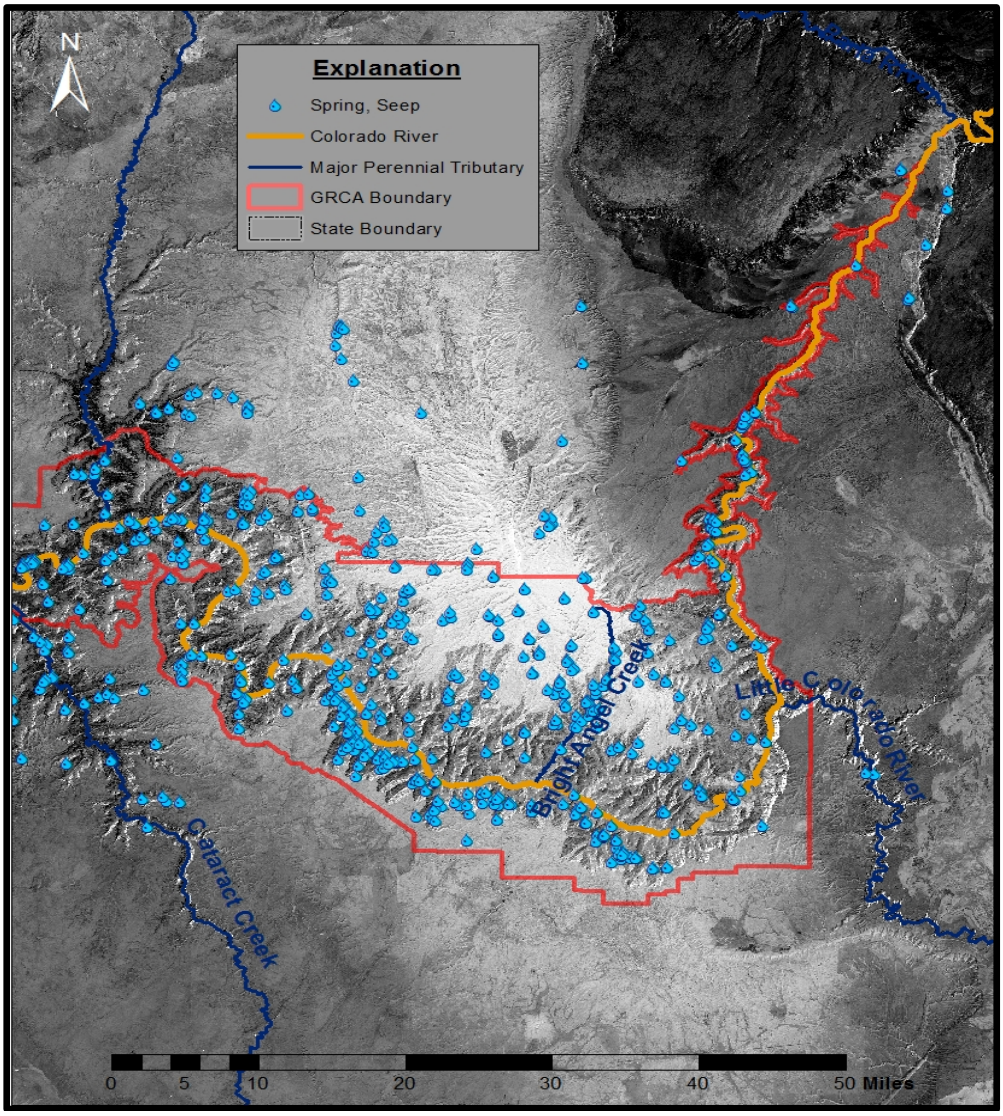


Pink and yellow arrows show direction of pipeline water flow
Figure by Ray Skeet, Grand Canyon Utilities

Springs/Seeps

Springs are a critical natural resource in Grand Canyon. Spring discharge is seen as a singular response to the hydrologic character of a much larger area and an indication of the status of the supplying aquifer system(s), which are often spatially unknown (Rice 2008). These waters provide base flow to the Colorado River, and drinking water to wildlife and visitors in an otherwise arid environment (Map 3.2). To date, there are 30 known perennial springs in Grand Canyon. Of those, Roaring Springs, off the North Rim, is the sole water supply for Grand Canyon's employees and millions of annual visitors. Springs also support valuable riparian habitats, where species diversity is up to 500 times greater than surrounding areas (Grand Canyon Wildlands Council 2004). The majority of the park's wildlife need dependable water resources and often base their home ranges on such sources. Grand Canyon springs are often locations of exceptional natural beauty and hold cultural significance to Traditionally Associated Tribes.

Map 3.2 Springs and Seeps Grand Canyon



Source: NPS 2013e

Grand Canyon houses ten out of twelve classified spring types (Springer et al. 2008). Springs and seeps range from the nearly imperceptible, only visible because of plant growth, to torrents blowing tens of thousands of gallons per minute out of cliff faces and caves. Springs are considered ecosystems in which groundwater reaches Earth's surface either at or near the land-atmosphere or land-water interface. A seep is considered a low flow spring, insufficient as a dependable backcountry water source (Springer et al. 2008). Flow from an individual spring will usually vary within the year, with highest flows associated with spring snowmelt (Rice 2008).

Seeps are often ephemeral and unreliable backcountry water sources. The largest springs are located below the North Rim due to higher elevations and precipitation, and the north-south dip of geologic units. The majority of groundwater south of the Grand Canyon primarily flows away from the South Rim, ultimately discharging at one of the two largest springs in the region: Blue Springs in the Little Colorado River or Havasu Spring in Cataract Canyon. These two springs are substantially larger than any North Rim springs and are the major contributors to the park's largest Colorado River tributaries, but neither is located within park boundaries. However regional studies show a substantial amount of water that flows towards the South Rim, supplying water to numerous small springs that provide the only sources of water to wildlife in the park south of the Colorado River. Previous assessments have concluded groundwater pumped from the regional aquifer south of the park will negatively impact Grand Canyon South Rim springs and seeps (USFS 1999).

As with tributaries, many Inner Canyon springs with reliable flows are accessed by trails or routes. River runners generally make use of streams and riparian areas downstream of large springs rather than the point of emergence itself, which is often difficult to access. However, backpackers are often traveling at a higher elevation and more regularly pass near spring sources. These visitors can damage spring sites by trampling spring-dependent vegetation and/or modifying the spring morphology to better collect drinking water. Focusing a diffuse discharge to a small area for water catchment alters the natural flow patterns that supplies spring-obligate and spring-dependent species, and may result in desiccation of some areas, reduction of overall site diversity. Trampling reduces site stability and increases water turbidity, which can be harmful to invertebrate and macro-invertebrate species.

Spring and seep water quality varies widely; however, a few patterns hold true. Generally, water quality of springs discharging below North Rim is better than that below South Rim. Additionally, springs with higher discharge volume (except Blue and Havasu Springs) have better water quality than low discharge springs. A number of springs and seeps have poor or even hazardous water quality. As stated earlier, many springs contain naturally occurring dissolved constituents coming from the spring's source geology. These may be gastrointestinal issue-causing levels of salts or other constituents, or even relatively toxic elements such as arsenic, lead, and selenium (ADEQ 2007). Radioactive elements (radionuclides) with suspected natural sources have been found in elevated concentrations in locations such as Salt Creek Spring (Monroe et al. 2005). In other locations such as Horn Creek Spring, elevated radionuclides have been found on multiple occasions, attributed to previous uranium mining below South Rim. Other water quality threats could be attributed, but not limited to, development and/or mining (Kenny 2001).

Soundscape

This section provides an overview of Grand Canyon's soundscape as it is affected by the Backcountry Management Plan. The term *soundscape* includes both natural and anthropogenic (i.e., human-caused) components. NPS policy considers *natural soundscape* to be the baseline condition against which current conditions in a soundscape are measured and evaluated (NPS 2006, 8.2.3); that is, natural soundscape is the foundation for evaluating noise-related effects of alternatives in Chapter 4 of this plan/DEIS.

Soundscape Characteristics

Because the NPS works to protect and enhance both park resources and visitor experiences, the NPS differentiates between physical sound sources and human perceptions of those sounds. *Acoustic resources* are physical sound sources**,** including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence). *Soundscape* can be defined as the human perception of those physical sound resources. The rhetorical question about the tree that falls in the forest may help illustrate this. Because no human is there to hear it, the resulting crash is not a part of the human soundscape. It is however, a significant part of the soundscape affecting the acoustic resources around that tree.

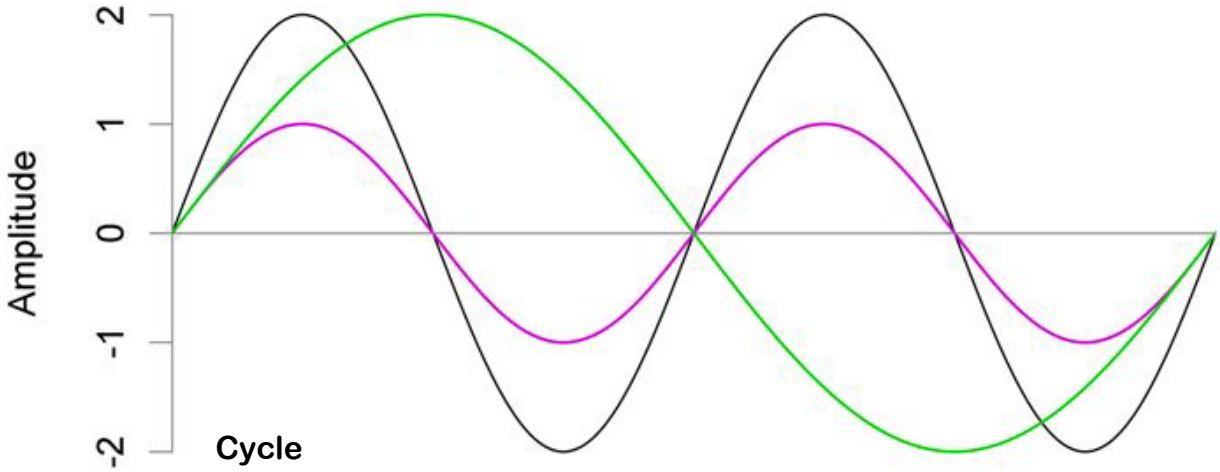
Soundscape is the total *acoustical environment,* which is the combination of *all* acoustic resources in a given area. This includes natural and cultural sounds, as well as non-natural human-caused sounds. Sound vibrations made by the falling tree are a part of the acoustical environment regardless of whether a human is there to perceive them. Bat echolocation calls, while outside of the realm of human soundscape, are also part of the acoustical environment. One can understand, then, why it is critical to take the entire acoustical environment into account when working to protect natural sounds.

Sound is perceived by humans as an auditory sensation created by pressure variations that move in waves through a medium such as air or water. It is measured in terms of *frequency* and *amplitude* (Templeton et al. 1997). *Noise* is sometimes used as a synonym for sound, but there is an important difference. Noise is a sound considered unwanted or inappropriate in an environment. In a national park setting, noise is usually a subset of human-made sound that detracts from the purpose, function, or management objectives in a particular park area, and/or adversely affects park resources or visitor experiences by modifying or intruding on natural soundscape, by impeding or masking natural sounds (NPS 2006) or by masking appropriate human sounds (e.g., traditional cultural activities, climbers communicating with each other). Noise can distract visitors from experiencing park resources, purposes, and values; affect the tranquility or setting of traditional cultural properties or park historic resources; and affect wildlife use patterns and daily life activities.

Frequency, sometimes referred to as pitch, is the number of times per second a sound pressure wave repeats itself. A drum beat has a much lower frequency than a whistle, and a bullfrog call has a lower frequency than a cricket. The units of frequency are called hertz (Hz). Humans with normal hearing can hear sounds 20 to 20,000 Hz.

Amplitude is the relative strength of sound waves (transmitted vibrations), which we perceive as loudness or volume. Amplitude is measured in decibels (dB), which refer to the sound pressure level or intensity. The lower threshold of human hearing is 0 dB. Moderate sound levels (a normal speaking voice, for example) are less than 60 dBA. Relatively loud sounds, like a vacuum cleaner, measure around 70 dBA. Some human sources such as military jets and rock concerts, and even some natural sources such as thunder, can exceed 120 decibels, and push the human pain threshold (Table 3.2).

Figure 3.3 Frequency and Amplitude



The magenta wave has one half the black wave's amplitude, and produces a quieter sound. The green wave completes half as many cycles as the black wave, thus its frequency is one half the black wave, and has a lower pitch
Source: http://www.nature.nps.gov/sound/science.cfm#level

Because the acoustical environment is made up of many sounds, the way we experience the acoustical environment depends on interactions between the frequencies and amplitudes of all the sounds (Figure 3.3). Sound levels are often adjusted (weighted) to match the hearing range of a given animal. Humans with normal hearing can hear frequencies between 20 Hz and 20,000 Hz, and amplitude as low as 0 dBA at 1,000 Hz. Sound levels adjusted for human hearing are expressed as A-weighted decibels or dBA. Table 3.2 shows common sound levels in dBA.

Decibels are measured on a logarithmic scale, on which an increase of 10 dB represents a doubling of perceived loudness and represents a ten-fold increase in sound level (Crocker 1997). In other words if the sound of one vacuum cleaner measures 70 dB, 80 dB would be equivalent to ten vacuum cleaners and would be perceived as twice as loud. A sound of 20 dB would be perceived as twice as loud as 10 dB, 30 dB would be perceived as four times louder than 10 dB, and 40 dB would be perceived as eight times louder than 10 dB.

Different sounds interact in interesting and sometimes surprising ways to determine what we hear in the environment. Some sounds may block out or mask others, depending on the frequencies and amplitudes involved, and some sounds may highlight or enhance our perception of others.

For a given set of sounds, factors such as climate, vegetation, topography, and our individual hearing sensitivity also contribute to our soundscape experience. For example, sound travels faster in warmer and more humid conditions. Sound also reflects from hard surfaces such as rock, water, or ice, and can travel great distances (the echo in a cave). Softer surfaces like leaf litter or snow tend to absorb sound. Understanding relationships between sound and landscape is vital to protecting acoustical environments and soundscapes for current and future generations.

Table 3.2 National Park Sound Levels Compared to Common Sound Levels

Sounds Measured in National Parks		Common Sounds	dBA
Human threshold of hearing			0
Volcano crater	Haleakala National Park	Human breathing at 10 feet (3m)	10
Leaves rustling	Canyonlands National Park	Whispering	20
Crickets at 16 feet (5m)	Zion National Park	Residential area at night	40
Conversation at 16 feet (5m)	Whitman Missions National Historic Site	Busy restaurant	60
Helicopter landing at 200 feet (60m)	Grand Canyon National Park	Curbside of busy street	80
Thunder	Arches National Park	Steam train whistle at 100 feet (30m)	100
Military jet at 328 feet (100m) above ground level	Yukon-Charley Rivers National Preserve	Automobile horn at 3 feet (1m)	120

Sound level of busy street (80 dBA), American Speech-Language Hearing Association, at http://www.asha.org/public/hearing/Noise/hearing/Noise/ Whisper/normal breathing (20 dBA/10 dBA), residential area at night (40 dBA), automobile horn (Berger and Kladden 2005) Busy restaurant (60 dBA): http://www.engineeringtoolbox.com/sound-power-level-d_58.html

Many factors affect how an individual responds to noise. Primary acoustical factors include sound energy level, its frequency and duration, whether the sound is steady or varying in frequency and energy level, and whether the sound carries information of interest to the individual. Non-acoustical factors also play a role in how an individual responds to sound. These factors vary from past experience and individual expectations to the predictability of when a noise may occur. The listener's activity also affects their response to noise (Mestre Greve Associates 2005).

Natural Soundscape

NPS policy and federal laws equate natural soundscape with the terms *natural quiet* and the more technical *natural ambient sound*. Natural ambient sound is the more appropriate term because nature is often not quiet (e.g., thunderstorms, wind, waterfalls, etc.). Grand Canyon is noted for its rich sound environment and unusual and noticeable natural quiet. In addition to being considered a park resource and value, natural sounds are also a key contributor to the visitor experience (e.g., visitors listening to a raven call or waterfalls or sitting quietly watching the sunrise, or experiencing solitude and the vastness of the canyon when everything is quiet).

Natural soundscape is a subset of total soundscape (i.e., the total acoustical environment) composed completely of natural sounds without human-made sounds (NPS 2006). Natural soundscape is an aggregate of all natural sounds in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sound humans can perceive, and are transmitted through air, water, and solid materials. Natural sounds are considered an inherent component of scenery, natural and cultural resources, and Wilderness. Physical and biological components such as wind, water, weather, birds, mammals, and insects create the natural soundscape. The natural soundscape can vary considerably among locations or times in a single location. At one end of the natural spectrum may be sounds associated with a severe thunderstorm; at the other, the complete absence of perceptible sound. Between these extremes, an array of sound conditions varies moment to moment, season to season. Sound is influenced by wind and its interaction with vegetation and irregular terrain; water as a result of movement in rainfall, streams, rapids, and waterfalls; animals, whose sound can be nearly continuous, such as insects, or intermittent, such as birds and coyotes; plants whose seeds dry and pop or whose limbs crack and fall; and, more rarely, geological activity in the movement of earth and rock, such as landslides or rockfalls.

Soundscape preservation and noise management are important components of achieving the NPS mission of preserving park resources unimpaired for the enjoyment of future generations (NPS 2006 Section

1.4.6). In accordance with NPS Management Policies 2006 (Section 4.9), the NPS preserves, to the greatest extent possible, park soundscapes as an integral part of complex natural and cultural resource systems, and restores to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (i.e., noise). The policy also requires NPS to protect natural soundscapes from unacceptable impacts. According to NPS Management Policies 2006, Section 1.4.7.1, these are impacts that, individually or collectively, would unreasonably interfere with the atmosphere of peace and tranquility, or the natural soundscape maintained in Wilderness and natural, historic, or commemorative park locations. NPS is also required to identify what levels and types of unnatural sound constitute acceptable impacts on park natural soundscapes, and 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 identified through monitoring as being acceptable to or appropriate for visitor uses at the sites being monitored (NPS 2006). Grand Canyon offers a wide range of natural and human-influenced soundscapes that vary widely in a complex interaction of factors such as sound source, distance, park location, timing, and physical conditions (such as weather and terrain). For example, sound conditions can be very different in remote Wilderness and backcountry areas than at busy Corridor locations like Phantom Ranch.

Natural Ambient Sound Levels

Grand Canyon National Park has been the subject of numerous studies, investigations, and monitoring efforts to identify and characterize natural ambient and existing sound levels throughout the park[37]. These studies show natural ambient sound levels vary throughout the park by location and time, and that there are areas with similar acoustic qualities (i.e., acoustic zones) that correspond to major vegetation types. *Natural ambient sound levels* include all natural sounds in a given area and exclude all mechanical, electrical, and other human-caused sounds. *Existing ambient sound levels* include all natural and non-natural sounds.

The best available science has been used to define natural ambient sound levels in representative locations and vegetation types throughout the park and to account for additions of human-caused noise that affect natural soundscape in these areas. In areas not affected by human-caused noise, variations in natural ambient sound levels are generally due to wind, water, and wildlife, and are affected by vegetation type and topography.

Natural ambient sound levels were measured in the most common park vegetation types (Ambrose 2006, NPS 2007, NPS 2007a): pinyon-juniper (33% of the park), desert scrub (42% of the park), and ponderosa pine forests (10% of the park). They were also measured at river/rapids in the park (NPS 2007a), and in three vegetation types outside the park (i.e., pinyon-juniper woodland, desert scrub, and conifer forest). Table 3.3 shows natural ambient sound levels for a variety of locations and their corresponding vegetation type.

Table 3.3 Select Natural Ambient Sound Levels by Location (2005, 2007)

Location Point Name	Vegetation/ Ambient Type	Natural Ambient (dBA)
Tuweep Ranger Station	Desertscrub	18.2
North Canyon	Desertscrub	18.2
Surprise Valley	Desertscrub	18.2
Pasture Wash	Desertscrub / Pinyon-Juniper Vegetation	18.2 to 20.0
Kanab Point	Desertscrub / Pinyon-Juniper Vegetation	18.2 to 20.0
Saddle Mountain	Spruce-Fir / Mixed Conifer Forest	22.8

[37]Studies include Ambrose 2006, HMMH 1993, NPS 2007, NPS 2007a, NPS 2008b.

Location Point Name	Vegetation/ Ambient Type	Natural Ambient (dBA)
Granite Gorge	Desertscrub	20.0
National Canyon	Desertscrub	17.0
Quartermaster Point	Desertscrub	17.0
Andrus Canyon	Pinyon - Juniper Vegetation	20.0
Kelly Point	Pinyon - Juniper Vegetation	20.0
Suicide Point	Pinyon - Juniper Vegetation	20.0
Cedar Ridge	Pinyon - Juniper Vegetation	20.0
Eremita Mesa	Pinyon - Juniper Vegetation	20.0
Tower of Ra	Pinyon - Juniper Vegetation	20.0
Bright Angel Point	Ponderosa Pine Forest	22.8
Rainbow Plateau	Ponderosa Pine Forest	22.8
Point Imperial	Ponderosa Pine Forest	22.8
Bass Camp	Colorado River Riparian	25.0 to 65.9*
Parashant Wash	Colorado River Riparian	25.0 to 65.9
Pumpkin Springs	Colorado River Riparian / Rapids	25.0 to 65.9
Stone Creek	Colorado River Riparian / Rapids	25.0 to 65.9
Phantom Ranch	Tributary Riparian / Desertscrub	18.2
Toroweap Overlook	Desertscrub	18.5
Upper Deer Creek	Tributary Riparian / Desertscrub	18.5

*River and river/rapids locations in Table 3.3 have a dBA *range* because most river sites have a range of sound levels depending on proximity to rapids, with parts of a site located away from the nearest rapid at lower decibel levels, and parts located near a rapid at higher levels depending on rapid size (e.g., parts of campsites at Hermit and Granite Rapids would be at the high end of the dBA range shown). The database used did not identify which points are close to large noisy rapids and which are near quieter running water
Source: Ambrose 2006, HMMH 1993, NPS 2007, NPS 2007a

Existing Backcountry Acoustical Environment

In 2005 and 2006 backcountry sound studies (NPS 2007a), almost all non-natural sounds at all sites were caused by aircraft during daytime hours (Table 3.4). At all sites, natural sounds were heard a majority of the time (89.6 to 99.8% of daytime hours), despite non-natural sounds audible 33.4 to 51.9% of daytime hours (both natural and non-natural sounds can often be heard at the same time). Aircraft (specifically jets and propeller planes) were the only non-natural sounds heard at all backcountry sites. Commercial high altitude jet aircraft were audible at all backcountry locations, even those in specially designated Grand Canyon Flight-free Zones (NPS 2011).

Table 3.4 Backcountry Non-Natural and Natural Sounds Percent Time Audible 7 am to 7 pm, Summer 2005/2006*

Site	Non-Natural Sounds	Natural Sounds
Ponderosa Pine	34.7 - 47.7	99.6 - 99.8
Pinyon-Juniper*	51.9	95.1
Desert Scrub	33.4 - 43.2	89.6 – 99.8

*No 2006 pinyon-juniper site recordings due to equipment failure, Source: NPS 2007a

In addition to the natural soundscape described above, the park's backcountry also includes a wide variety of human noise sources described in Table 3.5.

Measurements in the table are summarized as ranges of A-weighted decibels (dBA)38 decibel levels recorded at 100 feet and 400 feet from equipment operating in a manner typical of administrative use.

Table 3.5 Sound Levels of Typical Equipment Used in the Backcountry

Noise-Producing Equipment Type	Operation Condition	Distance (in feet) from the Equipment	Max Sound Level (dBA)
Aviation			
MD-900 Helicopter (Quiet technology)[39]	Takeoff Landing Overflight @ 400ft AGL	100	97.2 94.5 73.1
Bell407 Helicopter	Takeoff Landing Overflight @ 400 ft AGL	100	97.2 98.1 77.5
Vehicles			
2004 Honda Foreman ES ATV 450cc[40]	Idle Drive by (~20mph)	50	54.8 62.0
2001 Ford F250 XL Super Duty Pickup[40]	Idle Drive by (~15mph)	50	49.1 50.0
20ft Outboard boat	Drive by (39 mph)	50	80.8
Snowmobile with four-stroke motor[41]	Drive by (30 mph)	50	65-70
Backhoe[42]	Full power	50	78
Tools / Equipment			
Chainsaw – Stihl 044 28" bar[40]	Idle Full throttle Cutting	50	63.7 82.6 77.3
Pneumatic tools[42]	Full power	50	85
Rock drill[43]	Drilling	50	81

Helicopters are used for the majority of administrative flights involving emergency and non-emergency (e.g., maintenance, resource management, law enforcement, fire) operations. The park contracts for helicopter support, and uses a quiet technology MD-900 no-tail-rotor helicopter as the primary helicopter for most flights, with a Bell 407 (quiet technology configuration) as backup. Emergency helicopter operations account for an average of four flight hours per day during the peak use periods (May through September), and an average of 1.5 hours per day during the remaining months. Other non-emergency helicopter operations including maintenance, resource management, fire, average one hour per day, during most of the year. The number of daily flights increases when utilities in the Corridor Zone, such as the trans-canyon water pipeline breaks and repairs are needed to ensure water delivery to the developed areas. Backcountry helispots have been identified in a number of locations where many missions occur to facilitate safe landing (usually by only minor vegetation trimming).

[38] A-weighted decibels are weighted (A-weighting) to emphasize the same portions of the sound frequency spectrum that humans can hear well, rather than other weighting systems or non-weighted decibels which are not emphasized for human hearing.
[39] Falzarano, Sarah and Laura Leavy (October 29, 2007) Sound levels of helicopters used for administrative purposes at Grand Canyon National Park. NPS Report No. GRCA-07-05. http://www.nps.gov/grca/learn/nature/airoverflights_documents.htm.
[40] Levy, Laura and Sarah Falzarano (October 29, 2007) Sound levels of fire equipment used at Grand Canyon National Park. NPS Report No. GRCA-07-04. http://www.nps.gov/grca/learn/nature/airoverflights_documents.htm.
[41] Yellowstone Supplemental Winter Use Plan EIS (Feb 2013). https://parkplanning.nps.gov/document.cfm?parkID=111&projectID=40806&documentID=51874.
[42] U.S. Department of Transportation- Federal Highway Administration- FHWA (August 2006). FHWA Highway Construction Noise Handbook- see Table 9.1- actual measured Lmax @ 50 ft. https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/.
[43] Menge CW, Ross JC, and Volk JDS (2002) Technical Report on Noise: Personal Watercraft and Boating Activities at Glen Canyon National Recreation Area. HMMH Report No. 295860.370.

The park also operates a fixed-wing airplane for patrols (fire, law enforcement and boundary) and passenger transport with an NPS pilot on staff. The park airplane is used for about 360 flight hours per year, with approximately 30% of that use over the park for patrol/recon, personnel transport, forest health survey, wildlife survey/telemetry and aerial photography. The other 70% of airplane use would be mostly in transit to/from another location, flying over adjacent lands in support of Kaibab National Forest or BLM, or pilot training/airplane maintenance. The park airplane pilot follows established administrative routes designed to minimize noise impacts on sensitive areas whenever possible, however specific flight mission objectives may require the pilot to fly virtually anywhere over the park.

Recreational use of backcountry roads includes travel to and from overlooks, rim campsites, and trailheads. Administrative vehicles are used to conduct patrols, transport people and equipment, and engage in search and rescue, resource management, research law enforcement and maintenance activities. The park operates a variety of vehicles on park backcountry roads, but most administrative vehicle use occurs using pickup trucks and sport utility vehicles. Maintenance activities may require use of graders. A wide variety of other vehicles may occasionally be used for specific administrative tasks either initiated or contracted by the NPS, or conducted by other entities with NPS approval. No data are kept on the number, location, or timing of such uses.

North Rim roads are closed during winter and early spring months (generally December to May). However, up to 20 NPS and concession employees can overwinter on the North Rim to manage and maintain closed facilities. Snowmobiles are prohibited except for operations subsequent to and in support of official duties of the NPS and concessioners. The NPS has identified an oversnow route adjacent to the paved road. In 2012, the number of trips averaged two per day.

Park road and trail maintenance requires equipment, tools and activities that create noise. Corridor Zone trail work is one of the largest, continuous maintenance efforts in the park. Due to the geology, soils, use levels, winter run-off, and monsoonal weather patterns, corridor trails have a relatively fast rate of erosion and failure. Trail maintenance typically involves work crews of 5-20 individuals using hand tools, wheelbarrows, and rock gurneys. Repairs on Corridor trails frequently require the use of mechanized noise-producing equipment such as chainsaws and jackhammers, and explosives when necessary. Outside of the Corridor Zone, use of these tools is infrequent and is reviewed under a Minimum Requirement Analysis on a case-by-case basis.

Although most noise-related impacts will be analyzed in Chapter 4, Soundscape, some noise impacts are greater on visitor experience, wildlife, and wilderness character than on other impact topics, and are analyzed in those Chapter 4 sections. Also, any noise impacts in the park's backcountry from sources not associated with backcountry management actions are analyzed as cumulative impacts for the respective impact topics. Such noise sources include all aircraft overflights not associated with backcountry management, noise from mining operations outside the park, noise from frontcountry areas that can be heard in backcountry areas (e.g., train whistle, vehicles), and vehicle use on non-backcountry roads.

Cave Resources

Grand Canyon is not known for its caves, nor is it recognized as a cave park in the same way as Mammoth, Carlsbad, Wind, and Jewel Caves are, yet it likely contains more caves than any other NPS unit. Found in these myriad caves are substantial geological, paleontological, biological, and cultural resources. Many contain resources identified as nationally or internationally significant. Little information has been collected on these highly fragile and sensitive locations, and unauthorized visitation often creates irreparable impacts.

The Federal Cave Resources Protection Act of 1988 defines the term *cave* as

> "Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge, including any cave resource therein, and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Such term shall include any natural pit, sinkhole, or other feature that is an extension of a cave entrance or which is an integral part of the cave."

Grand Canyon has adapted this definition to include any feature 50 feet or longer where the entrance (drip line) is not wider than the cave is long (NPS 2013g). For example, by this definition, Redwall Cavern on the Colorado River is not a cave but an alcove. Cave resources include not only cave walls, floors, ceilings and speleothems, but any cultural or biological features contained in caves.

A stipulation of FCRPA states caves deemed "significant" must restrict unauthorized visitation to prevent resource injury and protect human health and safety. While caves on other federal lands must submit a nomination to receive the designation of a "significant cave," all caves on NPS lands are held significant and must be managed as such[44].

As many as 3,000 caves may occur in Grand Canyon National Park, but just over 450 have been documented. Most of these occur in exposures of the Redwall or Muav Limestone Formations, of which there is approximately 1,580 linear miles (2500 km) of exposure in Grand Canyon. Assuming an average density of 0.5 to 1.5 per km (documented range = 0 to 8), it could be reasonably expected that 1,500 to 3,000 caves will eventually be located (Rice 2011).

Entrances of many caves are accessible to backcountry travelers. A Redwall Limestone break defines most rim-to-river routes, putting both known and un-inventoried caves on paths where they are likely to be encountered. Several well-known caves are also accessible on day-hikes from Colorado River trips.

The majority of Grand Canyon caves require high skill levels to enter and explore, often including technical and hair-raising rappels off the Redwall Limestone's sheer edge to gain access. Internally, caves frequently contain vertical pits, loose floors and ceiling material, confusing passages, and tight constrictions. Proper equipment and training is absolutely mandatory for cave exploration and research.

Stantons Cave is a good example of a cave containing multiple caves resources. Named for Robert Brewster Stanton, and located just above the Colorado River at RM 31, it can be accessed easily from the river and via a hike down South Canyon from the rim. Stantons was the site of intensive archaeological and paleontological research in the 1960s and 1980s (Euler 1984). Over 100 split-twig figurines were found during initial excavations, and bones of extinct and extant animals, including California condor and Harrington's mountain goats, were recovered. Overall, Stantons Cave deposits have yielded 23 mammal and 70 bird species (Emslie 1988). Evidence of Colorado River paleo-flooding was documented from driftwood deposited in the cave 43,000 years ago, and sediments containing past pollen records dated back 700,000 years (Emslie 1988). Historic inscriptions of early Colorado River travelers remain in nearly pristine condition. Finally, Stantons Cave is home to one of the largest known maternity colonies of Townsend's big-eared bats, a Grand Canyon species of concern (see Chapter 3, Special Status Wildlife Species). Concerns over protecting existing bat populations and undocumented resources left uncovered led to the cave being gated in 1970, then repaired and modified multiple times until 1997 when a steel, bat-friendly gate was installed.

[44] 43 CFR 37.11(d) "…all caves on National Park Service-administered lands are deemed to fall within the definition of 'significant cave.'"

Increases in volume and types of backcountry travel including more remote travel, establishment of new routes, canyoneering and packrafting all have potential to increase encounters with and access to caves and cave resources. Unlike many above-ground resources, caves typically have no recovery mechanisms, and impacts are both cumulative and permanent. Grand Canyon is mandated to inventory, manage, and protect caves and cave resources for perpetuation of their geologic, paleontological, biological, and cultural resources and associations.

Cave Geologic Resources

Cave geologic resources include the cave itself, secondary mineral deposits such as gypsum and aragonite, and cave formations known as speleogens and speleothems. Speleogens are formations created by dissolution of cave passages and include pendants, pillars, scallops or domes; speleothems are secondary features most generally associated with caves such as stalactites, stalagmites, flowstone, and draperies.

Some caves contain speleothems of unusual quality and/or extremely delicate and susceptible to breakage, or of scientific value that could be seriously disturbed or destroyed by cavers. Examples of such speleothems include selenite needles, gypsum flowers or hair, epsomite or mirabolite crystals, hoods, helictites, and hydromagnesite balloons. Caves containing such delicate or rare features may require more protection and monitoring than others.

Besides being visually striking, cave formations can also provide important information on Grand Canyon's history and development. Cave formations called mammilaries form at the water table when a cave is still filled with water. As Grand Canyon was cut, these cave systems were drained, and mammilaries stopped growing. These features can be dated and give an indication of when different areas were drained, providing insight on timing of Grand Canyon incision. Newer features such as stalactites and stalagmites were formed by dripping water, sometimes over many thousands of years. Chemical signatures in waters that formed these features remain in the speleothems similar to the way tree rings develop, and can be used to investigate past climate patterns such as extended cold and warm periods, and wet and dry times.

Because cave and feature-forming processes in most cases have ceased, recovery from impacts takes a great deal of time, beyond the temporal scope of this plan, if at all. Many Grand Canyon caves are heavily decorated with minerals such as gypsum which is very sensitive to changes in humidity and direct human impact. Any changes to airflow, use, and traffic patterns can have a profound and permanent adverse effect.

Cave Cultural Resources

Grand Canyon's dry caves provide the ideal environment for archaeological material preservation. The few excavation projects involving archaeological deposits have yielded a rich array of materials not often found in open-air contexts due to cave protections from weathering and decay. The extremely fragile nature of artifacts, threats from looting and inadvertent damage, and an increase in backcountry use present a challenge to adequately manage cave archaeological sites. With only 6% of the park systematically surveyed for archaeological sites, and already over 60 identified associated with caves, it is very likely a great amount of material and information on the canyon's human history has yet to be discovered.

Archaeological resources associated with caves include small animal effigies (split-twig figurines), grass bundles, human-modified twigs, and small rock cairns dating from the Archaic period, some 2,000 to 4,000 years ago (Schroedl 1977, Emslie et al. 1995); prehistoric and protohistoric artifacts left by ancestral Puebloans, Cohonina, and ancestors of modern tribes; historic artifacts including, but not limited

to, excavation equipment left by researchers from the 1940s (Moffitt 2002), prospector artifacts (Bodenhamer 1984), guano mining (Huntoon 1989), and relicts from small cowboy camps.

Cave Paleontologic Resources

Caves often act as natural museums, protecting in excellent condition resources that would otherwise be lost to time. The relatively constant temperature, humidity, and other environmental conditions of caves are conducive to long-term preservation of organic material. Reduction or absence of direct sunlight reduces adverse effects of solar radiation on fossil remains, and fossils in caves are also typically sheltered from forces of weathering and erosion (Santucci et al. 2001).

Grand Canyon caves hold many superb examples of paleontological resources. Paleontological material includes bones, horns, hair, teeth, and other remains of Pleistocene-age animal species, some of which are now extinct (Harrington's mountain goat, dire wolf, Shasta ground sloth) and some that exist in the area (California condor). Pollen, seeds, and other plant parts, and bones and teeth of small animals found encased in animal dung and packrat middens (urine-cemented nest debris) provide invaluable evidence about ancient environments in the region (Euler 1984, Emslie 1988, Cole and Mead 1981, Phillips 1977). Grand Canyon caves have yielded remains of approximately 200 animal taxa and more than 200 plant taxa (Spamer 1993). Fossils of Paleozoic invertebrates including brachiopods, crinoids, bryozoans, and sponges are also found in the walls of limestone caves, and are often less weathered than those found exposed to the elements.

Within caves in arid regions like Grand Canyon, where humidity is usually very low, preservation of remains can occur through desiccation or mummification. This scenario enables preservation of soft tissues, hair, dung, and other remains that normally decay rapidly (Santucci et al. 2001). Caves sometimes preserve ancient dung deposits which occasionally become stratified over time and provide extremely valuable chronological information for paleoenvironmental reconstruction. Fossilized dung from herbivores may contain pollen and plant fragments that indicate diet, past floral assemblages, and climate. Carnivore and raptor scats or pellets may contain remains of other animals or insects. Of the ten caves known *worldwide* that contain sloth dung, six are in NPS units (two in Grand Canyon, and four in Guadalupe Mountains National Park) (Santucci et al. 2001).

As with other cave resources, paleontological resources are very susceptible to damage and disturbance, and cannot be replaced. The best example is the severe damage in Rampart Cave in 1976 and 1977 when a hiker-caused fire destroyed most of a vast deposit of Pleistocene-age ground sloth and mountain goat dung, bones, hair, and other soft tissue, as well as scientific information contained in the lost material and its stratification. Prior to the fire, Rampart Cave contained the thickest and least disturbed stratified Shasta ground sloth dung deposit known worldwide, with a nearly unbroken record dating 40,000 to 11,000 years ago (Long and Martin 1974, Hansen 1978).

Cave Biologic Resources

Grand Canyon caves also provide habitat for wildlife species including cave invertebrates, raptors, small ground-dwelling mammals, and several species of roosting and breeding bats, some of which are considered federal or state species of concern (Emslie 1988, Quinn and Petterson 1997). Caves in sheer Redwall cliffs provide protected roosting sites for federally endangered California condors, as they did thousands of years ago before the birds were extirpated from the region (Emslie 1988). Reintroduced to Grand Canyon in 1996, California condors are now occupying the same caves their ancestors used for nesting (Collins et al. 2000).

Cave use by wildlife tends to be seasonal. Condors hatch their young February to May, but fledged young may return to the nest through December. Townsend's big-eared bat young remain with their maternity colony May through August, extending the period of their sensitivity to impacts from encounters with

backcountry users. Multiple bat species also use caves year-round for daytime roosts or locations to consume prey during nighttime feedings. Most Grand Canyon caves are too warm to provide adequate hibernacula (hibernation sites) for species most commonly found in the region, but that is not to say they do not exist, as certain north-facing caves and caves passages lower than the entrance act as cold traps and perhaps provide suitable conditions.

There are multiple examples of how human activity in and around caves affect bat populations, including Bat Cave in the far western canyon near RM 266. At one point, this cave likely housed a colony of Mexican free-tail bats exceeding a million individuals, given the size of the guano deposits found in the cave. Human disturbance from interests in guano mining decimated the bat population and it is still just a fraction of what it once was (Pape 1998).

Biologic resources include creatures much smaller as well. New species, genera, and higher orders of cave-obligate (troglobites) or cave-preferring (troglophiles) invertebrates are being identified in caves all over the world. In spite of the small number of Grand Canyon studies, a few have been identified (Peck 1980, Drost and Blinn 1997). Even cave-obligate bacteria and other microbes are being discovered in other caves in the southwest, some of which show promise toward treatments for human diseases such as leukemia (NPS 2006d). These organisms are generally quite sensitive to changes in their environment including contact with humans and their microbial assembly.

Cave Hydrologic History Resources

Caves offer a unique opportunity to study current and paleo-hydrology of the Grand Canyon region. While the many spectacular active spring caves in the Muav Limestone such as Roaring, Tapeats, and Thunder Springs act as current drains of high plateaus surrounding the canyon, potentially thousands of caves in the Redwall Limestone tell a story of regional hydrology prior to Grand Canyon's existence. These caves formed millions of years ago below the water table. Aquifers and caves dissolved into them drained subsequent to incision of the canyon we see today, and formations found in caves may help provide a timeline of when this happened.

Roaring Springs emanates from a large cave system and provides all drinking water to Grand Canyon residents and millions of visitors. The large cave springs also supply Colorado River perennial tributaries. Increased visitation to these locations has potential to degrade water quality and disrupt sensitive invertebrate communities.

Vegetation

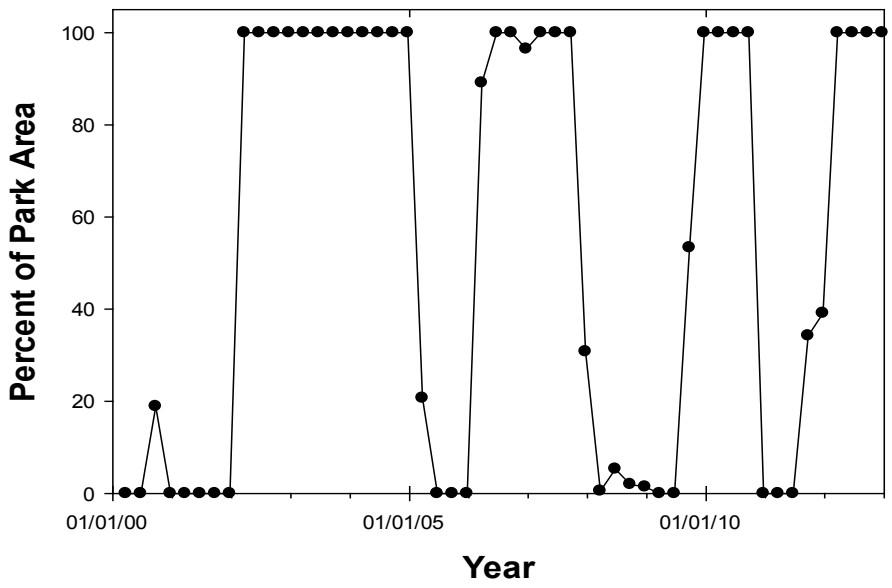
Grand Canyon's ecosystems are dominated by natural processes that support high levels of biodiversity and community resilience, and facilitate adaptation in the face of climate change. Species diversity begins with the park's proximity to five major biogeographic provinces (Rocky Mountain, Great Basin, Mohavean, Sonoran, and Great Plains). More than 1,750 vascular plant species, 167 fungi species, 155 bryophyte taxa, and 195 lichen species have been collected in the park. Grand Canyon hosts nine known endemic (seen only within park boundaries) plant species, while only 11% of park flora is exotic.

Primary drivers of plant community organization are elevation, climate, disturbance, topography, and soils. For example

- Grand Canyon's enormous elevational range, from less than 1,250 to 9,200 feet, produces the same change in conditions seen between southern Arizona and central Canada. This gradient is made more remarkable because plant communities normally separated by hundreds of miles are juxtaposed; rim conifer forests grow directly above desert communities
- Natural disturbance regimes include

  - scouring of riparian habitats from both North Rim snow runoff and late summer monsoonal thunderstorms, fires which annually burn 10,000 to 12,000 acres of forest and woodland habitats
  - drought which has both direct (desiccation) and indirect (increased susceptibility to insects and pathogens) impacts on plant mortality and germination. More than half the time during the first twelve years of this century, at least half of the park has experienced moderate to extreme drought conditions (National Drought Mitigation Center 2013) (see Figure 3.4)
- Over 150 different soil complexes have been described in the park (NRCS 2006 and NPS 2003). These range from skeletal soils above calcified hardpans to deep silty loams, all of which are set in a physical structure where small geographic distances give rise to very different growing conditions

Figure 3.4 Percent of Park in Moderate to Extreme Drought



Vegetation Associations
Interactions of these factors and biogeographic diversity have led to the identification of 216 distinct National Vegetation Classification Standard Vegetation Associations in the park. Each Association is a unique species assemblage based on a range of species composition, diagnostic species, and environmental conditions. Of these Associations, 79 had not been described in 15 years of NPS and Nature Conservancy vegetation mapping projects, and 32 of these represented such unique sets of environmental conditions, more sampling will be required before complete classification.

Most of these Associations will be affected by alternative elements. For the sake of simplicity, these Associations have been grouped into major life zones

- Spruce-Fir Forest
- Mixed-Conifer Forest
- Montane-Subalpine Grasslands
- Ponderosa Pine Forest
- Pinyon-Juniper Vegetation
- Shrub-Steppe
- Montane Shrublands and Interior Chaparral
- Desertscrub

- Desert Grassland
- Riparian

Spruce-Fir Forest
Spruce-Fir Forests (boreal), characterized by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and blue spruce (*Picea pungens*) cover 11,000 to 16,000 acres of Grand Canyon's highest elevation habitats, generally occurring above 8,200 feet. This forest type covers only 1% of the park and, although fire is rare in these habitats, approximately 30% of spruce-fir forest areas have experienced low to moderate intensity fires. The diversity and productivity of these habitats comes from deep soils and cool, moist conditions at high elevations on protected, north- and east-facing slopes. Snow can be found on the ground well into June. These forests are dense, with up to 240 mature trees per acre plot. Plant species richness is above-average for Grand Canyon habitats, varying 15 to 35 species per 0.1 acre. The cool, moist forest floor produces mosses, liverworts, and fungi. Exotic plants are rare in these habitats; non-native species comprise less than 3% of all species in these habitats, and account for less than 1% of total vegetative cover.

Mixed-Conifer Forest
Mixed-Conifer Forests, characterized by varying mixtures of Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), and ponderosa pine (*Pinus ponderosa*) cover 32,000 to 40,000 acres of the North Rim. This forest represents 3% of the park, and 35% of its coniferous forests. Mixed-Conifer Forests occur at elevations from 7,200 to 8,500 feet. Topography, soil development, soil moisture, and fire determine vegetative composition, with 55% of the park's Mixed-Conifer Forest stands having experienced fire over the last two decades. Mixed-Conifer patches grade across indistinct boundaries with Spruce-Fir Forests in areas with greater shade and moisture and Ponderosa Pine Forests and woodlands where soils are shallower and conditions warmer and drier. Patch sizes of different Mixed-Conifer associations vary greatly, as does relative contribution of each dominant and co-dominant species. The combination of moisture availability and warm daytime temperatures during the growing season results in Mixed-Conifer Forest being the Southwest's most productive coniferous forest (Moir 1993). Stands support tree densities ranging 100 to 400 trees per acre in a diversity of successional stages. Exotic plants are rare in these habitats, representing less than 5% of all species present, and less than 1% of the vegetative cover.

Montane-Subalpine Grassland
Montane-Subalpine Grasslands (meadows) occupy a small but important part of North Rim's higher-elevations. Herb- and grass-dominated areas covering 3,000 to 5,000 acres are dispersed among Spruce-Fir and Mixed-Conifer Forest habitats. In higher meadow edges, grasses are more common because conditions are drier. In lower and wetter areas near the centers, forbs and herbs are more common. Cooler temperatures created by dense, cold air settling in meadows plays a role in excluding woody species, as does higher soil moisture. Patches vary in size depending on local topography, soils, and groundwater conditions. Species richness is average for high-elevation park areas, ranging 15 to 30 species per 0.1 acre plot. Soils usually have a deep organic horizon. Cover of all species is relatively high, ranging up to 80%, with cover and richness of exotic species below 10%.

This is a rare vegetation type in the southwestern U.S., and Grand Canyon meadows have state and regional significance beyond their area. These meadows, although protected from livestock grazing for several decades, have been subjected to increasingly intense bison grazing since 2000. The contrast with the structure of surrounding forests also creates an edge effect beneficial to large and small wildlife.

Ponderosa Pine
Ponderosa Pine vegetation types, including savannahs, woodlands and forests, occupy 50,000 to 60,000 acres on both North and South Rims between 6,500 and 7,500 feet. The Ponderosa Pine Forest is 4 to 5%

of the park, and 54% of its conifer forests. It is the most widespread type of coniferous forest in the southwestern U.S. Stands of ponderosa pine have tree densities varying 120 to 160 stems per acre with understories ranging from sparse herbaceous to thick grass to shrubs or white fir and Douglas fir saplings. These habitats are not diverse, supporting fewer species than the Mixed-Conifer and Spruce-Fir stands with which they share the rims. Stand composition reflects influences of topography, precipitation, soils, and fire. Approximately 76% of the Ponderosa Pine Forest has experienced some fire in the last two decades, and 2,500 acres have had at least two fires. Fire management activities of the last two decades appear to have had mostly beneficial effects on Grand Canyon's Ponderosa Pine Forest, bringing most stands closer to the natural range of variability. Exotic species contribute little to these communities, representing less than 3% of total cover and less than 7% of species present.

Grand Canyon's Ponderosa Pine Forest has state and regional significance related to historic management practices. First, this forest was never extensively logged, being inaccessible to large permanent settlements and rail transport. In addition, more isolated areas, such as Powell Plateau, these forests did not experience grazing and fire suppression that changed forest structure elsewhere during most of the last century.

Pinyon-Juniper Vegetation

Pinyon-Juniper Vegetation communities (woodland and savannah) cover about a quarter of the park between conifer forests above and Interior Chaparral and Desertscrub below. They occupy 200,000 to 260,000 park acres below 6,561 feet. Both single-needle pinyon (*Pinus monophylla)* and two-needle pinyon (*Pinus edulis*) co-occur at varying relative densities with junipers, depending on biogeographic and climatic factors. Absolute tree densities vary widely, and snags and individuals with dead limbs and tops are scattered throughout the landscape. Patches of even-aged trees combine in a mosaic of multi-aged woodlands which include stands of very old (greater than 300 years) individuals. Drought, insects, and disease determine species composition; dispersed tree canopies prevent fire from carrying well in this vegetation type so fire has had little effect on these communities, affecting only about 2% of the total area each year. Pinyon is far more sensitive to drought than juniper, so the boundary between Pinyon-Juniper Woodlands and juniper savannahs can progress or retreat quickly (Breshears et al. 2005, Jennings et al. 2009). Although individual patches contain few species compared with higher elevation types, Pinyon-Juniper woodland communities are far more diverse when the entire area covered is considered. Exotic species are rare, accounting for less than 5% of total vegetation and less than 2% of species present.

Shrub-Steppe

At the lowest elevations on and near Grand Canyon's rims, big sagebrush (*Artemisia tridentata*) and Bigelow sagebrush (*Artemisia bigelovii*) define the Shrub-Steppe Community. Big sagebrush is found further back from the rims where soils are deeper and temperatures slightly cooler. Nearer the rims, where soils are shallow to bedrock and temperatures tend to be hotter in summer, Bigelow sagebrush predominates. Overall, sagebrush patches occupy just less than 5% of the park (50,000 to 60,000 acres). Occasional fires in denser stands, or years with exceptionally high precipitation, can shift composition toward perennial grasses and herbs. Species diversity of these areas is neither exceptionally high nor low, and exotic species are rare, accounting for less than 5% of cover and 3% of species present. The lack of historic grazing in Grand Canyon's patches of Shrub-Steppe makes this community unusual in the intermountain west where the norm has been conversion to farmland and pasture through fire and mechanical treatment.

Montane Shrublands and Interior Chaparral

In Grand Canyon, Montane Shrubland and Interior Chaparral vegetation occupy an area similar to Pinyon-Juniper (200,000 to 250,000 acres) in an important position as transition between Desertscrub communities at lower elevations and woodland and forest communities above. Chaparral is characterized by scrub oak (*Quercus turbinella*), manzanita (*Arctostaphylos pungens),* and other tough-leaved

evergreen shrubs growing in distinct patches, often widely separated from others. Infrequent fires key regeneration in both cool (Rocky Mountain) and warm (Arizona Desert Margin) chaparral types. In cooler and more mesic settings, Gambel oak (*Quercus gambelii*), three-leaf sumac (*Rhus trilobata*), snowberry (*Symphoricarpos oreophilus*), and mountain mahogany (*Cercocarpus ledifolius*) define Montane Shrubland patches. Although individual patches of both types are relatively depauperate, the overall species diversity is nearly twice that of more productive and dense vegetation types at higher elevations. Exotic species are rare and do not contribute significantly to overall vegetative cover.

Desertscrub

The most abundant Grand Canyon vegetation types are Desertscrub communities. They occupy 500,000 to 600,000 acres at 1,200 to 6,000 feet elevation and include representations of all four major North American deserts: the warm Mojave, Sonoran, Chihuahuan, and cold Great Basin. Desertscrub is usually found on young, undeveloped soils in dry environments where small changes in aspect can have large effects on germination and growing conditions. This warm desert vegetation characterized by creosote bush (*Larrea tridentata*), bursage (*Ambrosia dumosa*), honey mesquite (*Prosopis glandulosa*), cholla (*Cylindropuntia* spp.), and ocotillo (*Fouqueria spendens*) receives most of its precipitation in summer. Cool deserts, represented by Great Basin vegetation including blackbrush (*Coleogyne ramosissima*), shadscale (*Atriplex* spp.), and Mormon tea (*Ephedra* spp.), tend to receive more winter precipitation and often grow in saline soils. Productivity is limited by soil nutrition and precipitation. Fire is infrequent and usually of low severity except where exotic annual grasses create continuous fuels that carry fire. Turnover within patches is very slow (Webb et al. 1999, Bowers et al. 1995, Bowers et al. 1997), resulting from drought and localized disturbances from rockfalls and flash floods. Regeneration occurs episodically, often requiring presence of nurse individuals for successful establishment. Exotic species contribute to about 7% of overall vegetative cover.

Desert Grassland

Desert grassland and herbaceous vegetation generally occur during extended successional changes after human or natural disturbance to desert shrublands. Most patches occur in flats or gentle slopes at 3,500 to 5,500 feet and in the transition between Desertscrub and Chaparral. As with Desertscrub, Desert Grasslands occur as elements of both warm and cold desert regions, each with diagnostic species assemblages. Although there is very little in Grand Canyon (2,500 acres), Desert Grassland represents an important regional resource because elsewhere this type has generally been converted to agriculture or development.

Riparian

Riparian habitats occupy 16,120 acres or roughly 1.4% of Grand Canyon's total area. These are divided into two basic types

- **Hydro-riparian habitats** along perennial watercourses with year-round access to water and generally finer-grained soils. This includes areas by springs, seeps, perennial tributaries, and the Colorado River corridor with its dam-regulated flows
- **Xero-riparian habitats** in intermittent and ephemeral drainages. These are much more tolerant of extended dry periods, and soils tend to be coarser sands and gravels

Grand Canyon riparian areas of both kinds are focal points of plant and animal diversity. Hydro-riparian habitats cover about 0.5% of the park, but host 29% of park rare and endemic species. Tall, relatively dense trees and shrubs support unique wildlife assemblages. Xero-riparian habitats represent about 0.8% of the park, but also contain about 28% of the rare species. Riparian areas support five to ten times the species diversity and population densities of birds found in surrounding desert habitats.

In Grand Canyon, Riparian habitats are further divided according to whether or not they are in the Colorado River corridor. In the river corridor, primary community organizing forces of flooding, soils,

and disturbance have been regulated for 50 years since Glen Canyon Dam's completion. Without contrasting scouring spring floods and desiccating low winter flows, Colorado River corridor Hydro-riparian habitats have proliferated. Hydro-riparian vegetation accounts for nearly 95% of Riparian river-corridor vegetation, covering roughly 3,500 acres between the river shoreline and pre-dam average annual return flood level (ca. 90,000 cubic feet per second). Exotic species thrive in the new high-water zone, and tamarisk (*Tamarix ramosissima*) is the dominant riparian woody species, although native species such as coyote willow (*Salix exigua*), arrowweed (*Pluchea sericea*), baccharis (*Baccharis* spp.), and herbaceous species are common; composition and density varies with geomorphic setting and recent flows. The overall trend since 1963 has been encroachment of new high-water zone vegetation onto sandy beaches used by river recreationists for camping and lunch stops. Vegetation in this zone tends to recover relatively quickly from impacts.

Within the new high-water zone, rare habitats like fluvial marshes occur sporadically when geomorphology, soils, and inundation frequency combine in appropriate ways (Stevens et al. 1995). Marshes along the Colorado River are extremely dynamic, continually adjusting to yearly changes in dam-regulated flows. Total marsh area in the river corridor has ranged from less than 1.24 acres in 1987 after five years of sustained high flows to 62 acres in 1994 (Stevens et al. 1995). Rare plants such as stream orchids (*Epipactis gigantea*) are found only in these habitats. Birds, reptiles, and amphibians forage in these productive areas, and juvenile fish use the warmed, slower moving water for nurseries and sanctuaries from the mainstem's faster moving water.

Xero-riparian vegetation occurs on pre-dam river flood terraces, covering 225 acres above the new high-water zone. It is notably stable in absence of disturbance but takes decades to recover from impacts in the absence of high flows. In upper Marble Canyon, dominant native plants include netleaf hackberry (*Celtis laevigata* var. *reticulata*), California redbud (*Cercis occidentalis*), and Apache plume (*Fallugia paradoxa*). In the remainder of the canyon, catclaw acacia (*Acacia* greggii) and honey mesquite (*Prosopis glandulosa*) dominate. Perennial bunchgrasses and xerophytes (e.g., cacti) characterize the understory. Some mature trees in this zone are continuing to grow despite absence of historically high flows, but other plants are dying off. Exotic species, especially Russian thistle (*Salsola tragus*) and annual bromes (*Bromus rubens, B. diandrus, B. tectorum*) can occupy a significant portion of these habitats areas.

Outside the river corridor, riparian vegetation is primarily Xero-riparian. Over 8,900 (75%) of the 12,000 acres of non-corridor Riparian habitats are composed of catclaw acacia, honey mesquite, alkali goldenbush (*Isocoma acradenia*), and brickellbush (*Brickellia longifolia*) growing on dry wash edges and interfluves (land between two tributaries). Where water is present, along perennial tributaries and in seeps and springs, important and sensitive Hydro-riparian habitats develop, dominated by either trees (cottonwood, Goodding willow, and velvet ash) or water-loving shrubs (coyote willow and *Baccharis spp.*). Hydro-riparian habitats rank among the most productive and biologically diverse park terrestrial ecosystems, commonly hosting 100- to 500-fold higher concentrations of species than surrounding landscapes (Grand Canyon Wildlands Council 2004). They create isolated habitat islands that support many relict and endemic species. Given their small size, dependence on a rare and variable resource, and isolation from sources of recruitment, seep and spring habitats are particularly vulnerable to irreversible damage. These keystone habitats contribute significantly to regional biodiversity.

Exotic Plant Species

NPS Management Policies 2006 defines native species as "all species that have occurred, now occur, or may occur as a result of natural processes on lands designated as units of the national park system. Native species in a place are evolving in concert with each other." Exotic species are defined as "those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also referred to as non-native, alien, or invasive species. Because an

exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place."

Exotic plants are commonly colonizers of disturbed areas; however, they can also be aggressive, replacing late-successional native species in habitats relatively free of disturbance (Stohlgren et al. 1999). Although less than 10% of exotic species pose a threat to ecosystems (Williamson 1996), such species can displace native vegetation by robbing moisture, nutrients, and sunlight from surrounding plants resulting in native habitat loss and increased soil erosion. These species, also known as invasives, create long-term changes in plant community composition and structure, affecting entire populations of plants and animals. Exotics are considered the biggest threat to biodiversity after habitat destruction (Chornesky and Randall 2003, Randall 1996).

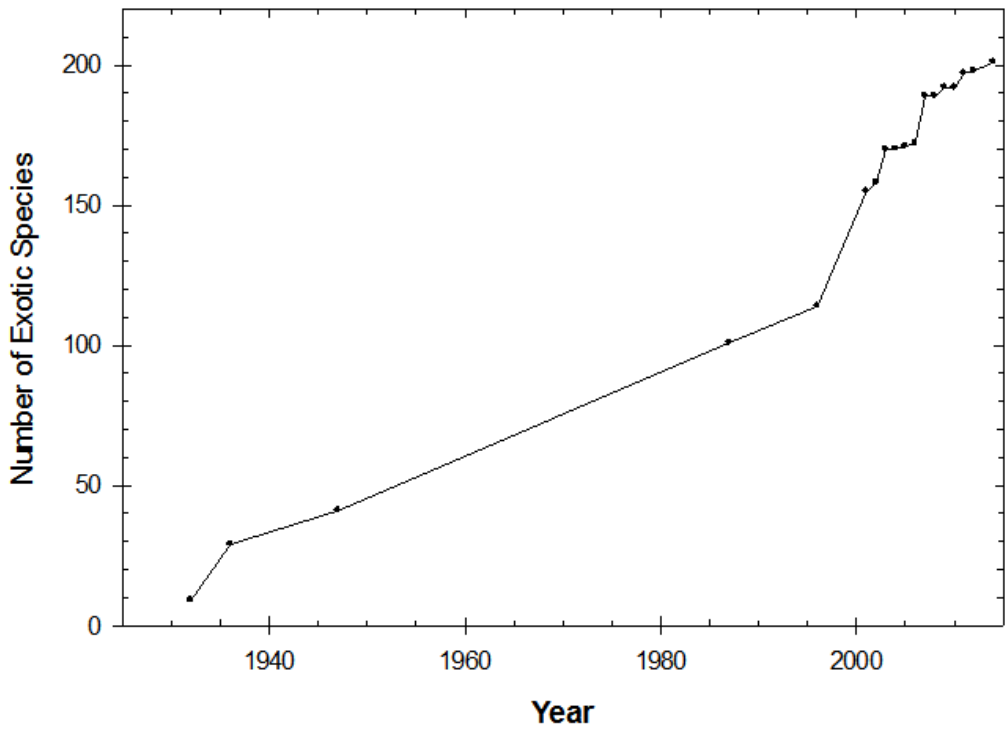
Worldwide, in the last few centuries, both numbers of exotic plant species and their abundance have increased dramatically, and national parks are no exception. At Grand Canyon, historical floristic surveys reveal, and Figure 3.5 illustrates, a steady increase in number of exotic plant species from 9 in 1932, to 29 in 1936, and 41 in 1947. Today, 201 exotic plant species have been documented inside park boundaries with more expected. It is estimated that roughly 50% of the park's total area currently contains exotic plant species; however, the entire park is at risk. Of these, many species are considered invasive and are of particular concern to managers because they could displace native vegetation.

One goal of Grand Canyon's Vegetation Program is to preserve or restore natural environmental conditions by preventing, containing, significantly reducing, or controlling exotic plant species infestations through the following core NPS strategies

- Prevent invasion
- Increase public awareness
- Inventory and monitor
- Conduct research
- Integrate planning and evaluation
- Manage invasive non-native plants

Specific measures in Chapter 2, Mitigations will help minimize exotic plant species spread in backcountry areas.

Figure 3.5 Number of Exotic Plant Species Recorded in Grand Canyon 1932-2012



Wildlife

Grand Canyon is a valuable wildlife resource due to the park's size, elevation range, and associated habitat variety. Park biologists have documented 90 mammals, 355 birds, and 56 amphibian and reptile species. Grand Canyon's diverse vegetation communities, as noted above[45], provide suitable conditions for both habitat generalists and specialists. Many wildlife species are habitat generalists, using ecosystems from Desertscrub through coniferous forest to meet basic requirements. Some species are habitat specialists, requiring specific vegetation composition and structural components to supply their needs and therefore may only occur on the North or South Rim, or along the river corridor.

The following descriptions focus on those wildlife groups most likely affected by proposed backcountry management actions, and includes wildlife habitat from river to rim. The following descriptions address general assemblies of different wildlife groupings (reptiles, amphibians, birds, mammals). Table 3.6 provides a habitat list with common species generally found in each habitat type. It is unlikely invertebrates would be measurably affected by proposed actions in this plan/DEIS, thus they are not considered for further analysis.

Table 3.6 Representative Wildlife Species by General Habitat Type

Common Name	Scientific Name	Common Name	Scientific Name
MIXED-CONIFER			
Birds		**Mammals**	
American Robin	*Turdus migratorius*	Big Brown Bat	*Eptesicus fuscus*
Blue Grouse	*Dendragapus obscurus*	Bushy-tailed Woodrat	*Neotoma cinerea*

[45] Spruce-Fir Forest, Mixed-Conifer Forest, Montane-Subalpine Grasslands, Ponderosa Pine Forest, Pinyon-Juniper Vegetation, Shrub-Steppe, Montane Shrublands and Interior Chaparral, Desertscrub, Desert Grassland, and Riparian.

Common Name	Scientific Name	Common Name	Scientific Name
Clark's Nutcracker	*Nucifraga columbiana*	Coyote	*Canis latrans*
Dark-eyed Junco	*Junco hyemalis*	Deer Mouse	*Peromyscus maniculatus*
Hairy Woodpecker	*Picoides villosus*	Least Chipmunk	*Eutamias minimus*
Hermit Thrush	*Catharus guttatus*	Long-tailed Vole	*Microtus longicaudus*
Mountain Chickadee	*Parus gambeli*	Mountain Cottontail	*Sylvilagus nuttallii*
Northern Flicker	*Colaptes auratus*	Mule Deer	*Odocoileus hemionus*
Steller's Jay	*Cyanocitta stelleri*	Porcupine	*Erethizon dorsatum*
Townsend's Solitaire	*Myadestes townsendi*	Red Squirrel	*Tamiasciurus hudsonicus*
Yellow-rumped Warbler	*Dendroica coronata*	Uinta Chipmunk	*Eutamias umbrinus*
Reptiles		Western Harvest Mouse	*Reithrodontom megalotis*
Mountain Short-horned Lizard	*Phrynosoma douglassi*		
PONDEROSA PINE			
Birds		**Mammals**	
American Robin	*Turdus migratorius*	Abert Squirrel	*Sciurus aberti*
Common Raven	*Corvus corax*	Bobcat	*Lynx rufus*
Dark-eyed Junco	*Junco hyemalis*	Coyote	*Canis latrans*
Flammulated Owl	*Otus flammeolus*	Deer Mouse	*Peromyscus maniculatus*
Grace's Warbler	*Dendroica graciae*	Elk	*Cervus canadensis*
Great Horned Owl	*Bubo virginianus*	Golden-mantled Ground Squirrel	*Spermophilus lateralis*
Hairy Woodpecker	*Picoides villosus*	Gray Fox	*Urocyon cinereoargent*
Mountain Chickadee	*Parus gambeli*	Long-legged Myotis	*Myotis volans*
Northern Flicker	*Colaptes auratus*	Mexican Woodrat	*Neotoma mexicana*
Pygmy Nuthatch	*Sitta pygmaea*	Mountain Lion	*Puma concolor*
Western Bluebird	*Sialia mexicana*	Mule Deer	*Odocoileus hemionus*
Western Tanager	*Piranga ludoviciana*	Porcupine	*Erethizon dorsatum*
Western Wood-Pewee	*Contopus sordidulus*	Striped Skunk	*Mephitis mephitis*
White-Breasted Nuthatch	*Sitta carolinensis*	Uinta Chipmunk	*Eutamias umbrinus*
Wild Turkey	*Meleagris gallopavo*	Western Harvest Mouse	*Reithrodontom megalotis*
Yellow-rumped Warbler	*Dendroica coronata*	Western Pipistrelle	*Pipistrellus hesperus*
Reptiles			
Great Basin Gopher Snake	*Pituophis melanoleucus*	Northern Sagebrush Lizard	*Sceloporus graciosus*
Mountain Short-horned Lizard	*Phrynosoma douglassi*	Plateau Lizard	*Sceloporus undulates*
PINYON-JUNIPER			
Birds		**Mammals**	
Ash-throated Flycatcher	*Myiarchus cinerascens*	Big Brown Bat	*Eptesicus fuscus*
Black-throated Gray Warbler	*Dendroica nigrescens*	Black-tailed Jack Rabbit	*Lepus californicus*
Blue-gray Gnatcatcher	*Polioptila caerulae*	Bobcat	*Lynx rufus*
Common Poorwill	*Phalaenpotilu nuttallii*	Cliff Chipmunk	*Eutamias dorsalis*
Common Raven	*Corvus corax*	Coyote	*Canis latrans*
Plain Titmouse	*Parus inornatus*	Desert Cottontail	*Sylvilagus audubonii*
Pinyon Jay	*Gymnorhynus cyanocephalus*	Elk	*Cervus Canadensis*

Common Name	Scientific Name	Common Name	Scientific Name
Say's Phoebe	*Sayornis saya*	Gray Fox	*Urocyon cinereoargent*
Scott's Oriole	*Icterus parisorum*	Long-legged Myotis	*Myotis volans*
Spotted Towhee	*Pipilo maculatus*	Mountain lion	*Puma concolor*
Steller's Jay	*Cyanocitta stelleri*	Mule Deer	*Odocoileus hemionus*
Western Bluebird	*Sialia mexicana*	Pinyon Mouse	*Peromyscus truei*
Western Scrub Jay	*Aphelocoma californica*	Rock Squirrel	*Spermophilus variegates*
White-Breasted Nuthatch	*Sitta carolinensis*	Stephen's Woodrat	*Neotoma stephensi*
Reptiles		Western Harvest Mouse	*Reithrodontom megalotis*
Mountain Short-horned Lizard	*Phrynosoma douglassi*	White-tailed Antelope Squirrel	*Ammospermophi leucurus*
Plateau Lizard	*Sceloporus undulatus*	White-throated Woodrat	*Neotoma albigula*
Sonoran Gopher Snake	*Pituophis melanoleucus*		
DESERTSCRUB / DESERT GRASSLAND / MONTANE SHRUBLANDS			
Birds		**Mammals**	
Ash-throated Flycatcher	*Myiarchus cinerascens*	Black-tailed Jack Rabbit	*Lepus californicus*
Black-throated Sparrow	*Amphispiza bilineata*	Cactus Mouse	*Peromyscus eremicus*
Blue-gray Gnatcatcher	*Polioptila caerulae*	Coyote	*Canis latrans*
Bushtit	*Psaltriparus minimus*	Deer Mouse	*Peromyscus maniculatus*
Common Poorwill	*Phalaenpotilu nuttallii*	Desert Cottontail	*Sylvilagus audubonii*
Common Raven	*Corvus corax*	Desert Woodrat	*Neotoma lepida*
Horned Lark	*Eremophila alpestris*	Gray Fox	*Urocyon cinereoargent*
Mountain Bluebird	*Sialia currucoides*	Botta's Pocket Gopher	*Thomomys bottae*
Mourning Dove	*Zenaida macroura*	Western Harvest Mouse	*Reithrodontom megalotis*
Plain Titmouse	*Parus inornatus*	White-tailed Antelope Squirrel	*Ammospermophi leucurus*
Red-tailed Hawk	*Buteo jamaicensis*		
Western Meadowlark	*Sturnella neglecta*		
Reptiles			
Black Collared Lizard	*Crotaphytus insularis*	Northern Whiptail	*Cnemidophorus tigris*
California King Snake	*Lampropeltis getulus*	Plateau Lizard	*Sceloporus undulates*
Collared Lizard	*Crotaphytus collaris*	Side-blotched Lizard	*Uta stansburiana*
Desert Striped Whipsnake	*Masticophis taeniatus*	Sonoran Gopher Snake	*Pituophis melanoleucus*
Great Basin Gopher Snake	*Pituophis melanoleucus*	Yellow-backed Spiny Lizard	*Sceloporus magister*
RIPARIAN			
Birds			
White-throated Swift	*Aeronautes saxatalis*	Common Merganser	*Mergus merganser*
Black-chinned ummingbird	*Archilochus alexandri*	Great Blue Heron	*Ardea herodias*
House Finch	*Carpodacus mexicanus*	Mallard	*Anas platyrhynchos*
Canyon Wren	*Catherpes mexicanus*	**Mammals**	
Black-throated Gray Warbler	*Dendroica nigrescens*	Ringtail	*Bassariscus astutus*
Yellow Warbler	*Dendroica petechia*	Beaver	*Castor Canadensis*
Common Yellowthroat	*Geothlypis trichas*	Western Spotted Skunk	*Spilogale gracilis*
Scott's Oriole	*Icterus parisorum*	Gray Fox	*Urocyon cinereoargent*
Dark-eyed Junco	*Junco hyemalis*	**Reptiles and Amphibians**	

Common Name	Scientific Name	Common Name	Scientific Name
Song Sparrow	*Melospiza melodia*	Red Spotted Toad	*Bufo punctatus*
Ash-throated Flycatcher	*Myiarchus cinerascens*	Rocky Mountain Toad	*Bufo woodhousei*
Blue-gray Gnatcatcher	*Polioptila caerulae*	Northern Whiptail	*Cnemidophorus tigris*
Say's Phoebe	*Sayornis saya*	Collared Lizard	*Crotaphytus collaris*
Broad-tailed Hummingbird	*Selasphorus platycerus*	Black Collared Lizard	*Crotaphytus insularis*
Violet-green Swallow	*Tachycineta thalassina*	Canyon Tree Frog	*Hyla arenicolor*
Cassin's Kingbird	*Tyrannus vociferans*	Desert Striped Whipsnake	*Masticophis taeniatus*
Lucy's Warbler	*Vermivora luciae*	Yellow-backed Spiny Lizard	*Sceloporus magister*
American Dipper	*Cinclus mexicanus*	Tree Lizard	*Urosaurus ornatus*
Black Phoebe	*Sayornis nigricans*	Side-blotched Lizard	*Uta stansburiana*

Reptiles and Amphibians

Approximately 56 reptile and amphibian species reside in Grand Canyon. The majority of species occur near water, such as along the river corridor or in Riparian sites. The highest densities and diversity tend to occur in Riparian areas due to the presence of water, abundant vegetation, and invertebrate food sources. Sixteen reptile species have been identified along the Colorado River (Carpenter 2003). Reptiles commonly associated with the river corridor include western whiptail lizard (*Cnemidophorus spp.)*, tree lizard (*Urosaurus ornatus)*, desert spiny lizard (*Sceloporus magister*), and Grand Canyon pink rattlesnake (*Crotalus atrox*).

Little is known about herpetofauna that inhabit Grand Canyon's forested communities. A variety of lizards and snakes inhabit plateau coniferous forests especially in Pinyon-Juniper Vegetation and Ponderosa Pine Forests. Common lizard species found on the plateau include greater short-horned lizard (*Phrynosoma hernandesi*), northern plateau lizard (*Sceloporus undulatus elongatus*), and northern sagebrush lizard (*Sceloporus graciosus graciosus*). The many-lined skink (*Eumeces multivirgatus*) is rare in the park and only found on South Rim. It is very secretive and hides beneath rocks or logs (Colorado River Wildlife Council 1982). The western skink (*Eumeces skiltonianus*) is rare in habitats from grasslands to forests on both rims and is usually associated with rocky areas. Primarily found on South Rim, the Sonoran gopher snake (*Pituophis catenifer affinis*) occurs in predominantly Desertscrub to Pinyon-Juniper Vegetation. The Great Basin gopher snake (*Pituophis catenifer deserticola)* is common in Ponderosa Pine Forests, Pinyon-Juniper Vegetation, and Desertscrub. The Great Basin rattlesnake (*Crotalus viridis lutosus*) is uncommon and prefers thinly forested rocky areas in Ponderosa Pine Forests, Pinyon-Juniper Vegetation, or Desert Grasslands. The Utah mountain kingsnake (*Lampropeltis pyromelana infralabialis*) is rare and found in ponderosa pine on North Rim. The wandering garter snake (*Thamnophis elegans vagrans*) is uncommon in Riparian areas or moist habitats of North Rim and rarely occurs on South Rim.

Amphibians are not well-represented in the park generally due to arid conditions and lack of surface water; few amphibians inhabit plateaus. Tiger salamanders (*Ambystoma tigrinum*) inhabit areas around pools, marshes, and water tanks in meadows in North Rim Ponderosa Pine to Spruce-Fir Forests. The Arizona tiger salamander (*Ambystoma tigrinum nebulosum*) is apparently limited to South Rim moist areas around marshes and water tanks. Great Plains toad (*Bufo cognatus*) and Great Basin spadefoot toad (*Spea intermontana*) can be found in Riparian areas or in Ponderosa Pine Forests. Rocky Mountain (*Bufo woodhousii*) and red-spotted toads (*Bufo punctatus)* are found in Inner Canyon Riparian areas along the river and perennial tributaries.

Birds

Grand Canyon's striking elevational and topographic diversity creates complex vegetation type mosaics, providing diverse bird habitat. Riparian habitats along the river provide breeding habitat, migratory

stopover sites, and wintering areas for birds throughout the year. Over 360 bird species have been recorded in the Grand Canyon region, approximately 250 in the river corridor (NPS 2010e). Some species are year-round residents such as canyon wren (*Catherpes mexicanus),* wild turkey *(Meleagrif gallapavo),* and American dipper (*Cinclus mexicanus)*, but most are migrants that use the river seasonally for breeding or as a travel corridor, or are from other canyon habitats and use the river corridor during nonbreeding or migratory seasons. Other species that breed in the canyon and are present through most of summer include song sparrow (*Melospiza melodia)*, house finch *(Carpodacus Mexicanus)*, and Bell's vireo (*Vireo bellii*). Waterfowl have been found to be more abundant in winter than other seasons and are particularly abundant in the canyon's upper reaches. Mallards (*Anas platyrhynchos*) and common mergansers (*Mergus merganser*) also breed in the park and build nests on the ground. Numerous transient birds such as great blue heron (*Ardea herodias*) and snowy egret (*Egretta thula*) use the canyon's Riparian habitats primarily during spring and fall migrations.

In plateau areas, a number of bird species are generalists and occupy a variety of habitats (Ponderosa Pine Forest, Ponderosa–Mixed-Conifer Forest transition, Mixed-Conifer Forest, and Montane-Subalpine Grasslands). Generalist forest species such as broad-tailed hummingbird (*Selasphorus platycerus)*, plumbeous vireo (*Vireo plumbeus*), brown creeper (*Certhia americana*), and evening grosbeak (*Coccothraustes vespertinus*) have been found in all forest types from Ponderosa Pine to Spruce-Fir. Breeding warbler diversity in Ponderosa Pine is second only to the Colorado River corridor, which has four breeding species. Secondary cavity nesters (e.g., violet-green swallow (*Tachycineta thalassina*), pygmy nuthatch (*Sitta pygmaea*), western bluebird (*Sialia mexicana*), and white-breasted nuthatch (*Sitta carolinensis*)) are also an important component of the Ponderosa Pine Forest bird community. Blue grouse *(Dendragapus obscurus*) occur on North Rim in Mixed-Conifer Forest.

Several raptors are closely associated with Ponderosa Pine including the rare northern goshawk (*Accipiter gentilis*), red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), great horned owl (*Bubo virginianus*), and northern pygmy owl (*Glaucidium californicum*). The northern goshawk breeds in high, forested mountains and plateaus across Arizona (usually above 6,000 feet); primary potential goshawk habitat in the park is in North Rim Mixed-Conifer and Ponderosa Pine habitats. As of 2007, 18 northern goshawk territories are identified in North Rim forests, and four in South Rim forests. The northern pygmy owl also occurs in Ponderosa Pine, but hunts during the day or at dusk (Brown et al. 1987). Flammulated owls (*Otus flammeolus*) are migratory and occur in dry, montane coniferous forests in central and western North America

Bats

During hibernation, bats are highly susceptible to disturbance, making hibernacula an important focus for management and protection efforts. Grand Canyon provides a variety of roosting and feeding areas for bat species. Two species, western red bat (*Lasionycteris borealis*) and Yuma myotis (*Myotis yumanensis*), occur primarily along the river corridor, roost in cliffs or trees, and forage in Riparian areas, though western red bats have also been detected on the rim between Grand Canyon Village and Desert View.

Species that typically roost in caves or cliff crevices include pallid bat (*Antrozous pallidus*), western pipistrelle (*Pipistrellus hesperus*), big free-tail (*Nyctinomops macrotis*), Mexican free-tail (*Tadarida brasiliensis*), California myotis (*Myotis californicus*), small-footed myotis (*Myotis lebii*), and Yuma myotis (*Myotis yumanensis*) (Hoffmeister 1986, BCI 2014). Western pipistrelles are a common Grand Canyon bat, especially in the canyon and along the rim. They usually live in cliffs and walls and are found at the canyon bottom and over rim coniferous forests.

Known Grand Canyon forest-dwelling bats include big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), and silver-haired bat (*Lasionycteris noctivagans*). These bats roost in dense foliage, beneath exfoliating bark, or in tree

cavities. Big brown bat colonies are known to roost in old growth aspen stands (Kalcounis and Brigham 1998, Willis et al. 2003), and there have been reports of them doing so on the South Rim (Ward 2005). Western red bats have been detected using the rim between Grand Canyon Village and Desert View.

A variety of bats use Ponderosa Pine Forests and forest openings, but little is known about their habits. The California myotis has been recorded roosting in South Rim ponderosa snags (Ward 2005). The small-footed myotis (*Myotis leibii*) is an uncommon resident of South Rim's eastern portion. Little is known about its habits, but it has been found in Pinyon-Juniper and Ponderosa Pine with western pipistrelles. The little brown bat (*Myotis lucifugus*) is very rare in Grand Canyon. It forages in openings from Ponderosa Pine to Spruce-Fir Forests. Little is known about the silver-haired bat in Grand Canyon. They are rare in habitats of Pinyon-Juniper, Ponderosa Pine, and into Spruce-Fir Forests, and could occur on both rims while migrating in spring or fall. The big brown bat is the largest bat commonly found in North and South Rim coniferous forests. They occur along the river corridor and in forested areas from Pinyon-Juniper into Mixed-Conifer, foraging over water and among pines. The fringed myotis occurs on both rims, but is uncommon on South Rim and rare on North Rim. They roost in trees, canyon cliffs, or buildings and feed over coniferous forests openings or water sources.

Small Mammals

A number of small mammals are habitat generalists using ecosystems including Desertscrub, coniferous forests, and Riparian areas. Deer mice (*Peromyscus maniculatus*) and western harvest mice (*Reithrodontomys megalotis*) are common throughout the park, and serve as important prey species for many predators. The deer mouse is the only rodent that depends directly on Riparian areas for its existence. Botta's pocket gopher (*Thomomys bottae*) inhabits South and North Rim's warmer west end. They use Desertscrub, Pinyon-Juniper and Ponderosa Pine Forests wherever suitable soil exists for digging. The brush mouse (*Peromyscus boylii*) uses a variety of park habitats, preferring Pinyon-Juniper Forests, Riparian areas, rocky slopes, and desertscrub, and sometimes Spruce-Fir Forests. Mexican woodrat (*Neotoma mexicana*), bushy-tailed woodrat (*Neotoma cinerea*), and Mexican vole (*Microtus mexicanus*) occur only on South Rim. The bushy-tailed woodrat occurs in Pinyon-Juniper Woodlands or Ponderosa Pine Forests, but is restricted to suitable rocky areas. The Mexican woodrat inhabits rocky areas in ponderosa pine, frequently along rim edges and sometimes into the pinyon-juniper belt. They often use the same habitat as rock squirrels (*Spermophilus variegates*). Mexican voles prefer areas that tend to be drier with sparse grass. The Uinta chipmunk (*Tamias umbrinus)*, least chipmunk (*Tamias minimus*), golden-mantled ground squirrel (*Spermophilus lateralis*), and Nuttall's cottontail (*Sylvilagus nuttallii*) are found only on North Rim. Shrews and voles occur in most habitats on the plateau ranging from rocky slopes to grassy meadows.

Carnivores

Most predators are highly mobile, hunting throughout Grand Canyon habitats. Eleven terrestrial mammalian carnivore species occur in the park. These include mountain lion (*Puma concolor*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), badger (*Taxidae taxus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale gracilis*), ringtail (*Bassariscus astutus*), and long-tailed weasel (*Mustela frenata).* Mountain lions occur throughout Arizona and can be found in any habitat, including Riparian areas. Black bears are thought to exist in very low densities on North and South Rims, and are reported sporadically on South Rim. Raccoons are likely restricted to lower elevations along the river and in more developed South Rim areas. Ringtails are primarily found along canyon rims and in developed areas. Skunks are found in South Rim pinyon-juniper and ponderosa pine forests and are probably present on North Rim; striped skunks occur in the canyon below 4,400 feet. Coyotes are common throughout the park and appear particularly common on South Rim. Bobcats are commonly found throughout the park in desert and wooded areas, especially along the pinyon-juniper belt. Badgers uncommonly occur in grasslands, pinyon-juniper, and ponderosa pine forests on both rims. In Arizona, long-tailed weasels occur from the Kaibab Plateau south

along the Mogollon Rim and in scattered mountain ranges in eastern Arizona. Long-tailed weasels are active year-round and primarily nocturnal.

Ungulates
Ungulates such as mule deer and elk occupy zones seasonally. Both elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) are found on the South Rim and use pinyon-juniper and ponderosa pine forests for food and shelter. Elk are not considered to be native to Grand Canyon, but have established park populations as a result of early-1900s introductions near Williams, Arizona. Mule deer occur on both North and South Rim and along the river corridor. Mule deer occupy a variety of habitats from Ponderosa Pine Forests desertscrub, but tend to avoid large openings and mature forest with closed canopy. On North Rim, mule deer depend on the pinyon-juniper zone for essential winter forage, and move into ponderosa pine, mixed-conifer, and spruce-fir during spring, summer, and fall. Deer begin migrating into mixed-conifer forest in early May and remain there and in spruce-fir until late September.

Special Status Plant Species

The Endangered Species Act of 1973, as amended, requires examination of impacts on all federally listed threatened or endangered species. NPS Management Policies 2006 repeats this requirement and adds that analyses examine impacts on state-listed species and Federal species proposed for listing. Grand Canyon is home to nine endemic plant species (known only from the park) one of which, sentry milk-vetch (*Astragalus cremnophylax cremnophylax*), is a federally listed plant species federally listed threatened and endangered species of concern. The Sentry Milk-Vetch Recovery Plan (USFWS 2006) recommended actions which Grand Canyon is implementing, some of which are in the park's backcountry.

Special Status Plant Species are listed by vegetation type. Ground surveys and habitat modeling were not conducted for this plan/DEIS; however, all known collections of Special Status Plant Species were assembled into a geo-database that can be spatially searched and analyzed.

Spruce Fir Forest
- No endemic plant species known to occur

Mixed-Conifer Forest
- No endemic plant species known to occur

Montane-Subalpine Grassland
- No endemic plant species known to occur

Ponderosa Pine Forest
- Grand Canyon goldenbush (*Ericameria arizonica*)

Pinyon-Juniper Vegetation
- Grand Canyon goldenbush
- Sentry milk-vetch
- North Rim milk-vetch (*Astragalus septentriorema*)
- Straightbranched catchfly (*Silene rectiramea*)

Shrub-Steppe
- Grand Canyon goldenbush

Montane Shrublands and Interior Chaparral

- Grand Canyon goldenbush
- Roaring Springs prickle poppy (*Argemone arizonica*)

Desertscrub

- Roaring Springs prickle poppy
- McDougall's yellowtops (*Flaveria macdougallii*)
- Mentzelia to-be-named (*Mentzelia canyonensis*)

Desert Grassland

- No endemic plant species known to occur

Riparian including seeps and springs

- Kaibab suncup (Chylismia confertiflora, syn. Camissonia confertiflora)
- McDougall's yellowtops
- Mentzelia to-be-named (Mentzeloa conyonensis)

Known sentry milk-vetch locations and potential future reintroduction sites are compiled in a geo-database with restricted public access due to the plant's endangered status. At present, human impacts at known locations are minor. The North Rim milk-vetch is located in the Pinyon-Juniper Vegetation on the Walhalla Plateau. This species was previously thought to be a population of endangered sentry milk-vetch, but is currently treated as a rare endemic species of concern until supplemental genetic work is completed.

Special Status Wildlife Species

Some of Grand Canyon's special status wildlife species may be impacted by backcountry use. Potential impacts may include modification of animal behavior including alteration of feeding, breeding, and socializing habits and accidental injury, energy loss, and impacts to offspring survival. Grand Canyon special status wildlife species are species that may be state, tribal, or federally listed (including proposed for federal listing and candidates for federal listing).For purposes of this plan/DEIS, special status wildlife species are divided into Federally Listed and Other Species of Concern (Table 3.7).

To ensure actions considered in this plan/DEIS do not jeopardize continued existence of federally listed, proposed threatened or endangered species, or proposed critical habitat for those species, the Endangered Species Act requires NPS consult with USFWS prior to planning or implementing park projects that may affect these species and/or their habitat.

A few special status wildlife species are not expected to be impacted by actions proposed in this plan/DEIS. The humpback chub (*Gila cypha)*, razorback sucker (*Xyrauchen texanus)*, flannelmouth sucker (*Catostomus latipinnis)*, and Kanab and Niobrara ambersnails (*Oxyloma haydeni kanabensis kanabensis* and *Oxyloma haydeni)* are not expected to be impacted by recreational backcountry use as they primarily reside in the Colorado River (fish) or remote and inaccessible habitats along the river corridor (snails). Grand Canyon cave pseudoscorpions (*Archeolarca cavicola)* inhabit only one park cave. Because pseudoscorpions spend most of their lives in crevices and seldom appear on open ground, this species is not expected to be impacted by recreational backcountry use. Thus, these species were dismissed from further analysis.

Table 3.7 Potentially Impacted Special Status Wildlife Species

Common Name	Scientific Name	Status			
		Federal	State	Navajo**	Other
Federally Listed Species (USFWS consultation required)					
Birds					
California condor	*Gymnogyps californianus*	XN	WSC	-	-
Mexican spotted owl	*Strix occidentalis lucida*	T	WSC	G3	-
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	WSC	G2	-
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	T	WSC	G3	-
Yuma clapper rail	*Rallus longirostris yumanensis*	E	WSC	-	-
Other Species of Concern					
Birds					
American peregrine falcon	*Falco peregrinus anatum*	D	WSC	-	SC
Bald eagle	*Haliaeetus leucocephalus*	D	WSC	-	-
Golden eagle	*Aquila chrysaetos*	-	-	G3	-
Mammals					
Desert bighorn sheep	*Ovis canadensis nelsoni*	-	-	G3	-
Allen's lappet-browed bat	*Idionycteris phyllotis*	-	-	-	SC
Greater western mastiff bat	*Eumops perotis californicus*	-	-	-	SC
Long-legged myotis bat	*Myotis volans*	-	-	-	SC
Mexican long-tongued bat	*Choeronycteris mexicana*	-	WSC	-	SC
Pale Townsend's big-eared bat	*Corynorhinus townsendii*	-	-	-	SC
Pocketed free-tailed bat	*Nyctinomops femorosacca*	-	-	-	SC
Southwestern myotis bat	*Myotis auriculus*	-	-	-	SC
Spotted bat	*Euderma maculatum*	-	WSC	-	SC
Western red bat	*Lasiurus blossevillii*	-	WSC	-	-

Federal Status
- E Endangered, in danger of extinction
- T Threatened, severely depleted
- XN Experimental, non-essential population; in Grand Canyon managed as federally threatened
- D Delisted

State Status
- WSC Wildlife of Special Concern in Arizona

Navajo Endangered Species List
- Group 1 (G1) No longer occurs on Navajo Nation lands. Arizona Game and Fish Department, 1996
- Group 2 (G2) Prospect of survival or recruitment is in jeopardy
- Group 3 (G3) Prospect of survival or recruitment is likely to be in jeopardy in the foreseeable future

** Navajo status determination is not used by any other affiliated Grand Canyon tribes

Other
- SC Species of Concern. Some information showing vulnerability or threat, but not enough to support listing under the Endangered Species Act. Some of these species are former USFWS Category 1, 2, and 3 species (Note: the Southwest Region, USFWS, no longer maintains a list of Category 1, 2, or 3 species)

Sources
66 Federal Register 54808
50 CFR 17.11–17.12
Fish and Wildlife Service. Endangered Species Program, https://www.fws.gov/endangered/
Arizona Game and Fish Department. Heritage Data Management System, http://www.azgfd.gov/w_c/edits/species_concern.shtml
Species names conform to the Integrated Taxonomic Information System (ITIS), http://www.itis.gov/

Federally Listed Special Status Wildlife Species

The Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), requires examination of impacts on all Federally Listed Threatened or Endangered Species. Federally listed threatened and endangered species and candidates found in Grand Canyon and analyzed in this plan/DEIS include

- California condor
- Mexican spotted owl
- Southwestern willow flycatcher
- Western yellow-billed cuckoo
- Yuma clapper rail

California Condor

The California condor (*Gymnogyps californianus*), was listed as endangered in March 1967[46], and the last free-flying condors were taken into captivity in 1987. In 1996, USFWS established a nonessential, experimental population in northern Arizona in the Vermilion Cliffs area, 30 miles north of Grand Canyon. Subsequent releases occurred in the same vicinity and in the Hurricane Cliffs, about 60 miles west of Vermilion Cliffs. By declaring the population nonessential, experimental, USFWS can treat this population as threatened and develop less restrictive management regulations than the mandatory prohibitions covering endangered species. This designation facilitates efforts to return condors to the wild by providing increased opportunities to minimize conflict between condor management and other activities. In Grand Canyon, condors have the full protection of a threatened species (USFWS 1996).

Condors, one of the world's largest flying birds, historically ranged along the U.S. west coast south to Baja California and northern Mexico. Condor populations were decimated by shooting, egg collecting, power-line collisions, and lead poisoning. Condors are opportunistic scavengers and feed primarily on large mammal carcasses. Foraging behavior includes long-distance reconnaissance flights. Nesting habitat includes various rock formations (caves, crevices, overhung ledges, and potholes). Roost sites include cliffs and tall trees, including snags (USFWS 1996). Condors are long-lived and do not breed until they are five to seven years old.

Courtship begins in December, and breeding pairs lay a single egg late January to early April. Eggs hatch after approximately 56 days, and young condors take their first flight at approximately six months of age. Young condors may be dependent on parents through the following breeding season (USFWS 1996).

Condors in Arizona totaled 75 free-flying birds and two chicks as of December 2013. All California condors in northern Arizona are fitted with radio transmitters that allow field biologists to monitor movements. Condors have been observed as far away as Flaming Gorge, Wyoming (The Peregrine Fund 2001). Monitoring data indicate condors use habitat throughout Grand Canyon. In fall and winter months, most condors spend time near Vermilion Cliffs and Marble Canyon and on Tonto Platform near South Rim's Developed Zone (The Peregrine Fund 2001). During spring and summer, condors frequent North and South Rims, the Kaibab Plateau (Rogers 2004), and southern Utah.

Potential nesting habitat exists on cliffs throughout the park. Since the first nesting attempt in 2001, 26 chicks have hatched in the wild and 19 have successfully fledged. Nests have been located in Marble Canyon, the Vermilion Cliffs, South Rim, Tapeats Creek, Tower of Ra, and the Kanab Creek Wilderness Area.

Mexican Spotted Owl

The Mexican spotted owl (*Strix occidentalis lucida*) was listed as threatened in 1993 (58 FR 14248), and a revised recovery plan was issued in 2012 (USFWS 2012). Mexican spotted owl (MSO) range extends from central Colorado and Utah south through Arizona, New Mexico, west Texas, and Mexico to Michoacán and Puebla. Mexican spotted owl critical habitat was designated in February 2001 and includes approximately 27,100 acres of mixed-conifer habitat on the North Rim and over 31,000

[46] Original listing under Endangered Species Preservation Act of 1966.

additional acres of designated Protected Activity Centers (PAC) in canyon habitat in the park. MSO are threatened primarily by habitat destruction and modification through timber harvest and wildfires. Other threats include increased interactions with predatory and competitive species resulting from habitat alteration (USFWS 2012). MSO can also be negatively impacted by human disturbance from activities such as recreation, overflights, and noise disturbance.

Grand Canyon falls in the Colorado Plateau Recovery Unit. The Recovery Plan for the Mexican Spotted Owl (USFWS 2012) provides three levels of habitat management: protected areas, recovery areas, and other forest and woodland types. Protected habitat in the Colorado Plateau Recovery Unit includes any PAC; mixed-conifer or pine-oak forest types with slopes over 40% where timber harvest has not occurred in the past 20 years; and all legally and administratively reserved lands. Outside PACs, the park contains approximately 10,430 acres of protected habitat, most of which occurs below the rim. Recovery habitat in the Colorado Plateau Recovery Unit includes mixed-conifer forest types or riparian habitats. Important MSO habitat components in these habitat types include high basal area uneven-aged tree structure, high percentage canopy cover, and high density of large trees, snags, and downed woody debris. MSO in canyonland habitat typically roost and nest in deep, narrow canyons with rocky topography, often with vertical or near-vertical cliffs that provide cooler and more humid conditions. Canyon MSOs roost on cliff ledges, cliffs, in caves or potholes, or in trees (Rinkevich and Gutierrez 1996, Willey 1998).

Grand Canyon MSO presence was confirmed in 1992 field surveys. Currently 46 PACs have been designated in the park for a total of approximately 31,000 acres. Grand Canyon biologists conducted a three-year radio-tracking study 2004 to 2006 to describe breeding ecology of Grand Canyon MSO and provide a foundation for a long-term nest monitoring program. Preliminary data analysis and field observations indicated roost and nest sites were located toward heads of canyons and in the Redwall Limestone geologic layer. These areas are shady and generally include some tree and shrub vegetation. No MSO nests or roosts are known to occur above the rim, but MSO have infrequently been detected above the rim during standard surveys, and telemetry data showed they sometimes forage in close proximity to the rim (Bowden 2006). Further data analysis is pending.

Courtship behavior between paired MSO generally begins in March. Eggs are laid near the end of March or early April, and young hatch after 30 days incubation. Owlets fledge at approximately 35 days of age (Ehrlich et al. 1988, USFWS 2012), but are dependent on parents for food for several weeks. Young disperse mid-September to early-October. Adult MSO may remain resident on territories throughout the year or may migrate short distances in winter to more open habitats at lower elevations (USFWS 2012). MSO diet varies depending on location and habitat, but in canyonland habitat consists primarily of small and medium rodents such as woodrats (*Neotoma* spp.), peromyscid mice, and microtine voles (Ward and Block 1995). Grand Canyon MSO have been found to hunt primarily below the rim in open desert scrub or pinyon-juniper habitat, with minimal use of plateau forests close to the rim (Bowden 2006).

Southwestern Willow Flycatcher

Southwestern willow flycatchers (SWFL) were listed as endangered in 1995 (60 FR 10694–10715). Critical habitat has not been designated in the park. The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of four subspecies of willow flycatcher (*Empidonax traillii*). Breeding range includes southern California, southern Nevada, southern Utah, Arizona, New Mexico, and southwestern Colorado. All subspecies winter in Mexico and Central America (Sogge et al. 1997). Southwestern willow flycatchers arrive on breeding grounds late April to mid-June (Sogge et al. 1997), and breed exclusively in dense riparian vegetation from sea level to over 8,500 feet. Nests are typically near open water or saturated soil. Among sites, dominant plant species, vegetation structure, and vegetation height vary widely. SWFL are insectivorous, and catch prey in the air or glean it from foliage (Ehrlich et al. 1988).

Historically, Arizona SWFL range included portions of all major watersheds (Swarth 1914, Phillips 1948, Unitt 1987); however, these watersheds have changed dramatically in many cases. As a result, most areas where SWFL were locally abundant now support few to none (Tellman et al. 1997). Brood parasitism by brown-headed cowbirds (*Molothrus ater)* represents a large threat to SWFL populations. Increases in cowbird populations are associated with livestock grazing, agriculture, and forest cutting. Threats to SWFL include widespread riparian habitat loss throughout the southwestern U.S. Fire has caused habitat loss at several southwestern U.S. breeding sites and is considered a critical threat to occupied and potential flycatcher habitat (Finch and Stoleson 2000).

Patches of potential willow flycatcher habitat occur in Grand Canyon along the Colorado River. There is little information on SWFL numbers along the river before Glen Canyon Dam construction. However, what data are available suggests SWFL were not common breeders along the Colorado River in Grand Canyon (Brown 1988, Brown 1991, Sogge et al. 1997). SWFL surveys have occurred in Grand Canyon along the Colorado River since 1982. Twenty-eight years of surveys have occurred along the Lees Ferry–Phantom Ranch stretch, while Phantom Ranch–Diamond Creek was surveyed a total of ten years, and Diamond Creek–Pearce Ferry was surveyed a total of 14 years since 1982. A noticeable decrease of adults and breeding pairs has occurred since the 1990s (NPS 2013i). The last observed breeding pair was made in 2010 (Palarino et al. 2010), while the last nest observed was in 2007 (McLeod et al. 2008).

This decrease in breeding SWFL is likely due to several site-specific factors including: 1) fluctuating and unstable hydrological conditions at the majority of potential breeding sites, which lead to a site being either too dry or too swift (water moving too fast through the site); and 2) increased tamarisk leaf beetle (*Diorhabda carinulata*) distribution causing increased defoliation of tamarisk-dominated sites.

Western Yellow-billed Cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) was listed as threatened on November 3, 2014 (79 FR 59992). This species is also an Arizona wildlife species of special concern and a Navajo Nation future jeopardy species. Western yellow-billed cuckoos were historically locally common in Arizona, California, New Mexico, Oregon, and Washington; local and uncommon in western Colorado, western Wyoming, Idaho, Nevada, Utah, and British Columbia (66 FR 38611–38626). Yellow-billed cuckoos are migratory, wintering from northern South America south to eastern Peru, Bolivia, and northern Argentina (Ehrlich et al. 1988). Starting mid- to late-May, cuckoos arrive on their breeding grounds which typically consist of large blocks of riparian habitat. Nests are placed in areas with dense understory foliage and are almost exclusively close to open water. Because of this tendency, humidity is believed to be a requirement for successful hatching and rearing of young (reviewed in 66 FR 38611–38626). Yellow-billed cuckoos are insectivorous, and the nesting cycle often coincides with outbreaks of tent caterpillars, katydids, or cicadas.

Population declines are attributed to widespread riparian habitat fragmentation and loss resulting from impoundments, channelization, groundwater pumping, conversion of land to agricultural and urban uses, and invasion of non-native plants, such as tamarisk. Potential yellow-billed cuckoo habitat only occurs downstream of Diamond Creek in the river corridor's western end (Hughes 1999). In 2006, one individual was detected in the park by USGS personnel (Johnson et al. 2007).

Yuma Clapper Rail

The Yuma clapper rail (*Rallus longirostris yumanensis*) was listed as endangered on March 11, 1967 (32 FR 4001). A five-year species review was completed in 2006, and currently the 1983 Recovery Plan is in the revision process. Although the majority of the population is found in Mexico, the Yuma clapper rail is only listed as endangered in the U.S. It is categorized as a subspecies with a high degree of threat and low recovery potential due to habitat loss that has to be actively managed (USFWS 2009).

The Yuma clapper rail occurs along the lower Colorado River (downstream of RM 234) and tributaries (Virgin, Bill Williams, Lower Gila Rivers) in Arizona, California, Nevada, and Utah; the Salton Sea in California; and the Cienega de Santa Clara and Colorado River Delta in Mexico (USFWS 2009). Between 2000 and 2008 the number of Yuma clapper rails in the U.S. has fluctuated between 503 and 890 (USFWS 2009).

The Yuma clapper rail is a secretive species and is not often seen in the wild; however, it does have a series of distinctive calls and is most often identified by those. This bird inhabits freshwater or brackish stream sides and marshes under 4,500 feet elevation. It is associated with dense riparian and marsh vegetation, dominated by cattails (*Typha* sp.) and bulrush (*Scirpus* ssp.) with a mix of riparian tree and shrub species. Yuma clapper rails may climb into a shrub or tree, but overall they do not perch above the ground (USFWS 2009). The clapper rail requires a wet substrate such as a mudflat, sandbar, or slough bottom that supports cattail stands of moderate to high density adjacent to shorelines. Other important factors are presence of vegetated edges between marshes and shrubby riparian habitat (tamarisk or willow thickets) and amount and rate of water level fluctuations. Nests are built three to six inches above the surface in sloughs and backwaters that support dense stands of bulrush and cattails, and breeding occurs March to early July. Along the lower Colorado River males begin calling in February and pair bonding occurs shortly after. There is evidence some populations may be more migratory than others and this could be based on habitat and a stable food source (Eddleman 1989, Corman and Wise-Gervais 2005). Very little is known about dispersal of adult or juvenile birds, but there is evidence of populations expanding northward along the lower Colorado River, Salton Sea, and central Arizona over the last 80 years (LCR MSCP 2004).

Marsh bird surveys were conducted in 2009 by the Lower Colorado River Multi-Species Conservation Program along portions of the lower Colorado River, adjacent backwaters, lakes, and marshes (Kahl 2009). The portion of Grand Canyon included in the Lower Colorado River Multi-Species Conservation Program (RM 234 to 277) was not included in these surveys. Yuma clapper rails were recorded at Grand Canyon 1996 to 2001; however, information about the clapper rail and its habitat in the lower Grand Canyon is extremely limited and surveys have not been conducted in the park in recent years.

McKernan and Braden (1999) reported the presence of Yuma clapper rails between Spencer Canyon (RM 246) and the park boundary (RM 277); these observations were made while conducting SWFL surveys. In 2001, three individual Yuma clapper rails were observed near Burnt Springs (RM 260) by San Bernardino College (pers. comm. San Bernardino College to Elaine Leslie 2001). Due to limited information about the clapper rail and its habitat in lower Grand Canyon, and lack of surveys in recent years, the park must rely heavily on limited information available.

Other Species of Concern

NPS Natural Resources Management Guideline (NPS 77) defines Species of Concern as "All native animal species within a park that face an immediate danger of losing their natural role in an ecosystem because of human-induced change." Species below, while not federally listed, warrant special monitoring or management due to population characteristics such as: local rarity, endemicy; park importance; species indicator status; species vulnerability to local population declines; and/or species or habitat sensitivity to human disturbance during critical life cycle periods. Therefore, species of concern and actions that may adversely affect them are analyzed in this plan/DEIS.

Other Species of Concern (Table 3.7) found in Grand Canyon and analyzed in this plan/DEIS include

- American peregrine falcon
- golden eagle
- Mexican long-tongued bat
- bald eagle
- desert bighorn sheep
- spotted bat

- greater western mastiff bat
- pale Townsend's big-eared bat
- southwestern myotis
- western red bat
- Allen's big-eared bat
- long-legged myotis
- pocket free-tailed bat

Bald Eagle
The bald eagle (*Haliaeetus leucocephalus*), listed as endangered in 1967, was reclassified as threatened in the lower 48 states in 1995, and was delisted in 2007. The bald eagle is a wildlife Species of Special Concern in Arizona, and is protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

Bald eagles are found in all Arizona counties, typically near lakes and rivers where they forage for fish (NPS 2006a). A small, resident bald eagle population breeds at selective Arizona sites. Bald eagles have been documented breeding along the Salt, Verde, and Bill Williams Rivers, along Tonto Creek, and at Roosevelt Lake in central Arizona. Bald eagles are not known to nest in Grand Canyon, but occur fall to early spring as migrants and winter residents. During the winter, migrating bald eagles are found from Glen Canyon Dam to approximately the Little Colorado River confluence, where they forage on trout. Known winter roosts for bald eagles include Nankoweap Creek near its confluence with the Colorado River, Bright Angel Creek near Phantom Ranch, Twin Overlooks, and Pasture Wash (NPS 2003a). In addition, bald eagles have been found along the Colorado River from RM 3 to RM 132, and on South Rim from Hermits Rest to Desert View. Bald eagles have also been sighted in North Rim forests and meadows near the entrance. In the 1980s and early 1990s many bald eagles congregated at the mouth of Nankoweap Creek to feed on spawning rainbow trout. Their numbers have been greatly reduced in recent years since changes in stream morphology have hampered trout movement into the creek and reduced eagle foraging opportunities. Despite diminished use of Nankoweap Creek, bald eagles remain a commonly seen raptor along the river in winter (NPS 2006a).

Golden Eagle
Golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and are widespread across northern hemisphere mountainous regions. On the Navajo Nation they are listed as a G3 species, meaning their prospect of survival or recruitment is likely to be in jeopardy in the foreseeable future throughout their Navajo Nation range.

Species habitat includes badlands, mountains, foothills, plains, and open grasslands associated with rock outcrops and cliff formations (Peterson 1990). These eagles typically nest on cliff tops or in large trees with a surrounding landscape view (Peterson 1990, Johnsgard 1990). Foraging habitat is open country with available perches and shrub-steppe vegetation that provides habitat for large prey populations, such as rabbits and rodents (Johnsgard 1990). They feed mainly on small and medium-sized mammals but also consume birds, reptiles, and fish (Johnsgard 1990).

Previous golden eagles surveys in the park documented a wide distribution, but low numbers, and only two nests (Olson 2003).

American Peregrine Falcon
The American peregrine falcon (*Falco peregrinus anatum*) was listed as endangered in 1970 (35 FR 8491–8498). On August 25, 1999, the USFWS removed the peregrine falcon from the list of endangered and threatened wildlife as a result of its recovery and establishment of stable populations throughout its historic range (64 FR 46541–46558). Peregrine populations declined as the result of chlorinated pesticides, especially DDT and its metabolite DDE, which accumulated in peregrines as a result of

feeding on contaminated prey. This interfered with calcium metabolism and caused a decline in reproductive success as the result of thin eggshells.

The American peregrine falcon breeds from central Alaska, central Yukon Territory, northern Alberta, and Saskatchewan east to the Maritimes and south to Baja California and the highlands of central Mexico (Johnsgard 1990, 64 FR 46542–46558). Peregrine falcons in subarctic areas are migratory while those in southern latitudes are generally resident.

Peregrines nest in scrapes on inaccessible cliff ledges and occasionally tall buildings. Nest sites are often near open water, and the same nest site may be used for many years. Eggs are laid mid-March to mid-May. Chicks hatch after approximately 30 days, and young fledge from the nest 35 to 42 days after hatching. Peregrine falcons feed primarily on other birds, such as songbirds, shorebirds, and waterfowl. Peregrines nest on cliffs below the rim or in side canyons throughout Grand Canyon. Formal surveys for peregrines in Grand Canyon were completed in 1988, 1989, 1998, and 1999 (Ward 2000). Approximately 75 peregrine eyries are known in the park.

Desert Bighorn Sheep

Desert bighorn (*Ovis canadensis nelsoni*) are sparsely distributed across the desert southwest's arid and semi-arid regions, and were extirpated from a significant part of historic range during the late 1800s and early 1900s primarily by disease and over-hunting (Wehausen et al. 1987, Valdez and Krausman 1999). Major restoration efforts were undertaken, sometimes with little success due to continuing effects of diseases transmitted from domestic sheep (*Ovis aries*) (Gross et al. 2000, Zeigenfuss et al. 2000, Singer et al. 2001). Although desert bighorn are adapted to arid conditions, this subspecies is vulnerable to drought-related impacts (e.g., shifts in forage succulence and availability) (Bender and Weisenberger 2005) which have major effects on desert bighorn population distribution (Colchera et al. 2009). Dispersal to and colonization of emergent suitable ranges is consequential to desert bighorn viability (Bleich et al. 1990, Epps et al. 2007). With dispersal (key to surviving natural and anthropogenic changes), human-related barriers and hazards become increasingly relevant to desert bighorn management. Human recreation has been implicated in desert bighorn population decline (Papouchis et al. 2001, Etchberger et al. 1989) by reducing survival and reproductive success. Finally, mountain lion predation may exacerbate effects of disease, declining habitat quality, and human disturbance especially when other prey (typically mule deer [*Odocoileus hemionus*]) decline (Kamler et al. 2002, Holl et al. 2004, Festa-Bianchet et al. 2006). The joint spatial configurations of human-related disturbance and barriers, domestic sheep, mountain lions, and accessible habitat will likely continue as important limiters to desert bighorn populations, even in large national parks.

Grand Canyon's bighorn population occupies the largest protected area for this subspecies on the Colorado Plateau. Bighorn in the park are unique in occupying an extensive deep canyon system centered on a major river. Almost all other bighorn populations occupy arid mountain ranges with limited water sources, near enough to other populations for demographic and genetic exchange. Although Grand Canyon repeatedly prioritized the need to inventory and monitor bighorn (NPS 1989b), the first funded efforts did not occur until 2010 and continue to date. Moreover, AZGFD lists desert bighorn as a "species of greatest conservation need" in its recent Comprehensive Wildlife Conservation Plan (AZGFD 2006, AZGFD 2011). The Navajo Nation listed this subspecies as Group 3: Highly likely to become extinct throughout its Navajo Nation range.

In 2010 Grand Canyon began to investigate threats to genetic connectivity, preferred habitat, and forage from predation, disease, and human disturbance to a vulnerable desert bighorn meta-population. Grand Canyon bighorn are patchily distributed throughout the Inner Canyon from rim to river. Occupancy of suitable habitat is currently being explored, focusing on aforementioned threats. Bighorn are completely absent along the Navajo boundary of the Colorado River where domestic sheep have historically grazed.

Productive forage varies seasonally and by location with primary species consisting of encelia (*Encelia farinose*), acacia (*Acacia greggii*), black grama (*Bouteloua eriopoda*), desert globemallow (*Sphaeralcia ambigua*), blackbrush (*Coleogyne ramosissima*), and Mormon tea. Most occupancy of known suitable habitat occurs along the river, but smaller bighorn herds have been routinely observed in habitat along and just below South Rim.

During breeding season (August–October), many bighorn aggregate along the river in unique population demes or family groups. Segregation of sexes (predominantly breeding males from breeding females) begins in November. Preliminary data indicates adult males move to higher elevations (i.e., Tonto/Esplanade Platforms) in winter–spring to access higher quality forage, at cost of increased predation by mountain lions. Adult females remain along the river year-round, providing adequate escape terrain and water availability especially during critical lambing times. Female bighorn seek isolation for lambing in discrete rugged habitat with steeper and more rugged terrain that reduces predation risk (Etchberger and Krausman 1999). Gestation is generally six months, with lambs born February–April. As such, the most important reproductive population segment, breeding females, are exposed year-round to river-based recreation and at risk of lower productivity. River-focused human recreation is thought to be detrimental to bighorn viability (MacArthur et al. 1982, Krausman and Hervert 1983, Legg 1988, Papouchis et al. 2001)

The Colorado River likely serves as a natural impediment for gene flow and connectivity between meta-populations. No collared bighorn have been documented crossing the river, and only anecdotal evidence suggests limited bighorn movements between north and south sides. Preliminary DNA analysis from 459 genotyped fecal samples collected during a two-week river trip identified 239 unique individuals, suggesting a sizeable population, but connectivity is still unknown. Young, non-breeding males are generally the avenue for dispersal and genetic flow. Limited information exists regarding bighorn occupancy of the canyon's middle and upper elevational reaches. These animals, by virtue of location, are more subjected to risks from disease transmission and predation. Further, bighorn occupying higher canyon elevations are routinely disturbed by overflights (Stockwell et al. 1991).

Bats

There are currently eight USFWS Species of Concern bat species found in Grand Canyon; two of these are also state-listed as endangered in Arizona (Mexican long-tongued bat and spotted bat). An additional species is state-listed only (western red bat). During hibernation, bats are highly susceptible to disturbance, making hibernacula an important focus for management and protection efforts.

Cave-, Crevice-, and Mine-associated Bat Species

Species that typically roost in caves or cliff crevices include spotted bat (*Euderma maculatum*), greater western mastiff bat (*Eumops perotis californicus*), Allen's big-eared bat (*Idionycteris phyllotis*), and pale Townsend's big-eared bat (*Corynorhinus townsendii*) (Hoffmeister 1986, Siders et al. 1999, BCI 2014). Although the pocket free-tailed bat (*Nyctinomops femorosaccus*) rarely ranges into Grand Canyon, when it does it roosts in crevices high on cliff faces in rugged canyons. Some of the above species use other habitats: Allen's big-eared bat may also roost in large snags, and spotted bats use ponderosa pine as foraging areas (see below).

For Mexican long-tongued bats (*Choeronycteris mexicana*) warm winter roosts in caves and mines are critical for survival. In some situations metal gates can be installed to allow bat passage while restricting human access. Such gates, when properly designed and installed (e.g., Stantons Cave), have allowed populations to recover at many sites where humans access disturbed bat colonies. Except for the Mexican long-tongued bat (nectar feeder), bats that regularly roost and feed in the park are insectivorous.

Forest-associated Bat Species
South Rim's most common bat, and especially evident foraging over pine forests and water is the long-legged myotis (*Myotis volans)* found in pinyon-juniper and ponderosa pine on both rims, but more common on South Rim. These bats roost in dense foliage, beneath exfoliating bark, or in tree cavities. The southwestern myotis (*Myotis auriculus*) is also primarily found in ponderosa pine habitat and other semi-arid woodland habitats. The western red bat (*Lasiurus blossevillii*) is in the genus commonly referred to as tree bats because they roost only in tree foliage. Like all tree bats, this species is solitary, aggregating only to mate and migrate. These three species typically feed along forest edges, in small clearings, or around street-lights where they hunt moths.

Cultural Resources

Cultural Resources Overview

Grand Canyon National Park, situated on the Colorado Plateau, has offered refuge and resources to people throughout 12,000 years of human use and occupation. The Grand Canyon remains significant for its ongoing role in the lives and traditions of American Indians. Archaeologists generally divide the human history of Grand Canyon into six broad periods; Paleoindian, Archaic, Formative, Late Prehistoric, Protohistoric, and Historic. Each period is represented in the human story of Grand Canyon's past.

Paleoindian Period (12,000–8,000 years ago)
As vast ice sheets retreated north and east, the Colorado Plateau consisted of open meadows, desert, and dense pine forests. In some places canyon walls were covered in forest, and water holes and pockets were plentiful. People moved in small organized groups across large tracts of land. They hunted large animals such as mammoth, sloth, bear, and wolf. This time period is characterized by very distinctive spear points used to hunt megafauna. These distinctive spear points are found across Arizona, New Mexico, and Texas. Two park locations have yielded fragmentary spear points from dating from this Clovis and Folsom tradition. Three additional sites in western Grand Canyon are also believed to contain Paleoindian artifacts.

Archaic Period (8,000–2,500 years ago)
As a response to changing environmental conditions, canyon inhabitant material culture and lifeway also changed. Relatively small groups established themselves in mobile camps, used smaller, but distinctive, projectile points (dart points), and in some Southwest locations, even began experimenting with cultivating plants. Their lifeway focused largely on a seasonal round, moving to different places during the year following game and seeking ripening plant foods. Diet during this time centered on species such as deer, rabbit, lizard, bighorn sheep, and plant foods such as agave and rice grass. In sites dating from this time we find small processing stones such as one-handed manos, grinding slabs, and abundant plant remains in trash context. These items suggest increased activities toward plant processing and more reliance on plants as a food source. Early attempts at agriculture begin during the Archaic though conclusive evidence of such activities has yet to be identified in Grand Canyon. Elaborate polychrome rock art and the split twig figurine complex are hallmarks of the Grand Canyon Archaic Period. Ritual placement of split twig figurines in cave settings here and elsewhere throughout the northern southwest region's basin and range are an intriguing aspect of Archaic people's ritual practices, though the purpose can never be known. Archaic period sites include hunting blinds, lithic scatters at meadow edges and water holes, temporary camps, rock art, and split twig figurine caches.

Formative: Basketmaker Period (2,500–1,200 years ago)
This period is distinguished by extensive use of baskets, sandals, and textiles, and some important technological advancements such as bow and arrow development and beginnings of pottery manufacturing. Habitations are often single pit houses with bell-shaped pits dug for storage. There is evidence of increased reliance on cultivated plants, primarily maize and squash, later supplemented with beans and cotton. The highest concentration of sites dating to this time period in the park is located in western Grand Canyon.

Formative: Ancestral Puebloan (1,200 years ago–700 years ago)
The term, Ancestral Puebloan, comes from the apartment-like habitation structures, (pueblos) people lived in during this time. Their reliance on agriculture–mostly notably beans, maize, and squash, allowed for more permanent housing, and increased the need for pest-resistant storage features. As people became more sedentary and their villages more populous, they developed distinctive architecture, artifacts, social organization, and religion. Craft specialization appears to flourish during this time, and pottery production began in the early Formative. Pottery in particular reflects mastery over the medium resulting in distinctive design styles archaeologists use to date archaeological deposits. Pottery wares are used as one means to identify different culture groups.

The distinctive pottery, architecture, and tool types indicate Grand Canyon's site distribution from these cultures. Like much of the Colorado Plateau, it appears Grand Canyon's population boom occurred during the Ancestral Puebloan period. The majority of park sites are of Puebloan age. There were major Puebloan groups occupying the area north (Virgin Branch) and south and east (Kayenta Branch) of the Colorado River. Modern Puebloan Indians are descendants of these ancestral people. By the 1200s the southwest dried and cooled. These conditions contributed to a decline in food production and Puebloan people moved to more environmentally favorable areas east of Grand Canyon. It appears, however, Puebloan people returned to the canyon periodically for resources, trade, and other activities.

Formative: Cohonina (AD 700–1175)
The name Cohonina was used to identify a distinctive culture group living in northern Arizona. The Cohonina inhabited a discreet area running east-west between the San Francisco Peaks and the Aubrey Cliffs, and north-south from the Colorado River to the Mogollon rim. The Cohonina made distinctive pottery called San Francisco Mountain Gray Ware. Their lifeway is understudied, but it appears they practiced a mixed subsistence strategy that included agricultural and resource gathering. Sites in Grand Canyon consisted of settlements located on both sides of the river, use of multiple areas for resource procurement, and small camps or hamlets. Early Cohonina sites have maize[47]. Evidence of maize has been used to postulate the Cohonina migrated to the area rather than developing in place from an earlier culture.

Late Prehistoric (AD 1300–Contact in 1540)
Current knowledge suggests that as Puebloan populations were moving out of the canyon, people from the west began to incorporate the canyon into their seasonal hunting and gathering cycles. These groups had a much different lifeway than previous Puebloan occupants. Because they were not strictly sedentary and reliant on crops, they were able to sustain themselves during the drier and cooler conditions found at Grand Canyon during the Late Prehistoric. They lived in smaller camps, built brush structures, and used communal roasting features and small clusters of fire pits. Archaeologists identify different pottery types during the Late Prehistoric of both local and imported varieties that characterize cultural transitions taking place.

[47] "*Maize* is preferred in formal, scientific, and international usage because it refers specifically to this one grain, unlike *corn*, which has a complex variety of meanings that vary by context and geographic region." Ensminger, Audrey H. (1994). *Foods and Nutrition Encyclopedia, 2nd ed*. CRC Press.

Protohistoric Period (1540–1900)
Incursion by white settlers, miners, and the tourist trade restrained indigenous groups to smaller and smaller territories. This period marked designation of permanent reservations and villages for the canyon's original inhabitants. Contact with settlers and military led to forced relocation out of the Grand Canyon area for some tribes. Side canyons accessing the river corridor were a place of refuge for some indigenous people during this time, as small bands of Hualapai and Southern Paiute hid from the U.S. army in the western canyon. Major Powell's journal documents discovery of native gardens along the river during his 1869 trip. Havasupai Indians lived at Indian Garden along the Bright Angel Trail and in a permanent settlement in the South Rim Village area. Southern Paiute bands used large areas across the Tuweep Valley for habitation and resource procurement. Navajo lived along the South Rim. Sites from the Protohistoric Period are characterized by a blending of the old and traditional with the new and innovative. Tools made of stone and bone and pottery are found, along with metal and glass used to fashion projectile points. Metal buckets, kitchen cutlery, and canned foods and beverages are found in such sites.

Historic Period Resources (1850–1960)
The Historic era includes American Indian sites, Euro American mining and exploration, ranching, tourism, and National Park Service sites. Evidence for these activities can be found throughout the park. Historic period American Indian wood structures and shrines are abundant particularly in pinyon-juniper forests that date to this period. Extraction sites are remnants of this time. Some miners found they were more successful as tour operators. John Hance, William Wallace (WW) Bass, Louie Boucher, and others led canyon trips for years entertaining visitors from far and wide. Historic camp sites, corrals, and inscriptions are evidence of historic ranching, mining and sheepherding. Rim camps and side-canyon drainages contain remains of historic period tourism. Civilian Conservation Corps (CCC) structures, fire towers, historic trail and road features all constitute remains of activities intended to enhance visitor use and resource protection. CCC buildings and structures in Grand Canyon date to the period 1933 to 1942.

Grand Canyon Backcountry/Wilderness

Managers often think about the significance of cultural resources in terms of their potential to reveal new knowledge about human history and culture. The significance of historic properties lies in their ability to provide information relative to American history, architecture, archaeology, engineering, and culture and is present in districts, sites, buildings, structures and objects. These properties must also be significant under one or more of the following criteria

a. associated with events that have made a significant contribution to broad patterns of our history or
b. associated with lives of significant persons in our past or
c. embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction or
d. have yielded or may be likely to yield, information important in history or prehistory

To be considered eligible for listing on the National Register of Historic Places, historic properties must retain integrity of location, design, setting, materials, workmanship, feeling, and association. It is not necessary for any given property to retain all of these qualities of integrity, but qualities of integrity necessary to preserve the significance of the property must remain intact. For example, archaeological sites considered eligible for the National Register of Historic Places because of their research potential should retain integrity of location, design, materials, and workmanship. Ethnographic resources, historic buildings and structures, and cultural landscapes may need to retain more of the seven elements of integrity to retain eligibility.

National Register evaluations require properties evaluated under Criteria a, b, and c be informally subjected to the significance test; that is, would the property, in its current condition, be recognized by the participants of the historic event, the historically important person, or the architect involved in its development? If the answer to this question is yes, the property retains the qualities of integrity needed for eligibility; if the answer is no, the property probably does not retain integrity and may not be eligible (NPS 2002a). Elements of integrity are values most likely at risk as a result of backcountry use activities.

American Indians see cultural sites in another way, as markers left by their ancestors, providing evidence of their past and of their continuing ties to this grand landscape. Such places are the embodiment of those who came before and imbued with spirits of the associated tribes' ancestors. Backcountry and Wilderness users value the opportunity to experience sites in situ. Our knowledge of the extent and distribution of the canyon's cultural resources continues to grow. With 6% of the park scientifically studied for such phenomena, we should expect the number of documented backcountry cultural resources to increase over time. Management necessary to protect some sites must be adaptable to adequately protect newly identified resources of cultural concern.

Archaeological Resources

Based on site records and GIS data (NPS 2013b, NPS 2013c), to date a total 2,800 archaeological sites, both prehistoric and historic, are known in the park's backcountry. These sites represent the full range of human occupation and use. Most known backcountry archaeological sites have been determined eligible for the National Register by the SHPO under Grand Canyon's multiple property nomination, Archaeological Resources of Grand Canyon National Park (NPS 1984a).

The NPS has conducted a limited number of systematic survey projects of rim and Inner Canyon backcountry areas. Thus, the total number of archaeological sites in locations used for recreation activities is not yet known. Evidence of prehistoric backcountry occupation is seen in the wide variety of resource types present including pueblos, small habitation structures, storage features, rock shelters, thermal features and roasters, artifact scatters and caches, water control features, trails, rock art, mining adits, roads, telephone and telegraph lines, historic dumps, and tree towers. A few backcountry Archaeological Resources have been known since the 19th century (Hilltop Ruin for example), but most sites were documented during limited surveys beginning in the 1960s and continuing until the present. Systematic monitoring of backcountry site conditions, with exception of the river corridor, has only been undertaken over the last 15 years or so (NPS 2013b).

Table 3.8 provides an overview of commonly found archaeological site types in the park's backcountry. Note the list describes the primary site component at recorded sites. Many also have features such as artifact scatters, thermal features, and other features of concern to cultural resource managers.

Table 3.8 Most Common Backcountry/Wilderness Archaeological Site Types

Site Type	Count	Comment
Agricultural structures	21	Rock alignments, rock terraces, check dams
Artifact scatter	493	Historic and prehistoric materials, ceramic scatters, lithic scatters, and multi-artifact type concentrations
Culturally modified trees	21	Dendroglyphs and trees modified by addition of fencing materials, phone line installation, and evidence of wood cutting
Extractive sites	23	Mining activities, historic borrow locations, and lithic quarries. Note five of the sites are believed to date to the prehistoric or protohistoric period
Granary or storage	63	

Site Type	Count	Comment
Habitation without structures	133	No structures noted
Habitation with structures	852	Some sites with historic structures
Protected habitation	176	Rock shelters, alcoves, cliff dwellings
Rock Art	116	Petroglyphs, pictographs, historic inscriptions
Special use sites	25	Split twig figurine caches and other non-conforming site types
Special use structures	47	Windbreaks, corrals, kivas, exclosures
Thermal features	575	Roasting pits, hearths, mescal pits, and "hunting, fishing, gathering features" (this category was used in the past to indicate roasting features)

Table 3.9 shows use and/or periods of occupation for known backcountry sites in Grand Canyon. Some sites contain multiple components, meaning their date-ranges may reflect use or occupation in more than one period. Unexcavated sites are dated primarily based on presence of diagnostic artifacts such as projectile points, certain lithic debitage types, pottery styles, cans, bottles, and historic documentation. Not all sites can be dated because some lack diagnostic materials. Others are known to be prehistoric, but cultural time period cannot be further refined due to lack of projectile points, architectural features, pottery, or other dateable materials.

Table 3.9 Backcountry/Wilderness Archaeological Site Distributions by Time Period

Time Period	Count	Comment
Paleoindian	4	Includes one partial Folsom point from the Inner Canyon, and three sites with Paleoindian artifact types in western Grand Canyon
Archaic	85	Early (4), Middle (4), Late (21), unspecified Archaic (56)
Formative	1300	Basketmaker II (7), Basketmaker III (12), Pueblo I (65), Pueblo II (573), Pueblo III (96), Pueblo unspecified (lacked diagnostics for differentiation, 547)
Late Prehistoric	8	
Protohistoric	190	
Historic	303	
Unknown Prehistoric	871	

Historic Structures

The vast majority of historic buildings and structures are concentrated in National Historic Landmark Districts (NHLD) in the park's frontcountry including Grand Canyon Village and Grand Canyon Lodge NHLDs, and historic districts, such as the Desert View Historic District. However, 195 historic buildings and structures are currently identified in backcountry areas. These properties include Native American historic-period wooden structures used for residential, ceremonial, and ranching purposes; fence lines, cabins, mining camp facilities, tourist developments, and historic trails. Some of the more notable buildings are listed in Table 3.10. Additional buildings and structures will be evaluated for their historic significance throughout the life of the Backcountry Management Plan.

Table 3.10 Backcountry/Wilderness [1] Historic Structures, Districts, and Landmarks

Building or Area	Comment
Bass Camp and Trails Historic District	Trails, cisterns, tent pads, darkroom, other camp features, Bass Camp to Havasupai Point Road, Bass Camp to Topocoba Hilltop Road (South Rim)
Bass' Shinumo Camp	Inner Canyon
Bass' Tramway	Inner Canyon
Beamer's Cabin	

Building or Area	Comment
Boucher's Camp developments	Cabin, corral, and storage structure
Cross-canyon Corridor Historic District	Bright Angel, North and South Kaibab, and River Trails, Bright Angel Trail Resthouses (4); Indian Garden buildings and structures (6); Phantom area buildings and structures (30), Cottonwood area buildings and structures (1); Black Bridge; Cross-canyon telephone line and plaque; Fossil Fern Exhibit
Fire Lookouts	Kanabownits, North Rim; North and South Rim Tree Towers
Grandview Mine Historic District	Mine infrastructure, equipment, tunnels, adits, buildings
Hermit Creek Historic Camp	Stone foundations, paths, aerial tram, root cellar, pipeline
Inner Canyon Trails determined eligible for the National Register	Bass, Grandview, Hermit, New Hance, Thunder River. Determinations for other Inner Canyon trails ongoing
North Rim Cabins	Basin Cabin, Greenland Lake Salt Cabin, Kanabownitz Cabin, Muav Saddle Cabin, North Rim Fire Lookout Cabin
Pumpkin Springs Cabin and Foundation	
Santa Maria Springs Resthouse and Outhouses	
Signal Hill Historic District	Signal Hill Fire Lookout, outhouse, and landscape features; Pasture Wash Ranger Station, barn, cistern, water catchment, fencing
Tuweep Ranger Station Complex	Station, water catchment system, stone retaining wall, root cellar, garage
1956 Grand Canyon TWA-United Airlines Mid-Air Collision Site National Historic Landmark[48]	On April 29, 2014 the Grand Canyon site of the 1956 TWA-United Airlines crash was designated as a national historic landmark. On June 30, 1956, a Trans World Airlines Super Constellation L-1049 and a United Airlines DC-7 collided in uncongested airspace 21,000 feet over Grand Canyon, killing all 128 people onboard the two flights. The tragedy spurred an unprecedented effort to modernize and increase safety in America's postwar airways, culminating in the establishment of the modern Federal Aviation Administration. Other improvements resulting from the crash included nationwide radar coverage and technologies such as collision avoidance systems and flight data recorders

[1]Table includes buildings and structures in the National Park Service List of Classified Structures inventory. Additions to this list are ongoing

Traditional Cultural Properties and Ethnographic Resources

American Indian groups in the region recognize certain tangible and intangible properties as important in their tribal histories. These properties, which may or may not include archaeological sites, are referred to as ethnographic resources or as Traditional Cultural Properties (TCPs). Like archaeological sites, TCPs are given consideration under NHPA, as amended. "A traditional cultural property, then, can be defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1990). Ethnographic resources may also overlap with archaeological sites and are defined in NPS management policies as 'basic expressions of human culture' and are often identified as special cultural and natural features in the park that are of traditional and cultural significance (NPS 2006).

Regional American Indian Tribes including the Hualapai, Havasupai, Southern Paiutes, Navajo, Hopi, Zuni, and Yavapai-Apache, continue to use Grand Canyon for specific traditional and cultural purposes. All of these tribes consider the entire Grand Canyon to be sacred. Many tribal members continue to practice traditions which have been passed down through oral traditions from generation to generation.

[48] http://www.nps.gov/nhl/news/LC/spring2013/GrandCanyonES.pdf.

The canyon's importance in these practices and in tribal identities speaks to the tribes' enduring canyon connections and cannot be overstated.

From rim to rim, the canyon is considered and treated as eligible as a TCP by the NPS and associated tribes. This means the canyon plays an active role in historically rooted beliefs, customs, and practices of associated tribes. Grand Canyon is associated with cultural practices or beliefs of living communities, is rooted in the history of these communities, and is important to maintaining their continued cultural identity. Park archaeological sites, shrines, resource locations, seeps, springs, plants, and animals are viewed by associated tribes as traditional or sacred in importance.

Tribal studies of the Colorado River corridor through Grand Canyon, summarized in Neal and Gilpin (2000), focused on the river corridor, but most tribes have identified ethnographic resources outside the river corridor (Hedquist and Ferguson 2012). These studies generally identified ethnographic resource types including archaeological sites (rock art sites, trails, graves), sacred sites, places mentioned or described in traditional histories, subsistence areas, boundary lines (with or without markers), natural landmarks, minerals, plants, animals, and water. Archaeological sites are considered ancestral by the tribes. Sacred sites, places mentioned or described in traditional histories, subsistence areas, and boundary lines may or may not have archaeological manifestations. Landmarks, minerals, plants, animals, water, and springs are natural phenomena having cultural significance to the tribes. There are innumerable places of cultural importance to the canyon's Traditionally Associated Tribes, the locations and importance of which we may never fully understand.

Cultural Landscapes

As defined in the NPS 2006 Management Policies, cultural landscapes are settings humans create in the natural world. They are intertwined patterns of things both natural and constructed, expressions of human manipulation and adaptation of the land. Grand Canyon's backcountry currently contains only one defined Cultural Landscape, the Cross-canyon Corridor Cultural Landscape. This landscape includes Bright Angel, South Kaibab, North Kaibab, and Colorado River Trails, the CCC-era Cross-canyon telephone line, Bright Angel Trail Resthouses, the South Kaibab Trail Fern Exhibit, and specific sites: Indian Garden, Phantom Ranch, Cottonwood Campground, Roaring Springs, and South Kaibab and North Kaibab Trailhead areas. Characteristics of this Cultural Landscape include land uses and activities, patterns of spatial organization, response to the natural environment, cultural traditions, circulation networks, vegetation, buildings, structures, and features.

Visitor Use and Experience

Diverse Recreation Opportunities by Design

The Recreation Opportunity Spectrum (ROS) is a framework implemented by numerous federal land managing agencies and embedded in outdoor recreation planning and management (Driver and Brown 1978, Clark and Stankey 1979, Stankey et al. 1985, Shelby and Heberlein 1986, Graefe et al. 1990, BOR 2004, Manning 2011). ROS recognizes individual and societal benefits achieved through pursuit of recreation activities are a function of the settings in which they occur. Settings, in turn, are comprised of *resource*, *social*, and *managerial* dimensions, and may be described as a continuum of conditions ranging from pristine to developed (*resource*), low to high visitor densities (*social*), and minimal to strict regimentation (*managerial*). ROS is a systems-oriented approach to planning that organizes different combinations of these variables. It acknowledges linkages between recreation motivations, activities,

settings, and benefits and is used to provide a diverse range of recreation opportunities for a diverse populace.

Visitor Use and Experience discusses Grand Canyon backcountry conditions by describing available Recreation Motivations, Activities, Settings, and Benefits.

Recreation Motivations
Visitors to Grand Canyon's backcountry have diverse motivations for pursuing various recreation activities. Among these motivations include appreciation of nature, being in a wild setting, opportunities for solitude, escape, challenge, exploration, and being with family and friends (Towler 1977, Underhill et al. 1986, Stewart 1997b, Backlund et al. 2006, Backlund et al. 2008). Table 3.11 summarizes some of these motivations and includes a number of items widely used in the field of outdoor recreation to measure them (Driver and Toucher 1970, Driver 1975, Driver and Brown 1975, Driver 1976, Driver and Bassett 1977, Driver and Brown 1978, Haas et al. 1980, Driver and Rosenthal 1982, Driver 1985, Schreyer and Driver 1989).

Table 3.11 Recreation Motivations and Scale Measurement Items

Motivations	Scale Measurements
Nature Appreciation	• To view scenery and scenic beauty • To enjoy the smells and sounds of nature
Solitude	• To experience tranquility • To be away from crowds of people
Escape	• To give your mind a rest • To get away from the usual demands of life
Challenge	• To take risks • To chance dangerous situations
Exploration	• To discover new things • To experience new and different things
Family and Friends	• To be with friends • To do something with family

Source: Adapted from Manning 2011, pg. 179-181

Recreation Activities

Recreation motivations may be satisfied through participation in activities such as day hiking, backpacking, overnight camping, trail running, stock use, RABT, canyoneering, biking, and driving for pleasure. A number of studies of Grand Canyon's backcountry have been conducted regarding some of these activities, but less is known about others. For instance, studies of use levels and crowding on trails and at campsites have been conducted for nearly twenty years (Manning et al. 1997, Stewart 1997a, Stewart 1997b, Cole and Stewart 2002, Backlund et al. 2006, Backlund et al.2008). However, further research regarding trail running, canyoneering, RABT, biking, and driving for pleasure is needed. What is known about recreation activities occurring in the backcountry is described briefly below.

Day Hiking
Backcountry day hiking is a popular activity among Grand Canyon visitors as illustrated by the numerous books, guides, and brochures published on the topic (Adkison 2006, Kaiser 2011, Grubbs 2012). Currently, day hiking is not limited, and permits are not required. A number of day hiking studies in the backcountry have been conducted and include research on trails across backcountry management zones (Stewart 1997a, Manning et al. 1997, Backlund et al. 2006). Results of this research are discussed in more detail on a Zone-by-Zone basis below in Chapter 3, Visitor Use and Experience, Recreation Settings.

Commercially guided day hiking is presently allowed with no limit on the number of commercial use authorizations issued for this activity. As of January 2014, 34 companies guide day hiking trips in Grand Canyon's backcountry and must follow permit requirements. Commercial day hiking is permitted only on established trails and must meet park hiking/Hike Smart standards (www.nps.gov/grca/planyourvisit/hike-tips.htm). Recommended locations for commercially guided day hiking include

- Bright Angel Trail to Three-Mile Resthouse
- South Kaibab Trail to Cedar Ridge
- North Kaibab Trail to Supai Tunnel
- Hermit Trail to Santa Maria Springs or Dripping Springs
- Grandview Trail to designated turnaround at Coconino Saddle
- Tanner Trail to Escalante Saddle (75-Mile Canyon Overlook)

Under current regulations, commercial day hikes are not to be advertised as endurance events, and commercial rim-to-river-to-rim hikes are prohibited.

Backpacking and Overnight Camping

Backpacking and overnight camping in Grand Canyon's backcountry is a longstanding tradition among outdoor enthusiasts as evidenced by its vast literature (Steck 2002, Butchart 1996, Fletcher 1968). Backcountry and Wilderness overnight use is managed to provide hiking opportunities that "challenge almost every hiking ability and taste" (NPS 1988, pg. 4). To maintain the integrity of this backpacking opportunity spectrum, a variety of management practices have been implemented including systematic zoning. Not only does this system broadly characterize management zones as Corridor, Threshold, Primitive, and Wild, but the zoning system further delineates Zones into Use Areas (for further details see Chapter 3, Visitor Use and Experience, Recreation Settings, and Appendix C). Visitor use limits have been established for each Use Area (including maximum group size limits), and camping is either designated or at-large (dispersed). Management zone classification, Use Area delineation, camping designations, group size, and use limits define the Backcountry Reservation and Permitting System and provide diverse and high quality visitor experiences. The Backcountry Reservation and Permitting System also organizes valuable information regarding visitor use patterns and trends. Furthermore, numerous studies investigating the quality of backpacking and overnight camping experiences in Grand Canyon have been conducted (Stewart 1997b, Backlund et al. 2008). Results from these studies and information collected from the Backcountry Reservation and Permitting System are discussed in greater detail on a Zone-by-Zone basis in Chapter 3, Visitor Use and Experience, Recreation Settings. A total 94,277 user nights were spent in Grand Canyon's backcountry in 2012.

Commercially guided backpacking and overnight camping are also presently allowed with no limit on numbers of commercial use authorizations. As of January 2014, 22 companies guide backpacking and overnight camping trips. Under current regulations, commercially guided trips are limited to maintained trails only. Because commercially guided backpacking requires a Commercial Use Authorization and overnight backcountry permit, information regarding commercial use patterns and trends is available. This information is presented in further detail on a zone-by-zone basis in Chapter 3, Visitor Use and Experience, Recreation Settings.

Extended Day Hiking and Running

Currently there are no limits to trail running and no permits required. Little is known about trail running at Grand Canyon other than what has been captured anecdotally by park rangers (Stohlgren et al. 2013), although that is beginning to change. Visitor use monitoring has estimated during busy spring and fall weekends 400 to 600 people hike or run Corridor Zone trails rim-to-rim or rim-to-river (NPS 2013h).

Further research is needed to address this user group and potential impacts to visitor experience and/or park resources.

Stock Use
Stock use has been part of the Grand Canyon experience since before the park's designation. Currently, private, commercial, and administrative stock use is managed and guided by the park's 2010 Mule Operations and Stock Use EA and FONSI (NPS 2010f) which summarize stock use patterns and limits (https://parkplanning.nps.gov/documentsList.cfm?projectID=26166). Current stock use levels are also presented in Chapter 3, Visitor Use and Experience, Recreation Settings.

River-assisted Backcountry Travel
RABT uses portable personal watercraft to allow backcountry travelers to access routes and trails along the Colorado River. Per Grand Canyon's Compendium of Closures and Use Restrictions (NPS 2013g), the main RABT restriction is a five-mile river-travel limit as part of any overnight backcountry trip. For further information see the Compendium (http://www.nps.gov/grca/learn/management/publications.htm). While RABT has been documented at the park for some years (Butchart 1996), little is known about the activity and further research is needed to address potential impacts on visitor experience and/or park resources.

Canyoneering
Canyoneering may be technical or non-technical and includes a variety of travel techniques providing backcountry visitors access to remote and often narrow canyons. Grand Canyon canyoneering routes are described in numerous publications, but canyoneering has not been explicitly addressed as a recreation activity as in other national parks (http://www.nps.gov/zion/learn/management/index.htm). Furthermore, there are no canyoneering limits (excluding Compendium exceptions http://www.nps.gov/grca/learn/management/publications.htm). No canyoneering permits are required, although backcountry permits are required for canyoneering that includes overnight use. While canyoneering has been documented at the park for some years (Butchart 1996), little is known about the activity and further research is needed to address potential impacts on visitor experience and/or park resources.

Bicycling
Bicycling is currently allowed on established roads and designated trails outside Wilderness. Little is known about this activity, although use levels are thought to be low. This may be due to bicycling opportunities on adjacent lands such as USFS's Rainbow Rim and the Arizona Trail. Commercially guided bicycle tours, under an unlimited number of Commercial Use Authorizations, are permitted to Swamp Point, Kanab Point, 150 Mile Canyon, Tuweep, Vulcans Throne, Point Sublime, Tuckup Canyon, the W-1A Road, and Rowe Well and Pasture Wash Roads from Forest Service Road 328.

Driving For Pleasure and Rim Car Camping
There are approximately 75 miles of road in the backcountry. These primitive roads currently exist in 300-foot-wide non-wilderness corridors and provide access to remote trailheads, rim campsites, and scenic overlooks. Visitors may spend only a few hours driving these roads for pleasure or multiple days and nights camping at designated sites. Numerous vehicle types may be used for travel ranging from single-rider dirt bikes to high-passenger-capacity all-terrain-vehicles. The only day use limits on driving for pleasure in backcountry exist at Tuweep where a maximum 30 vehicles or 85 visitors at one time has been established (General Management Plan, pg. 54). As with overnight backpacking, overnight rim car camping is permitted based on management zone classification, Use Area delineation, camping designations, group size, and use limits. Use limits are discussed in greater detail on a zone-by-zone basis in Chapter 3, Visitor Use and Experience, Recreation Settings.

Commercial Vehicle Tours to Tuweep, including jeeps and vans, are granted through a CUA. Currently six CUAs exist, and each holder is allowed to conduct two trips per day, Monday through Friday, and one trip per day Saturday and Sunday. Each trip is limited to one vehicle with no overlap trips from the same company. The vehicle used is limited to 15 passengers or less, and 22-feet in length or less.

Backcountry Management Zones

Grand Canyon's backcountry is comprised of four management zones: Corridor, Threshold, Primitive, and Wild. In keeping with ROS, zones provide a broad range of recreation opportunities by arraying various combinations of resource, social, and managerial conditions. Most Zones are encompassed between canyon rim and Colorado River. It is important to note the inextricable link between Zones; for example, backpackers may encounter river rafters while traveling through or staying at beach campsites; visitors driving for pleasure and camping along the rim may encounter backpackers driving the road or parking at trailheads. Each of Grand Canyon's backcountry management zones is described below in terms of recreation opportunities and varying resource, social, and managerial conditions.

Corridor Zone
Of current backcountry management zones, the Corridor Zone offers the most developed recreation opportunities including Bright Angel and North and South Kaibab Trails; Cottonwood, Bright Angel, and Indian Garden developed campgrounds; Phantom Ranch tourist lodging; ranger stations; and sewage and water treatment facilities. The Corridor Zone provides a transition from developed rim areas to Inner Canyon backcountry.

Corridor Zone Resource Setting
The Corridor Zone is characterized by its modified natural environment. Resource conditions are managed to protect sensitive resources while providing a wide range of visitor use opportunities above and below the rim. Compared to other Zones, resources are more frequently altered to accommodate relatively high use levels for recreation activities in keeping with the outdoor recreation management principle that intense use often requires intense management (Manning 2011).

Corridor Zone Managerial Setting
The Corridor Zone is the most intensively managed Grand Canyon backcountry Zone. Corridor trails are maintained to accommodate high levels of hiker and stock use. Maintained facilities include ranger stations, water pumping stations, sewage treatment plants, the transcanyon pipeline and drinking water, composting and flush toilets at campgrounds and resthouses, and frequent signage for interpretation and information purposes at trailheads, destinations, and mile markers. NPS helicopter and mule operations maintain these facilities, and NPS presence is constant year-round including interpretive programs and safety patrols.

Corridor Zone Social Setting
The Corridor Zone is the most visited backcountry management zone. Corridor Zone trails receive high day use including hikers, mules, horses, and long-distance hikers and runners. Overnight camping is limited by permit to developed campgrounds. Canyoneering activities are also accommodated. With such diverse user types and a semi-developed environment, high encounter rates with a variety of users are inferred, and minimal opportunities for solitude and self-reliance exist.

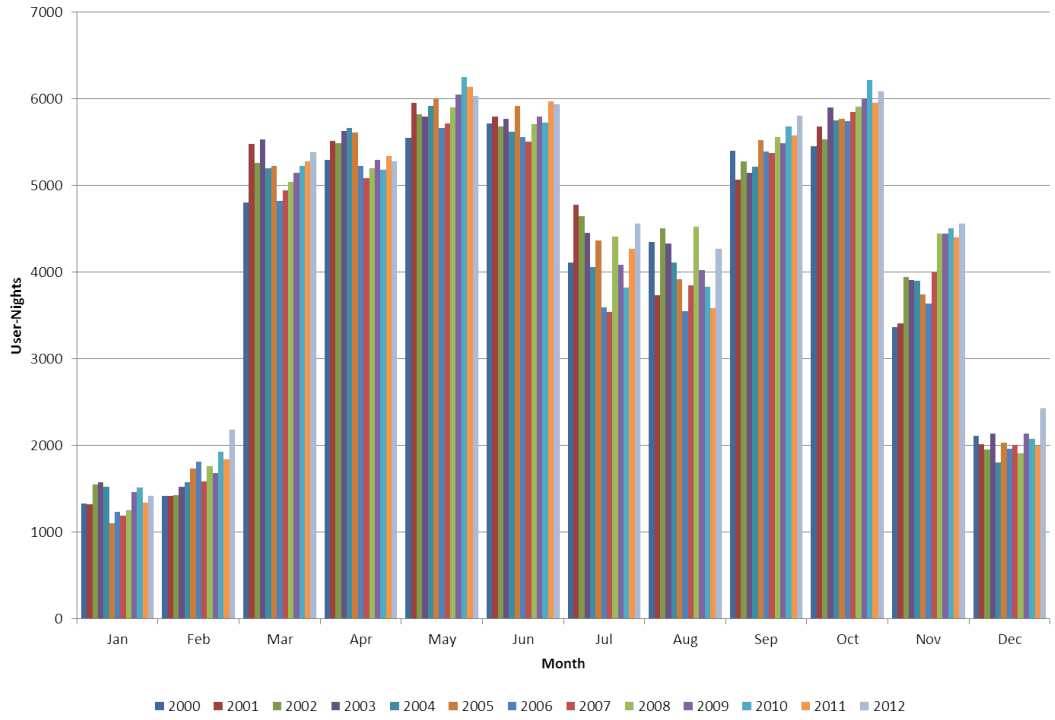
Corridor Zone Visitor Use Levels
The Backcountry Reservation and Permitting System, along with numerous studies investigating quality of backpacking and overnight camping experiences (Stewart 1997b, Backlund et al. 2008, Manning et al. 1997), provides valuable information regarding Corridor Zone visitor use patterns and trends. For instance, Figure 3.6 illustrates visitor use trends over the past 12 years in Corridor Campgrounds

(Cottonwood, Bright Angel, Indian Garden). In 2012, 53,821 user nights were spent in the Corridor Zone. This same information, interpreted in group nights, reveals 15,291 small group nights and 799 large group nights in the Zone in 2012.

Information related to Corridor Zone commercial overnight use is collected through the Backcountry Reservation and Permitting System shows 2,316 commercial user nights at Bright Angel Campground in 2012, or 11% of overall use in that Use Area. A total of 5,011 commercial user nights, or 9.3% of overall Corridor Zone user nights, were spent in the Corridor Zone in 2012.

A number of studies have considered Corridor Zone visitor use levels (Stewart 1997b, Backlund et al. 2008, Manning et al. 1997, Backlund et al. 2006) as an element of visitor experience. For example, one study used pre-trip, onsite, and post-trip questionnaires to assess use level impact on overnight backcountry visitor experience (Stewart 1997b). This report noted "experiencing solitude" and "escaping daily situations" were important motivations among overnight backcountry users. The report also considered experiential consequences of crowding in light of the 1988 Backcountry Management Plan's encounter rate standards for each management zone. In the Corridor Zone, "50% of respondents indicated…the number of other hiking groups encountered would *not* make a difference" (Stewart 1997b, pg. 9-10). Respondents who reported the number of group encounters would make a difference were asked to "enter the highest number of groups encountered per day that would be acceptable." Results noted 19.3 was the mean score for the highest number of groups acceptable per day in the Corridor Zone, and 80% of respondents reported 30 encounters or less per day was acceptable. To some degree, these evaluations are in keeping with the managerial standard of "large numbers" of encounters assigned to the Corridor Zone by the 1988 BCMP (pg. 37). The report concluded the "quality of backcountry experiences is affected by encountering *both* other people *and* recreational impacts" (Stewart 1997b, pg. 12).

Figure 3.6 Corridor Zone Use Trends 2000 to 2012



A more recent study of Grand Canyon overnight backcountry visitors also considered visitor use levels as an element of visitor experience (Backlund et al., 2008). This study assessed daytime encounters with

other people by asking respondents recall how many groups they encountered on trips. Table 3.12 illustrates study results based on daytime encounter categories stratified across seasons. Spring and fall have highest encounter rates, and this is corroborated by Figure 3.6's Corridor campground use trends. Results compared with 1988 BCMP managerial standards (pg. 37) were generally found to meet standards.

Table 3.12 Percent Respondents Reporting Daytime Corridor Zone Encounters By Season

	0 Groups	1-3 Groups	4-7 Groups	8-10 Groups	11+ Groups	Don't Know
Winter	4.6	20.3	22.4	17.8	29.7	5.2
Spring	1.6	12.0	15.5	15.8	50.3	4.7
Summer	2.2	13.5	25.4	13.5	40.1	5.3
Fall	3.2	17.1	18.4	11.1	46.0	4.1

The 2008 study also noted concern over potential increase in user types in the backcountry. Table 3.13 illustrates percentage of user types encountered by overnight backpackers traveling the Corridor Zone. The report also noted potential for conflict among user types and suggested protocol or etiquette development to reduce conflict.

Table 3.13 User Types Encountered Corridor Zone

User Type	Day Hikers	Overnight Backpackers	Horses/ Mules	Motorized River Trips	River Runners[49]	Commercial Hikes	Aircraft Tours
Percent User Types Encountered	94	100	87	18	23	14	14

Another issue the 2008 study addressed was number of other groups camped within sight or sound of overnight users. Respondents were asked to indicate number of groups they heard or saw at night. As with number of daytime contacts, results were compiled by categories of groups camped within sight or sound, and were stratified by season (Table 3.14). Results were compared with managerial standards from the 1988 BCMP (pg. 37), and generally found standards were being met.

Table 3.14 Percent Respondents Reporting Corridor Zone Nighttime Encounters by Season

	0 Groups	1-2 Groups	3-5 Groups	6+ Groups	Don't Know
Winter	11.9	23.1	27.5	32.1	5.4
Spring	3.8	16.8	23.1	55.5	.8
Summer	9.1	14.3	30.7	41.6	4.3
Fall	8.9	15.4	24.4	50.0	1.2

A number of studies have considered Corridor Zone day hiking (Stewart 1997a, Manning et al. 1997, Backlund et al. 2006). For example, a 2006 study assessed number of day hikers using Bright Angel, and South and North Kaibab Trails through use of automated and hand counts (Backlund et al. 2006). Study results indicate "daily averages ranged 464 to 787 day hikers for Bright Angel, 302 to 567 day hikers for South Kaibab, and 146 to 208 day hikers for North Kaibab" (Backlund et al. 2006, pg. i). Through questionnaires, the study also estimated approximate distances hiked by Corridor Zone visitors. Approximate distance day hikers traveled on each trail is illustrated in Figure 3.7 to 3.9; results are

[49] Defined as river runners taking hikes from the river.

stratified across fall and summer. As noted earlier, during busy spring and fall weekends, it is estimated 400 to 600 people hike or run Corridor Zone trails rim-to-rim or rim-to-river (NPS 2013h)."

Figure 3.7 Bright Angel Trail Day Hikers Destinations by Season

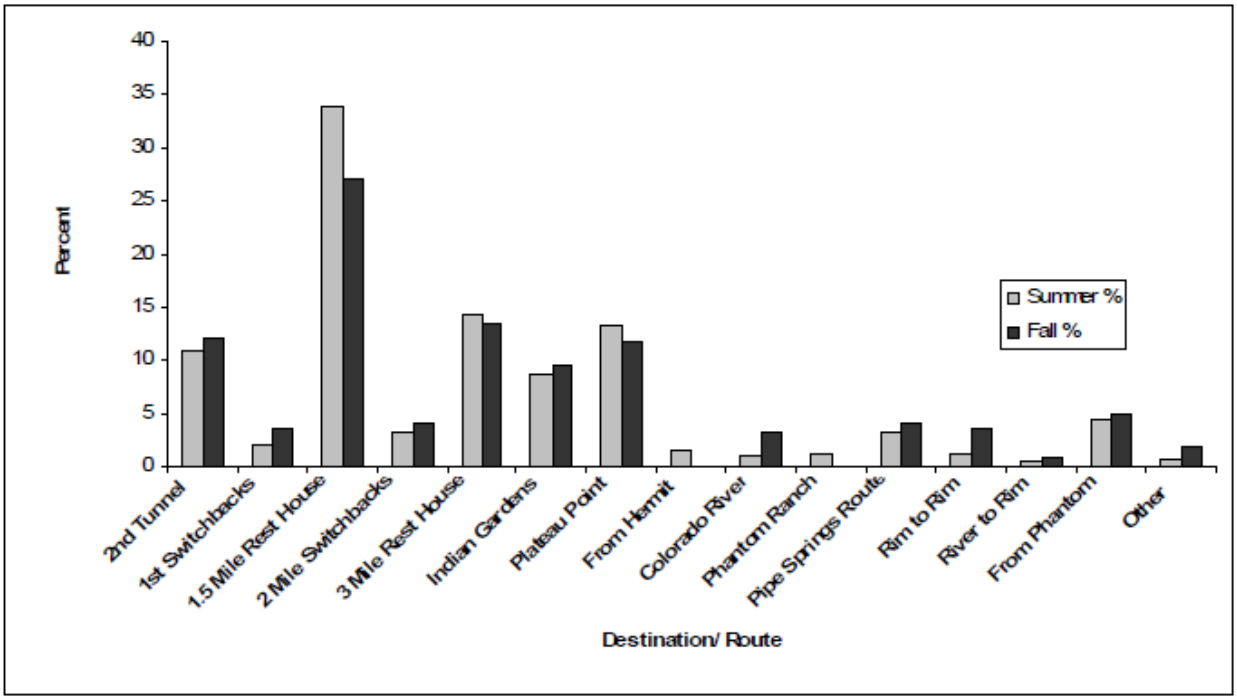


Figure 3.8 South Kaibab Trail Day Hikers Destinations by Season

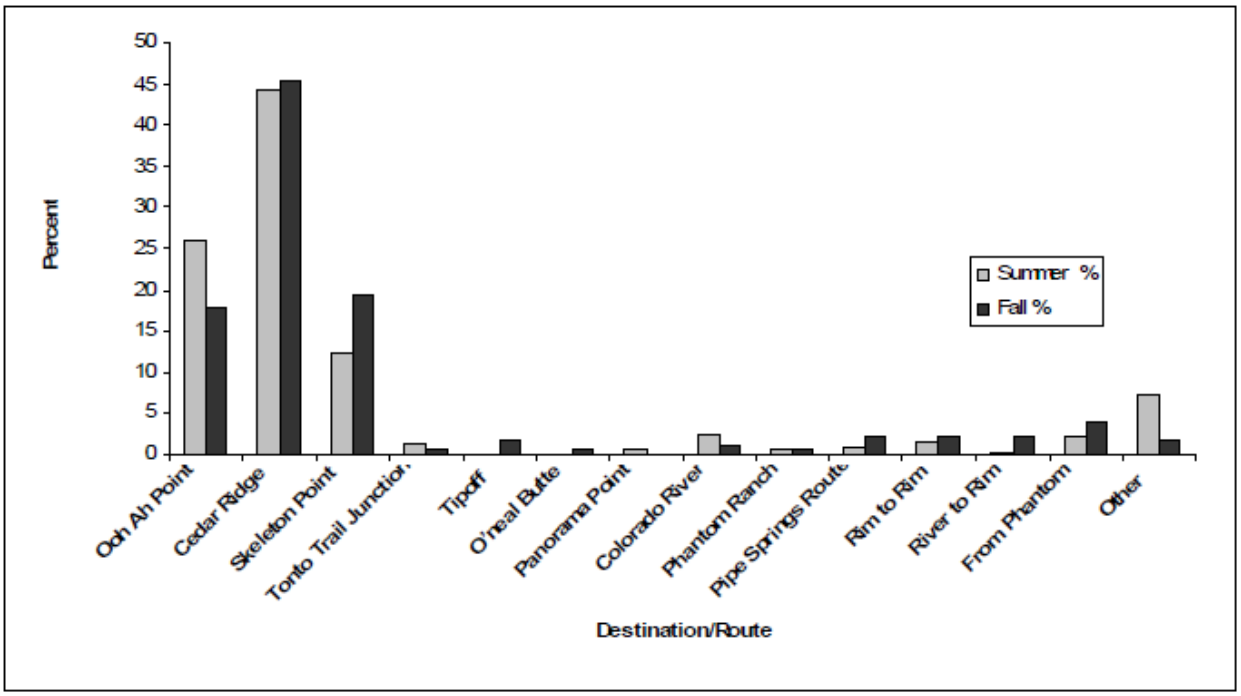
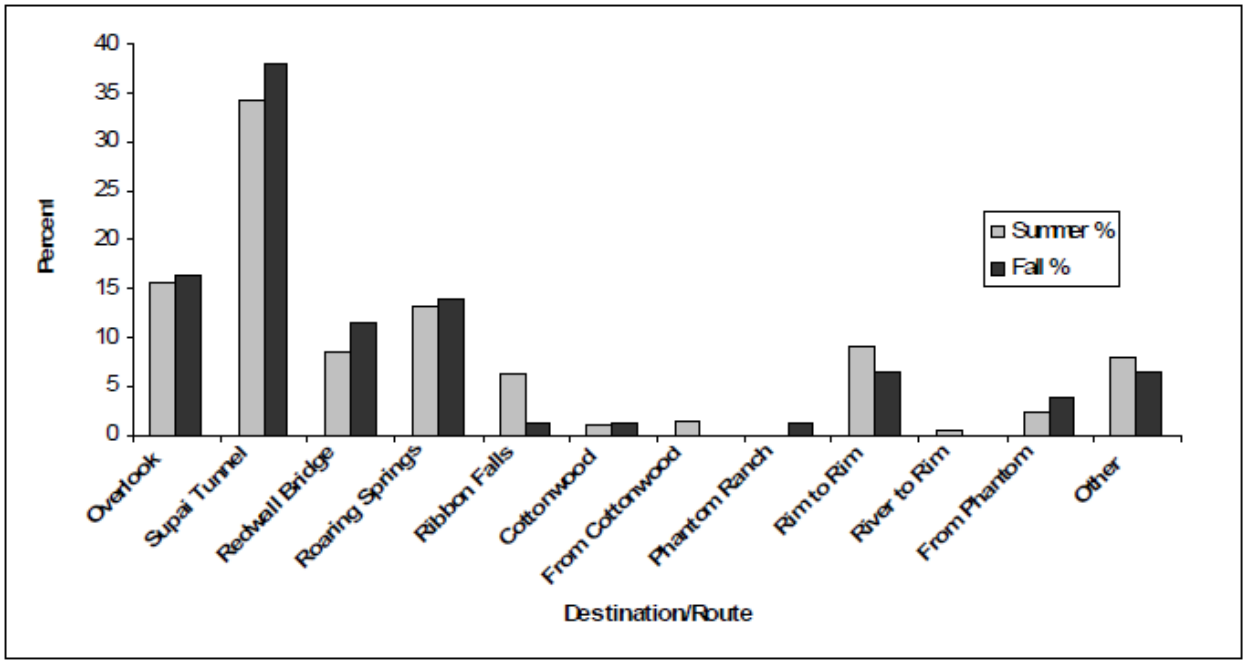


Figure 3.9 North Kaibab Trail Day Hikers Destinations by Season



Another questionnaire asked day hikers to rate a series of potential problems encountered. Some results are illustrated in Table 3.15 (Manning et al. 1999).

Table 3.15 Percent Respondents Reporting Problems on Corridor Zone Day Hikes

Problem	Evaluation	Summer	Fall
Too many other hikers	Not a problem	46.58	53.13
	A small problem	45.34	43.75
	A big problem	8.07	3.13
	Don't know	0.00	0.00
Inconsiderate People	Not a problem	81.99	78.13
	A small problem	13.66	15.63
	A big problem	4.35	6.25
	Don't know	0.00	0.00
Groups encountered too large	Not a problem	65.84	75.00
	A small problem	28.57	25.00
	A big problem	4.97	0.00
	Don't know	0.62	0.00
Too many places congested with people	Not a problem	53.42	62.50
	A small problem	39.13	37.50
	A big problem	7.45	0.00
	Don't know	0.00	0.00

Another Corridor Zone day hiking study focused on Bright Angel Trail (Stewart 1997a). Data collection was conducted over 1994 and 1995 summers and included onsite interviews, trails counts, and mail-back questionnaires. This study found at least 1,200 day hikers per day hiking Bright Angel Trail, of which about one fourth were hiking below the first Resthouse (Stewart 1997a, pg. 6).

Other Corridor Zone recreation uses include stock trips, Phantom Ranch overnight lodging, and river trip passenger exchanges. Private, commercial, and administrative stock use is managed and guided by the park's 2010 Mule Operations and Stock Use EA and FONSI (NPS 2010f). In 2012, there were 4,962 commercial stock rides on North Kaibab Trail to Supai Tunnel, and 2,949 commercial stock rides on Bright Angel Trail that overnighted in Phantom Ranch lodging and traveled out South Kaibab Trail. Phantom Ranch accommodates stock trips, hikers, and river runners, and provided 12,604 room-nights to Corridor Zone visitors in 2012. Phantom Ranch also provides a logical location for river trip passenger exchanges. In 2012, 8,152 people hiked out of Phantom Ranch from commercial river trips, and 2,304 hiked in. For private river trips, 486 passengers hiked into Phantom Ranch in 2012.

Visitors participate in numerous activities in Grand Canyon's Corridor Zone. This includes trail running, canyoneering, and RABT. However, less is known about these Corridor Zone activities and further research is needed to consider potential impacts on park resources and visitor experience.

Threshold Zone

Within the current continuum of land use classifications, the Threshold Zone offers the second most developed opportunities. It is comprised of Use Areas such as Hermit Creek and Rapids, Upper and Lower Tapeats, and Deer Creek among others (see Table 2.14d for a complete listing of Threshold Use Areas). Notable trails in this Zone include Hermit and Deer Creek Trails and Thunder River Trail's lower section. The landscape is largely undisturbed except in destination areas where use is concentrated. For example, camping is mostly limited to designated areas, and management interventions are sometimes taken to protect resources in those areas (e.g., composting toilets). Threshold Use Areas provide the opportunity to transition from a developed backcountry experience (Corridor Zone or rim) to Wilderness and are generally close to rim and Inner Canyon developed areas.

Threshold Zone Resource Setting

The Threshold Zone is characterized as a largely natural environment with moderate to high potential for use-related impacts. Resources are managed to perpetuate natural conditions and processes in conjunction with providing visitor use opportunities. Sensitive resources are provided the maximum protection possible, and some resources may be altered to restore a disturbed area or preserve cultural resources.

Threshold Zone Managerial Setting

The Threshold Zone is the second most intensively managed backcountry zone, but receives significantly less management interventions than the Corridor Zone. Trails are designated and maintained infrequently for resource protection, historic preservation, and visitor safety. Most camping areas are designated and many include composting toilets maintained in accordance with Grand Canyon's MRA (see Appendix). Signs are limited to trailheads, campsites, and trail junctions, and NPS presence (ranger patrols, maintenance, and resource management) is infrequent. Aircraft or motorized/mechanized equipment is not allowed (except during emergency operations or absolutely critical operations to protect natural and cultural resources as determined on a case-by-case basis through MRA and Superintendent approval).

Threshold Zone Social Setting

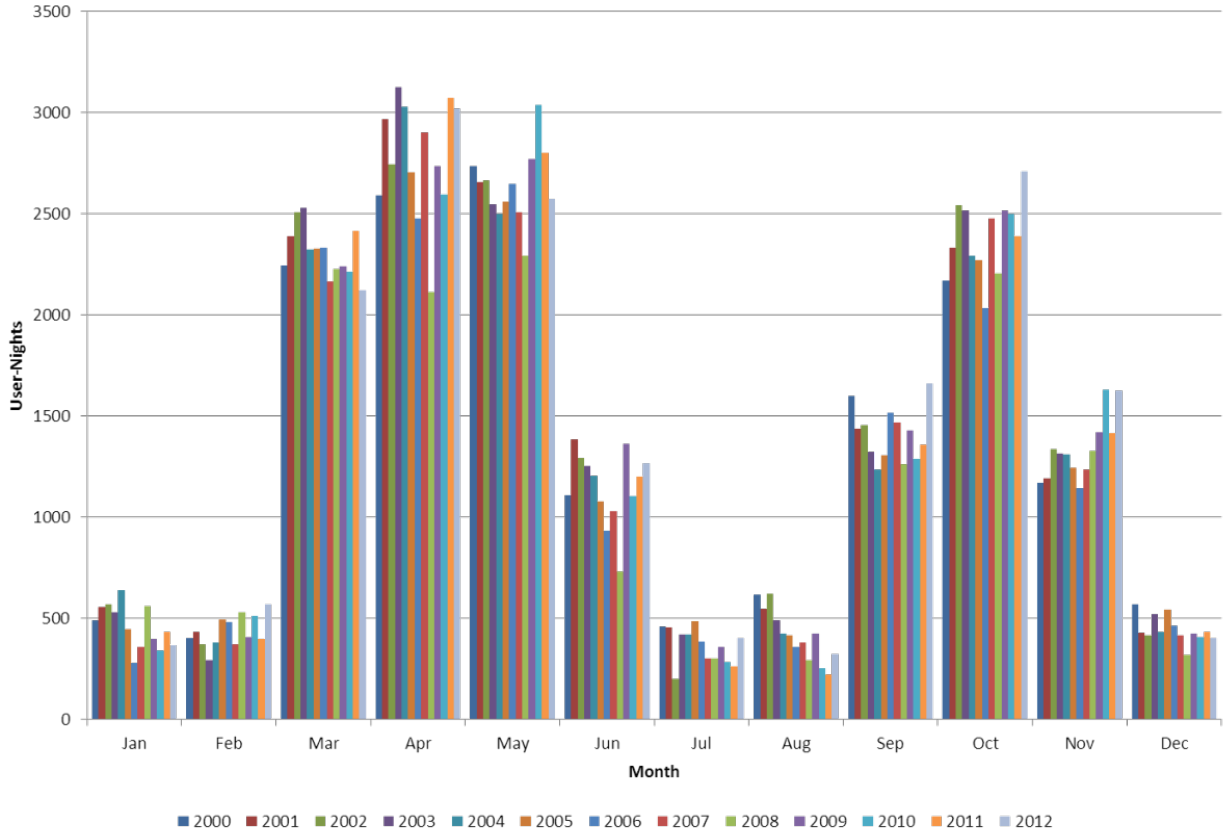
As the second most developed Zone, with proximity to the rim and Corridor Zone, and access to iconic sites such as Thunder River and Deer Creek Falls, the Threshold Zone is in high demand among visitors. Threshold Zone trails receive moderate to high use including hiking, backpacking, and canyoneering. Overnight camping is limited by permit, and maximum group size is 11. While trail encounters remain low to moderate, there is high probability of camping in sight and sound of other groups at designated sites. Still, opportunities for solitude remain, and natural sounds can predominate (except in areas beneath flight corridors).

Threshold Zone Visitor Use Levels

The Backcountry Reservation and Permitting System, along with numerous studies investigating quality of backpacking and overnight camping experiences (Stewart 1997b, Backlund et al. 2008), provides valuable information regarding Threshold Zone visitor use patterns and trends. Figure 3.10 illustrates visitor use trends over the past 12 years in the Threshold Zone (including Use Areas such as Hermit Creek and Rapids, Upper and Lower Tapeats, and Deer Creek). In 2012, 17,078 user nights were spent in the Threshold Zone. This information interpreted in group nights reveals 4,656 small group nights and 390 large group nights spent in the Threshold Zone in 2012

Information related to Threshold Zone commercial overnight use has been collected through the Backcountry Reservation and Permitting System. A total 1,572 commercial user nights were spent in the Threshold Zone in 2012, which is 9.2% of overall user nights spent in the Threshold Zone.

Figure 3.10 Threshold Zone Use Trends 2000 to 2012



A number of studies also considered Threshold Zone visitor use levels (Stewart 1997b, Backlund et al. 2008, Manning et al. 1997, Backlund et al. 2006) an element of visitor experience. For instance, the 1997 study considered experiential consequences of crowding in light of 1988 BCMP encounter rate standards for each management zone. In the Threshold Zone, "12% of respondents indicated "…the number of other hiking groups encountered would *not* make a difference" (Stewart 1997b, pg. 9-10). Six was the mean score for the highest number of groups acceptable per day in the Threshold Zone, and 95% of respondents reported ten encounters or less per day was acceptable. These evaluations are in keeping with 1988 BCMP managerial standards of ten encounters per day assigned to the Threshold Zone (pg. 37, www.nps.gov/grca/parkmgmt).

The 2008 study also considered Threshold Zone visitor use levels an element of visitor experience (Backlund et al. 2008). Table 3.16 illustrates study results based on daytime encounter categories across seasons. Results compared with 1988 BCMP managerial standards (pg. 37) were generally found to meet standards.

Table 3.16 Percent Respondents Reporting Threshold Zone Daytime Encounters by Season

	0 Groups	1-3 Groups	4-7 Groups	8-10 Groups	11+ Groups	Don't Know
Winter	23.3	54.6	11.8	3.8	6.5	0.0
Spring	10.9	45.2	28.3	6.2	8.4	.9
Summer	19.9	50.0	15.2	4.6	9.2	1.1
Fall	16.5	49.6	23.9	4.1	5.6	.3

The 2008 study also noted concern over a potential increase in the number of user types using the backcountry. Table 3.17 illustrates percentage of user types encountered by overnight backpackers traveling in the Threshold Zone.

Table 3.17 User Types Encountered on Threshold Zone Trips

User type	Day hikers	Overnight backpackers	Horses/ mules	Motorized river trips	River runners[50]	Commercial hikes	Aircraft tours
Percent User Type Encountered	79	93	33	21	32	7	32

Another issue the 2008 study addressed was number of other groups camped within sight or sound of overnight users while at camp. As with number of daytime contacts, results were compiled by categories of groups camped within sight or sound, and stratified by season (Table 3.18). Results compared with 1988 BCMP managerial standards (pg. 37) were generally found to meet standards.

Table 3.18 Percent Respondents Reporting Threshold Zone Nighttime Encounters by Season

	0 Groups	1-2 Groups	3-5 Groups	6+ Groups	Don't Know
Winter	59.6	34.4	3.2	2.8	0.0
Spring	43.8	33.5	18.5	3.2	1.1
Summer	60.3	30.1	4.8	3.5	1.3
Fall	49.0	38.2	9.4	3.5	0.0

A number of studies have also considered Threshold Zone day hiking (Manning et al. 1997, Backlund et al. 2006). For example, the 2006 study investigated visitor use along Hermit, Grandview, and Widforss Trails (Backlund et al. 2006). Study results indicate counts from Threshold Zone trails were "too small to provide reliable daily averages" (Backlund et al. 2006, pg. i), but approximate distance day hikers traveled on each trail is illustrated in Figure 3.11 to Figure 3.13. Results were stratified across fall and summer.

[50] Defined as river runners taking hikes from the river.

Figure 3.11 Grandview Trail Day Hiker Destinations by Season

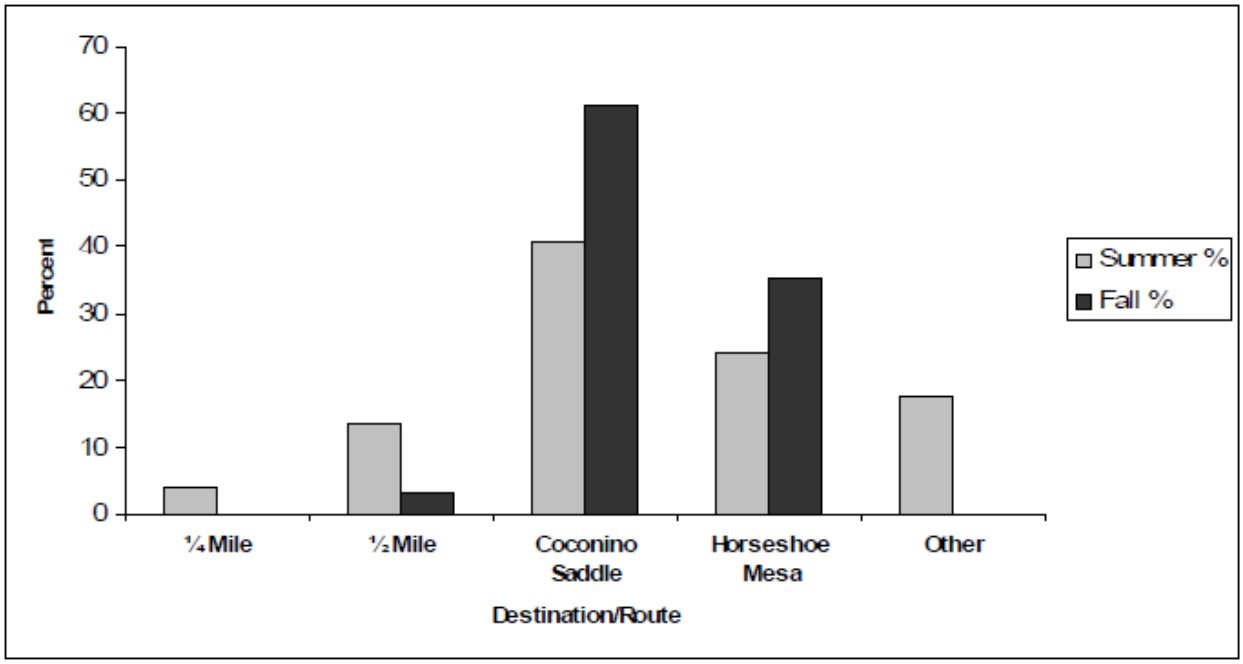


Figure 3.12 Hermit Trail Day Hiker Destinations by Season

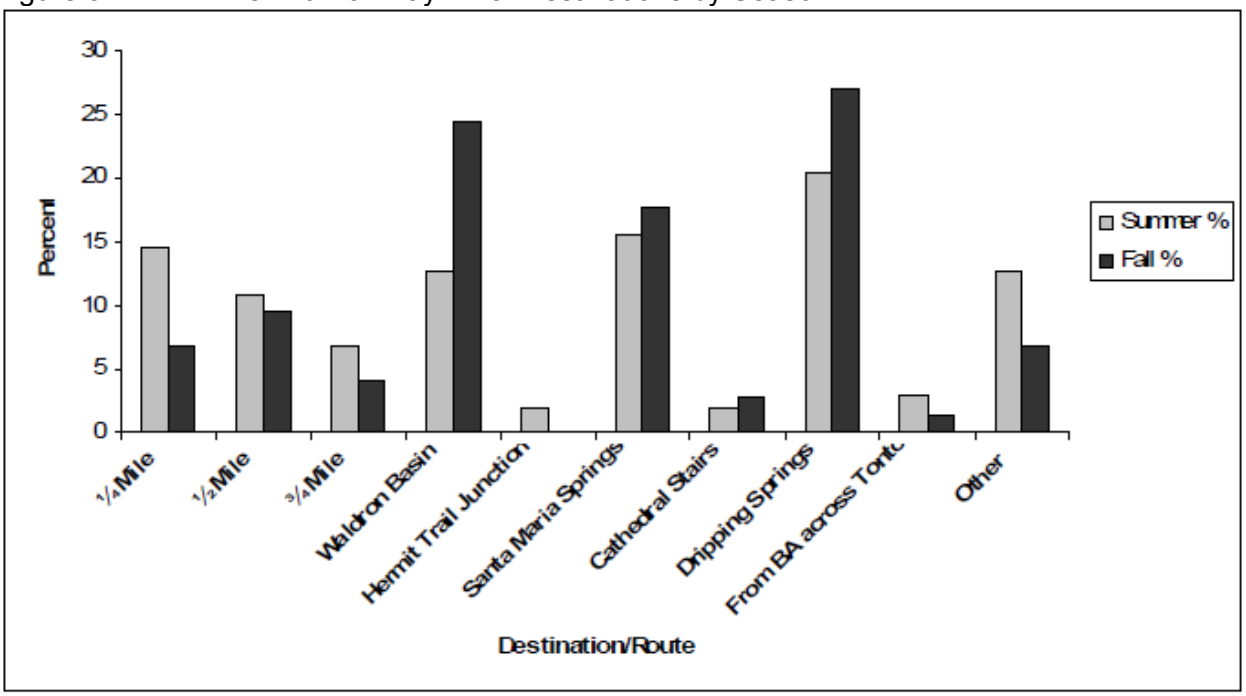
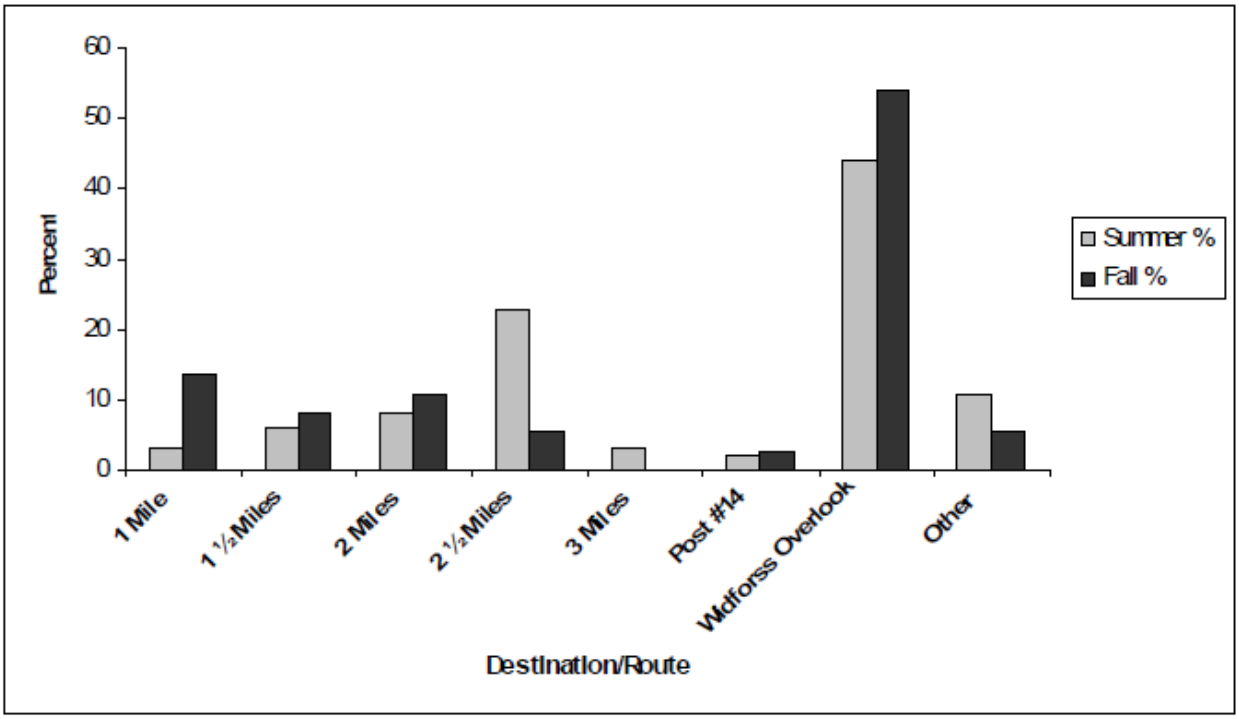


Figure 3.13 Widforss Trail Day Hiker Destinations by Season



Another study conducted summer/fall 1997 considered day hiker experience (Manning et al. 1997). A questionnaire asked day hikers to rate a series of potential problems encountered. Some results are illustrated in Table 3.19.

Visitors participate in numerous Threshold Zone activities including trail running, canyoneering, biking, RABT, driving for pleasure, and rim car camping. However, less is known about these Threshold Zone activities and further research is needed to consider potential impacts on park resources and visitor experience.

Table 3.19 Percent Respondents Reporting Problems on Threshold Zone Day Hikes

Problem	Evaluation	Summer	Fall
Too many other hikers	Not a problem	63.33	60.71
	A small problem	30.00	32.14
	A big problem	6.67	7.14
	Don't know	0.00	0.00
People that were inconsiderate	Not a problem	86.67	78.57
	A small problem	10.00	14.29
	A big problem	0.00	7.14
	Don't know	3.33	0.00
Groups encountered were too large	Not a problem	66.67	78.57
	A small problem	33.33	14.29
	A big problem	0.00	7.14
	Don't know	0.00	0.00
Too many places congested with people	Not a problem	63.33	60.71
	A small problem	30.00	21.43

	A big problem	6.67	17.86
	Don't know	0.00	0.00

Primitive Zone
The Primitive Zone offers undeveloped opportunities to experience wild lands and solitude, and is comprised of Use Areas such as Nankoweap, North Bass, and Kanab Point among others (see Table 2.14d for a complete listing of Primitive Zone Use Areas). Notable trails include Nankoweap and North Bass. Examples of Primitive Zone rim car camping opportunities also exist at SB and Kanab Points. The landscape is largely undisturbed, with human-use impacts most evident near water sources and trails. Camping is almost entirely at-large, although camp areas may be defined to address resource impacts, and composting toilets may be placed as a last resort measure to address human-waste problems. Primitive Zone Use Area destinations and trails are more remote and distant from developed areas than in the Threshold Zone.

Primitive Zone Resource Setting
The Primitive Zone landscape remains primarily undisturbed by human impacts. As with the Threshold Zone, resources are managed to perpetuate natural conditions and processes while providing visitor use opportunities. Sensitive resources are provided maximum protection possible, and some resources may be altered to restore disturbed areas or preserve cultural resources.

Primitive Zone Managerial Setting
The Primitive Zone is the second least intensively managed backcountry Zone, but receives significantly more management interventions than the Wild Zone. Only some trails are designated; maintenance is infrequent and only for resource protection, historic preservation, and visitor safety. All camping areas are at-large with exception of North Rim's Fire and Swamp Points. Composting toilets are placed as a last resort to protect resources in sensitive areas. Signs are limited to trailheads and some trail junctions, and NPS presence (ranger patrols, maintenance, resource management) is infrequent. As with Threshold and Wild Zones, aircraft or motorized/mechanized equipment is not allowed (except during emergency operations or absolutely critical operations to protect natural and cultural resources as determined on a case-by-case basis through MRA and Superintendent approval).

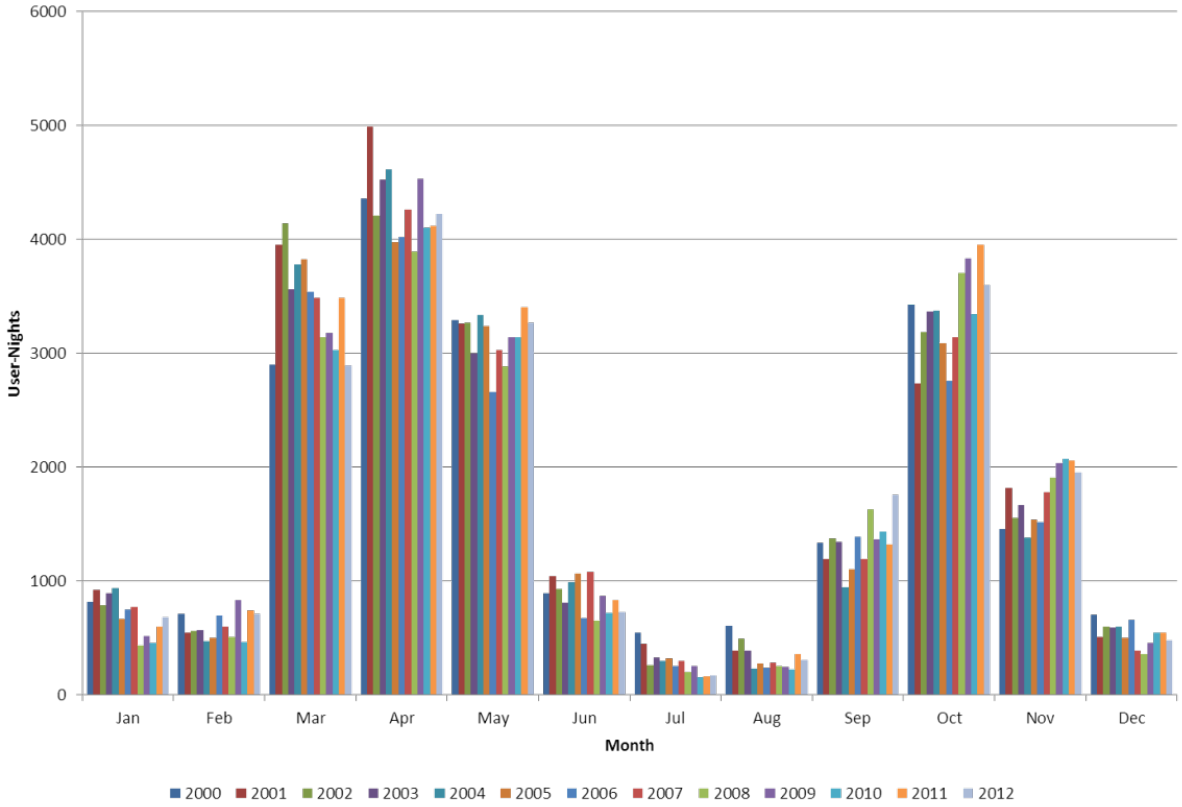
Primitive Zone Social Setting
As the second least developed Zone, with remote sites and trails long distances from developed areas, the Primitive Zone provides many opportunities for solitude. Primitive Zone trails receive low to moderate use including activities such as hiking, backpacking, and canyoneering. Overnight camping is limited by permit; maximum group size is 11. Trail encounters remain low to moderate, and there is low probability of camping in sight and sound of other groups. Opportunities for solitude are plentiful and natural sounds prevail (except in areas beneath flight corridors).

Primitive Zone Visitor Use Levels
The Backcountry Reservation and Permitting System, along with numerous studies investigating quality of backpacking and overnight camping experiences (Backlund et al. 2008), provides valuable information regarding Primitive Zone visitor use patterns and trends. For instance, Figure 3.14 illustrates Primitive Zone visitor use trends over the past 12 years (including Use Areas such as Nankoweap, North Bass, and Kanab Point). In 2012, 20698 user nights were spent in the Primitive Zone. This same information interpreted in group nights reveals 5,551 small-group nights and 564 large-group nights in the Primitive Zone in 2012.

Information related to Primitive Zone commercial overnight use has been collected through the Backcountry Reservation and Permitting System. A total 1,861 commercial user nights were spent in the Primitive Zone in 2012, which equates to 9.0% of overall Primitive Zone user nights.

A number of studies have considered Primitive Zone visitor use levels (Stewart 1997b, Backlund et al. 2008, Manning et al. 1997, Backlund et al. 2006), and considered use levels an element of visitor experience. For instance, the 1997 study considered experiential consequences of crowding in light of 1988 BCMP encounter rate standards for each management zone. In the Primitive Zone, "10% of respondents indicated …the number of other hiking groups encountered would *not* make a difference" (Stewart 1997b, pg. 9-10). The mean score for the highest number of Primitive Zone groups acceptable per day was 2.7, and 95% of respondents reported that five encounters or less per day was acceptable. These evaluations are in keeping with the 1988 BCMP managerial standard of five encounters per day assigned to the Primitive Zone (pg. 37).

Figure 3.14 Primitive Zone Use Trends 2000 to 2012



The 2008 study considered visitor use levels an element of Primitive Zone visitor experience (Backlund et al. 2008). Table 3.20 illustrates study results based on daytime encounter categories across seasons. Results compared with 1988 BCMP managerial standards (pg. 37) were generally found to meet standards.

Table 3.20 Percent Respondents Reporting Primitive Zone Daytime Encounters by Season

	0 Groups	1-3 Groups	4-7 Groups	8-10 Groups	11+ Groups	Don't Know
Winter	53.8	35.2	5.7	1.1	4.2	0.0
Spring	27.9	48.8	15.6	2.6	4.3	0.9
Summer	51.7	34.1	6.9	1.1	4.6	1.9
Fall	34.5	53.4	7.5	1.3	2.0	1.3

The 2008 study also noted a concern over potential increase in number of user types using backcountry. Table 3.21 illustrates percentage of Primitive Zone user types encountered by overnight backpackers.

Table 3.21 Primitive Zone User Types Encountered

User type	Day hikers	Overnight backpackers	Horses/ mules	Motorized river trips	River runners	Commercial hikes	Aircraft tours
Percent User Type Encountered	56	82	11	17	28	6	27

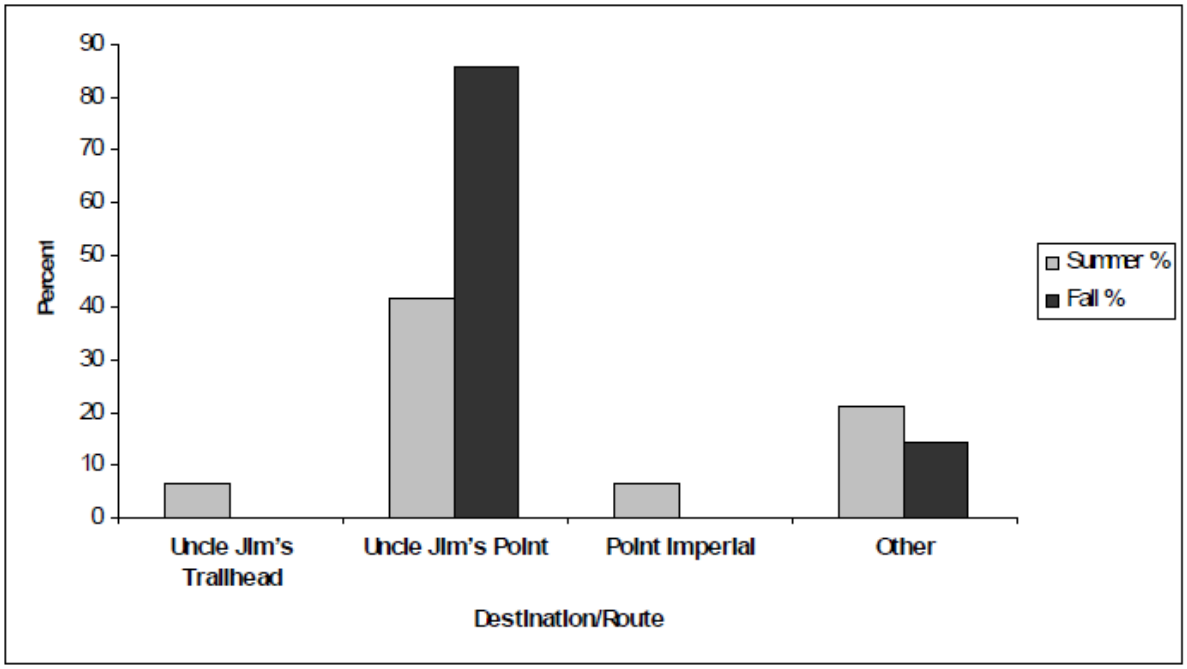
Another issue the 2008 study addressed was the number of other groups camped within sight or sound of overnight users while at camp. As with number of daytime contacts, results were compiled by categories of groups camped within sight or sound by season (Table 3.22). Results compared with 1988 BCMP managerial standards (pg. 37) generally found standards being met.

Table 3.22 Percent Respondents Reporting Primitive Zone Nighttime Encounters by Season

	0 Groups	1-2 Groups	3-5 Groups	6+ Groups	Don't Know
Winter	89.9	9.3	.4	1.3	0.0
Spring	71.1	24.2	2.6	1.2	1.0
Summer	83.3	9.3	1.3	4.4	1.8
Fall	81.7	15.4	0.9	0.2	1.8

A number of studies also considered Primitive Zone day hiking (Manning et al. 1997, Backlund et al. 2006). For example, the 2006 study investigated visitor use along Ken Patrick Trail (Backlund et al. 2006). Study results indicate counts were "too small to provide reliable daily averages" (Backlund et al., pg. i), but approximate distances day hikers traveled is illustrated in Figure 3.15. Results were stratified across fall and summer.

Figure 3.15 Ken Patrick Trail Day Hiker Destinations by Season



Another study conducted in the fall of 1997 considered day hiker experience (Manning et al. 1997). A questionnaire asked day hikers rate a series of potential problems encountered. Some results are illustrated in Table 3.23.

Table 3.23 Percent Respondents Reporting Problems on Primitive Zone Day Hikes

Problem	Evaluation	Fall
Too many other hikers	Not a problem	84.21
	A small problem	7.89
	A big problem	7.89
	Don't know	0.00
People that were inconsiderate	Not a problem	89.47
	A small problem	10.53
	A big problem	0.00
	Don't know	0.00
Groups encountered were too large	Not a problem	78.38
	A small problem	13.51
	A big problem	2.70
	Don't know	5.41
Too many places congested with people	Not a problem	81.58
	A small problem	13.16
	A big problem	2.63
	Don't know	1.19

Visitors participate in numerous Primitive Zone activities including trail running, canyoneering, biking, RABT, driving for pleasure, and rim car camping. However, less is known about these Primitive Zone activities and further research is needed to consider their potential impacts on park resources and visitor experience.

Wild Zone
The Wild Zone offers outstanding opportunities for solitude and requires the highest level of self-reliance. Use areas are large and remote, the landscape is largely undisturbed, and natural processes predominate. Camping is at-large and hikers rarely encounter other groups. Trails are unimproved and route-finding is often required. Access to Wild Zones is typically through Threshold and Primitive Zones, although remote trailheads may also be located on other federal and tribal lands.

Wild Zone Resource Setting
Wild Zone landscapes remain primarily undisturbed by human impacts, and natural processes predominate. Resources are managed to perpetuate natural conditions and processes, and sensitive resources are provided the maximum protection possible. As with Threshold and Primitive Zones, some resources may be altered to restore a disturbed area or preserve cultural resources.

Wild Zone Managerial Setting
The Wild Zone is the least managed backcountry Zone. Most trails are unimproved; maintenance is infrequent and only for resource protection. All camping areas are at-large. There are no toilets or facilities; signs are limited to trailheads. NPS presence (ranger patrols and resource management) is infrequent. As with Threshold and Primitive Zones, aircraft or motorized/mechanized equipment is not allowed (except during emergency operations or absolutely critical operations to protect natural and cultural resources as determined on a case-by-case basis through MRA and Superintendent approval).

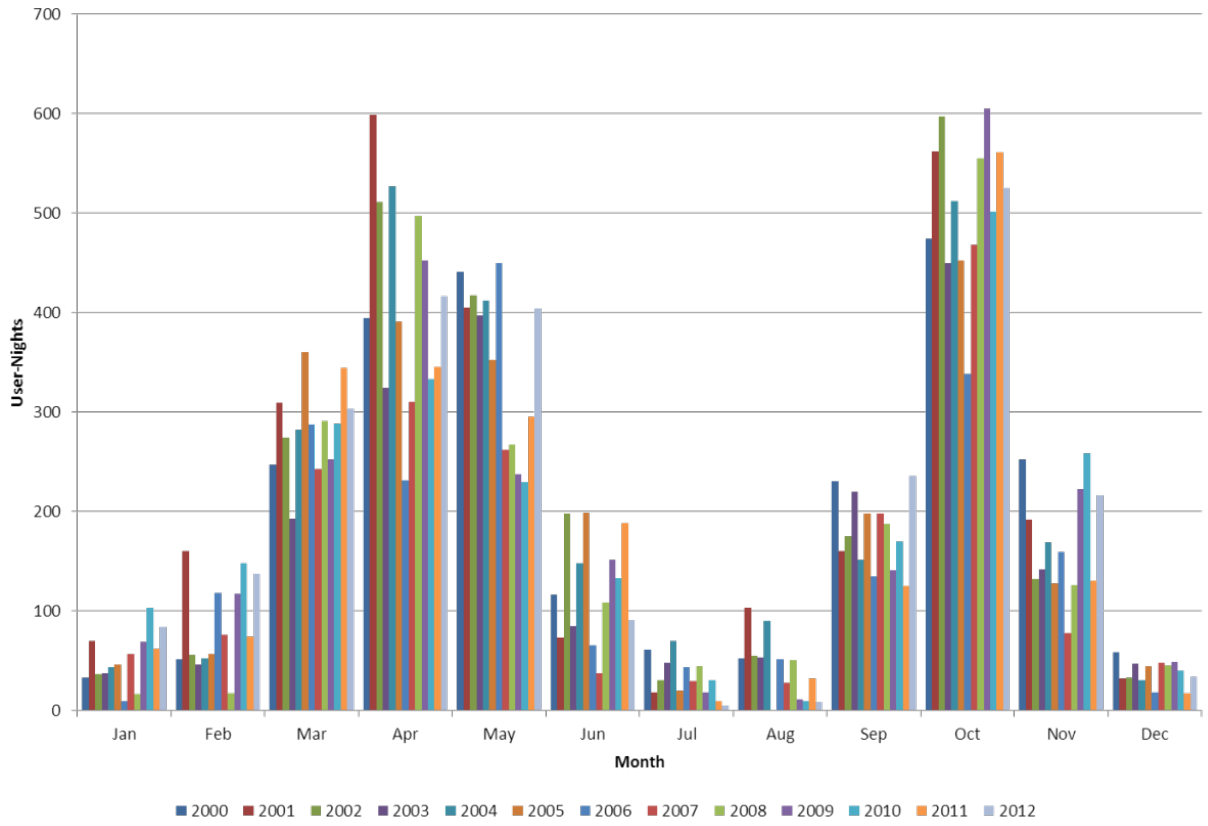
Wild Zone Social Setting
As the least-developed Zone, with remote sites, large Use Areas, and trails located long distances from developed areas, the Wild Zone requires the highest level of self-reliance. Wild Zone trails receive low use and include activities such as hiking, backpacking, and canyoneering. Overnight camping is limited by permit; maximum group size allowed is 11. Trail and campsite encounters are minimal. Opportunities for solitude are outstanding, and natural sounds prevail (except in areas beneath flight corridors).

Wild Zone Visitor Use Levels
The Backcountry Reservation and Permitting System, along with numerous studies investigating quality of backpacking and overnight camping experiences (Stewart 1997b, Backlund et al. 2008), provides valuable Wild Zone information regarding visitor use patterns and trends. For instance, Figure 3.16 illustrates Wild Zone visitor use trends over the past 12 years. In 2012, 2,463 user nights were spent in the Wild Zone. This information interpreted in group nights reveals 759 small-group nights and 58 large-group nights in the Wild Zone in 2012.

Information related to Wild Zone commercial overnight use was collected through the Backcountry Reservation and Permitting System. For instance, a total 94 commercial user nights were spent in the Wild Zone in 2012, which equates to 3.8% overall Wild Zone user nights.

A number of studies considered Wild Zone visitor use levels (Stewart 1997b, Backlund et al. 2008). Studies have considered use levels as an element of visitor experience. For instance, the 1997 study considered experiential consequences of crowding in light of 1988 BCMP management zone encounter rate standards. In the Wild Zone, “11% of respondents indicated…the number of other hiking groups encountered would *not* make a difference” (Stewart 1997b, pg. 9-10). The mean score for the highest number of Wild Zone groups acceptable per day was 1.3, and 80% of respondents reported two encounters or less per day was acceptable. These evaluations are generally in keeping with the 1988 BCMP managerial standard of one Wild Zone encounter per day (pg. 37).

Figure 3.16 Wild Zone Use Trends



The 2008 study considered visitor use levels an element of Wild Zone visitor experience (Backlund et al., 2008). Table 3.24 illustrates results of this study based on daytime encounter categories stratified across seasons. Results compared with 1988 BCMP managerial standards (pg. 37) were generally found to meet standards.

Table 3.24 Percent Respondents Reporting Wild Zone Daytime Encounters by Season

	0 Groups	1-3 Groups	4-7 Groups	8-10 Groups	11+ Groups	Don't Know
Winter	82.4	5.9	0.0	5.9	5.9	0.0
Spring	58.9	22.5	7.3	4.0	6.0	1.3
Summer	78.9	10.5	10.5	0.0	0.0	0.0
Fall	64.9	24.6	2.6	1.8	6.1	0.0

The 2008 study also noted a concern over potential increase in number of user types using backcountry. Table 3.25 illustrates percentage of Wild Zone user types encountered by overnight backpackers.

Table 3.25 Wild Zone User Types Encountered

User type	Day hikers	Overnight backpackers	Horses/ mules	Motorized river trips	River runners[51]	Commercial hikes	Aircraft tours
Percent User Types Encountered	58	75	28	28	39	11	30

[51] Defined as river runners taking hikes from the river.

Another issue the 2008 study addressed was number of other groups camped within sight or sound of overnight users at camp. As with number of daytime contacts, results were compiled by categories of groups camped within sight or sound and were stratified by season (Table 3.26). Results were compared with 1988 BCMP managerial standards (pg. 37), and generally found standards were being met.

Table 3.26 Wild Zone Percent Respondents Reporting Nighttime Encounters by Season

	0 Groups	1-2 Groups	3-5 Groups	6+ Groups	Don't Know
Winter	100.0	0.0	0.0	0.0	0.0
Spring	89.5	7.5	.8	.8	1.5
Summer	83.3	5.6	5.6	5.6	0.0
Fall	93.8	5.4	0.0	.9	0.0

Visitors participate in numerous Wild Zone activities including day hiking, trail running, canyoneering, biking, RABT, driving for pleasure, and rim car camping. However, less is known about these activities in the Wild Zone and further research is needed to consider their potential impacts on park resources and visitor experience.

Recreation Benefits

It is well understood that "recreationists participate in selected activities in specific settings to fulfill motivations that in turn lead to benefits" (Manning 2011 pg. 196). Further, it has long been suggested recreation opportunities should range "from the flowerpot at the window to the wilderness" (Wagar 1951), and managers should consider their "diverse resource base capable of providing a variety of satisfactions" (Stankey 1974). The sections above illustrate diverse *motivations* of Grand Canyon's backcountry visitors, the wide-range of backcountry *activities* visitors may participate in, and distinguishes resource, managerial, and social *settings* across four management zones. Recreation Benefits synthesizes satisfaction levels across Grand Canyon's diverse backcountry as an outcome of this systems-oriented approach to recreation planning.

Studies of day hiking (Backlund et al. 2006) and overnight backpacking (Backlund et al. 2008) at Grand Canyon measured satisfaction levels of recreationists. The day hiking study found the "vast majority of day hikers are satisfied with their experiences" (Backlund et al. 2006, pg. 55). And the backpacking study found "among overnight backcountry users, overall satisfaction is moderately high" (Backlund et al. 2008). Both studies included visitors across management zones and noted varying sensitivities to resource, managerial, and social conditions. However, it is important to note "uniformly high levels of satisfaction are of only limited usefulness to recreation managers" (Manning 2011, pg. 15), and these studies only include participants of two recreation activities in Grand Canyon. Further research is needed to include participants in the diverse park recreation activities available.

Socioeconomic Environment

The affected environment includes three distinct economies and populations: 1) regional and local, 2) backcountry visitors, and 3) commercial operators that take visitors into the park's backcountry. Affected areas consist of Grand Canyon National Park (primarily in Coconino County and partly Mohave County, Arizona) and the primary gateway communities within 80 miles (or about an hour and a half driving time). This section focuses on the economy generated by Grand Canyon backcountry use and places it in the context of the region's economy.

Primary gateway communities include: Flagstaff, Tusayan, Williams, Cameron, Marble Canyon, Fredonia, Jacob Lake, and Supai (Coconino County) and Peach Springs (Mohave County), Arizona and Kanab (Kane County), Utah (Map 3.3).

Total population of affected communities in 2010 was 77,260 (Table 3.27). The affected region experienced a population increase of 23% from 2000 to 2010 (U.S. Census Bureau 2000, U.S. Census Bureau 2010). The population increase for the affected region is higher than the national population increase of approximately 10% from 2000 to 2010, and similar to the 25% increase recorded for the state of Arizona (U.S. Census Bureau 2010).

Table 3.27 Communities Population in the Affected Region (Map 3.3)

Community	2000	2010	Percentage of Total (2010)
Cameron	978	885	1.1
Flagstaff	52,894	65,870	82.8
Fredonia	1,036	1,314	1.7
Grand Canyon Village	1,430	2,004	2.7
Marble Canyon	NA	NA	NA
Supai	503	465	0.6
Tusayan	562	558	0.7
Williams	2,842	3,023	3.8
Coconino County Total	**59,683**	**74,119**	**93.2**
Peach Springs, Arizona	600	1,090	1.4
Kanab, Utah	3,564	4,312	5.4
Total	**62,979**	**77,260**	**100.0**

Sources: 2000, 2010 data, U.S. Census Bureau data, U.S. Census Bureau
NA = not available

Regional and Local Economies

Grand Canyon National Park and its visitors have an impact on the local economy through visitor spending. Table 3.28 displays this impact on the local region which is defined to encompass Coconino County, Arizona including gateway communities Tusayan, Williams, Flagstaff and Cameron south of the park as well as Jacob Lake, Kanab, and Fredonia north of the park (Stynes and Sun 2005). Although this information is 12 years old, it is very specific to Grand Canyon and provides the best information available.

Table 3.28 Grand Canyon Visitor Spending Economic Impacts (2003)

Sector/Spending Category	Direct Sales	Jobs	Personal Income
Motel, hotel, cabin or B&B	$90,022,000	1,638	$39,311,000
Camping fees	$4,774,000	32	$620,000
Restaurants and bars	$63,093,000	1,565	$25,479,000
Admissions and recreation	$66,225,000	1,417	$24,381,000
Other vehicle expenses	$32,864,000	310	$5,376,000
Retail trade	$31,748,000	624	$14,693,000
Wholesale trade	$4,681,000	50	$1,737,000
Local productions of goods	$5,037,000	18	$410,000
Total Direct Effects	**$298,442,000**	**1,786**	**$112,007,000**

Source: Stynes and Sun 2005

Table 3.29 Affected Region Communities Demographic Data* (Map 3.3)

Community	Population	Median House-hold Income	Unemployment Rate	Employment			
				Occupation	%	Industry	%
Cameron	885	$29,000	8.0%	Management, business, science, arts	3.5%	Natural resources, construction, maintenance	9.9%
				Service	17.9%	Production, transportation, material moving	23.6%
				Sales/office	45.0%		
Flagstaff	65,870	$65,648	7.3%	Management, business, science, arts	34.0%	Natural resources, construction, maintenance	7.6%
				Service	23.9%	Production, transportation, material moving	9.8%
				Sales/office	24.8%		
Fredonia	1,314	$46,705	4.1%	Management, business, science, arts	16.7%	Natural resources, construction, maintenance	16.7%
				Service	19.9%	Production, transportation, material moving	28.2%
				Sales/office	18.5%		
Grand Canyon Village	2,004	$59,861	2.0%	Management, business, science, arts	20.7%	Natural resources, construction, maintenance	6.1%
				Service	35.9%	Production, transportation, material moving	9.5%
				Sales/office	27.8%		
Supai	208	$33,000	No data available	Management, business, science, arts	23.3%	Natural resources, construction, maintenance	10.0%
				Service	26.7%	Production, transportation, material moving	10.0%
				Sales/office	30.0%		
Williams	3,023	$45,281	3.9%	Management, business, science, arts	22.1%	Natural resources, construction, maintenance	10.1%
				Service	35.7%	Production, transportation, material moving	8.4%
				Sales/office	23.7%		
Peach Springs	1,090	$45,385	17.6%	Management, business, science, arts	10.3%	Natural resources, construction, maintenance	15.0%
				Service	39.9%	Production, transportation, material moving	4.3%
				Sales/office	30.4%		
Kanab Utah	4,312	$45,639	3.2%	Management, business, science, arts	38.1%	Natural resources, construction, maintenance	9.8%
				Service	23.3%	Production, transportation, material moving	4.7%
				Sales/office	24.2%		

Source: U.S. Census Bureau, 2007-2011 American Community Survey (http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml#none, accessed 5/10/13)
*No demographic data available for Marble Canyon or Tusayan

Demographic data available for communities in the affected region are displayed in Table 3.29. Median household incomes range $29,000 to $65,648, while unemployment rates are 2 to 17.6%. National statistics show $52,762 for median household income, and 8.7% for unemployment (U.S. Census Bureau 2013).

Regional and Local Economies Communities

The community most likely affected by alternatives in this plan/DEIS is Flagstaff, Arizona, primarily due to its role as a hub for regional travel, number of backcountry guide services, and availability of backcountry gear and supplies. Other communities such as Williams, Cameron, Marble Canyon, Tusayan, Jacob Lake, Fredonia, and Kanab receive more indirect social and economic impacts from Grand Canyon backcountry use. Las Vegas was not included because direct economic spending from backcountry users is considered too small (especially compared with other local economic activities) to have any discernible influence on the city's economy of more than $2.4 billion. Local communities in the affected region, and their relationships with Grand Canyon backcountry activities, include

Flagstaff, Arizona
Flagstaff (population approximately 66,000) is the largest city in the region, a major transportation hub, and a residential and commercial center. As a result, many Grand Canyon backcountry users gather in Flagstaff, buy food, equipment, and stay at local hotels and motels before arriving at Grand Canyon. Six commercial companies that offer overnight and day hiking trips into the park's backcountry are based in Flagstaff.

Grand Canyon Village, Arizona
Grand Canyon Village is located in Grand Canyon National Park on South Rim. Approximately 2,000 people live in the village and are employed by the National Park Service, park concessioners, the Grand Canyon School, the U.S. Postal Service, the bank, and various other entities.

Cameron and the Navajo Nation, Arizona
The Navajo Nation is located in Arizona, New Mexico, and Utah. Navajo Nation lands border the park to the east and are adjacent to the Colorado River between RM 0 and RM 61 (confluence of the Colorado and Little Colorado Rivers). These lands include two tribal parks (Marble Canyon and Little Colorado) adjacent to the park's eastern boundary (on the western Navajo boundary). Hiking trails leading into the park such as Jackass Canyon, Salt Trail Canyon, and Totahatso Point are on Navajo Nation land and require tribal day or overnight permits and a $5 per night camping fee. These permits are available through the Navajo Nation Parks and Recreation Department.

The Navajo community nearest Grand Canyon is Cameron (population 885), located at the junction of U.S. Highway 89 and U.S. Highway 64. Gas, food, lodging and shopping are available in Cameron. Industries supporting this community include retail sales, arts, entertainment, food service, and recreation. No estimates exist for regional economic impacts of Grand Canyon backcountry users spending in Cameron.

Marble Canyon, Arizona
Marble Canyon, including Cliff Dwellers and Vermilion Cliffs, is a rural community of approximately 500 people near Lees Ferry. Prior to Glen Canyon Dam construction, Lees Ferry was the only Colorado River crossing for many miles. Dam construction has created a thriving Colorado River rainbow trout fishery which has become a major tourist draw between Lees Ferry and Glen Canyon Dam upstream, and contributor to the local economy. Lees Ferry is the starting point for virtually all Grand Canyon boating trips. Many boaters purchase fuel, food, refreshments, and equipment in Marble Canyon (NPS 2005a).

Supai Village and the Havasupai Reservation, Arizona
The Havasupai Reservation is located west of Grand Canyon Village and south of the Colorado River, and includes land on the rim as well as below. Supai Village is located on the reservation in Havasu Canyon (home to approximately 465 tribal members).

Tourism is the main economic basis for the tribe. However, there is no road to Supai, so tourists visit by hiking or riding (horse or mule) an eight-mile trail or taking a helicopter. Supai has a campground, lodge, general store, cafe, and post office. Horses are also available for rent. Visitors are charged an entry fee of $35, a camping fee of $17 per night, and a $5 environmental fee per person. No data are available on how much is collected on a yearly basis.

Road access to South Bass Trail and Pasture Wash area requires crossing Havasupai lands on Forest Service Road 328, which departs Highway 64 between Tusayan and the park's entrance station. At the Havasupai boundary there is a fee station where a $25 per vehicle access fee is collected by the Havasupai Tribe. No data is available on the amount of money collected by the tribe for access to the park across tribal lands.

Tusayan, Arizona
Tusayan is a gateway community of about 550 permanent residents (U.S. Census Bureau 2010) on Highway 64 just outside Grand Canyon's south entrance. This town has seven motels, approximately 15 restaurants, and a half dozen other establishments offering tourism-related goods and services. The local economy is dependent on Grand Canyon visitors.

Peach Springs and the Hualapai Reservation, Arizona
The Hualapai Reservation is south of the Colorado River, west of Grand Canyon. Tribal, public school, and state and federal governmental services provide the bulk of current full-time employment. The tribe's principal economic activities include tourism, cattle ranching, timber sales, and arts and crafts.

Economic activity tied to Grand Canyon is vital to the Hualapai Tribe and its economy. This economic activity is generated primarily from river trips, helicopter tours, and visits to Grand Canyon Skywalk. Visitors interested in accessing the park's backcountry across Hualapai land are required to obtain a tribal permit. However, the tribe generally does not permit backpacking or day hiking on reservation lands.

Fredonia, Arizona
Though in Arizona, Fredonia is a sister community to Kanab, Utah. In 2010, Fredonia's population was 1,300; its economy is based primarily on tourism and agriculture (U.S. Census Bureau 2010). The Kaibab Band of Paiute Indians tribal office is located 15 miles west of Fredonia. Grand Canyon tourists journeying to and from North Rim influence Fredonia.

Kanab, Utah
Kanab, Utah is a city of about 4,300 people just north of the Arizona-Utah border, and the Kane County seat. Tourism is the leading industry for Kanab due to its close proximity to Bryce Canyon, Grand Canyon, and Zion National Parks. Grand Canyon tourists journeying to and from North Rim heavily influence Kanab. One transportation company offering tours to Toroweap is located in Kanab.

Backcountry Visitor Generated Economy

Based on reported gross receipts and backcountry permit estimates, park visitors spend over $2 million annually on commercially guided trips in the park's backcountry. In addition, it is assumed both commercial and non-commercial backcountry users purchase equipment, supplies, and services.

Commercial Backcountry Visitor
Commercial operators are permitted to run commercial trips in the park's backcountry under commercial use authorizations. Activities permitted commercially include backpacking, day hiking, transportation tours, horse and mule rides, and bicycling.

Commercial backpacking trips are advertised for an average of $250 per day (data collected from company websites, May 2013). Exact prices vary depending on the operator, trip length, and trip location.

For day hiking, costs range from $100 to $500 per day depending on where the trip originates, group size, hike length, and whether other activities and/or food services are included.

Transportation tours, day and overnight, to Toroweap average $230 per person and usually originate in Las Vegas, Nevada or Kanab, Utah. Day trips are 7 to 12 hours long and overnight trips are generally 24 hours.

Commercial mule rides occur in Grand Canyon, primarily on Corridor Zone trails. This activity and the socioeconomics were addressed in the Mule Operations and Stock Use EA (NPS 2010f). Additional changes to number of commercial groups allowed at Toroweap (see Chapter 2, action alternatives, limits vary by Alternative) could impact stock trips in that location, and are analyzed in Chapter 4. The Mule Operations and Stock Use EA and FONSI (NPS 2011a) allowed six commercial stock trips to Toroweap annually.

Commercial bicycling is permitted in a few backcountry locations. Because the popular and spectacular Rainbow Rim Trail is located near the park on USFS land, commercial trips focus on this trail.

Commercial bicycle trips may enter the park to sightsee, hike, or take short rides, and some stay at the North Rim's lodge or campground. Backcountry bicycling trips that include a North Rim visit cost an average $236 per day for 4 to 12 days.

Primary economic sectors impacted by visitor spending including commercial backcountry visitor spending are motels, hotels, and B&Bs; admissions and recreation; restaurants and bars; and retail trade. For commercial backcountry trips, the assumption is that much spending in the admissions and recreation services sector is in wage and benefits paid to commercial trip guides and staff. It is estimated commercial backcountry users contribute $43 per day per person (plus fees visitors pay to commercial operators per person per day) to Grand Canyon's regional economy from backcountry trip purchases and other trip-related spending (Stynes and Sun 2005). Regional spending consists of that portion of commercial backcountry visitor's goods or services purchases (such as commercial trips) that occur in the Grand Canyon region's economy. Commercial backcountry visitor spending outside the Grand Canyon region are not counted in Chapter 4's analysis.

Non-commercial Backcountry Visitor
Non-commercial backcountry users spend less per day than commercial users because they do not purchase commercial operator services. Stynes and Sun (2005) found backcountry campers spend an average $43/person/day in the region. However, this estimate does not include hotel or motel stays before or after a backcountry trip. This includes those people that spend the night in the backcountry, but does not account for day hikers or other day use activities such as canyoneering or visiting backcountry rim areas by foot, vehicle, or bicycle. Further, this estimate does not include lodging if a backpacking group stays in a hotel or motel before or after a backcountry overnight trip.

As previously mentioned, primary economic impacts of park visitor spending including commercial backcountry visitor spending are motels, hotels, or B&Bs; recreation and amusements; restaurants and bars; and retail trade.

Commercial Operators

As of January 2014, 22 operators offer overnight backpacking trips, and 34 offer day hiking in the park's backcountry (some operators offer both backpacking and day hiking and are therefore counted twice in the previous numbers). Three operators offer Toroweap transportation tours and one offers backcountry stock trips. Eleven operators offer bicycling trips in the park, some of which occur on North Rim. Operators must obtain a one-year NPS commercial use authorization (CUA).

Commercial operators with verifiable client lists obtain backcountry permits through the same process as the non-commercial public. In 2012, 8,538 user-nights out of the total 94,277 were commercial which equates to approximately 9.1%. When looking at the Corridor Zone, commercial trips made up approximately 9.3% of user-nights. Commercial use was 9.2% in the Threshold Zone, 9.0% in the Primitive Zone, and 3.8% in the Wild Zone when compared to non-commercial user-nights.

The NPS does not have use statistics for day hiking, bicycling, Toroweap stock, or transportation tours because reporting requirements are not currently a condition of the CUA.

Commercial Operators Revenues and Expenses

From 2010 to 2014, total gross receipts from commercial operators for backcountry activities (including overnight backpacking, day hiking, bicycling, and transportation tours to Tuweep) were reported at $2 to 3.5 million yearly. Approximately five operators had gross receipts exceeding $250,000 annually. However, reporting requirements for gross receipts are not standardized or reported consistently across companies. Amounts may not be exact as some operators may include income from trips provided in other locations. Based on user data and estimated day use, commercial operator profits likely vary from a few thousand to hundreds of thousands of dollars annually depending on the number of trips conducted in Grand Canyon.

Backcountry operator costs can be separated into four categories

- Direct Operating Expenses: customer services such as guide salaries, food, and supplies
- Indirect Operating Expenses: office salaries and, in some cases, management fees
- Fixed Expenses: business costs such as rent, insurance, taxes, and depreciation costs which do not vary significantly as level of service changes
- CUA Fees: currently $350 for up to one-year permit paid directly to the NPS

Park Management and Operations

Park management and operations refers to

- Staffing level adequacy
- Park infrastructure quality and effectiveness in protecting and preserving vital resources and providing for an enjoyable visitor experience, and
- Administrative backcountry use

Staffing

The Superintendent is ultimately responsible for park management and operations. In 2014, Grand Canyon National Park employed 512 employees (of which 313 are permanent) to manage operations including visitor services and facilities, resource management and preservation, planning and environmental compliance, emergency medical services (EMS), law enforcement, search and rescue operations (SAR), fire operations, air operations, facilities management and maintenance, and administrative functions.

Park divisions with backcountry responsibilities include Facilities Management (trails, facilities, monitoring), Visitor and Resource Protection (backcountry permits, Inner Canyon rangers, EMS/SAR), Concessions Management (contracts, CUA), Interpretation and Resource Education (signage, information, interpretation), Science and Resource Management (resource stewardship, monitoring) and Office of Planning and Compliance (environmental analysis).

Backcountry and Wilderness recreational and administrative use is currently managed in accordance with the 1988 Backcountry Management Plan, the 2006 Colorado River Management Plan, the 1995 GMP, and applicable NPS laws, policies, and regulations. Table 3.30 summarizes the park's divisions with backcountry management responsibilities.

Table 3.30 Current Backcountry/Wilderness Management Operations and Responsible Park Division

Park Division	Backcountry/Wilderness Management Operation	Staff/FTE*
Visitor and Resource Protection	Ranger activities: backcountry/Wilderness patrols, visitor education, search and rescue, backcountry permits	28.3**
Science and Resource Management	Research, resource management, inventory and monitoring, restoration/rehabilitation, tribal relations	11.0
Concessions Management	Commercial use management	~1.0
Interpretation and Resource Education	Education and interpretation	2.3
Facilities Management	Trail and facility maintenance; rehabilitation/restoration	28.8
Office of Planning and Compliance	Environmental analysis	~1.0

* FTE or full-time equivalent (100% time allocated) indicates staff time associated with backcountry/Wilderness management operations. Science and Resource Management FTE do not include compliance. River management staff not included

** An FTE may be one full-time position (permanent or seasonal), ten positions that contribute one-tenth of their time toward a particular responsibility, or any other combination

Ranger Activities

Visitor and Resource Protection (VRP) rangers are responsible for backcountry operations including visitor education, law enforcement, emergency medical response, SAR, preventative search and rescue (PSAR), backcountry permit issuance and verification, and resource protection. VRP rangers help to maintain backcountry toilets, assist interpretation with visitor education, and provide support for science and resource management activities. Rangers conduct patrols throughout the backcountry year-round. Three backcountry ranger stations exist in the Corridor Zone (Indian Garden, Phantom Ranch, and Manzanita [Roaring Springs/Cottonwood]), and one at the road-accessible primitive area Tuweep.

Tuweep is in the remote northwestern part of the park. Besides the Ranger Station, the area includes a dirt access road, trailhead access, overlook, and a campground with designated sites and composting toilets. The campground has 10 sites for a maximum of 65 people. Tuweep is a day use area, except for the campground and those with backcountry permits. The park's General Management Plan set day use limits

at a maximum of 30 vehicles or 85 visitors. Total limits include visitors to Toroweap Overlook, the campground, the Vulcans Throne area and local trails. One VRP ranger is responsible for managing this area, in addition to other remote backcountry areas in western Grand Canyon. Volunteers have been recruited over the past few years to assist the ranger with various duties. The ranger is responsible for medical assistance, law enforcement, backcountry patrols, resource protection, maintenance, education and interpretation, and any other staffing needs.

Canyon District rangers provide resource protection, law enforcement visitor and emergency services to all land areas below the rim of the Grand Canyon and are responsible for staffing Corridor Zone ranger stations. Phantom Ranch and Indian Garden Ranger Stations are staffed 365 days a year. Manzanita (Roaring Springs/Cottonwood) is staffed periodically from May to November. Rangers respond to medical incidents (200–250 per year) and initiate SAR evacuation for medical emergencies. In the Corridor Zone, rangers deal with approximately 250 law enforcement incidents and one to two arrests each year. Most law enforcement incidents deal with permit or resource violations.

During river patrols, river rangers assist with patrolling backcountry areas adjacent to the river corridor. South Rim and North Rim District rangers patrol rim backcountry areas.

A VRP ranger, usually a Canyon District ranger is assigned daily to respond to SAR calls. Grand Canyon averages 300 SAR calls per year. SAR incidents can occur anywhere in the backcountry. Typical rescues include visitors suffering from dehydration, heat exhaustion, and trips and falls. SAR Shift assigns resources to respond to the incident. Incidents can be simple hiker assists where the patient is able to hike out on their own to more complex missions involving the helicopter or technical rescue skills.

Preventative Search and Rescue

The PSAR program was developed to improve hiker education and decrease related injuries in 1997, and there was a subsequent 27% decrease in heat related incidents. In 2003 the program was redesigned as the *HIKE SMART* program with improved messaging.

PSAR rangers staff the upper sections of trails, primarily the Corridor trails, starting in May and continuing through October. PSAR statistics show that 38% of the general hiking public enters Grand Canyon's Corridor trails unprepared. 1% of hikers needed some form of physical, mental or medical support. PSAR averages 650 general contacts per day on the three busiest trails, South Kaibab, North Kaibab and Bright Angel.

Fire and Aviation

Fire and Aviation programs are also within this division. Fire operations are covered in the 2012 Fire Management Plan and will be discussed in Chapter 4 in cumulative impacts. The Aviation program provides support to the Facility Maintenance Division, Visitor and Resource Protection as well as other divisions. This support includes but is not limited to safety training, short haul, reconnaissance, fire activities, transfer of passengers, transporting supplies and equipment, and SAR incidents.

Backcountry Permits Program

The Backcountry Information Center (BIC) manages permit programs for overnight backcountry, Wilderness, and river use. All overnight backcountry/Wilderness users, and river trip participants camping away from their river trip camp, are required to obtain overnight backcountry use permits. Each year the BIC responds to tens of thousands of telephone calls, emails, and letters from individuals seeking information, hiking advice, and overnight backcountry permits; over 12,000 hiking groups (over 38,000 participants) succeed in obtaining one or more overnight backcountry permits. In 2012 this resulted in 94,248 backcountry user-nights, of which 53,911 occurred in the Corridor Zone.

Dependent on staffing, BIC employees not only manage the permit program but also patrol the backcountry for compliance with permits, clean backcountry toilets, and retrieve abandoned gear and other litter.

Currently, approximately 28.3 VRP FTE contribute to backcountry operations

Science and Resource Management
Research, Resource Management, Inventory/Monitoring
The Division of Science and Resource Management (SRM) conducts, coordinates, and contracts resource management and research activities, often in close cooperation with other park divisions, cooperators, and tribes. SRM is comprised of resource management specialists (cultural, wildlife, fisheries, vegetation, physical resources, and social sciences), planners, and research program managers. SRM has primary responsibility for inventory, monitoring, and stewardship of cultural resources, wildlife, threatened/endangered species, other park resources, and visitor experiences. In cooperation with park rangers, trail crew, recreation planners, and other park staff, SRM staff executes project elements to address resource concerns and impacts, including visitor impacts on vegetation, soils, archaeological sites, wildlife habitat, water quality, and campsite condition.

All research conducted in the park is reviewed and authorized through SRM. Research must meet park goals and objectives, and is reviewed to ensure compliance with NEPA, ESA, NHPA and consistency with Wilderness management objectives. Currently, 11 SRM FTE contribute to backcountry operations.

Concessions Management
The Concessions Management Division manages 22 concession contracts held by commercial operators including backcountry mule trips and commercial use authorizations (CUAs) for backpacking, day hiking, vehicle tours, and bicycle tours.

The Concessions Management Division also manages permits for filming and short-term special uses such as special events, public assembly, First Amendment activities, and weddings. Most of these activities do not occur in the backcountry; however, on occasion a special event may be permitted in the backcountry and is reviewed on a case-by-case basis. Currently, approximately one Concessions Management FTE contributes to backcountry operations.

Interpretation and Resource Education
The Division of Interpretation and Resource Education cooperates with other park divisions, universities, nonprofit organizations, and educational groups to provide educational opportunities throughout Grand Canyon, develop curricula and written interpretive materials and exhibits, and conduct backcountry service projects tied to SRM projects. Inner Canyon Interpretive programs are provided for backcountry visitors whether they are backpackers or mule riders. Interpretive staff members also provide interpretive training for licensed guides, outfitters, and other groups. Interpretive staff works in the inner canyon, March through November. Phantom is staffed 7 days per week and Indian Garden is staffed 3-4 days per week. Currently, 2.3 Interpretation and Resource Education FTE contribute to backcountry operations.

Facilities Management
Trail and Facility Maintenance
The trail crew maintains trails by conducting routine maintenance and rehabilitation/restoration projects. In addition, trail crew is responsible for maintaining backcountry toilets and managing the park's mule operation. The facility maintenance division operates the water and wastewater facilities and maintains the buildings and infrastructure in the canyon, all of which are located in the Corridor Zone. Finally, facility management maintains roads in the park's backcountry. Currently, approximately 28.8 FTE (26.8

Trail Crew and approximately two between Utilities and Road Crew) contributes to backcountry operations.

Office of Planning and Compliance
The Office of Planning and Compliance (OPAC) provides compliance and planning services when management activities require written environmental compliance (e.g., NEPA, NHPA, ESA) and Minimum Requirement Analysis as required by NPS Wilderness management policy. Currently, approximately one OPAC FTE contributes to backcountry operations.

Backcountry Infrastructure

In general, infrastructure includes roads providing access to and in the park, housing for staff required to work and live in the park, visitor orientation facilities, administrative buildings, management-support facilities, and utilities such as phones, sewer, water, and electric.

For this plan/DEIS, infrastructure with potential to be affected includes backcountry roads and trails; backcountry recreation facilities such as campgrounds and toilets; and backcountry management support facilities.

Backcountry Roads and Trails
Unpaved roads, trails, and routes are used for backcountry travel and access to remote areas and trailheads. Roads are used and managed primarily for motor vehicle travel; 75 miles of backcountry roads are open to visitor use (Appendix C, Backcountry Roads and Trails).

Trails are the predominant mode of backcountry transportation for park personnel, visitors, and stock. Grand Canyon has approximately 1,000 miles of maintained and unmaintained trails and routes at five levels of NPS classification (see Appendix D, Trail Class Standards). Corridor Zone Trails are classified as Class 4 (Highly Developed) and have extensive rock work and trail structures including bridges, retaining walls, rock riprap, log cribbing, and drainage structures. Backcountry Trails in Threshold and Primitive Zones are maintained to lower levels (Class 1, 2 or 3) while still protecting historical feature integrity.

Backcountry Recreation Facilities
In the Corridor Zone, camping is only allowed in established campgrounds. All campgrounds have tent pads, drinking water, picnic tables, food storage, bulletin boards, emergency phones, and toilets. Indian Garden has shade structures. The Threshold Zone has some established campsites with toilets. Table 3.31 identifies NPS-maintained backcountry toilet facilities described above.

Table 3.31 Backcountry Toilet Locations by Management Zone

Zone	Location		Type
Corridor	**Bright Angel Trail**		Composting/ Dehydrating
	Mile-and-a-half Resthouse	Indian Garden	
	Three-Mile Resthouse	Pipe Creek	
	South Kaibab Trail		
	Cedar Ridge	Tipoff	
	North Kaibab Trail		
	Cottonwood	Roaring Springs	
	Manzanita	Supai Tunnel	
	Phantom Ranch		Flush
	Delta Area	Campground	

Zone	Location				Type
Threshold	Hermit Creek Monument Creek	Horn Creek Deer Creek Clear Creek	Upper Tapeats Horseshoe Mesa	Uncle Jim Point Sublime	Composting/ Dehydrating
Primitive	Tanner Delta				
Tuweep (Proposed Road Natural)	Tuweep Campground; Toroweap Overlook				

Backcountry Management Support Facilities
The Corridor Zone has significant infrastructure to support visitor services, resource protection and research, maintenance, concession operations, and emergency services. Infrastructure includes utilities (telephones, electricity, data lines, water, sewage treatment, water pump stations), ranger stations, bunkhouses, remote quarters, bridges, scientific facilities, campground facilities, pack bars, toilets, concessioner facilities, mule barns, contact stations, amphitheaters, emergency phones, resthouses, helipads, hitchrails, SAR caches, weather stations, kiosks/bulletin boards, signs, radio utilities, and other historic landscape features.

Management support facilities are limited in other backcountry areas and include signs, temporary scientific structures and instruments, and emergency communication facilities.

Transcanyon Pipeline
The park's primary domestic water supply is provided by Roaring Springs, a natural spring located approximately 3,500 feet below North Rim. The 16-mile transcanyon pipeline, installed in the mid-1960s, feeds water to both sides of the canyon (see Figure 3.2).

To deliver drinking water to the heavily visited South Rim, the Pipeline runs downhill from Roaring Springs (with connections at Cottonwood Campground and Phantom Ranch) across the Colorado River on a suspension bridge, and Plateau Point and Indian Garden by residual pressure. At Indian Garden a pump station lifts water through a branched pipeline: one pipe follows a directionally drilled borehole to South Rim's developed area; another follows Bright Angel Trail to Three-Mile and Mile-and-a-half Resthouses. For North Rim, water is pumped from Roaring Springs via a seven-mile pipeline to storage tanks on top.

Portions are exposed and susceptible to breaks. Due to age, rockfall, and flood the Pipeline is continuously failing, and substantial reoccurring maintenance is required. Because of its remote and rugged location, access is only by trail or helicopter.

Administrative Use

In 2012, approximately 168 backcountry permits were issued for administrative use. Permits were issued to Grand Canyon National Park staff, Albright Training Center staff and students, the American Conservation Experience, Arizona Game and Fish Department staff, and non-NPS researchers. Trips were conducted to monitor and manage natural and cultural resources, restore native plants and remove non-native plants, maintain trails and toilets, educate and orient staff and visitors, and accomplish research. The backcountry permit system shows approximately 1,200 user nights for Administrative Use.

In addition to permitted trips, there are a number of patrols, resource management projects, and trail work that occur in the backcountry without a permit. Sometimes these groups set up a spike camp, for example Trail Crew sets up a camp along the South Kaibab Trail to complete necessary trail work and minimize

travel time to work location. For backcountry patrols, rangers often hike without permits so they can move as needed and not displace visitors.

Partnerships

NPS resource management, research, and educational trips are often supported through partnerships, cooperative agreements, and grant-funded programs. Educational trips have also been conducted under partnerships or agreements with universities, colleges, and other agencies. These groups participate in both day and overnight trips in the backcountry. Groups participating in these overnight trips obtain backcountry permits and are considered Administrative Use as described in the previous section.

Adjacent Lands

The park's backcountry and associated recreational use are influenced to varying degrees by agencies that administer or manage lands and resources adjacent to Grand Canyon National Park (see Map 3.3). Backcountry use, in turn, has potential to affect management of these lands and resources.

Other NPS Entities

Glen Canyon National Recreation Area
Glen Canyon National Recreation Area (GLCA) borders Grand Canyon National Park and encompasses 1,254,306 acres upstream of Grand Canyon, most of which is comprised of Lake Powell above Glen Canyon Dam, but also includes approximately 15 miles of the Colorado River below the dam. Attractions in this 15-mile river reach include a rainbow trout fishery, Lees Ferry historic ranch and ferry properties, hiking trails, and spectacular scenery. Private boating is popular, and daily, concession-operated, flat-water raft trips are available from the dam to the Lees Ferry dock. Several professional fishing guides operate out of Lees Ferry. The concessioner-operated flat-water trips and commercial fishing guides are overseen by GLCA.

Management guidance is provided by the 1979 GLCA General Management Plan (NPS 1979b) and the Strategic Plan for Glen Canyon National Recreation Area and Rainbow Bridge National Monument (NPS 2005c). Glen Canyon staff manages most of the Lees Ferry area.

Hiking opportunities in the Lees Ferry and Marble Canyon areas of GLCA consist primarily of day use (Cathedral Wash, Paria Canyon day hikes, etc.). There is no access to Grand Canyon's backcountry in this area; however, visitors to GLCA can access Grand Canyon backcountry from nearby BLM lands.

Lake Mead National Recreation Area
Lake Mead National Recreation Area (LAKE) encompasses 1,495,664 acres, mostly downstream (west) of Grand Canyon National Park. Former LAKE lands north of Grand Canyon were incorporated into Grand Canyon-Parashant National Monument. Guidance for management is provided by the 1986 Lake Mead National Recreation Area General Management Plan (NPS 1986a) and the 2002 Lake Management Plan (NPS 2002b).

Lake Mead lands border Grand Canyon's backcountry on Grand Canyon's west end.

Grand Canyon–Parashant National Monument
Established in 2000, Grand Canyon–Parashant National Monument borders western Grand Canyon between Grand Wash Cliffs and Toroweap Valley north of the Colorado River. The 1,014,000-acre monument is located on public lands administered and co-managed by BLM and NPS. Primary access to

Grand Canyon National Park in this area is by BLM roads. In 2008, BLM and NPS completed a Resource Management Plan (BLM/NPS 2008) for Grand Canyon-Parashant to guide management and use in the monument. This remote area has no paved roads or facilities other than Bar 10 Ranch, a private inholding which provides a variety of guest services.

Grand Canyon-Parashant National Monument borders approximately 15 of Grand Canyon's backcountry Use Areas and provides access to numerous Grand Canyon hiking and canyoneering opportunities. A number of roads throughout Grand Canyon-Parashant attract vehicle touring including jeeps, motorcycles, and all-terrain vehicles (ATV). Bar 10 Ranch, accessed across Grand Canyon-Parashant land or by helicopter from Grand Canyon National Park, offers overnight accommodations and area tours. Ranch guests can access Grand Canyon from several nearby locations including the Whitmore Trail.

Bureau of Land Management

Arizona Strip Field Office
The BLM, Arizona Strip Field Office manages, or in the case of Grand Canyon-Parashant National Monument, co-manages (with the NPS) approximately 2.8 million acres north and west of Grand Canyon. Included in this vast region are two national monuments and eight Wilderness areas.

In 2008, BLM completed revisions of the Arizona Strip Resource Management Plan (BLM 2008) and the Vermilion Cliffs National Monument Resource Management Plan (BLM 2008a). Grand Canyon staff members participated in the planning process to address issues that involve both Grand Canyon and subject lands.

In addition to access described for Grand Canyon-Parashant, BLM lands afford access to Grand Canyon in Marble Canyon below Navajo Bridge (such as Soap Creek and Rider and North Canyons). These lands border five of Grand Canyon's backcountry Use Areas. Visitors access Grand Canyon for both day and overnight hiking and technical canyoneering, and may camp overnight on BLM lands as part of this use. Permits are not required for overnight use on BLM land.

U.S. Forest Service - Kaibab National Forest
Two units of the Kaibab National Forest border Grand Canyon: Tusayan Ranger District on the South Rim (approximately 326,000 acres) and North Kaibab Ranger District on the North Rim (approximately 646,400 acres). Forest Service roads and a few backcountry trails provide access to Grand Canyon's backcountry.

From the Tusayan Ranger District, Grand Canyon can be accessed at Grandview and Rowe Well Roads. North Kaibab Ranger District roads provide access to Grand Canyon's backcountry including Nankoweap, North and South Canyon, Bill Hall, and Thunder River trailheads, as well as Fire and Swamp Points. These trails are long and difficult, and lengthy drives over primitive roads are required to reach the trailheads. Use is predominantly by backpackers.

Located in the North Kaibab National Forest on Grand Canyon's rim, the 17-mile Rainbow Rim Trail provides mountain biking and hiking opportunities. It is very popular with non-commercial and commercial bicyclists and hikers. In addition, the North Kaibab National Forest provides overnight camping opportunities, both at-large and in campgrounds, for visitors to both the forest and Grand Canyon.

Tribal Lands

Navajo Nation

The 12.5 million-acre Navajo Nation borders Grand Canyon National Park along the Colorado River's eastern bank from RM 0 near Lees Ferry to RM 61.5 at the Little Colorado River confluence. The Department of the Interior and Navajo Nation disagree on the boundary location. The Department of the Interior has determined Grand Canyon's eastern boundary and the Navajo Nation's western boundary generally lies 0.25 mile east of the historic high waterline on the Colorado River's eastern bank. The Navajo Nation asserts the boundary lies either in the middle of the river or along the river's eastern/southeastern bank. The NPS/Navajo Nation boundary continues midstream in the Little Colorado River Gorge for approximately two miles, where the NPS boundary turns south to the rim near Cape Solitude.

Navajo Nation lands include two tribal parks (Marble Canyon Tribal Park and Little Colorado River Gorge Tribal Park) adjacent to Grand Canyon's eastern boundary (on the western Navajo boundary). Relatively few campsites and attraction sites are located on the Navajo Nation in the canyon, but river runners do explore some side canyons, and some may venture more than 0.25 mile from the river. A limited number of non-commercial river runners also use rim-to-river trails that cross Navajo lands (e.g., Eminence Break, Salt Trail).

Lees Ferry rangers inform boaters that if they travel 0.25 mile above the pre-dam high water line, on river left, between Lees Ferry and the Little Colorado River they are on Navajo Nation lands, and hiking and camping on Navajo land requires a permit from the Navajo Parks and Recreation Department. Given the area's remoteness and shortage of enforcement personnel, non-compliance appears common. Non-permitted tribal use land is considered trespassing by the Navajo Nation and a concern to local residents. Where the river is accessible from the rim (e.g., Jackass Canyon), anglers and hikers are frequent visitors to the river, sometimes competing with river runners for campsites. At some future time, the Navajo Nation may choose to develop reservation lands adjacent to Grand Canyon, including recreational opportunities.

Havasupai Reservation

The 188,077-acre Havasupai Reservation is located within, and along the rim of, Grand Canyon. The reservation is most commonly accessed via Route 66 and Indian Road 18 to Hualapai Hilltop. The reservation can also be reached by Forest Road 328 which departs Highway 64 near between Tusayan and the park's South Entrance Station. The reservation can also be reached from the river by hiking up Havasu Canyon approximately four miles. Day hikers often venture onto tribal land to enjoy Havasu Creek's spectacular waterfalls, although the hike is a relatively long one: eight miles round-trip to Beaver Falls, 12 miles round-trip to Mooney Falls, 14 miles round-trip to Havasu Falls, and 18 miles round-trip to Supai village. A permit and associated fee is required to access Havasupai tribal land. As resources allow, the tribe stations personnel at reservation boundaries to ensure compliance, and NPS personnel inform park visitors of the required fee. Camping within the reservation is permitted only in designated campgrounds.

Hualapai Reservation

The Hualapai Tribe occupies a 992,463-acre reservation south of the Colorado River near the park's western end. The Hualapai Tribe and the Department of the Interior (DOI) disagree on the boundary location between the Hualapai Indian Reservation and Grand Canyon National Park. The Hualapai Tribe and DOI claim jurisdictional authority from about River Mile 164.5 to about River Mile 273.5 from the center of the river to the highwater [sic] mark on river left. A Memorandum of Agreement between the Hualapai Tribe, Grand Canyon National Park, and Lake Mead National Recreation Area was signed September 2000 to reduce further conflict on this issue and work towards a productive relationship. The

parties have committed themselves to mutual management to minimize the practical and operations impact of the boundary dispute (Hualapai Tribe, Grand Canyon, and Lake Mead 2000).

Visitors interested in accessing Grand Canyon's backcountry across Hualapai land are required to obtain a permit from the tribe. However, the tribe generally discourages this and does not typically permit backpacking or day hiking on reservation lands.

Wilderness Character

Background
Approximately 94% of Grand Canyon or 1,143,918 acres qualify for Wilderness designation as described in the 1964 Wilderness Act and NPS Management Policies 2006. Grand Canyon Wilderness complements other designated and proposed Wilderness Areas north of Grand Canyon on other NPS, BLM, and USFS lands (interactive map http://www.wilderness.net/map). If combined with over 400,000 acres of contiguous Designated and Proposed Wilderness, this area would be second only to the Death Valley Wilderness as the largest, primarily desert Wilderness area (Table 3.32, Map 3.3) in the U.S.

For a Grand Canyon Wilderness history, laws, and policies, see Chapter 1, History of Grand Canyon Wilderness Planning and Management.

Table 3.32 Wilderness Areas Contiguous to Grand Canyon (Map 3.3)

Proposed Wilderness	Manager		Acres
Grand Canyon	NPS	Proposed lands would be managed as Wilderness as required by NPS Management Policies and Director's Order 41. No actions would be taken that diminish Wilderness eligibility until legislative processes are complete	1,143,918
Grand Canyon-Parashant			190,475
Designated Wilderness			
Mount Trumbull Mount Logan	BLM	Grand Canyon-Parashant National Monument	7,880 14,650
Paria Canyon-Vermilion Cliffs	BLM	Vermilion Cliffs National Monument	112,500
Saddle Mountain	USFS	Kaibab National Forest	40,539
Kanab Creek	USFS/ BLM	Kaibab National Forest (68,600) Bureau of Land Management (6,700)	75,300
		Total Combined Acreage	**1,585,262**

Grand Canyon Wilderness Description
The Grand Canyon's Wilderness rim begins on the far west end where the park and Wilderness is bounded by BLM, LAKE, and Hualapai Reservation lands (Map 3.3). This area contains the Grand Wash Cliffs escarpment on the Colorado River's south side. On the river's north side, remote Grand Canyon Wilderness areas include the Sanup Plateau and the Uinkaret Mountains' southern extension, bounded by Grand Canyon–Parashant National Monument with its proposed and designated Wilderness areas (Table 3.32).

Grand Canyon Wilderness' northwest area includes Toroweap Valley and Kanab Plateau. Toroweap Valley's primitive, non-wilderness road corridor provides access to the Tuweep road-accessible primitive area, Tuweep Ranger Station, campground, and Toroweap Overlook. The Kanab Plateau is characterized by flat-to-gently rolling expanses of pinyon-juniper woodlands, presenting a contrast to the Inner Canyon desert below. Non-wilderness road corridors provide access to scenic overlooks, trailheads, and camping

at Kanab, SB, and Tuckup Points, and 150 Mile Canyon. This area is bounded by BLM and USFS lands including Kanab Creek Wilderness co-administered by both agencies.

The North Rim's Wilderness on the Kaibab Plateau includes expansive forests and meadows. Access to North Rim's Wilderness interior is primarily by foot. Primitive, non-wilderness road corridors provide access to scenic overlooks, camping, and trailheads at Swamp and Fire Points, and Point Sublime. This area is bounded by USFS lands including Saddle Canyon Wilderness Area.

On the South Rim north of Desert View, the Wilderness includes the 12-mile hiking route to Cape Solitude above the confluence of the Little Colorado River. This area is bounded by the Navajo Reservation. The Wilderness continues west of Hermits Rest, and is bound on the south by the USFS–NPS Boundary Road, on the west by the Havasupai Reservation. Access to the area (Pasture Wash) requires travel across Havasupai Tribal lands. A non-wilderness road corridor provides access to South Bass Trailhead and Havasupai Point.

The majority of Grand Canyon Wilderness lies in the Inner Canyon (below the rim). The exception is the non-wilderness Corridor Zone along Bright Angel, South Kaibab, and North Kaibab Trails which includes campgrounds, guest cabins, and administrative facilities.

Incomplete or Unavailable Information

CEQ (1502.22) requires agencies obtain information "relevant to reasonably foreseeable significant adverse impacts," "essential to a reasoned choice among Alternatives," or if "costs of obtaining it are not exorbitant." Costs are measured in both money and time. EISs should state when data are lacking, models are error-prone, or insufficient research and experience are available for predicting impacts accurately.

To that end it should be noted that Grand Canyon does not have a Wilderness Stewardship Plan that comprehensively defines wilderness character or assesses Grand Canyon wilderness character's current condition as prescribed by guidance issued during preparation of this plan/DEIS including

- Keeping it Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring (NPS 2014)
- Wilderness Stewardship Plan Handbook: Planning to Preserve Wilderness Character (NPS 2014a)

However, the park has described and analyzed Wilderness qualities and Character and impacts of management actions on the same in resource management and project plans and NEPA documents (EAs, EISs, etc.) including the Colorado River Management Plan, Fire Management Plan, Exotic Plant Management Plan, Comprehensive Fish Management Plan, Resource Management Plan, etc., and has committed to managing park Wilderness "to preserve its wilderness character" as prescribed by law and policy (see Management below).

The Greater Grand Canyon Landscape Assessment, a separate ongoing process to assess park natural and cultural resource conditions, will provide a foundation for a state of the Wilderness assessment by identifying priority resources and appropriate conditions, synthesize information on current status and trends, and evaluate potential threats to resources and wilderness character. The GGCLA, expected to be completed in 2015, will allow Grand Canyon managers to integrate current and future monitoring and adaptive management processes to address internal and external threats to Wilderness resources

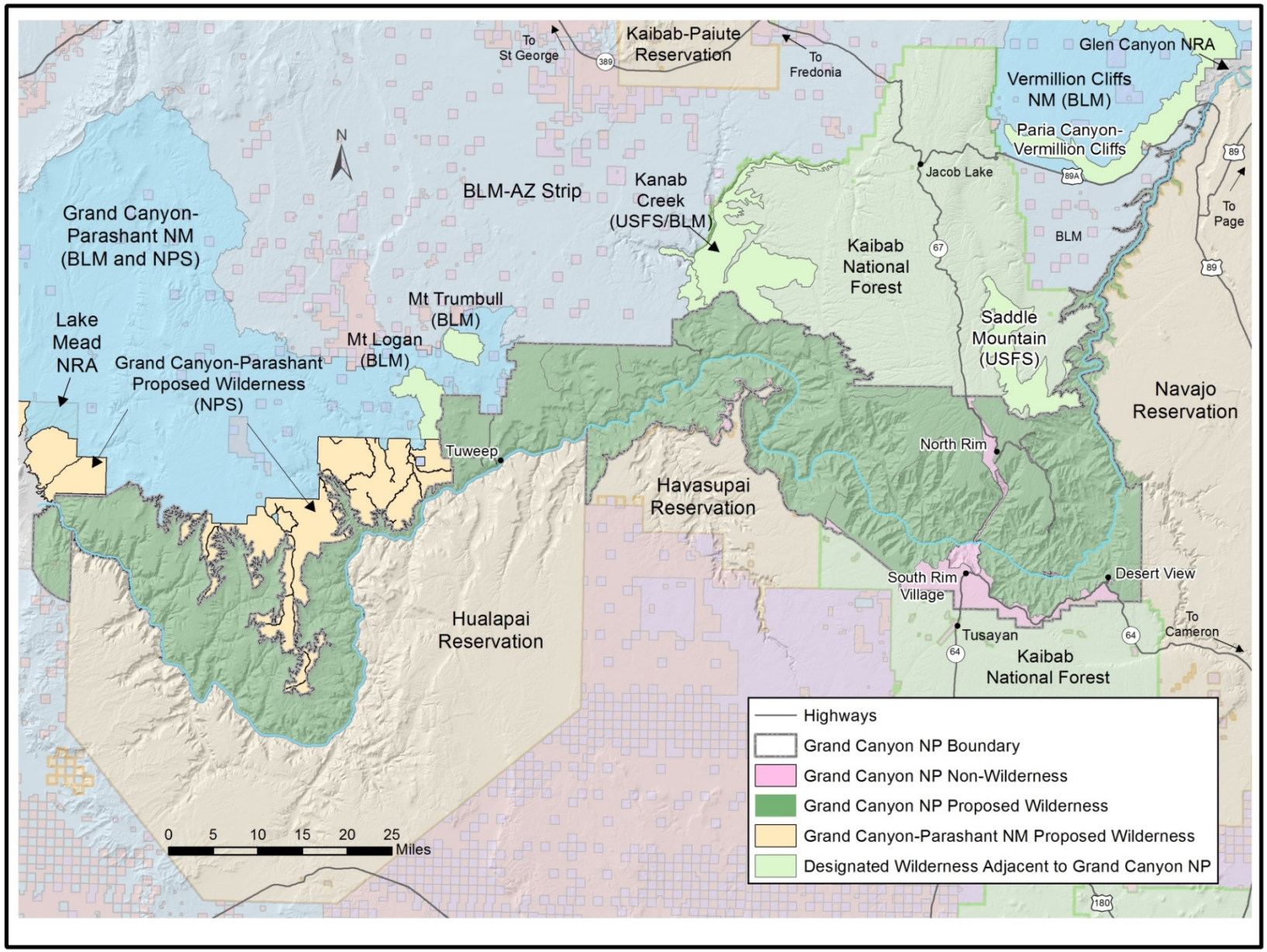
Wilderness Management

Section 4 of the Wilderness Act describes authorized uses of Wilderness. Subsection 4(a) declares, with specific legislative references, the Wilderness Act shall be supplemental to purposes for which national forests, parks, and refuges have been established.

Subsection 4(b) states in part, “Except as otherwise provided in this Act, each agency administering any area designated as Wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character.” Thus, except for specified provisions in the legislation, Wilderness areas shall be devoted to recreational, scenic, scientific, educational, conservation, and historical uses.

Subsection 4(c) prohibits certain uses (unless specifically provided elsewhere in the Act) inconsistent with Wilderness preservation. With the exception of minimum actions needed for administrative duties and emergency health and safety procedures, the Act prohibits temporary roads, motor vehicle use, motorized equipment or motorboats, landing of aircraft, mechanical transport, structures, and installations.

Map 3.3 Grand Canyon Wilderness and Adjacent Lands



Section 4 also addresses special provisions for certain Wilderness uses. Subsection 4(d) (1) states in part, "Within Wilderness areas designated by this Act use of aircraft or motorboats, where these uses have already become established, may be permitted to continue…" These uses are subject to such restrictions as the administering federal official deems desirable. Subsection 4(d)(5) permits performance of commercial services in Wilderness "to the extent necessary for activities proper for realizing recreational or other Wilderness purposes of this act."

NPS Wilderness Management Policy requires management decisions be consistent with Minimum Requirement Analysis (Appendix E). When determining MRA, potential disruptions of wilderness character and resources will be considered. MRA applies to all administrative activities. Grand Canyon established a MRA to document decisions related to administrative activities. NPS policy also states commercial recreational services are subject to MRA.

Wilderness Character

According to the GMP (NPS 1995), areas proposed for Wilderness offer visitors opportunities for solitude and primitive recreation. An important GMP provision states, "The management of these areas should preserve Wilderness values and character."

Subsection 2(c) of the Wilderness Act defines *Wilderness* as

> *A Wilderness, in contrast with those areas where man and his 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.*

The same subsection 2(c) further defines Wilderness as having the following characteristics

- Undeveloped land retaining its primeval character in influence without permanent improvements or human habitation
- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation
- May contain ecological, geological, scientific, educational, scenic, or historical value

Wilderness character is defined by DO/RM 41 as, "The combination of biophysical, experiential, and symbolic ideals that distinguishes Wilderness from other lands. The five qualities of wilderness character are Untrammeled, Undeveloped, Natural, Solitude or a Primitive and Unconfined Type of Recreation, and Other Features of Value."

This plan/DEIS adopts definitions and concepts developed through an interagency process to establish a framework for monitoring conditions related to wilderness character (Landres et al. 2008, NPS 2014, NPS 2014a). All Wilderness areas, regardless of size, location, or any other feature, are unified by the statutory definition. The five qualities of wilderness character are

- **Untrammeled**
  Wilderness is essentially unhindered and free from modern human control or manipulation. This quality pertains to actions that manipulate or control ecological systems

- **Natural**
  Wilderness ecological systems are substantially free from the effects of modern civilization. This quality pertains to the intended and unintended human-caused effects on natural and cultural resources conditions

- **Undeveloped**
  Wilderness is essentially without permanent improvements or modern human occupation. This quality pertains to the presence of temporary or permanent scientific installations and facilities and the use of motorized equipment and transportation within Wilderness

- **Outstanding opportunities for solitude or a primitive and unconfined type of recreation**
  Wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation. This quality pertains to visitor opportunities to experience a primitive setting and remoteness from sights and sounds of people and recreational structures within the Wilderness

- **Other Features of Scientific, Educational, Scenic or Historical Value**
  DO/RM 41 defines Other Features of Value as attributes not required of or found in every Wilderness that reflect a Wilderness' specific wilderness character, and is based on the Wilderness Act's Section 2(c) that states a Wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This component captures important Wilderness elements not covered in the other four wilderness character qualities such as cultural or paleontological resources. Grand Canyon Wilderness protects an important cultural history and extensive archaeological record, and Grand Canyon has identified cultural resources as an important component of wilderness character.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

The "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternative elements described in this Draft Backcountry Management Plan and Environmental Impact Statement (plan/DEIS). In addition, this chapter includes a list of issues related to the impact topics identified in public and internal scoping and tribal consultation, a summary of laws and policies relevant to each impact topic, intensity definitions (negligible, minor, moderate, and major) and methods used to analyze impacts including direct, indirect, and cumulative impacts. As required by the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA), a summary of the environmental consequences for each alternative is provided in Table 2.16, and the organization of these topics, correspond to the resource discussions contained in Chapter 3, Affected Environment.

For a complete discussion guiding authorities, refer to the section titled "Related Laws, Policies, Plans, and Constraints" in Chapter 1, Purpose of and Need for Action.

General Assumptions

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

ANALYSIS PERIOD

This plan/DEIS establishes objectives and specific management actions needed to backcountry use in Grand Canyon National Park for at least the next 20 years; therefore, the analysis period used for assessing impacts is 20 years into the future. The impact analysis for each alternative is based on the principles of adaptive management, which would allow the NPS to change management actions over time as new information emerges through monitoring the results of management actions, ongoing research, or the development of new technology.

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The general geographic study area for this plan/DEIS is Grand Canyon National Park in its entirety. However, the area of analysis may vary by impact topic beyond the boundaries of the park as applicable.

TYPE OF IMPACTS

The following general assumptions are used for all impact topics. Where these vary for an impact topic, it has been noted in the section "Assumptions, Methodology, and Intensity Definitions."

- Direct: Impacts would occur as a direct result of backcountry management actions.
- Indirect: Impacts would occur from backcountry management actions but would occur later in time or father removed in distance.
- Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- Adverse: A negative change to the appearance or condition of the resource.

INTENSITY DEFINTIONS

The terms “impact” and “effect” are used interchangeably throughout this document. The impacts are qualitatively and quantitatively assessed using definitions that provide the reader with an idea of the intensity of a given impact on a specific topic. The intensity definition is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts.

In order to focus on measurable impacts, the analysis includes those impacts that are minor or greater. Impacts negligible or less are not discussed in most cases.

FORMAT FOR THE ANALYSIS

For each impact topic, issues related to the topic, desired conditions, guiding regulation and policies, methodology, intensity definitions, and assumptions for that topic are presented first to provide context for how the resource topic was evaluated. These sections are then followed by the detailed impact analysis and description of potential impacts for each alternative.

CUMULATIVE IMPACTS

The CEQ regulations that implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the park and, if applicable, the surrounding region.

Table 4.1 summarizes the actions that could affect the various resources at the park. These actions are described in more detail in the “Related Policies, Laws, Plans, and Actions” section of this document (see Chapter 1, Purpose of and Need for Action).

Table 4.1 Cumulative Impact Scenario

Impact Topic	Past Actions	Present Actions	Future Actions
Soils	Glen Canyon Dam operations Fire Management Plan (2012) Mule Operations and Stock Use Plan (2011) Trespass wildlife Recreational use by other users such as river runners	Glen Canyon Dam operations Fire management Stock use on Corridor Trails Trespass wildlife Recreational use by other users such as river runners	Long-term Experimental and Management Plan for Operation of Glen Canyon Dam Fire management Stock use on Corridor Trails Trespass wildlife Recreational use by other users such as river runners
Water Resources	Glen Canyon Dam operations Fire management Trespass wildlife Recreational use Contamination of surface waters	Glen Canyon Dam operations Fire management Trespass wildlife Recreational use Contamination of surface waters	Long-term Experimental and Management Plan for Operation of Glen Canyon Dam Fire management Trespass wildlife Recreational use Contamination of surface waters Proposed developments near South Rim
Soundscape	Commercial air tours Transportation flights Aircraft flights for fire management Flights by other agencies, tribes and landowners Vehicle, building, machinery and electronic noise from developed areas Motorboats on the Colorado River	Commercial air tours Transportation flights Aircraft flights for fire management Flights by other agencies, tribes and landowners Vehicle, building, machinery and electronic noise from developed areas Motorboats on the Colorado River	Commercial air tours Transportation flights Aircraft flights for fire management Flights by other agencies, tribes and landowners Vehicle, building, machinery and electronic noise from developed areas Motorboats on the Colorado River
Cave Resources	River management and recreation	River management and recreation	River management and recreation Cave and Karst Management Plan
Vegetation	Glen Canyon Dam operations River management Fire management Trespass wildlife Mule Operations and Stock Use Plan (2011)	Glen Canyon Dam operations River management Fire management Trespass wildlife Stock use	Glen Canyon Dam operations River management Fire management Stock use

Impact Topic	Past Actions	Present Actions	Future Actions
Wildlife	Fire management Overflights Maintenance/construction Vegetation/habitat restoration River management Glen Canyon Dam operations	Fire management Overflights Maintenance/construction Vegetation/habitat restoration River management Glen Canyon Dam operations	Fire management Overflights Maintenance/construction Vegetation/habitat restoration River management Glen Canyon Dam operations
Special Status Plant Species	Glen Canyon Dam operations River management Fire management Trespass wildlife Stock use	Glen Canyon Dam operations River management Fire management Trespass wildlife Stock use	Glen Canyon Dam operations River management Fire management Trespass wildlife Stock use
Special Status Wildlife Species	Fire management Overflights Maintenance/construction Vegetation/habitat restoration (tamarisk removal) River management Glen Canyon Dam operations	Fire management Overflights Maintenance/construction Vegetation/habitat restoration River management Glen Canyon Dam operations	Fire management Overflights Maintenance/construction Vegetation/habitat restoration River management Long-term Experimental and Management Plan for Operation of Glen Canyon Dam
Archaeological Resources	Fire management Maintenance activities Glen Canyon Dam operations	North Rim road improvements Archaeological site mitigation Fire management Maintenance Glen Canyon Dam operations	Archaeological site mitigation Fire management Maintenance Long-term Experimental and Management Plan for Operation of Glen Canyon Dam
Historic Structures	Fire management Construction and maintenance Vandalism, human waste disposal issues, litter, campfires	Maintenance activities Fire management Vandalism, human waste disposal issues, litter, campfires	Transcanyon pipeline Maintenance activities Fire management Vandalism, human waste disposal issues, litter, campfires
Traditional Cultural Properties and Ethnographic Resources	Fire management Maintenance activities Glen Canyon Dam operations Colorado River Management Archaeological site mitigation	North Rim road improvements Archaeological site mitigation Fire management Maintenance Glen Canyon Dam operations	Archaeological site mitigation Fire management Maintenance Long-term Experimental and Management Plan for Operation of Glen Canyon Dam
Cultural Landscapes	Fire management Construction and maintenance activities Non-native plant growth	Unauthorized maintenance activities Additional of non-compatible features	Transcanyon pipeline Fire management Construction and maintenance activities Non-native plant growth

Impact Topic	Past Actions	Present Actions	Future Actions
Visitor Use and Experience	Fire management Aircraft overflights Colorado River Management Plan Construction projects Glen Canyon Dam operations Stock use	Changes to outdoor lighting Colorado River Management Plan Fire management Aircraft overflights Motor boats on the river Construction projects Glen Canyon Dam operations Mule Operations and Stock Use EA	Transcanyon pipeline Colorado River Management Plan Fire management Aircraft overflights Motor boats on the river Construction projects Glen Canyon Dam operations Stock use
Socioeconomic Resources	Colorado River Management Plan Education and interpretation Aircraft overflights Construction projects	Colorado River Management Plan Education and interpretation Aircraft overflights Construction projects	Potential developments in Tusayan and other adjacent communities Transcanyon pipeline Colorado River Management Plan Education and interpretation Aircraft overflights Construction projects
Park Management and Operations	Fire management Corridor facility maintenance Transcanyon pipeline maintenance Trail maintenance Colorado River use and resource management Management of commercial services Ranger operations Education and interpretation Fisheries Management	Fire management Corridor facility maintenance Transcanyon pipeline maintenance Trail maintenance Colorado River use and resource management Management of commercial services Ranger operations Education and interpretation Fisheries Management	Fire management Corridor facility maintenance Transcanyon pipeline maintenance Trail maintenance Colorado River use and resource management Management of commercial services Ranger operations Education and interpretation Fisheries Management
Adjacent Lands	Fire management Mining Recreational use Aircraft overflights Exotic plant management Construction projects	South Rim Transportation Plan South Entrance Road and Desert View Improvements Fire management Mining Recreational use Aircraft overflights Exotic plant management Construction projects	Potential developments in Tusayan and other adjacent communities Fire management Mining Recreational use Aircraft overflights Exotic plant management Construction projects

Impact Topic	Past Actions	Present Actions	Future Actions
Wilderness Character	Fire management Mining Recreation use Aircraft overflights Exotic plant management Fish management Motorized and non-motorized use River use and research	Fire management Mining Recreation use Aircraft overflights Exotic plant management Fish management Motorized and non-motorized use River use and research	Fire management Mining Recreation use Aircraft overflights Exotic plant management Fish management Motorized and non-motorized use River use and research Long-term Experimental and Management Plan for Operation of Glen Canyon Dam

The analysis of cumulative impacts was accomplished using four steps:

Step 1 — Identify Resources Affected

Fully identify resources affected by any of the alternatives. These include the resources addressed as impact topics in Chapters 3 and 4.

Step 2 — Set Boundaries

Identify an appropriate spatial and temporal boundary for each resource.

Step 3 — Identify Cumulative Action Scenario

Determine which past, present, and reasonably foreseeable future actions to include with each resource. Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a reasonable official of ordinary prudence would take such activities into account in reaching a decision. These activities include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite (U.S. Department of the Interior NEPA regulations 43 CFR 46.30).

Past, present and reasonably foreseeable future actions are listed in Table 4.1.

Step 4 — Cumulative Impact Analysis

Summarize impacts of these other actions (x) plus impacts of the proposed action (the alternative being evaluated) (y), to arrive at the total cumulative impact (z). This analysis is included for each resource in Chapter 4.

Natural Resources

Soils

ISSUES

Issues regarding soils identified through public and internal scoping include

- NPS has a duty to protect natural resources, including soils, within the park
- Human waste from backpackers changes soil chemistry locally
- Disturbance from hiking leads to soil erosion, especially in area with soil crusts
- River assisted backcountry travel could lead to local social trailing
- Canyoneering activities have the potential to increase impacts to skeletal soils, wetland soils, and create social trails which increase erosion
- Conversion of roadbeds to trails may increase use in some areas, increasing soil loss and social trailing
- Rim-based car camping may increase soil loss within the footprint of camping areas
- High use areas such as Hermit and Monument are heavily impacted by users burying waste in a small area
- Canyoneering is introducing users to areas which are relatively unvisited and show few impacts from recreation. Limitations placed on use levels to reduce impacts in one location may shift use to others places with even less evidence of use

DESIRED CONDITIONS

- The overall desired condition for soils in Grand Canyon are to function in as natural a condition as possible, except where special considerations are allowable under policy

METHODOLOGY

A profile of soils impacts was developed based on the 2002 NRCS Grand Canyon Soil Survey (Chapter 3), the NRCS Soil Data Viewer, site investigations, and an existing literature review. Impact significance was determined through consideration of topography, soil types, and foreseeable future development for each alternative.

INTENSITY DEFINITIONS

Soil-specific impacts from backcountry activities are characterized for each alternative based on intensity definitions defined below.

Intensity

Negligible	Adverse impacts to soils and biological crusts would not be perceptible or measurable. Beneficial impacts improve the condition of soils at minute levels. Any changes to soil productivity, integrity, stability, or fertility would be imperceptible.
Minor	Beneficial or adverse effects to soils and biological crusts would be barely perceptible or measurable. Adverse impacts to soil productivity, integrity, stability, or fertility would be small and reversible. Beneficial effects would improve the condition of soils slightly.

Moderate Beneficial or adverse impacts to soils and biological crusts readily perceptible and measurable. Effects to soil productivity, integrity, stability, or fertility readily apparent and would result in a change to soils character. Mitigation measures would be necessary to offset adverse effects and would likely be successful. Beneficial effects would substantially improve the condition of soils, greatly reducing the amount of mitigation necessary.

Major Adverse impacts to soils and biological crusts would be readily perceptible, measurable, and constitute a substantial change from current conditions. Effects to soil productivity, integrity, stability, or fertility would be readily apparent and would substantially change the character of the soils. Mitigation measures to offset adverse effects would be needed, they would be extensive, and their success would not be guaranteed. Beneficial effects would return soils back to natural conditions, and mitigation would not necessary

Context

Localized Impacts at campsites, lunch stops, attraction sites, and along trails within a hydrologic zone (shoreline, new high-water zone, old high-water zone), and up side canyons or at seeps and springs

Regional Impacts within an entire Use Area or across many parts of a management zone

Duration

Short-term Impacts occur over one season. Soils and biological crusts return to pre-disturbance condition the next year

Long-term Impacts accumulate over several seasons, lasting longer than one year

ASSUMPTIONS

Assumptions specifically related to the alternatives and their impacts on soils are

- Geographic areas with potential for impacts to soils include trails, lunch stops, attraction sites, campsites, roads and natural road corridors and areas accessible to hikers, canyoneers, and packrafters
- Impacts to biological crusts are long-term because when crusts are trampled, they take many years to recover
- Non-commercial and commercial groups are considered to behave similarly at campsites; however, impacts to soils from small groups (compared to large groups) are different. Large groups tend to spread out more, especially at sites with limited campable area
- The more time groups spend at a campsite, the greater probability for impacts to soils outside the campable area because they are more likely to explore the area outside of camp and would likely impact more areas from human waste through trailing and catholing
- User nights and group nights available for commercial use would fill more consistently than those available for non-commercial use because trips would be advertised and promoted by commercial companies
- Commercial groups tend to be larger than non-commercial groups (average of 5.1 users/group vs. 3.3 users/group)
- Non-summer hiking is more conducive to longer overnight backcountry trips and exploring side canyons, as the summer's extreme heat precludes hiking far from trails and campsites
- Designated campsites focus impacts to soils, including compaction, trailing, and loss, in an area centered on the barren core. At-large camping leads to social trailing and soil loss/erosion in a more diffuse pattern.

- Large groups have disproportionately greater impacts on areas than small groups. Members of large groups tend to spread out into unaffected areas in search of solitude and areas to sleep, expanding the areas of disturbed soils and cleared vegetation.
- Impacts can occur any time of year, but soils and biological crusts are especially susceptible to erosion, compaction, and gullying during spring runoff and summer monsoons. Soil texture, organic-matter content, and surface conditions influence susceptibility to disturbance. Soil characteristics and moisture content at time of impact influence degree to which physical properties are affected. Soil moisture content can also play a major role in determining compaction disturbance since compaction often increases in wet soils. Biological crusts are susceptible year-round, but are particularly vulnerable during dry, hot months

IMPACT ANALYSIS

Potential Day and Overnight Use Impacts to Soils

Because many of the impact topics include aspects of day hiking, camping, stock use, vehicles, and bicycles, impacts of these activities are described in this section then referred to when these activities are mentioned in the sections that follow.

The primary consequence of backcountry use on soils is compaction and erosion (Liddle 1975). Impacts vary with frequency, type of use, season, soil type, and environmental settings (Cole 2004, Leung and Marion 2004). Trampling disrupts soil structure and removes overlying litter and vegetation which protect it from erosion by wind and water. The greatest impacts occur during the initial onset of use, with subsequent impacts adding progressively less damage (Olive and Marion 2009, Kissling et al. 2009, Cole 2004, but see Monz 2013). Foot- and bicycle traffic have more or less equal impacts on soil (Pickering et al. 2010, Pickering et al. 2011, Thurston and Reader 2001), but stock and motor vehicles have impacts 15 to 30 times as rapid and severe (Buckley 2004). Trails in moist soils (e.g., riparian areas) and steep topography are especially susceptible to erosion following recreation use (Phillips and Phillips 1976, Cole 2004).

Recreation impacts to soil crusts in Grand Canyon are of special concern because they reduce erosion and promote growth of vascular plants in areas of low rainfall that otherwise support only limited vegetation (Cole 1990, Belnap et al. 2001, NRCS 1997, Bowker 2007). Trampling by humans and stock disrupts the structure of crusts, reduces soil microbial activity, and leads to loss of the protective properties of intact crusts (Beymer 1989, Brotherson et al. 1983, Cole 1990, Belnap et al. 2001, Bowker 2007). In addition, the integrity of the soil microbiota is important because crust components themselves vary with soils, moisture, and associated vegetation (Andersen and Rushforth 1976, Johanson 1993, Belnap et al. 2001) and therefore losses of crusts would represent losses to the biological integrity of the park. As with compaction and erosion of soils, the most severe impacts to crusts happen with the onset of disturbance (Cole 1990).

User-created trails ("social trails") multiply the impacts of backcountry recreation in camping areas, attraction sites, and areas without maintained trails. Users in camps and attraction sites without backcountry toilets will fan out through surrounding areas and enter unaffected areas to deposit human waste. Social trails near campsites are also created by users seeking shade and / or solitude. In Grand Canyon's desert setting, much recreation is focused on fragile riparian areas of side canyons without maintained trails. Braided trails and multiple campsites develop when the area enters a cycle in which bare, compacted soils erode, leading users to create new trails in which vegetation is trampled and soils erode (Phillips and Phillips 1976).

Human waste disposal in the backcountry has several impacts to soils. Deposition of urine and feces changes soil chemistry and creates potential infection sources in areas with heavy visitation in addition to surface disturbance from cat holing and disturbance and erosion along social trails (Carothers and

Johnson 1984, Climburg et al. 2000). Generally, backcountry users will seek out unused areas and will avoid areas with extensive waste and toilet paper (Cole 1990a), leading to expansion of impacted areas.

ALTERNATIVE A

Alternative A would continue existing management practices resulting in current trends in visitor use and recreation opportunities. Routine impacts to soils under Alternative A are from backcountry recreational use, and park operations and administrative use. Most backcountry activities impact soils to varying degrees.

Climbing Management

Climbing occurs on overnight backpacking, day use, and river trips. The number of visitors engaging in climbing activities is unknown but climbing has been occurring for decades (Butchart 1976, Tomasi and Tomasi 2001). Impacts to soils are unlikely to occur during climbing activity itself, but access to and use of climbing routes has potential to impact soils via trailing and damage during access, staging, and belay. Continuing current management practices related to climbing would continue the minor to moderate, adverse, localized, short and long-term impacts to soils.

Canyoneering Management

Canyoneering is an emerging activity for which little data about use levels and impact exists. However, access to and use of canyoneering routes has potential to impact soils (see *Potential Day and Overnight Use Impacts to Soils*). Currently, no group size or number limits exist for these activities, unless the trip is part of an overnight itinerary for which a permit is required; then group size is based on Use Area limits. With no change in management, negligible to minor, adverse, localized, short and long-term impacts would continue to occur to soils.

Extended Day Hiking and Running Management

In general, Corridor Zone trail width is sufficient to accommodate Extended Day Hiking and Running without trail users stepping aside onto previously undisturbed areas. However, because no limits on group numbers or size currently exist, congestion occurs, causing impacts to soils when users step off the trail. General trail etiquette and minimum impact techniques could mitigate impacts, but no consistent method of information dissemination exists. Continuation of current management of extended day hiking and running would result in minor to moderate, adverse, localized, short and long-term impacts to soils.

Tuweep Day Use Management

Tuweep vehicle and people numbers at one time were set by the 1995 GMP. However, numbers are not limited and insufficient durable surfaces exist to accommodate current use levels. Results are constant impacts on soils primarily from vehicles (see *Potential Day and Overnight Use Impacts to Soils*). Continuing current management of Tuweep day use would produce minor to moderate, adverse, localized, short and long-term impacts to soils.

Use Area Management

Since management zones and Use Areas were established by the 1988 Backcountry Plan, it has been determined that some Use Areas cannot support their assigned level of use without adverse impact. For example, some camp areas designed in 1988 are too small for large groups which results in continuous expansion of sites (see *Potential Day and Overnight Use Impacts to* Soils). In Use Areas with planned heavy and designated campsites, users who cannot stay on itinerary due to difficult topography have created additional camps where soils become compacted and eroded. The 1998 Backcountry Plan included no strategy for altering use intensity (group number or size) when backcountry impacts exceed limits of acceptable change. Minor to moderate, localized, short and long-term adverse impacts would continue to occur to soils under current management.

Human Waste Management
Grand Canyon's current strategy for backcountry human waste management has negative impacts on soils. In high use areas without toilet facilities (e.g., Granite Rapids, Hermit Rapids), there are many and extensive impacts to soils arising from disposal of human waste (see *Potential Day and Overnight Use Impacts to Soils*). Minor to moderate, adverse, localized, short and long-term impacts would continue to occur to soils as a result of continuing current human waste management.

Administrative Use
Administrative use includes resource management, maintenance, visitor protection, visitor education, and research. Administrative users are subject to the same overnight permit requirements as other users, and overall impacts to soils are similar (see *Potential Day and Overnight Use Impacts to Soils*). Impacts to soils from camping and hiking related to administrative use would be minor, adverse, short and long-term, and localized.

Administrative use also includes maintenance and restoration activity in the backcountry which requires activities outside established camps and trails. Trail maintenance, vegetation restoration, work on backcountry facilities, and firefighting all have minor to moderate, adverse, localized, short to long-term impacts on soils. However, hardening of trails, addressing erosion problems, and restoring vegetation to stabilize soils would result in minor to moderate, beneficial, localized and regional, long-term impacts to soils.

NPS and Cooperating Association Programs (Non-commercial Services)
The National Park Service and its official cooperating association, the Grand Canyon Association and its field institute (Grand Canyon Field Institute), provide public non-commercially guided services which are subject to the same overnight permit requirements as other users, but have no day use limits. Backcountry day use, such as interpretive talks, has similar impacts to those caused by other day users (see *Potential Day and Overnight Use Impacts to Soils*). However, impacts may be lessened because group leaders are required to provide Leave No Trace guidance and alert participants if resource concerns are observed. Overnight and day use from non-commercial groups is less than 1% of total use and therefore impacts to soils resulting from continuing current management would be minor, adverse, localized, and short to long-term.

Commercial Overnight Backpacking
Commercial overnight backpacking trips are subject to the same overnight permit requirements as other backcountry users, and impacts to soils would be similar (see *Potential Day and Overnight Use Impacts to Soils*). Commercial overnight backpacking comprises approximately 9.1% of total overnight backpacking in the park. Commercial use authorizations require some guide qualifications including Leave No Trace training and knowledge of park regulations, resource protection, and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, fewer impacts to soils are expected when compared to uneducated backcountry users. Continuing current management of commercial overnight backpacking would result in negligible to minor, adverse, localized, short and long-term impacts to soils.

Commercial Day Hiking
Commercial day hiking trips are subject to group size limits (11 people/group), guide-to-client ratios, and guide qualifications requirements. The latter include Leave No Trace, park regulations, resource protection, and trail etiquette. Impacts to soils would be similar to non-commercial day users (see *Potential Day and Overnight Use Impacts to Soils*); with qualified and educated guides familiar with Grand Canyon backcountry, fewer impacts to soils are expected. Continuing current management of

commercial day hiking would produce negligible to minor, adverse, localized, short and long-term impacts to soils.

Commercial Backcountry Vehicle Tours (Tuweep)
Under current management, up to 10 commercial backcountry vehicle tours per day (five at a time) are allowed at Tuweep. These groups are not expected to have a large impact on soils because commercial tours are currently permitted on park roads open to private vehicles, and initial soil damage has already occurred. Areas of soil disturbance would expand on occasions when the area is crowded and maneuvering is required for turnarounds and to let vehicles pass. Negligible to minor, adverse, localized short and long-term impacts to soils would continue to occur from continuing current management of backcountry vehicle tours at Tuweep.

Maximum Group Size for Overnight Backpacking by Zone
Current maximum group size for overnight backpacking for all Management Zones is 1-6 persons in a small group and 7-11 persons in a large group. The number of groups per area is based on management zone objectives (see Table 2.14d) and capacity of the use area. Large and small groups are assumed to affect areas differently. Large groups tend to spread more and have greater impacts beyond a campsite's barren core perimeter. Impacts of both small and large groups in Corridor and Threshold Zones tend to occur in already disturbed areas where soil loss and damage has occurred for years. Continuing current distribution of groups in backcountry Use Areas would produce minor to moderate, adverse, localized, short and long-term impacts to soils.

Backcountry Roads, Trails, and Routes
Under Alternative A, unpaved roads have, for decades, experienced soils loss to varying degrees depending on use and setting. Roads closed since 1993 under the Superintendent's Compendium have experienced some restoration, primarily passive. Some of these former roadbeds are used by hikers as routes, and some have been converted to trails (e.g., Cape Solitude and Cape Final). Under Alternative A, minor to moderate, beneficial, localized, long-term impacts would continue to occur to soils where continued closures of roads and restoration have occurred. Under Alternative A, moderate, adverse, localized, long-term impacts would continue to occur to soils from continued use of vehicles on roads still open, and from continued illegal motorized use on roads in the backcountry.

Tuweep Facilities
Tuweep Facilities, which have been in place for decades, include a campground with nine small and one large site, toilets, and Toroweap Overlook parking (Map 2.2). Adverse impacts to soils including compaction and erosion occur in previously disturbed areas such as along roads, at the Overlook, and at campsites. Continuing current management would result in continuing localized, minor, adverse, long-term impacts to soils.

Corridor Zone Camping
Corridor Zone camping includes 56 small and 4 large campsites at three well-established campgrounds maintained for decades: Indian Garden, Phantom Ranch, and Cottonwood. Initial soil loss occurred during campsite creation and subsequent loss and damage occurred as visitors expanded campsite boundaries and created social trails. Impacts to soils continue (see *Potential Day and Overnight Use Impacts to Soils*), but the extent of possible further damage is somewhat limited by campground boundaries and the campsites' hardened condition. Continuing current management would result in negligible to minor, adverse, localized, short and long-term impacts to soils.

Deer Creek/Tapeats Creek Complex
The current number of groups allowed per night in this complex of Use Areas (Map 2.3) is 12, including large groups. Impacts to soils from groups are similar to other Use Areas, with large groups causing

impacts by extending campsite boundaries (see *Potential Day and Overnight Use Impacts to Soils*). Continuing current distribution of large and small groups in the Complex would continue the minor to moderate, adverse, localized, short and long-term impacts to occur to soils.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Impacts to soils from overnight groups in Hance and Cottonwood Creeks and Cremation Use Areas are similar to those in other Use Areas with at-large camping: concentrations of impacts and use occur near water and shade (see *Potential Day and Overnight Use Impacts to Soils*). Continuing current management of the area would continue the negligible to minor, adverse, localized, short and long-term impacts to soils.

Cumulative Impacts
Cumulative impacts on soils were determined by combining the impacts of Alternative A with other past, present, and reasonably foreseeable future actions as described in Table 4.1. The most significant actions that have affected, and would continue to affect, backcountry soils are Glen Canyon Dam operations, river recreational users, fire management, stock use on Corridor Zone trails, and trespass wildlife (e.g., burros).

Glen Canyon Dam impedes natural sediments moving downstream to replace Grand Canyon's eroding beach soils. Fluctuating flows and experimental floods heavily affect removal and deposition of beach sediments in Marble Canyon. In the Lower Gorge, Hoover Dam impedes sediment flow downstream from the lower end of the Colorado River in the park, and large amounts of sand and silt are deposited in Grand Canyon's west end. These dams have adverse, regional to localized, year-round, long-term, major effects on soils.

Recreational river users access river campsites and contribute to soil erosion, trailing, biological crust loss, and compaction. Many attraction sites in the backcountry which are difficult to access from the rim are day hikes from the river, and compaction and erosion result from activities in tributaries. Administrative river trips, mostly limited to groups of 16 or less, contribute to soils impacts in the river corridor and side canyons. These additional users have localized, adverse, year-round, short to long-term, minor to moderate effects on soils.

Fire management activities in the park impact soils primarily in rim forests and woodlands, and are described in the Fire Management Plan EIS. Activities in areas surrounding the park include numerous treatments to reduce hazardous fuel loads and restore fire regimes completed or planned by the Kaibab National Forest. Fire management impacts on soils are minor to major, adverse to beneficial, localized to regional, and short to long-term.

Trespass wildlife can cause major soils impacts. By the late 1970s, over 100 years of feral burro impacts on resources including widespread impacts to soils caused the NPS to write and implement the Feral Burro Management Plan and EA (NPS 1980c). Researchers from the Museum of Northern Arizona studying feral burros in 1977 concluded feral burros change natural conditions of park soils through compaction, erosion, and trampling of *Tortula spp*. moss crusts. In 2003, park staff revisited these plots and noted the burros' multiple trails still apparent after 20 years. Since not all burros were removed, they continue to impact Grand Canyon soils.

On North Rim, bison damage high-elevation springs and meadows, creating trails and disturbing soils (Minard 2003a, Minard 2003b). Trespass wildlife impacts would continue to have minor to major, adverse, localized to regional, long-term, year-round effects on soils.

Cumulative impacts of Alternative A combined with the impacts described here would be major, adverse, localized to regional, and both short and long-term. Alternative A would contribute a small amount to these adverse impacts.

Conclusion
Under Alternative A, minor to moderate, adverse, localized, short and long-term impacts to soils would result from recreational use in areas from climbers, canyoneers, and RABT users; campsite expansion by large groups in all Use Areas; continued inappropriate human waste disposal in high use areas; damage related to Corridor Zone trail congestion associated with extended day hiking and running; and visitor impacts at Tuweep.

Minor to moderate, beneficial, localized, short and long-term impacts would result from continuation of passive and active restoration of closed roads, and management activities such as trail maintenance and social trail obliteration.

Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

The following proposed changes apply to all action alternatives.

Climbing Management
Climbing occurs on overnight backpacking, day use, and river trips. The number of visitors engaged in climbing activities is unknown. Impacts to soils occur during approach, along the cliff base, from rappelling and belaying, and camping activities (see *Potential Day and Overnight Use Impacts to Soils*). Under all action alternatives, there would be increased minimum impact climbing education, a system for monitoring use levels, and a framework for assessing anchor use which would inform management of potential problem areas and decrease impacts to soils. Minor to moderate, localized, adverse short and long-term impacts would occur to soils.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for resource protection implemented at specific locations
- Climbing Management Plan development (separate NEPA would be completed)

When surveys and other data indicate climbing-related damage to soils, one or more of these actions would be taken. Information from day use permits would better inform management of potential problem areas. Reducing the numbers or sizes of groups in an area would decrease impacts when necessary and seasonal restrictions could reduce impacts when soils are more erodible or soil crusts are susceptible to impacts. Considering these beneficial impacts and the adverse impacts of climbing, minor, adverse, localized, short and long-term impacts would occur to soils.

Canyoneering Management
Canyoneering is an emerging activity for which little data about use levels and impacts exists. However, access to and use of canyoneering routes has potential to impact soils as described in *Potential Day and Overnight Use Impacts to Soils*. Under all action alternatives there would be a maximum group size of

six, increased minimum impact education, a system for monitoring use levels through the permitting process, and a framework for assessing anchor use. Impacts to soils would be minor to major, localized, adverse short and long term.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for resource protection implemented at specific locations

When surveys or other data indicate that canyoneering is causing undesirable impacts to soils, one or more of these actions could be taken. Day use permits would further inform management of potential problem areas and restricting or changing numbers of day or overnight users would decrease impacts to soils. Minor to moderate, adverse, localized, short and long-term impacts would continue to occur to soils from continued canyoneering.

Extended Day Hiking and Running Management

In general, trail width is sufficient to accommodate use without users having to step aside onto undisturbed soils. However, damage occurs when large groups encounter other users and step off the trail when passing. Implementation of a day use permit system and accompanying minimum impact and trail etiquette education would help protect soils by informing managers about use levels and educating users about impacts. Negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Management Actions Potentially Implemented through Adaptive Management

- Establishment of group size limits
- Establishment of daily use limits by trail
- Designation of specific days for group or individual events
- Adopt policies for other trails / routes

When survey or other data indicate that extended day hiking and running is having undesirable impacts to soils, one or more of these actions could be implemented. Limiting group sizes or total numbers of users per day would reduce congestion and the need for moving off-trail on corridor and other trails. Limiting use to specific dates may avoid impacts when soils are wet or otherwise susceptible to damage. Negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Tuweep Day Use Management

Initial soil loss and damage on Tuweep roads, trails, campsites, and parking areas has already occurred. Implementation of a visitor information and education system about day use and camping would help minimize further soils impacts by informing users when the area is already full. Minor to moderate, adverse, localized short and long-term impacts would occur to soils.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

When survey or other data indicate that day use at Tuweep is producing undesirable impacts to soils, one or more of these actions could be implemented. Adjusting the numbers of parties and vehicles at the overlook would decrease impacts to soils, and designating specific days for group events would allow

managers to avoid times when soils are susceptible to impacts. Minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Use Area Management
Proposed Use Area management actions would reduce or minimize recreation impacts to soils. Along the Hermit Trail (Hermit Use Area), limited sites exist for at-large camping, and a designated site would concentrate use in one already impacted area. The proposed decrease in number of groups in the Granite Rapids Use Area would bring use levels into alignment with area size and its multiple uses. The proposed redefinition of the Deer Creek/Tapeats Creek Complex (Map 2.7) would align Use Areas and campsites with current use patterns which would result in creation of user-defined campsites and social trails, resulting in compacted and eroded soils. Under all action alternatives, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

When surveys or other data indicate that adverse impacts are occurring to soils in other Use Areas, one or more of these actions would be implemented. These actions are designed to adjust use levels to the capacity of the Use Area and avoid erosion, soil compaction and expansion of barren cores at designated sites. Minor to moderate, adverse, localized short and long-term impacts would occur to soils.

Human Waste Management
Implementation of a human waste carry-out program at River Zone backcountry sites, and the requirement for commercially-guided trips to carry out waste in Use Areas without toilets would help minimize impacts to soils by reducing surface disturbance and soil chemistry changes. Negligible to minor, adverse, localized short- and long term impacts would occur to soils.

Management Actions Potentially Implemented through Adaptive Management

- Replace existing toilets
- Install primitive toilets
- Remove existing toilets
- Implement seasonal or year-round waste carry-out in Use Areas

When survey or other data indicate that human waste disposal in backcountry areas is causing undesirable impacts to soils, one or more of these actions could be implemented. Replacing, installing, or removing backcountry toilets would allow managers to prevent damage to soils associated with human waste. Carry-out programs would prevent disturbance of soils associated with cat holing and backcountry toilet use. Negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Administrative Use
No changes from Alternative A are proposed. Therefore there would be no change in impacts to soils from Alternative A.

Guided Services
Under all action alternatives, commercial use would be through concession contracts and a limited number of CUAs which stipulate group size, guide-to-client ratios, management zones allowed, vehicle length limits, and descriptions of non-authorized activities. Impacts from commercial clients are similar to those from non-commercial users (see *Potential Day and Overnight Use Impacts to Soils*). Under all action alternatives, negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

The most noticeable impact to soils under Alternative B is from overall use in the park's backcountry. Most activities that occur in the backcountry effect soils in some way with varying impact.

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, there would be no change in group sizes in the Corridor and Threshold Zones compared to Alternative A. Therefore impacts to soils would be the same in these Zones: minor to moderate, adverse, localized, short and long-term. In primitive and wild zone areas and two Use Areas in the Threshold Zone (South Bass trailhead and Point Sublime), large groups (7 to 11 users) would be excluded. Although large groups are only 7 to 10% of group nights in Wild and Primitive Zones, they represent nearly a quarter of user nights in those areas. By excluding large groups, damage to soils at and beyond established campsites would be reduced. Under Alternative B, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would occur in Corridor and Threshold Zones with a limited number of nights in adjacent Primitive Zone Use Areas when part of a larger itinerary. Rules for user night distribution would result in commercial trips occupying 10.9% and 10.6% respectively of all user nights in Corridor and Threshold Zones, and 4.4% of user nights in Primitive Zones. Commercial overnight backpacking would not occur in the Wild Zone. Based on the assumption of no difference in impacts between commercial and non-commercial users, the higher percentage of Corridor and Threshold users on commercial trips (11.6% vs. 9.7%, and 11.5% vs. 9.4%, respectively) no change is expected from current management practices. Because contracts and CUAs require Leave No Trace education and other best backcountry practices, impacts would be expected to remain the same or decrease even though commercial groups tend to be larger than non-commercial groups. Decreased commercial user nights in Primitive and Wild Zones (9.2% to 4.4%, and 1.7% to 0% respectively) would decrease impacts to soils. Under Alternative B, negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Commercial Day Hiking
Commercial day hiking trips would be similar to Alternative A; therefore impacts to soils would be the same as under Alternative A. Negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative B, commercial backcountry vehicle tours at Tuweep including stock use would be limited to two trips per day versus the current 10 trips. These tours are expected to have limited impacts on soils because they are currently permitted on park roads open to private vehicles outside Wilderness. Under Alternative B, minor, adverse, short and long-term, localized impacts would occur to soils at Tuweep.

Backcountry Roads, Trails, and Routes
Alternative B proposes to upgrade several unmaintained routes on South and North Rims to Wilderness trails. Cape Solitude, Francois Matthes, Walhalla Glades and Tiyo Point Trails would change from unmaintained routes on old roadbeds to Class 1 (minimal/undeveloped) Wilderness trails (see Chapter 2 and Appendix D). Alternative B also allows restoration, active or passive, of approximately 18 miles of other former roadbeds such as those that access Komo Point. Designating a single trail from multiple, braided trails would reduce impacts to soils (see *Potential Day and Overnight Use Impacts to Soils*). Under Alternative B, trail compaction from trail maintenance and use would have localized, minor to moderate, adverse impacts on soils.

Tuweep Facilities
Under Alternative B, Toroweap Overlook parking would be relocated closer to Tuweep Campground as recommended in the park's GMP. Vulcans Throne Road would be converted to a trail. By allowing Overlook and former Vulcans Throne Road soils to recover, expected impacts would be beneficial, localized, minor to moderate, and short to long-term. Under Alternative B, negligible to moderate, adverse, localized, short and long-term impacts would occur to soils.

Corridor Zone Camping
Under Alternative B, two Corridor Zone campgrounds (Indian Garden and Bright Angel) would remain the same. At a third Campground, Cottonwood, four small campsites would be added. Construction and use of these additional campsites would cause a loss of soils at a limited spatial scale. Impacts would be further limited by the selection of already disturbed areas for these campsites. Other impacts would continue to occur as described in *Potential Day and Overnight Use Impacts to Soils*). Under Alternative B, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Deer Creek/Tapeats Creek Complex
Under Alternative B, total Complex group number would decrease from 12 to 10 and no large groups would be permitted. These actions would lead to 13% fewer people in the Complex at one time on average: 12% fewer in spring and 15% fewer in August, September, and October. This would reduce the effects of users in the area. Converting Lower Tapeats Creek Use Area from designated to at-large camping in Bonita Use Area would allow heavily impacted soils at that site to recover, but would create impacts associated with dispersed camping elsewhere (see *Potential Day and Overnight Use Impacts to Soils*). Current campsite sizes are sufficient for small groups but not for large groups. By excluding large groups, damage would be reduced. Under Alternative B, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Deer Creek Narrows
Climbing and rappelling into Deer Creek Narrows is currently prohibited under an annual prohibition in the Superintendent's Compendium, but under Alternative B, the closure would be permanent. However, there are no sensitive soils in the Narrows, so under Alternative B, negligible, beneficial, localized, short and long-term impacts would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative B, Hance and Cottonwood Creeks, and Cremation Use Areas would continue to be managed in the Primitive Zone. Under Alternative B, group number permitted per night would change from two small and one large to three small. Current campsite sizes are insufficient for large groups which greater damage to soils (see *Potential Day and Overnight Use Impacts to Soils*). Under Alternative B, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Cumulative Impacts
Cumulative impacts on soils were determined by combining impacts of this alternative with other past, present, and reasonably foreseeable future actions (see Table 4.1). These impacts would be the same as those described for Alternative A and are major, adverse, localized to regional and short and long-term. Cumulatively, the effects of Alternative B, when combined with other past, present, and reasonably foreseeable future actions would be major, adverse, localized to regional, and short and long term. Alternative B would contribute a small amount to this effect.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, moderate, adverse, localized, short and long-term impacts to soils would result from increased use and more users with time to explore at Cottonwood Campground, and new soil disturbance from relocation of the Toroweap overlook parking area.

Moderate, beneficial, localized, short to long-term impacts would result from continuation of closed road passive and active restoration, exclusion of large groups in Primitive and Wild Zones, reductions in group size and number in the Deer Creek/Tapeats Complex and Hermit and Granite Rapids Use Areas, River Zone waste carry-out, and recovery of former road and overlook parking at Tuweep. Beneficial impacts would also come from increased education in trail etiquette and Leave No Trace from commercial backpacking and day hiking guides, and monitoring and education of climbers, canyoneers, and RABT users through the permitting process.

Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C, maximum group size for all four management zones would be the same as under Alternative A. Therefore, impacts to soils would be the same as under Alternative A. Minor to moderate, adverse, localized, and regional short and long-term impacts would continue to occur to water resources.

Commercial Overnight Backpacking
Under Alternative C, commercial overnight backpacking would be allowed in Corridor, Threshold, and Primitive Zones. User night distribution would result in commercial trips occupying 9.6% of the total overnight backcountry use permitted. Under this alternative, proposed caps on group use exist. There would be an overall increase of 16% in commercial group nights versus Alternative A, including a 19% increase in the Corridor Zone, a 50% increase in the Threshold Zone, and a 15% decrease in Primitive Zone. Commercial Overnight Backpacking would not be allowed in the Wild Zone, decreasing impacts to soils in the Primitive and Wild Zones. Because contracts and CUAs would require Leave No Trace and other best backcountry practices, impacts would decrease.

Under Alternative C, increased commercial use would create negligible to minor, adverse, localized, short and long-term impacts to soils in Threshold and Primitive Zone Use Areas.

Under Alternative C, in the Wild Zone, there would be negligible, beneficial change in impacts to soils.

Commercial Day Hiking
Commercial Day Hiking trips would be similar to Alternatives A and B, but two additional longer hikes would be added: Bright Angel Trail to Indian Garden, and South Kaibab Trail to Skeleton Point, extending the scope of potential impacts. The trips would remain subject to guide-to-client ratios and guide qualifications including training in Leave No Trace, rules and regulations, resource protection, and trail etiquette. Group size would be 11 persons including guides, with a second guide required for trips of eight or more clients. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to soils. Under Alternative C, negligible to minor, adverse, localized, short and long-term impacts would occur to soils.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative C, commercial backcountry vehicle tours at Tuweep would be limited to three trips per day including stock use versus 10 per day under Alternative A. These tours are expected to have limited impacts on soils because they are currently permitted on park roads open to private vehicles outside Wilderness. Under Alternative C, minor, adverse, short and long-term, localized impacts would occur to soils.

Backcountry Roads, Trails, and Routes
Alternative C proposes to upgrade several unmaintained routes on South and North Rims to Wilderness trails. Eremita Mesa, Cape Solitude, Francois Matthes Point, Walhalla Glades, Komo Point, and 12 miles of Kanab Plateau ranch roads would change from unmaintained routes on old roadbeds to Class 1 (minimal/undeveloped) Wilderness trails (see Chapter 2). Alternative C also proposes to upgrade the Tiyo Point trail to Class 4 (Appendix D) to accommodate stock use. Under this alternative, 31 miles of active and/or passive restoration would occur. The Boundary Road on the South Rim would be open to vehicle and bicycle access, which would open surrounding areas to potential increased use and would lead to new impacts to soils (see *Potential Day and Overnight Use Impacts to Soils*). The road is in poor condition and during the rehabilitation, widening, and routine maintenance required for upgrades, pull-offs and turn-around sites would likely develop, leading to compaction, soil loss, and considerable disturbance. Under Alternative C, moderate to major, adverse, localized and regional, short and long-term impacts would occur to soils if the proposed roads are opened to vehicle use.

Tuweep Facilities
Under Alternative C, management of Tuweep facilities would be the same as under Alternative A. Therefore, impacts to soils would be the same as under Alternative A. Minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Corridor Zone Camping
Under Alternative C, three Corridor Zone campgrounds would change: one small campsite would be added at Indian Garden, four small and one large campsite would be added at Cottonwood Campground, and two small campsites at would be created at Roaring Springs, opening that area to overnight use. Campsite creation at Roaring Springs would lead to increased social trailing and soils damage as people would have more time to explore the area. Campsite construction would cause permanent soil loss. Other impacts would continue to occur as described in *Potential Day and Overnight Use Impacts to Soils*. Under Alternative C, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Deer Creek /Tapeats Creek Complex
Under Alternative C, total number of groups in the complex would decrease from 12 to 11, Use Areas would decrease from 6 to 5 with elimination of Lower Tapeats, addition of Bonita, and splitting of

Surprise Valley between Upper Tapeats and Deer Creek (Map 2.7). Large groups would still be permitted. Total users in the Deer Creek/Tapeats Creek Complex would decrease by 1.2%. Fewer people in the Complex at one time would have beneficial impacts to soils. Removal of Lower Tapeats Creek Use Area designated campsite would allow heavily impacted soils to recover at that site. Current campsite sizes are sufficient for small groups, but larger groups expand campsite impacts and damage soils (see *Potential Day and Overnight Use Impacts to Soils*). Under Alternative C, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Deer Creek Narrows
Climbing and rappelling into the Deer Creek Narrows would be unrestricted. Access to climbing activities would cause impacts to limited soils in that area. However, there are no sensitive soils in the Narrows, so under Alternative C, negligible, adverse, localized, short and long-term impacts would occur to soils.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance and Cottonwood Creeks would convert from Primitive to Threshold Zone, which would increase total number of user nights in the Threshold Zone by 5.8%, and decrease total user nights in Primitive Zones by 1.1%. Designated campsites may be established and a toilet installed. Cremation Use Area would have a portion with designated camping with a maximum group size of 11. The construction of the designated campsite would lead to a small-scale soils loss, but could lead to future soils protection as camping is restricted to one site. Under Alternative C, minor, short-term, localized, adverse impacts would occur during campsite creation to soils in Hance Creek, Cottonwood Creek, and Cremation Use Areas, and minor, beneficial, localized, short and long-term change in impacts to soils from concentration of camping in a single area.

Cumulative Impacts
Cumulative impacts on soils were determined by combining impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Alternative A. These impacts would be the same as those described for Alternative A and are major, adverse, localized to regional and short and long-term. Alternative C would contribute a small amount to this impact.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, major, adverse, localized, short to long-term impacts to soils would result from increased users with time to explore at new campsites at Cottonwood, Roaring Springs and Indian Garden Campsites, stock use on the Tiyo Point Trail, construction impacts and traffic on the Boundary Road, return of users to Deer Creek Narrows, and potential camp and toilet construction activities at Hermit, Granite and Cremation Use Areas.

Minor, beneficial, localized, short to long-term impacts would result from continued passive and active closed road restoration; group size and number reduction in the Deer Creek/ Tapeats Creek Complex; focus of impacts on designated sites in Hermit, Cremation, and Granite Rapids Use Areas; River Zone waste carry-out; increased education in trail etiquette and Leave No Trace techniques from commercial backpacking and day hiking guides; and monitoring and education of climbers, canyoneers and RABT users through the permitting process. Minor to major beneficial, localized, long-term impacts would result from adding toilets to Hance and Cottonwood Use Areas which would be managed in the Threshold Zone.

Cumulative impacts would be major, adverse, localized to regional, short and long-term of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative D, large groups (7 – 11 users) would be excluded from backcountry Use Areas in Wild, Primitive, and Threshold Zones. Large groups would only be allowed in the Corridor Zone. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, and 7% of group nights in the Threshold Zone, they represent nearly a quarter of user nights in those Zones. By excluding large groups from the park's more remote areas, impacts to soils at and beyond the periphery of established campsites would be minimized (see *Potential Day and Overnight Use Impacts to Soils*). In the Corridor Zone, group sites are established and of the size appropriate to accommodate large groups. In those areas, most of the damage to soils has already occurred. Minor beneficial, localized, short and long-term impacts to soils would occur in Threshold, Wild and Primitive Zones, and negligible to minor, adverse, localized short and long term impacts would occur to soils in the Corridor Zone.

Commercial Overnight Backpacking

Under Alternative D, commercial overnight backpacking would only be allowed in Corridor Zone. Based on the assumption of no difference between commercial and non-commercial users, the higher percentage of Corridor Zone users on commercial trips would not lead to changes from current management practices. If CUAs and concession agreements require education for Leave No Trace and other best backcountry practices, impacts would decrease with commercial use. The decrease in commercial user-nights in other Zones would likely lead to slight decreases in impacts because other groups would be occupying those areas at slightly lower levels and by slightly smaller groups. Under Alternative D, negligible adverse, localized, short and long-term impacts would occur to soils.

Commercial Day Hiking

Alternative D would limit commercial day hiking trips to three trail sections in the Corridor Zone, and remove Tanner, Grandview, and Hermit Trails from commercial day hiking use. Group size would remain 11 persons including guides. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to soils. Under Alternative D, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Commercial Backcountry Vehicle Tours (Tuweep)

Under Alternative D, commercial backcountry vehicle tours would be limited to a single trip per day including stock use. Impacts to soils are expected to be low because commercial transportation tours are permitted only on park roads open to private vehicles outside Wilderness. One trip per day with stock use in that limit, combined with group size and vehicle length limits would help protect soils. Under Alternative D, minor, adverse, short and long-term, localized impacts would occur to soils.

Backcountry Roads, Trails, and Routes

Alternative D proposes to upgrade the Cape Solitude Trail (12.4 miles) from an unmaintained route on an old roadbed to a Class 1 (minimal/undeveloped) Wilderness trail. Compaction and soils loss from the upgrade would have localized, minor to moderate adverse impacts, but channeling use from multiple braided trails to a single trail would reduce impacts over time. For these reasons, trail impacts outside the trail tread would decrease and lead to increased protection of soils resources. Eremita Mesa Trail would remain an unmaintained route on old roadbed in Wilderness. The Boundary Road would remain closed to vehicle and bicycle access, limiting new access and potential impacts to soils in that area. North Rim unmaintained routes would remain old roadbeds. Road access would be maintained to Kanab and SB Points, and 150-Mile and Schmutz Trailheads. With these changes, approximately 25 miles of restoration, active or passive, would occur. Under Alternative D, negligible to moderate, adverse, localized, short and long-term impacts would occur to soils.

Tuweep Facilities
Under Alternative D, Toroweap Overlook parking would be re-located closer to Tuweep Campground as recommended in the GMP. Vulcans Throne Road would be converted to trail. By allowing soils in the Overlook area and former Vulcans Throne Road to recover, expected impacts of these actions would be beneficial, localized, minor to moderate, and short to long-term. Under Alternative D, negligible to moderate, adverse, localized, short and long-term impacts would occur to soils.

Corridor Zone Camping
Under Alternative D, Corridor Zone campgrounds at Indian Garden, Bright Angel, and Roaring Springs would remain the same. Two small campsites would be added at Cottonwood Campground. Construction of these campsites would cause compaction of and disturbance to soils at a limited spatial scale, but impacts would decrease by selecting an already disturbed area. Other impacts would continue to occur as described in Alternative A. Under Alternative D, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Deer Creek/Tapeats Creek Complex
Under Alternative D, the total number of groups in this complex would decrease from 12 to 8 and no large groups would be permitted. These actions would lead to a reduction of 11% of groups using the area, and 18% fewer people in the complex at one time, which would have beneficial impacts to soils. Converting the Lower Tapeats Creek Use Area from designated to at-large camping would allow heavily impacted soils time to recover at that site but would create impacts to soils associated with at-large camping. Current campsite sizes are sufficient for small groups, but not for large groups. In this complex, more than 82% of large group activity takes place in spring and after summer rains with more than 83% of all activity occurring during this period. By excluding large groups from these areas, damage to soils at and beyond the periphery of established campsites would be minimized (see *Potential Day and Overnight Use Impacts to Soils*). Under Alternative D, minor, adverse, short and long-term, localized impacts would occur to soils from Deer Creek/Tapeats Creek Complex configuration.

Deer Creek Narrows
Climbing and rappelling into the Deer Creek Narrows is currently prohibited and reviewed annually. Under Alternative D, the closure would be permanent. This closure would protect limited soils in that area. This alternative would also limit use of The Patio to one river trip at a time reducing congestion in the area and associated impacts to soils (see *Potential Day and Overnight Use Impacts to Soils*). However, there are no sensitive soils in the narrows, so under Alternative D, impacts to soils would be negligible, beneficial, localized, short and long-term.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative D, Hance and Cottonwood Creeks and Cremation Use Areas would continue to be managed as Primitive Zone Use Areas. Rather than two small and one large group allowed in each per night, three small groups would be allowed. Current campsite sizes are sufficient for small groups, but not large groups. Under Alternative D, minor to moderate, adverse, localized, short and long-term impacts would occur to soils.

Cumulative Impacts
Cumulative impacts on soils were determined by combining impacts of this alternative with other past, present, and reasonably foreseeable future actions described in Alternative A. These impacts would be the same as those described for Alternative A and are major, adverse, localized to regional and short and long-term. Alternative D would contribute a very small amount.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized, short and long-term impacts to soils would result from trailing in new areas associated with climbing, RABT, and canyoneering; trail construction and maintenance; and impacted area expansion in the Corridor Zone and at Tuweep.

Moderate, beneficial, localized, short and long-term impacts to soils would occur from continuation of passive and active closed road restoration, creation of single trails from Wilderness routes, restriction of commercial day hikes to three segments, exclusion of large groups outside the Corridor Zone, group size and number reductions in the Deer Creek/Tapeats Creek Complex and Hermit, Granite Rapids, and Cremation Use Areas, River Zone waste carry-out; recovery of former road and Overlook parking at Tuweep; increased education in trail etiquette and LNT techniques from commercial backpacking and day hiking guides, and education of climbers, canyoneers, and RABT users.

Cumulative impacts would be moderate to major, adverse, local to regional, short and long-term of which Alternative D would contribute a very small amount.

Water Resources

ISSUES

Issues regarding water resources identified through public and internal scoping include

- Impacts to tributary creeks, seeps and springs in narrow slot canyons from emerging recreation activities should be anticipated and managed
- Identify, monitor and mitigate recreation impacts on desert springs and streams (e.g., trailing and uninformed use) that may threaten local populations of at least three endemic insect species
- Several trails are along, adjacent, or crossing tributaries and springs/seeps. At-large camping is also often too close to or at a water resource. Sedimentation impacts from these activities can alter a tributaries' hyporheic zone (erosion, soil compaction/loss, de-vegetation, bank failure)
- Backcountry compost bathrooms include leachate pipes that drain directly into the ground, acting as potential groundwater contamination point sources
- Increased car camping increases the possibility of leakage of mechanical fluids near sensitive water sources and impacts on road surface/soil erosion

DESIRED CONDITIONS

Grand Canyon desired conditions to preserve natural spring and stream flows and water quality:

- Quality and chemical integrity of park surface and ground waters supports all native life, and meets or exceeds designated use standards.
- Hydrologic integrity of park surface and ground waters supports natural geomorphic processes of fluvial systems, hydrogeological processes in aquifer systems, and supports native life.

METHOLOGY

The general process for assessing impacts is discussed earlier in this chapter. To analyze the effect of each alternative on water resources, staff compiled all available information on visitor use and water resources (quantitative and qualitative) in the backcountry including formally collected data from NPS, USGS, and academic cooperators, information from published works, and personal communication with resource specialists. From this pool, the best available data for resource locations, past documentation and studies of impacts, and the most recent research for springs, seeps, tributaries and other hydrologic resources in

the park were assembled. Effects specific to water quality are characterized for each alternative based on the intensity definitions presented in this Section. Maps of documented cultural and natural resources and focal points for visitor backcountry use (campsites, trails, routes, and attraction sites), including data on use intensity, were used to identify areas of resource concern where concentrations of sensitive resources overlapped with visitor Use Areas.

INTENSITY DEFINITIONS

Effects on water resources are characterized for each alternative based on the intensity definitions presented below.

Intensity

Negligible Chemical, physical, or biological changes to water resources and alterations to flow volumes would not be detectable. Impacts would not produce obvious changes in the condition of the water resource and/or water quality.

Minor Adverse: Chemical, physical, or biological changes to surface water and groundwater quality would be detectable. Impacts to flow volumes and hydrogeologic processes would be detectable, but measures would be within historic norms.

Beneficial: Impacts would result in detectable changes in biological, chemical, or physical aspects of water quality, hydrologic integrity, or hydrogeologic processes. Results would move measures towards desired conditions.

Moderate Adverse: Deterioration of chemical, physical, or biological measures of water quality would be detectable and result in values outside of historic norms. Deterioration of hydrologic integrity of surface waters or hydrogeologic processes would be detectable and result in values outside historic norms. Mitigation measures would be required to address conditions, and these would likely result in successful outcomes.

Beneficial: Impacts to the water resource would result in detectable improvements in overall water quality, hydrologic integrity, and/or hydrogeologic processes. Measures of condition would move substantially towards desired conditions.

Major Adverse: Changes to chemical, physical or biological aspects of water quality, hydrologic integrity, or hydrogeologic function would represent a significant degradation from historical baseline conditions. Contamination of surface waters would violate water quality regulations. Impacts to hydrology could result in major changes to stream morphology (i.e., channelization) and functions of springs and seeps. Mitigation measures would be required to address impacts, but their success would not be guaranteed.

Beneficial: Impacts to the water resource would result in measurable improvements in overall water quality, hydrologic integrity, and/or hydrogeologic processes. Measures of condition would move substantially towards desired conditions.

Context

Localized Impacts would occur to water resources at attraction sites with water features, individual tributaries, sinkholes, or at seeps or springs.

Regional Impacts would occur in multiple tributaries or in multiple sites along tributaries, multiple sinkholes, seep and/or springs.

Duration

Short-term Impacts would range from one day to 6 months, with no lingering results. Baseline conditions would return within this term.

Long-term Impacts would last longer than 6 months to one year or would

ASSUMPTIONS

The general assumptions used for analysis of effects for each alternative are discussed in the Introduction to Chapter 4. Assumptions that specifically relate to the alternatives in this document and their effect on water resources are presented below.

- Adaptive management actions are intended to improve resource conditions and visitor experience; therefore it is assumed that the impact of implementing management actions would be beneficial to water resources
- Water in tributaries and springs are more sensitive and prone to recreational impacts than the Colorado River because contaminants, including soaps and sunscreen are diluted with higher flow volumes. Higher discharge volume springs and tributaries similarly have better water quality than low discharge water features
- The probability of impacts to water resources occurring in tributaries and springs increases as the level of visitation increases. Large groups have greater impacts than small groups, and longer stay at water features by recreationists result in increased impacts
- Recreational impacts to aquatic resources are more likely in the summer due to the high air temperatures and the increased desire of visitors to cool off in side streams. Fall and winter hiking are more conducive to exploring side canyons, as the extreme heat of the summer precludes hiking long distances, but users are less likely to get into the water to swim
- The more time groups spend at a site, the greater the probability for impacts to water resources to occur outside of the camping area
- Information on minimum impact camping techniques is provided to backcountry users through the Backcountry Reservations Office. Commercial trips are assumed to have guides trained in minimum impact practices and must adhere to all environmental regulations
- Impacts to water resources can be time sensitive. Although there is no dormant period in aquatic ecosystems, impacts would likely be more pronounced during low-volume discharge months (such as May and October) than high volume months (July and January). Summer is a period of low discharge, peak water temperatures, and the lowest dissolved oxygen levels, so dependent native fauna and recreational users are likely to be more pronounced then. The frequency of recreational impacts to water resources are likely to be greater in the summer due to the high air temperatures and the increased desire of visitors to interact with water to cool off, especially in side streams. Monsoon storms (summer-fall) can cause flooding that impacts aquatic resources.

IMPACT ANALYSIS

Potential Day and Overnight Use Impacts to Water Resources

Because many Backcountry Management Plan impact topics involve some aspect of day hiking and / or camping, this sections is used as a reference for potential impacts of these activities to water resources when they are mentioned in the sections that follow.

The predominant impact of backcountry recreation on water resources is its effects on water quality. In the desert environment, recreation tends to be focused on perennial and intermittent tributaries where shade and water are available. Hikers promote bank instability, leading to entrainment of sediment and turbidity which is associated with bacterial contamination. Disposal of human wastes too close to streams and springs is another source of contamination at camps, attraction sites and along trails. Some Corridor and Threshold Zone Use Areas have composting and dehydrating toilets which drain directly onto the ground or into the soil without a lined catchment, and so become a point source for contamination of nearby tributaries. Infrequent maintenance or malfunction of backcountry toilets often encourages backcountry users to abandon them and resort to catholing in areas where soils are unable to accommodate the activity at a high level of users. Backcountry users cool off and bathe in tributaries, and introduce personal care products like sunscreens, lotions, and soaps to the water. Trash, including both general trash (food packaging, broken gear) and gear associated with climbing activities (webbing bolts, carabiners anchors), has been found routinely in tributaries that are heavily visited by users.

Backcountry users also affect the hydrologic integrity of tributaries. Campers and hikers create dams and pools to increase water depth for cooling and bathing. Activity on stream banks removes vegetation and compacts soils leading to increased runoff and impacts to the hyporheic zone. The sewage treatment plant at Phantom Ranch is routinely operating above its capacity during spring and fall, leading to increased diversion of water from Roaring Springs to users in the Corridor Zone

ALTERNATIVE A

Alternative A would continue existing management practices, resulting in current trends in visitor use and recreation opportunities. The most noticeable impact to water resources under Alternative A is from overall use in the park's backcountry. Most activities that occur in the backcountry revolve within or around water resources, with the level of direct and indirect impacts varying on location.

Climbing Management

Climbing occurs on overnight backpacking and day use trips, as well as in backcountry areas accessed from river trips. Access to and use of climbing routes has the potential to adversely impact water resources because routes are often accessed along tributaries (see *Potential Day and Overnight Use Impacts to Water Resources*). Currently, there is no park specific climbing policy or consistent method for dissemination of minimum impact practices to these users. Minor to moderate adverse, short-term, localized impacts would continue to occur to water resources if current management continues.

Canyoneering Management

Canyoneering is an increasing activity for which little data about use levels and impacts exists. Groups of up to 11 persons may engage on an overnight canyoneering trip. An analysis of canyoneering routes in a recently published book (Martin 2013) shows that, on average, routes traverse riparian habitats for around 40% of their lengths which would adversely impact water resources through promoting bank instability (see *Potential Day and Overnight Use Impacts to Water Resources*). Currently, there is no park specific canyoneering policy. Impacts on water resources from canyoneering would continue to be minor to moderate adverse, short-term, localized and regional if current management practices continue.

Extended Day Hiking and Running Management

In general, extended day hiking and running are focused in the Corridor Zone and day use peaks during weekends in May and October. Runners and hikers use the creeks for cooling down, therefore the potential of contamination and bank destabilization increases (see *Potential Day and Overnight Use Impacts to Water Resources*). When the water filling stations are closed, hikers and runners access creeks and trampling along the creeks increases. There is currently no consistent method for dissemination of

this information to these users. Continuing current management practices would continue to produce minor to moderate, adverse, localized, short-term impacts to water resources.

Tuweep Day Use Management
The number of vehicles and people at one time are limited by the 1995 General Management Plan (NPS 1995), but consistent impacts to vegetation and soils would have indirect adverse impacts to water resources by increasing compaction, bare soil, and runoff and decreasing infiltration. The Tuweep restroom currently drains directly into the ground, with no leachate field, potentially being a point source of water contamination to Saddle Horse Creek. Negligible to moderate, adverse, localized to regional, short and long-term impacts would continue to occur to water resources if current management of Tuweep day use continues.

Human Waste Management
Human waste management in the backcountry and wilderness includes different types of toilet facilities and regulations on waste disposal. Backcountry visitors are required to bury human waste at least 200 feet from tributary streams and carry out the toilet paper; this method, known as catholing, is sometimes difficult because soils are rocky or very thin. The variety of impacts of human waste management on water quality is described under *Potential Day and Overnight Use Impacts to Water Quality*. Continuing current management of human wastes would result in minor to moderate, adverse, short-term, and localized impacts to water resources.

River Assisted Backcountry Travel
Current management of RABT includes a five-mile limit on any river travel associated with a backcountry permit. River travel day use is not permitted. Groups of up to 11 persons engage in RABT associated with canyoneering and backpacking itineraries. Six of the 32 canyoneering routes in Grand Canyon described in a recent book (Martin 2013) which require RABT for completion would be disallowed under the 5-mile limitation (36.7 Mile Canyon, Tatahatso Wash, Cork Spring Canyon, Fern Glen Canyon, Willow Canyon and Stairway Canyon). The increased use of RABT has led to recreationists entering areas that were previously difficult to access, many of which include standing or flowing water, but little or no data on use levels or impacts are available. Although impacts to water resources during river travel itself are expected to be negligible, there would be impacts from overnight use (see *Potential Day and Overnight Use Impacts to Water Resources*). Minor, adverse, localized and regional, short and long-term impacts would continue to occur to water resources if current management of RABT were to continue.

Tribal Lands and Interests
Several perennial tributaries feeding into the Colorado River originate outside park boundaries on tribal lands. Water is a culturally significant resource. NPS consultation with tribes and visitor education promotes awareness on local water resource issues and water quality concerns. Direct impacts would be analyzed on a site-specific basis, and working cooperatively with tribes would result in continuing minor, beneficial, long-term, regional impacts to water resources.

Administrative Use
Administrative use includes resource management, maintenance, visitor protection, visitor education, and research. NPS and research projects undergo the appropriate compliance process and include mitigations that minimize adverse impacts and ensure resource protection to the greatest extent possible. As with recreational use, administrative use outside of established trails and campsites has the potential to impact water resources (see *Potential Day and Overnight Use Impacts to Water Resources*). Minor adverse, localized and regional, short to long-term impacts would continue to occur to water resources if current management of Administrative Use continues. Minor to moderate, beneficial, local, and long-term effects

would continue to result from restoration and mitigation activities such as revegetation and bank stabilization.

NPS and Cooperative Association Programs (Non-commercial Services)
NPS and cooperator programs are subject to the same overnight permit requirements as other users, and have no day use limits. Day use, such as interpretive talks that enter the backcountry, have similar impacts to those caused by regular day users; however, the impacts tend to be less because the on-site group leaders are required to provide basic Leave No Trace technique guidance and be available to alert participants if resource concerns are observed. Minor, adverse, localized, short and long-term impacts would continue to occur to water resources if current NPS and Cooperator programs continue.

Commercial Overnight Backpacking
Commercial backpacking trips are subject to the same overnight permit requirements as other backcountry users and the impacts to water resources would be similar (see *Potential Day and Overnight Use Impacts to Water Resources*). The CUAs identify guide qualifications, including training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there should be fewer impacts to water resources. Minor, adverse, localized, short and long-term impacts would continue to occur to water resources.

Commercial Day Hiking
Commercial day hiking is currently recommended for only the upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails; impacts are limited spatially to natural water resources at Santa Maria and Dripping Springs. Commercial day hiking trips are subject to group size limits, guide-to-client ratios, and guide qualifications requirements. The latter include training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to water resources. Minor, adverse, short-term, localized impacts would continue to occur to water resources if current management of commercial day hiking continues.

Maximum Group Size for Overnight Backpacking by Zone
Currently users in all Management Zones receive permits for either large groups (7-11) or small groups (1-6). Large and small groups affect areas differently (see *Potential Day and Overnight Use Impacts to Water Resources*). Impact in Corridor and Threshold Zones tend to occur in already disturbed areas near designated campsites. Tributaries in at-large areas tend to receive similar types of impacts but at lower levels than areas with designated campsites. Continuing current management practices for group sizes in Management Zones would produce minor to moderate, adverse, localized, and regional short and long-term impacts to water resources.

Backcountry Roads, Trails, and Routes
Designated roads and trails have experienced vegetation and soil loss for decades. There has been restoration, primarily passive, on some of the roads that have been closed or converted to trails, and some active restoration on segments of a few former roads (e.g., Cape Final). Impacts to vegetation and soils would alter the natural hydrology of the area (i.e., runoff). Assuming appropriate compliance is implemented in case of active restoration to prevent contamination of water resources (i.e., springs, seeps, sinkholes) from use of chemicals and/or synthetic salts, negligible to minor, adverse, localized, short and long-term impacts would continue to occur to water resources under current management of backcountry roads, trails, and routes.

Tuweep Facilities
Tuweep facilities include a campground, the Toroweap scenic overlook with parking and a restroom, and local trails. Although the 1995 GMP called for removal and relocation of parking and a composting toilet from the overlook to the campground area, the actions were never implemented. Soil compaction of the road and overlook parking has potential to create runoff and affect water resources in Saddle Horse Creek. In general, hiker and stock use of Saddle Horse Trail would also impact the spring and creek (see *Potential Day and Overnight Use Impacts to Water Resources*). Baseline and current conditions for water quality of this creek are unknown. Minor, adverse, short and long-term localized impacts would continue to occur.

Corridor Zone Camping
The 56 small and four large campsites at Indian Gardens, Phantom Ranch, and Cottonwood are well-established and have been maintained for decades. Campgrounds are located in close proximity to Bright Angel and Phantom Creeks, and campers have impacts typical of other backcountry users (see *Potential Day and Overnight Use Impacts to Water Resources*). Minor adverse impacts occur during the cooler fall and winter months, otherwise moderate, adverse, localized, short and long-term impacts would continue to occur to water resources if current management of Corridor Zone camping continues.

Deer Creek/Tapeats Creek Complex
The current number of groups per night in this overall complex of five Use Areas is 12, including both small and large groups. Designated campsites in Deer Creek and Upper and Lower Tapeats Creek are within 10 meters of perennial streams; and visitors in small and large groups have impacts described in *Potential Day and Overnight Use Impacts to Water Resources*. Minor to moderate, adverse, localized to regional, short and long-term impacts would continue to occur to water resources in the complex if current management continues.

Deer Creek Narrows
Climbing and rappelling into the narrow section of Deer Creek is currently prohibited under the Superintendent's Compendium and is reviewed annually. This prohibition protects the water resources in the area by reducing use and contamination from personal care products including sunscreens. Minor, beneficial, short-term, localized, impacts would continue to occur to water resources in the Deer Creek Narrows if the prohibition continues.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
The impacts to water resources from the groups in these Use Areas are similar to that in other Use Areas with at-large camping by both small and large groups (see *Potential Day and Overnight Use Impacts to Water Resources*). In Hance Creek and Cottonwood Creek, the visitor-established campsites at these at-large camping areas are adjacent to or adjoining perennial streams. Minor to moderate, adverse, localized, short and long-term impacts would continue to occur to water resources if current management continues.

Cumulative Impacts
Cumulative impacts were determined by combining the impacts of Alternative A with other past, present, and reasonably foreseeable future actions having impacts on water resources. Past and ongoing activities and management actions considered in this analysis include Glen Canyon Dam Operations, fire management, contaminants originating outside or inside park boundaries, trespass ungulates, and water developments originating in or outside of the park, and management of recreational use under the Colorado River Management Plan.

Flows in the Colorado River are heavily regulated, historic levels of turbidity and flow and temperature fluctuations are a fraction of their former norms, and geomorphic processes have been severely changed (Collier et al. 1996, Webb et al. 1999), all of which create major adverse impacts on natural hydrologic

and geomorphic functions. Negative impacts of fires on the rims and below the rims include ash and debris draining into tributaries during snowmelt and summer rainstorms. Trespass ungulates and feral burros damage springs and seeps on the rims and in the inner canyon (Minard 2003b, Bennett et al. 1977). The consensus among climate scientists predicts significant declines in precipitation on both the Colorado Plateau and the headwaters areas of the Colorado River (Bates et al. 2008). Diversion of Roaring Springs water for use in the developed areas of the park exceeds 350 acre-feet per year (Ingraham et al. 2001); and proposed groundwater developments near the South Rim threaten Grand Canyon tributaries and springs (Rice 2012). Bacterial and chemical contamination is highest in tributaries that drain the largest areas (ADEQ 2007). River runners access some backcountry attraction sites with water in numbers far greater than hikers and backpackers (e.g., Little Colorado River, Deer Creek, and Tapeats Creek) creating adverse impacts via dams used to make pools, plus contamination with bacteria, personal care products, and pharmaceuticals.

Beneficial impacts from education and interpretation of resources are minor, long-term and regional. Cumulatively, the effects of Alternative B, when combined with other past, present and reasonably foreseeable actions, would result in major, adverse, long-term, localized and regional impacts on water resources. Alternative A would have a very small contribution to this cumulative effect.

Conclusion
Under Alternative A, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses and would include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features.

Minor, beneficial, local to regional, short and long-term impacts would result from educating visitors on minimum impact practices and the passive restoration or recovery of old roadbeds.

Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative A would contribute a very small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Elements common to all action alternatives to manage backcountry resources are described in this section, along with their potential impacts to water resources. Most activities that occur in the backcountry impact water resources in some way, with the level of impact varying.

Climbing Management
Under all action alternatives, there would be an increase in minimum impact climbing education, a system for monitoring use levels, and a framework for assessing the use of anchors, all of which would help protect water resources. Increased education and monitoring would have beneficial impacts on water resources which are expected to be negligible to minor, short to long term and localized.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect resources
- Climbing Management Plan development (separate NEPA would be completed)

When survey or other data indicates that climbing is creating undesirable impacts to water resources, one or more of these actions could be implemented. Day use permitting would inform managers of potential problem areas as they develop. Restricting group numbers and numbers of individuals seasonally or indefinitely would result in beneficial impacts to water resources. Minor, beneficial, short and long-term, localized impacts would occur to water resources.

Canyoneering Management
Under all action alternatives, the maximum group size for canyoneering groups would be six persons and would result in beneficial effects. There would be an increase in minimum impact education, a system for monitoring use levels, and a framework for assessing the use of anchors, all of which would help protect water resources. A group size limit, increased education and monitoring would have beneficial impacts on water resources which are expected to be minor, short to long term and localized.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites

Monitoring day use would inform management of potential problem areas as they develop. Placing restrictions on numbers of groups and group sizes, either seasonally or indefinitely, would have beneficial impacts to water resources. Minor beneficial, short and long-term, localized impacts to water resources would occur.

Extended Day Hiking and Running Management
All action alternatives propose implementing a day use permit for extended day hiking and/or running in defined areas. Additionally, Minimum Impact and Trail Etiquette Education Programs would be implemented. The implementation of a permit for extended day use would have negligible impacts on water resources, but education may have beneficial impacts. Although beneficial, it is expected the impacts from increased etiquette and messaging through a permit system would result in negligible impacts to water resources.

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Daily maximum use limits by trail
- Designated days for group or individual events
- Adopting similar policies for other trails

When survey or other data indicate extended day use is having negative impacts on water resources, one or more of these actions could be implemented. Limiting group sizes or total users per day on trails would result in beneficial impacts on water resources. Similar rules may eventually be required on other running routes in the future. Negligible to minor, beneficial, localized, short and long-term impacts would occur to water resources from extended day use.

Tuweep Day Use Management
The implementation of a visitor information and education system about day use and camping would help minimize further impacts to water resources by preventing expansion of the affected area. Negligible to minor, beneficial, localized to regional, short and long-term impacts would occur to water resources.

Management Actions Potentially Implemented through Adaptive Management
- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

Limiting permits and number of vehicles per party, and limiting group events to specific days would result in beneficial impacts to water resources. Negligible to minor beneficial, localized, short and long term impacts would occur to water resources..

Use Area Management
The proposed Use Area management actions would reduce or minimize recreation impacts to water resources by bringing use levels into alignment with the size and capacity of Hermit, Monument Creek, Granite Rapids, and the Deer-Tapeats Creek Complex. Negligible to minor, beneficial, localized, short and long-term impacts to water resources would occur from these actions.

Management Actions Potentially Implemented through Adaptive Management
- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

Adjusting limits to the numbers and sizes of groups in backcountry use areas and adjusting camping types in areas would allow managers to make changes when survey or other data indicate that the level of use in an area is causing adverse impacts to water resources. Negligible to minor, beneficial, localized, short and long-term impacts to water resources would occur.

Human Waste Management
The implementation of a human waste carry-out program at backcountry sites in the River Zone and the requirement for commercially guided trips to carry out waste in Use Areas without toilets would result in beneficial impacts to water resources by reducing potential contamination. Minor to moderate, beneficial, short-term, and localized impacts would occur to water resources.

Management Actions Potentially Implemented through Adaptive Management
- Replace existing toilets
- Install primitive toilets
- Remove existing toilets
- Implement seasonal or year-round waste carry-out in Use Areas

When survey or other data indicate that use levels are beyond what Use Areas can support and water resources are adversely affected, one or more of these actions would be taken. Beneficial impacts would result from the removal of toilets adjacent to water resources as well as the placement of new or existing

toilets at the proper distance from water resources. Minor to moderate, beneficial, short-term, and localized impacts would occur to water resources.

River-assisted Backcountry Travel
The implementation of day use permits for RABT trips and implementation of a maximum group size would help minimize impacts to water resources through increasing the opportunity of minimum impact education and the creation of a framework to monitor levels and locations of use. Implementation of a six-person maximum group size and other actions would reduce adverse impacts. Negligible to minor, short and long-term, localized, impacts to water resources would occur.

Administrative Use
No change is proposed from Alternative A. Therefore, impacts would be the same as Alternative A. Minor adverse, localized and regional, short to long-term impacts would occur to water resources. Minor, beneficial, localized, and long-term effects to water resources would arise from restoration and mitigation activities such as revegetation and bank stabilization.

Guided Services (NPS, Cooperative Association, Commercial)
Under all action alternatives, commercial use would be through concession contracts with a limited number of CUAs, both of which would identify guide qualifications for training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. Authorizations for guided services all include stipulations on group size, guide to client ratios, management zone limits, and descriptions of non-authorized activities. Commercial guides would be required to adhere to all environmental regulations including camping near or swimming and wading in perennial streams and it is expected that guided services would be more diligent in protecting park resources. Minor, adverse, localized, short and long-term impacts would occur to water resources.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these common to all alternatives action items.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these common to all alternatives action items.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, the maximum group size in Corridor and Threshold Zones would be 11 persons, and Primitive and Wild Zone maximum group size would be six persons. While the number of permits would be the same as Alternative A, the number of visitors in the Primitive and Wild Zones would decrease. Although large groups account for only 7% to 10% of group nights in Primitive and Wild Zones, they represent nearly a quarter of the user nights in those areas. By allowing only small groups, adverse impacts to water resources and water quality at and beyond the periphery of established campsites would be reduced due to reduction in group size and overall use. Minor adverse, long-term, localized and regional impacts to water resources would occur.

River Assisted Backcountry Travel
Under Alternative B, RABT would be managed by 31 river sections. Four sections are closed to RABT use. Sections are defined by tributary canyons that serve as entry and exit points at their upper and lower boundaries and the network of trails and routes they connect. RABT users would be limited to one river section per trip or two sections if on different days.

One of the 32 Grand Canyon canyoneering routes described in Martin's (Martin 2013) description of RABT routes would be disallowed under Alternative B because its start and end points are in different RABT segments. The river portion of the National Canyon route begins at RM 164 and ends at RM167; the change from RABT segment 21 to 22 happens at RM 165 at Tuckup Canyon. Alternative A disallows six of these.

Impacts to water resources would be slightly different from Alternative A where five routes are disallowed (see *Potential Day and Overnight Impacts to Water Resources*).but, only small group RABT would occur; the addition of access to 35-Mile, Tatahatso, Cork Spring, Fern Glen, Willow and Stairway Canyons in Alternative B would have negligible to minor adverse impacts to water resources, as there is a low density of springs and seeps. The 31-mile river section management strategy allows more access to routes on a backcountry itinerary. Overall, minor, adverse, short and long-term, localized impacts to water resources would occur.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would be allowed in Corridor and Threshold Zones, with a limited number of nights allowed in adjacent Primitive Zone Use Areas when part of a larger itinerary. No commercial use would be allowed in the Wild Zone. Under all action alternatives, the number of commercial groups per night (i.e., group nights) for each zone would be capped. Under Alternative B, the number of group nights for Corridor Zone campgrounds and Threshold Use Areas would result in a 2% to 3% increase in commercial use annually. Under concession contracts, commercial trips would have stringent requirements for resource protection, including Leave No Trace training and other best management practices. Beneficial impacts to water resources would result from minimizing impacts to water quality from adherence to regulations on camping distances and human waste disposal, and protection of water resources by limiting trailing and minimizing modifications to streambed to provide pools for cooling. Negligible to minor, adverse, short and long-term, localized impacts to water resources would occur.

Commercial Day Hiking
Commercial day hiking destinations would be limited to the upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails; impacts are limited spatially to natural water resources at Santa Maria and Dripping Springs. The maximum group size would be 11 with guide to client ratios. Commercial guides would be trained in Leave No Trace techniques, park rules and regulations, and basic overview of resource protection and trail etiquette. Beneficial impacts would include education and minimizing vegetation trampling at springs. Negligible to minor, adverse, short-term, localized impacts to water resources would occur.

Backcountry Roads, Trails, and Routes
Under Alternative B, approximately 30 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails. Impacts to vegetation and soils alter the natural hydrology of an area (i.e., compaction, runoff). Channeling use to a single trail and the conversion would reduce compaction runoff and further protect water resources.

Unmaintained routes, old roadbeds and trails on the Walhalla Plateau are part of the Bright Angel Creek and/or Clear Creek watersheds. Bright Angel Creek is one of the largest perennial tributaries and located in the Corridor Zone is highly used by visitors for recreation and/or drinking water source (especially in the winter season). Assuming appropriate compliance is implemented in case of active restoration to prevent contamination of water resources (i.e., springs, seeps, sinkholes) from use of chemicals and/or synthetic salts, there would be negligible to minor adverse impacts to water resources. Overall, converting approximately 30 miles of old roadbeds from unmaintained routes to Class 1 trails would result in minor, adverse, short-term, localized and minor beneficial, long-term, regional impacts to water resources.

Tuweep Facilities
Under Alternative B, overlook parking would be re-located closer to the campground as recommended in the1995 GMP. By allowing soils on the road segment and in the overlook area to recover, the expected impacts of these actions would be beneficial to water resources. The relocation of the overlook parking to near the campground would have minor beneficial long-term, localized impacts on water resources compared to the no-action alternative. Overall, negligible to minor adverse impacts would occur to water resources.

Corridor Zone Camping
Under Alternative B, campsites at Indian Garden and Bright Angel Campgrounds would remain the same. There would be the addition of up to four small campsites at Cottonwood Campground. The addition of campsites is not expected to directly impact water resources, however, more recreational users with time to explore water features would create the potential for impacts. Campgrounds are located in close proximity to tributaries, and campers enjoy cooling off in the creek during the hot summer months frequently damming sections to create swimming holes. These activities increase turbidity, entraining bacteria, and increases contamination from personal care products such as sunscreens. Minor adverse impacts occur during the cooler fall and winter months, otherwise moderate, adverse, localized, short and long-term impacts to water resources would occur.

Deer Creek / Tapeats Creek Complex
Under Alternative B, the total number of groups within the complex would decrease from 12 to 10, the Use Areas would be refined from five to four, and no large groups would be permitted. These actions would lead to 13% fewer people in the complex at one time on average: 12% fewer in spring and 15% fewer in months of August, September and October, which would have beneficial impacts to water resources. The removal of the Lower Tapeats Creek Use Area for camping and the exclusion of large groups from the complex would be beneficial for water resources by reducing visitor impact in an area where no part of the campsite was further than 100m from a perennial creek. Minor to moderate, adverse, localized, long-term impacts to water resources would occur.

Deer Creek Narrows
Under Alternative B, the current closure under the Superintendent's Compendium would become permanent. This closure protects the water resources in the area by reducing use and contamination from sunscreens. Minor, beneficial, short and long-term, localized impacts to water resources in the Deer Creek Narrows would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative B, these three Use Areas would continue to be managed as Primitive Zones and only small groups would be allowed. In Hance Creek and Cottonwood Creek, the visitor-established campsites at these "at-large" Use Areas tend to be adjacent to or adjoining perennial streams. Small group size is expected to reduce impacts to water resources including contamination from sunscreens and bank instability from vegetation trampling and trailing. Minor, adverse, short and long-term, localized impacts to water resources would occur to water resources.

Cumulative Impacts
Cumulative impacts were determined by combining the impacts of Alternative B alternative with other past, present, and reasonably foreseeable future actions having impacts on water resources. These impacts of past, present and reasonably foreseeable future actions are described under alternative A and would be the same as under Alternative A. Cumulatively, the effects of Alternative B, when combined with other past, present and reasonably foreseeable action, would result in major, adverse, long-term, localized and

regional impacts on water resources. Alternative B would have a very small contribution to this cumulative effect.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would result from recreational uses would be perceptible and measurable including the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features.

Minor to moderate, beneficial, localized and regional, short and long-term impacts would result from smaller group sizes, closing Deer Creek narrows, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices.

Cumulative impacts to water resources would be major, adverse, localized to regional, and long-term of which Alternative B would contribute a very small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C, the maximum group size for all four zones would continue to be 11 persons, with both small and large groups allowed in all management zones. Large groups tend to spread out more and have greater impacts beyond the perimeter of the campsites. Similar to Alternative A, minor to moderate, adverse, short and long-term, localized and regional impacts to water resources would occur.

River Assisted Backcountry Travel
Under Alternative C, RABT would be management by 11 river sections, and four sections would be closed to RABT use. RABT users would be limited to one river section per trip or two sections if on different days. Most of the anticipated impact would be to resources in the tributary canyons on routes associated with RABT, rather than from the river travel itself.

None of the 32 Grand Canyon canyoneering routes requiring RABT described by Martin (Martin 2013) would be disallowed under Alternative C compared to six disallowed under Alternative A. Access to 35-Mile, Tatahatso, Cork Spring, Fern Glen, Willow, and Stairway Canyons in Alternative C would have negligible to minor adverse impacts to water resources, as there is a low density of springs and seeps.

Although impacts to water resources during river travel is expected to be negligible, increased access to remote tributary sites potentially would lead to impacts (see *Potential Day and Overnight Use Impacts to Water Resources)* Overall impacts to tributaries and seeps and springs would be similar to Alternatives A and B; minor, adverse, short and long-term, localized impacts would occur to water resources.

Commercial Overnight Backpacking
Under Alternative C, commercial overnight backpacking would be allowed in Corridor, Threshold and Primitive Zones. No commercial use would be allowed in the Wild Zone. Under all action alternatives, the number of commercial groups per night (i.e., group nights) for each zone would be capped. Under Alternative C, the number of group nights for Corridor Zone campgrounds would be similar to Alternative A, the Threshold Use Areas would result in up to 3% increase, and commercial use in Primitive Use Area would decrease from current commercial use levels annually. Under concession

contracts, commercial trips would have stringent requirements for resource protection, including Leave No Trace training and other best management practices. Beneficial impacts to water resources would result from minimizing impacts to water quality from adherence to regulations on camping distances and human waste disposal, and protection of water resources by limiting trailing and minimizing modifications to streambed to provide pools for cooling, especially in Threshold and Primitive Zones with camping adjacent to tributaries. While overall use of campsites adjacent to tributaries would continue to have adverse impacts on water resources, a slight increase in commercial use in Threshold and Primitive Use Areas would result in minor beneficial short and long-term, localized and regional impacts to water resources. Overall, negligible to minor, adverse impacts would occur to water resources.

Commercial Day Hiking
Commercial day hiking trips would be similar to Alternatives A and B, but there would be two additional longer hikes added, Bright Angel Trail to Indian Garden and South Kaibab Trail to Skeleton Point, extending the scope of potential impacts. Commercial day hikes to Indian Garden would likely use the day use area to rest and cool off. The maximum group size would be 11 with guide-to-client ratios. Commercial guides would be trained in Leave No Trace techniques, park rules and regulations, and basic overview of resource protection and trail etiquette. Beneficial impacts would include education and minimizing vegetation trampling at springs. Negligible to minor, adverse, short-term, localized impacts to water resources would occur.

Backcountry Roads, Trails, and Routes
Under Alternative C, approximately 44 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails, and six miles converted to a Class 4 trail to accommodate stock use to Tiyo Point. In addition, the Boundary Road, currently an administrative use road, would be opened. Impacts to vegetation and soils alter the natural hydrology of an area (i.e., compaction, runoff). Channeling use to a single trail and the conversion would reduce compaction runoff and further protect water resources.

Unmaintained routes, old roadbeds and trails on the Walhalla Plateau are part of the Bright Angel Creek and/or Clear Creek watersheds. Bright Angel Creek is one of the largest perennial tributaries and located in the Corridor Zone is highly used by visitors for recreation and/or drinking water source (especially in the winter season). Assuming appropriate compliance is implemented in case of active restoration to prevent contamination of water resources (i.e., springs, seeps, sinkholes) from use of chemicals and/or synthetic salts, there would be minor adverse impacts to water resources. The conversion of the Tiyo Point route to a Class 4 trail open to stock would have adverse impacts to soils and vegetation potentially affecting runoff in the area.

The Boundary Road would be open to vehicle access. Adverse impacts to water resources due to runoff associated with construction required for upgrading the road to current standards and increased compaction of soils would occur. Minor to moderate, adverse, short to long-term localized impacts to water resources would occur from Boundary Road construction and conversion of Tiyo Point Class 4 trail.

Tuweep Facilities
This action is the same as Alternative A; the overlook parking would not be re-located closer to the campground as recommended in the 1995 GMP. Soil compaction of the road and overlook parking has potential to create runoff and affect water resources in Saddle Horse Creek. In general, hiker and stock use of Saddle Horse Trail would also impact the spring and creek. However, baseline and current conditions for water quality of this creek are unknown. Minor, adverse, short and long-term localized impacts would continue to occur.

Corridor Zone Camping
Under Alternative C, there would be the addition of one small campsite at Indian Garden, four small and one large campsite at Cottonwood Campground, and the creation of two small campsites at Roaring Springs, opening that area to overnight use. The addition of a campsite at Indian Garden and Cottonwood Campgrounds would have adverse impacts to water resources due to increased numbers of overnight visitors with time to explore water features. Campgrounds are located in close proximity to tributaries, and campers enjoy cooling off in the creek during the hot summer months frequently damming sections to create swimming holes. These activities increase turbidity, entraining bacteria, and increases contamination from personal care products such as sunscreens. The creation of campsites at Roaring Springs (currently the day use area) would lead to an increase in social trailing along Roaring Springs and Bright Angel Creeks, promoting an increase in bank instability and changes in stream turbidity. The addition of campsites at Roaring Springs would increase potential adverse impacts to water quality due to the presence of visitors with more time to spend at and near the creek and greater use of composting toilets in the floodplain. Moderate, adverse, localized, short and long-term impacts would occur to water resources.

Deer Creek / Tapeats Creek Complex
Under Alternative C, the total number of groups within the complex would decrease from 12 to 11, the Use Areas would be refined from five to four, and would allow large and small groups in all Use Areas within the complex. The Upper Tapeats designated camp area would increase by one small group. The total users in the Deer Creek/Tapeats Creek Complex would decrease by 1.2%. Fewer people in the complex at one time would have beneficial impacts to water resources; however the addition of one small group campsite as Upper Tapeats would have adverse impacts. Upper Tapeats Creek and Deer Creek are within 10 meters of perennial streams; and visitors use streams for cooling off and obtaining drinking water. Impacts to water resources would include contamination from sunscreens and soaps, streambed modification from damming and/or bank instability and vegetation trampling from trailing. Moderate, adverse, short to long-term impacts, localized to regional impacts to water resources would occur.

Deer Creek Narrows
Climbing and rappelling into the narrow section of Deer Creek would be unrestricted. Access to climbing activities would cause direct impacts to the water resources in that area in the form of increases in turbidity and contamination from sunscreens. Minor, adverse, short and long-term term impacts to water resources in the Deer Creek Narrows would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance and Cottonwood Creeks would convert from Primitive to Threshold, which would increase the total number of user nights in the Threshold Zones by 5.8% and decrease the total number of user nights in Primitive Zones by 1.1%. Designated campsites may be established and a toilet installed depending on the need. Assuming current human waste disposal issues are properly addressed and managed, beneficial impacts to water resources would result from the installation of toilets. Designated campsites would also direct visitor use patterns when place proper distances from water resources. Impacts from small and large groups would include contamination from sunscreens and bank instability from vegetation trampling and trailing. Minor to moderate adverse would continue to occur in Hance Creek and Cottonwood Creek.

Cremation Use Area would have a portion with designated camping with a maximum group size of 11. Furthermore, already visitor-established sites are not directly adjacent to water resources. Designated camping would benefit management by directing and concentrating use in a manner that protects park resources. Overall, minor to moderate, adverse, localized, short to long-term impacts to water resources would occur.

Cumulative Impacts
Cumulative impacts were determined by combining the impacts of Alternative C alternative with other past, present, and reasonably foreseeable future actions having impacts on water resources. These impacts of past, present and reasonably foreseeable future actions are described under alternative A and would be the same as under Alternative A. Cumulatively, the effects of Alternative C, when combined with other past, present and reasonably foreseeable action, would result in major, adverse, long-term, localized and regional impacts on water resources. Alternative C would have a small contribution to this cumulative effect.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, short and long-term, local and regional impacts to water resources would include the addition of up to eight Corridor Zone campsites, large and small group camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons including Deer Creek Narrows. Impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features.

Minor, beneficial, short and long-term, localized and regional impacts would result from converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact practices.

Cumulative impacts to water resources would be major, adverse, localized to regional, long-term and year-round of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, the maximum group size in Threshold, Primitive and Wild Zones would be six persons. Large groups (7 to 11 persons) would only be allowed in the Corridor Zone. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, and 7% of group nights in the Threshold Zone, they represent nearly a quarter of the user nights in those areas. Large groups are assumed to have greater adverse impacts in comparison to small groups. By allowing only small groups, adverse impacts to water resources and water quality at and beyond the periphery of established campsites would be reduced due to reduction in group size and overall use. In the Corridor Zone, the group campsites are established at a better distance from the tributary, and are of the size that is appropriate to accommodate large groups. Minor adverse, long-term, localized and regional impacts to water resources would occur.

River Assisted Backcountry Travel
Under Alternative D, RABT would be restricted to an 11 mile limit and four river sections would be closed to RABT use. None of the 32 Grand Canyon canyoneering routes requiring RABT described in a recent book (Martin 2013) would be disallowed under Alternative D, versus 5 disallowed under Alternative A.

Most of the anticipated impact would be to resources in the canyons on routes associated with RABT, rather than from river travel. For example, half the routes described in a recent book on canyoneering in Grand Canyon (Martin 2013) require a RABT segment to complete. Increased recreation in canyon bottoms which were previously difficult to access increases the potential to impact water resources (see *Potential Day and Overnight Use Impacts to Water Resources*). Access to 35-Mile, Tatahatso, Cork Spring, and Stairway Canyons in Alternative D would have negligible to minor impacts to water

resources, as there is a low density of springs and seeps. Similar to all action alternatives, minor, adverse, short to long-term, localized and regional impacts would occur to water resources.

Commercial Overnight Backpacking
Under Alternative D, commercial overnight backpacking would only be allowed in Corridor Zone, Group nights would be capped for Corridor Zone campgrounds, resulting in a projected increase of 8% over current commercial use in the Corridor Zone. Under concession contracts, commercial trips would have stringent requirements for resource protection, including Leave No Trace training and other best management practices, including minimizing trailing and modifications to streambeds to provide pools for cooling. While adverse impacts would continue from use, beneficial impacts to water resources from guided services would be localized along Garden Creek and Bright Angel Creek. Negligible to minor, beneficial, short and long-term impacts to water resources would occur. Overall, negligible to minor, adverse, short and long-term local impacts would occur to water resources.

Commercial Day Hiking
Commercial day hiking trips would be limited the upper segment of the Bright Angel, South Kaibab, and North Kaibab trails; areas absent of natural water resources. Direct impacts to water resources would not occur.

Backcountry Roads, Trails, and Routes
Under Alternative D, the 12.4 mile unmaintained Cape Solitude route would be converted to a Class 1 wilderness trail, and other former fire and ranch roads remain unmaintained hiking routes. Impacts to vegetation and soils alter the natural hydrology of an area (i.e., compaction, runoff). Other former roads would remain undisturbed and allowed to passively restore. Assuming appropriate compliance is implemented in case of active restoration to prevent contamination of water resources (i.e., springs, seeps, sinkholes) from use of chemicals and/or synthetic salts, negligible to minor adverse impacts would continue to occur to water resources. Overall, negligible to minor, adverse, short and long-term, localized and regional impacts to water resources would occur.

Tuweep Facilities
Same as Alternative B, overlook parking would be re-located closer to the campground as recommended in the1995 GMP. By allowing soils on the road segment and in the overlook area to recover, the expected impacts of these actions would be beneficial to water resources. The relocation of the overlook parking to near the campground would have minor beneficial long-term, localized impacts on water resources. . Overall, negligible to minor adverse impacts would occur to water resources.

Corridor Zone Camping
Under Alternative D, campsites at Indian Garden, Bright Angel and Roaring Springs campgrounds would remain the same. There would be the addition of two small campsites at Cottonwood Campground. The addition of campsites is not expected to directly impact water resources, however, more recreational users with time to explore water features would create the potential for impacts. Campgrounds are located in close proximity to tributaries, and campers enjoy cooling off in the creek during the hot summer months frequently damming sections to create swimming holes. These activities increase turbidity, entraining bacteria, and increases contamination from personal care products such as sunscreens. Minor adverse impacts occur during the cooler fall and winter months, otherwise moderate, adverse, localized, short and long-term impacts to water resources would occur.

Deer Creek/Tapeats Creek Complex
Under Alternative D, the total number of groups within the complex would decrease from 12 to 8, the use zones would be refined from five to four, and no large groups would be permitted. These actions would lead to a reduction of 11% of groups using the area and 18% fewer people in the complex at one time,

which would have overall beneficial impacts to water resources. Minor, adverse, short and long-term, localized to regional impacts to water resources would occur.

Deer Creek Narrows
Under Alternative D, the current closure under the Superintendent's Compendium would become permanent and the number of groups at one time visiting the patio and narrows would be restricted. The closure protects the water resources in the area by reducing use and contamination from sunscreens. Minor to moderate beneficial, short and long-term localized impacts to water resources in the Deer Creek Narrows would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Same as Alternative B; these three Use Areas would continue to be managed as Primitive Zones and only small groups would be allowed. In Hance Creek and Cottonwood Creek, the visitor-established campsites at these "at-large" Use Areas tend to be adjacent to or adjoining perennial streams. Small group size is expected to reduce impacts to water resources including contamination from sunscreens and bank instability from vegetation trampling and trailing. Minor, adverse, short and long-term, localized impacts to water resources would occur.

Cumulative Impacts
Cumulative impacts were determined by combining the impacts of Alternative D alternative with other past, present, and reasonably foreseeable future actions having impacts on water resources. These impacts of past, present and reasonably foreseeable future actions are described under alternative A and would be the same as under Alternative A. Cumulatively, the effects of Alternative D, when combined with other past, present and reasonably foreseeable action, would result in major, adverse, long-term, localized and regional impacts on water resources. Alternative D would have a very small contribution to this cumulative effect.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, short and long-term, localized and regional impacts to water resources would result from recreational uses include the addition of Corridor Zone campsites, camping (at-large or designated) adjacent to perennial streams, and climbing or canyoneering in narrow canyons with seeps, springs and other water resources. These impacts include chemical and bacterial contamination from bathing and human waste disposal, increased soil runoff and turbidity from destabilized banks and soil disturbance, and accumulation of litter and trash in water features.

Minor to moderate, beneficial, short and long-term, localized and regional impacts would result from smaller group sizes in Wilderness Zones, closing and limiting visitation at Deer Creek narrows area, converting old roadbeds to trails, the proper type and placement of backcountry toilets and increased visitor education on minimum impact.

Cumulative impacts to water quality would be major, adverse, localized to regional, and long-term of which Alternative D would contribute a very small amount.

Soundscape

ISSUES

Issues regarding soundscapes identified through public and internal scoping include

- Overall protection of Grand Canyon soundscapes and compliance with related law and policy

- Impacts to natural soundscape due to air tours, administrative aviation (rescue flights, material transport, etc.), commercial jets, motor boats, motorized equipment, and personal electronic devices need to be addressed
- Provide opportunities for enjoyment of natural sounds, such as bird calls and songs, and solitude
- Noise disturbances by humans can directly and indirectly affect terrestrial wildlife, including avoidance of an area, abandonment of a nest or den site, flushing of animals, behavior modifications and habituation to humans, injury or possibly mortality, and increased exposure to predation
- Management of administrative use should be done in ways which reduce or eliminate the noise disturbance to visitors and wildlife especially in Wilderness zones

DESIRED CONDITIONS

Visitor opportunities exist throughout Grand Canyon to experience natural sounds. The sounds of civilization are generally confined to developed areas, and noise from air tours and commercial overflights are restricted to flight corridors. Soundscapes maintained to allow tribal songscapes to persist.

METHODOLOGY

The general process for assessing impacts to the environment is discussed in Section 4.1 of this chapter. Effects specific to the natural soundscape are characterized for each alternative based on the intensity definitions presented below.

Context, timing (including frequency of occurrence), duration, and intensity all interact in a complex manner that determines the level of noise impact from an activity. In some cases the analysis of all the factors can indicate a certain impact level where analysis of only a single factor may indicate a much different impact level.

Table 4.2 provides estimates of the amount of time backcountry noise sources are present and/or audible, as well as how frequently they occur at Grand Canyon. These estimates were verified by the Grand Canyon staff most involved with the specific activity and equipment (e.g., for park helicopter use the park helibase manager, for trail maintenance the park trail maintenance supervisor).

Table 4.2 Estimates of Time Noise Sources are Present or Audible in the Backcountry

Source	Context	Duration	Timing
Helicopter			
Backcountry toilet maintenance	Localized	Short-term 15 min	Seasonal 1 to 9 loads, 1 to 2 times per year
SAR / Medical Evacuation (hovering/ landing/take-off)	Localized	Short-term 30 min	Year-round Primarily during high use periods
Landing and take-off	Localized	Short-term 10 min	Year-round Corridor: daily during high use River: 1 to 3 times per year Other Zones: rarely
Transit	Localized to Regional	Short-term 2 - 3 min	Year-round Corridor: daily during high use River: once per week or less Other Zones: once per week or less

Source	Context	Duration	Timing
Airplane			
Transit	Localized to Regional	Short-term 2 - 3 min	Year-round Corridor: rarely River and other zones: weekly during high use periods
Roads			
Loud vehicles such as Large trucks, Off-highway vehicles, less muffling	Localized to Regional	Short-term 5 - 20 min	Year-round High-use roads: up to 8 times / day Low-use roads: twice per day, one day per week
Cars and SUVs, normal muffling	Localized to Regional	Short-term 1 - 10 min	Year-round High-use roads: up to 8 times / day Low-use roads: up to twice per day, one day per week
Road Maintenance Grader, backhoe, chainsaw	Localized to Regional	Short to Long-term 1 to 3 days, 4 hrs. per day	Seasonal During good weather, once per 5 - 10 years, plus annual clearing of downed trees in spring
Trails			
Maintenance activities and equipment	Localized	Short to Long-term	Seasonal Corridor: Annually, plus intensive work with mechanized equipment once per 3 - 5 years. Other zones: once per 10-30 years, no mechanized equipment

For this impact assessment, the time noise is present as shown in above Table 4.2 will be used along with representative decibel levels described in Chapter 3.

INTENSITY DEFINITIONS

Intensity

Negligible Natural soundscape would predominate. Noise effects would be at lowest levels of detection and barely perceptible, with neither adverse nor beneficial consequences. When noise is present, it is for very short durations and/or very infrequent.

Minor Adverse: Natural soundscape would predominate. Noise effects would be perceptible and measurable. When noise is present, it is generally at low levels, infrequently present for short durations and not in especially sensitive areas (e.g., culturally sensitive areas or special status wildlife habitat).

Beneficial: Natural soundscape would predominate. Noise effects would be reduced a small amount (less than 25%).

Moderate Adverse: Natural soundscape would be affected by human noise intrusions, but usually less than 25% of the day (7am to 7pm). Noise effects would be easily perceived and measurable. Noise would be at moderate levels for short durations or at lower levels in especially sensitive areas (e.g., culturally sensitive areas or special status wildlife habitat) or for long durations.

Beneficial: Natural soundscape would predominate. Noise effects would be reduced by 25-50%.

Major — Adverse: Natural soundscape would be affected by human noise intrusions 25% or more of the day (7am to 7pm). Noise effects would increase with noise easily perceived and measurable. Noise would tend to dominate the area for much of the day at moderate or greater levels for greater durations.

Beneficial: Natural soundscape would predominate. Noise effects would be reduced more than 50%.

Context

Localized — Impacts would occur to a small area such as a campsite or attraction site, or to a single backcountry Use Area or trail

Regional — Impacts would occur over a large area, such as several backcountry Use Areas, trails, and/or one or more Backcountry Management Zone.

Duration

Short-term — Impacts would be temporary, without lasting effects. The natural soundscape would return to pre-disturbance conditions within a day or two.

Long-term — Impacts would be relatively continuous or recurring, with potentially permanent effects, OR impacts would be great enough that natural soundscape would not return to pre-disturbance conditions for more than a few days.

Timing

Natural sounds and human-caused sounds vary daily, seasonally, and even minute-to-minute. During seasons with lower levels of use, noise levels are also generally lower than seasons with higher use. During daylight-hours noise levels are typically higher than night-time, due to increased human activity and available recreational opportunities. Daytime use in the backcountry can be looked at as a "pulse" of noise that is introduced at various times of the day, in various parts of the backcountry, and for varying durations. Timing also considers periods of higher or lower sensitivity to noise impacts, and whether the noise occurs frequently or infrequently, occurs randomly or regularly, and whether it occurs for long or brief periods of time.

ASSUMPTIONS

Assumptions that specifically related to the alternatives in this document and their effect on soundscape are presented below.

- The primary effects of backcountry management on the park soundscape are due to noise associated with administrative use of aircraft, vehicles on park roads, tools used for such activities as trail and road maintenance, and the potential for increased use of personal electronics (amplified music devices and wireless phones). Most of these noise sources are common to all alternatives.
- Backcountry visitors and resources under and near commercial air tour flight routes will continue to experience noise generated from large numbers of commercial helicopter and fixed-wing airplane tours and transportation flights. (i.e., more than 100 flights per day on some routes during busy times of year). Backcountry visitors and resources in other areas away from the flight routes may experience noise from aircraft, but generally not as frequently or as numerous as under or near the flight routes, and the aircraft will generally be at higher altitudes and lower sound energy levels.

- If deemed the minimum tool, maintenance of backcountry toilets would continue using helicopters. For the purposes of the analysis, assume that additional facilities would increase helicopter use.
- Noise levels caused by backcountry recreational activities are usually temporary, in that discontinuance of the source would allow the opportunity for the natural soundscape to return to the condition that existed prior to the particular recreational activity. However, effects from the sound may have caused changes, such as displacement of birds, which result in a changed natural soundscape.
- Visitors in the Wild and Primitive Zones are the most sensitive to sound impacts, followed in order by Threshold, River, Road Natural, and Corridor Zones. That is, the same amount of noise would have a greater impact on soundscape in the Wild Zone than in the Corridor Zone.

Direct and Indirect Impacts to Soundscape
The primary direct impacts to natural soundscapes from backcountry management and use are attributed to noise from administrative flights, construction and maintenance activities, and vehicles on unpaved backcountry roads. Lesser impacts are derived from user groups such as backpackers, hikers, mule riders, and others; use of personal audio equipment and facilities (heating and air conditioning, water pumps, water treatment, etc.) in the Corridor Zone. Cumulative impacts are derived from commercial air tours, other overflights, boat motors, mining activities outside the park, and frontcountry vehicle noise.

Alternative elements related to recreational activities including Maximum Group Size for Overnight Backpacking, Climbing, Canyoneering, Extended Day Hiking and Running, Bicycling, River-assisted Backcountry Travel, Commercial Overnight Backpacking and Day Hiking would normally have negligible impacts on soundscape. Normal conversation and communication may vary by activity or group size; however the effects on soundscape are low and infrequent; therefore, these elements are not analyzed for soundscape impacts.

Specific management actions and recreational activities with direct impacts to soundscape are analyzed under Backcountry Management Zones, Tuweep Day Use, Human Waste Management, Administrative Use, Commercial Backcountry Vehicle Tours, Backcountry Roads, Trails and Routes, and Tuweep Facilities.

IMPACT ANALYSIS

ALTERNATIVE A
Alternative A would continue existing management practices, resulting in current trends in visitor use and recreation opportunities. The most noticeable impact to soundscape Alternative A is from administrative use of the park's helicopter for emergency and non-emergency operations. As explained above not all recreation activities have direct impacts to soundscape, however those activities involving helicopters, vehicles and hand or mechanized tools impact soundscapes to varying degrees.

Backcountry Management Zones
Management zoning is a tool for managers to structure planning and set resource priorities. Each management zone prescribes overnight use levels, guides backcountry management actions, and provides opportunities for a wide variety of backcountry experiences and management prescriptions. Current management zones include road corridors adjacent to or within the Corridor, Threshold, Primitive, and Wild Zones. The Colorado River corridor also overlaps with all backcountry zones. Noise sources within zones are produced by activities within zones rather than the zone designations and would be analyzed accordingly.

Tuweep Day Use Management
The number of vehicles and people at one time are limited by the 1995 General Management Plan (NPS 1995). Current day use at Tuweep generates noise from vehicles and user groups. For the most part, use is dispersed (except at the campground) and vehicle noise is infrequent and typically short in duration. Currently there are no limits on the number of vehicles in a day use party, and vehicle capacity standards of 30 vehicles at one time are exceeded on popular weekends. Minor, adverse, short-term impacts would continue to occur to soundscapes.

Human Waste Management
Human waste management impacts natural soundscapes primarily via helicopter-supported maintenance at backcountry toilets as described in the 2003 EA/FONSI for *Replacement, Rehabilitation, and Maintenance of Backcountry and Corridor Toilets* (NPS 2003b). The primary use of helicopters is for the removal of waste. In Wilderness zones (Threshold and Primitive), waste is removed once or twice yearly depending upon use levels at designated campsites. Maintenance activities including general upkeep and stirring of composts is generally done on hiking patrols. Corridor Zone toilets are maintained more frequently and typically require more flights due to the volume of human waste. Adverse impacts to soundscape include helicopter noise. As described in Table 4.2 the duration of one flight or noise source is 15 minutes or less. Minor to moderate, adverse, short-term, localized impacts would continue to occur to soundscapes.

Administrative Use
As described in Chapter 3 Soundscape, administrative activities that impact the backcountry soundscape include use of the helicopter or airplane for toilet maintenance, boundary patrols, resource management, research, and other maintenance and emergency operations. In addition, administrative use of backcountry roads for patrols, maintenance, resource management and other activities also impact soundscape to varying degrees. The impacts of these administrative activities are analyzed under the corresponding elements including human waste management, roads and trails management, and Tuweep.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial backcountry vehicle tours are allowed at Tuweep only. There are currently five permit holders and each operator may do up to two trips per day, for a potential of 10 trips in one day. Each group is restricted to 15 people including guides. While it is rare that multiple trips are at Tuweep on the same day, noise impacts from multiple vehicles would be perceptible for short durations. Minor, adverse, short-term, localized impacts would continue to occur to soundscapes.

Backcountry Roads, Trails and Routes
Park road and trail maintenance requires equipment, tools and activities that create noise. Corridor Zone trail work is one of the largest, continuous maintenance efforts in the park. Due to the geology, soils use levels, winter run-off, and monsoonal weather patterns, corridor trails have a relatively fast rate of erosion and failure. Trail maintenance typically involves work crews of 5-20 individuals using hand tools, wheelbarrows, and rock gurneys. Repairs on Corridor Zone trails frequently require the use of mechanized noise-producing equipment such as chainsaws, jackhammers, and, rarely, explosives. Outside of the Corridor Zone, use of these tools is infrequent and is reviewed under a Minimum Requirement Analysis on a case-by-case basis. Non-wilderness road corridors receive minimal maintenance for resource protection and visitor access purposes on an infrequent basis. As shown in Table 4.2 noise intensity near maintenance activity is high, however the frequency and duration of the noise lessen overall impacts and result in minor to moderate, adverse, short-term, localized impacts to soundscape. For Wilderness trails outside of the Corridor Zone, impacts to soundscape would continue to be minor, adverse, short-term, localized

Tuweep Facilities
Recreational facilities at Tuweep include the campground and Toroweap Overlook and local trails. The campground is limited to 10 groups: 9 small groups (maximum 6 people and 2 vehicles) and 1 large group (maximum 11 people and 4 vehicles). There are two toilets at the campground. Although the 1995 General Management Plan called for removal and relocation of the overlook parking and toilet, the actions were never implemented. Adverse impacts to soundscape include recreational vehicle noise from campground and day use, and noise from toilet maintenance that involves vehicles and pumps. Minor adverse, short-term, localized impacts to soundscape would continue to occur.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have the potential to contribute to cumulative impacts on soundscape. Aircraft flights above and outside the park are the primary cumulative noise source impacting most of the park, and the vast majority of those aircraft are not in support of backcountry management at Grand Canyon. For example, the number of air tour and related flights reported by Grand Canyon air tour operators are in the neighborhood of 100,000 each year, whereas administrative flights in support of backcountry management number less than 1,000 per year (less than 1% of air tour and related flights).

Present and foreseeable future actions overlap with some past actions and include flights for fire management, commercial air tour and transportation flights, flights by other agencies, tribes and landowners, and other overflights (e.g., commercial, military, General Aviation).

Noise from ground-based sources such as vehicles, building noise, machinery, and electronics, also adversely impacts soundscape, but is mostly concentrated in the Developed Zone (2% of the park) and adjacent Use Areas, although a small component exists in other zones from vehicles on remote unpaved roads, motorboats on the Colorado River, fire management activities, and mining activities outside the park. Noise from ground-based sources varies greatly, sometimes with high Average Sound Levels and high Percent Time Audible. It is usually localized. Even though there is some spread into nearby backcountry areas by a few noise sources such as the train whistle, a very generous estimate of the amount of spread would still keep the extent of such noise impact at less than 10% of the park.

Aircraft contribute by far the most prevalent non-natural noise over most of the park; there are no areas in Grand Canyon National Park where the natural soundscape is not adversely affected by aircraft noise some of the time. High-altitude flights are often the lone human noise source in remote areas of the park away from air-tour routes—the only reminder of civilization in otherwise very remote, primitive wilderness. When audible much of the time, and visible (including lights and/or contrails), high-altitude flights diminish the opportunity for people to experience Grand Canyon's rare and remarkable natural quiet and solitude, even though the source of the sound and visual impact is far above.

Cumulative effects to soundscape from past, present, and reasonably foreseeable future actions discussed above are moderate to major, adverse, short to long-term, and regional. Alternative A would contribute a small amount to this adverse impact.

Conclusion
Under Alternative A, minor to moderate, adverse, localized and short-term impacts would result from continued administrative use of aircraft for backcountry toilet servicing, resource management, and boundary patrols; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for trails and roads maintenance. While some of these noise sources are louder and more intense during the time they are present, they are present for short times, and are infrequent.

Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones

In addition to the current management zones, two new zones would be created: the Road Natural Zone and the River Zone. The Road Natural Zone includes the non-wilderness road corridors, trailheads and scenic overlooks. The number of designated sites and the number of vehicles at trailhead or overlooks would be limited. Identifying a Road Natural Zone does not affect overall use levels, but describes limits on the number of vehicles at designated campsite. Beneficial impacts would result from the reduction in vehicle noise. The River Zone overlay would not impact natural sounds. Overall, minor, beneficial, short and long-term localized impacts would occur to soundscapes.

Tuweep Day Use Management

The implementation of a visitor information and education system about day use, speed limits, and vehicle impacts camping would help minimize impacts to soundscape. Additional actions that could be implemented through adaptive management (day use permit or reservation system, establishment of number of vehicles per party, and designated days for group events) would further protect soundscape resources. Implementation of adaptive management actions would result in minor, beneficial, short and long-term, localized impacts to soundscapes.

Human Waste Management

The implementation of a human waste carry-out program at backcountry sites in the River Zone and the requirement for commercially guided trips to carry out waste in Use Areas without toilets would have negligible impacts on soundscape. However, beneficial impacts from the removal of backcountry toilets would reduce the number of maintenance flights. Placement of additional toilets would likely increase the number of flights resulting in adverse impacts to soundscape in localized areas. Minor beneficial, long-term, localized impacts would result from removal of toilets, and minor adverse, short and long-term, localized impacts would occur from placement of additional toilets in the backcountry.

Commercial Backcountry Vehicle Tours (Tuweep)

Under Common to All Action Alternatives, commercial backcountry vehicle tours would be limited to one vehicle per tour with a 15 person limit. Minor, beneficial, short and long-term, localized impacts to soundscapes would occur.

Cumulative Impacts

Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion

Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Commercial Backcountry Vehicle Tours (Tuweep)

Under Alternative B, only two trips (tours) would be allowed per day and only one if a commercial stock trip was scheduled, resulting in a maximum of two tour vehicles per day. Noise from tour vehicles would result in minor adverse, short and long-term, localized impacts to soundscape.

Backcountry Roads, Trails and Routes
Under Alternative B, approximately 30 miles of unmaintained routes on old roadbeds would be converted to Class 1 Wilderness trails. The development of trails would require use of a variety of hand tools, and impacts to soundscape would be perceptible near the activity area. If deemed the minimum tool, motorized tool use would have adverse impacts to soundscape for short durations. Road maintenance of non-wilderness road corridors would have impacts similar to Alternative A. Overall, minor, adverse, short-term, localized impacts to soundscape would occur.

Tuweep Facilities
Under Alternative B, no changes to the campground would occur, and the day use parking would be relocated from the overlook to a site adjacent to the campground. Adverse impacts from new development would be short-term and more intensive. Noise impacts from vehicle noise and associated activities adjacent to the campground would be more concentrated and of short duration. Vehicle noise from servicing the overlook toilet would be rare and of a short duration. Overall, minor to moderate, short-term, localized impacts to soundscape would occur.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. These impacts would be the same as under Alternative A: moderate to major adverse, long-term and regional. Cumulatively, the effects of Alternative B on soundscape, when combined with the other past, present, and reasonably foreseeable actions, would be moderate to major adverse, long-term and regional. Alternative B would contribute a small amount to this adverse effect.

Conclusion
Under Alternative B and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 trails and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground.

Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep.

Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative B would contribute a small amount.

ALTERNATIVE C

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative C, up to three trips during weekdays and two trips on weekends would be allowed. The maximum number of tour vehicles would be three per day. Noise from tour vehicles would result in minor adverse, short and long-term localized impacts to soundscape.

Backcountry Roads, Trails and Routes
Under Alternative C, approximately 45 miles of unmaintained routes on old roadbeds would be converted to Class 1 or Class 4 Wilderness trails, and the 14-mile Boundary Road would be open to public use. The development of trails would require use of a variety of hand tools, and impacts to soundscape would be perceptible near the activity area. If deemed the minimum tool, motorized tool use would have adverse impacts to soundscape for short durations. Adverse impacts from the development of the Boundary Road

would be long-term and road use would have long-term impacts to soundscape. Road maintenance of other non-wilderness road corridors would have impacts similar to Alternative A. Overall, minor to moderate, adverse, short and long-term, localized impacts to soundscape would occur.

Tuweep Facilities
Same as Alternative A, there would be no changes to the campground, and the day use parking would remain at the overlook. Toilet servicing would be done once or twice per year by a vehicle and pump. Minor adverse, short-term, localized impacts to soundscape would occur.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. These impacts would be the same as under Alternative A: moderate to major adverse, long-term and regional. Cumulatively, the effects of Alternative C on soundscape, when combined with the other past, present, and reasonably foreseeable actions, would be moderate to major adverse, long-term and regional. Alternative C would contribute a small amount to this adverse effect.

Conclusion
Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; the development of the Boundary Road and recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for development of Class 1 and 4 trails and road maintenance.

Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, separation of day use parking near the overlook, and potential for establishing vehicle limits at Tuweep.

Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative C would contribute a small amount.

ALTERNATIVE D

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative D, only one tour would be allowed per day. The reduced number of tour vehicles and associated noise would result in minor beneficial, short and long-term, localized impacts to soundscape.

Backcountry Roads, Trails and Routes
Under Alternative D, approximately 12 miles of an unmaintained route would be converted to a Class 1 Wilderness trail. The development of trails would require use of a variety of hand tools, and impacts to soundscape would be perceptible near the activity area. If deemed the minimum tool, motorized tool use would have adverse impacts to soundscape for short durations. Road maintenance of non-wilderness road corridors would have impacts similar to Alternative A. Overall, minor, adverse, short-term, localized impacts to soundscape would occur.

Tuweep Facilities
Same as Alternative B, no changes to the campground would occur, and the day use parking would be relocated from the overlook to a site adjacent to the campground. Adverse impacts from new development would be short-term and more intensive. Noise impacts from vehicle noise and associated activities adjacent to the campground would be more concentrated and of short duration, and truck and pump noise

servicing the campground and Overlook toilets would be rare and short-term. Overall, minor to moderate, short-term, localized impacts to soundscape would occur.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. These impacts would be the same as under Alternative A: moderate to major adverse, long-term and regional. Cumulatively, the effects of Alternative D on soundscape, when combined with the other past, present, and reasonably foreseeable actions, would be moderate to major adverse, long-term and regional. Alternative D would contribute a small amount to this adverse effect.

Conclusion
Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, localized and short-term impacts would result from administrative use of aircraft for backcountry toilet servicing; recreational and administrative vehicle use on park roads, and hand and/or mechanized tools used for such activities as trail and road maintenance; and from concentrating use by relocating Tuweep day use parking from the overlook to an area adjacent to the campground.

Minor beneficial, short and long-term localized impacts would result from human waste carry-out requirements, designated camping with vehicle limits in the Road Natural Zone, and potential for establishing vehicle limits at Tuweep, and increased number of unmaintained trails and routes in Wilderness.

Cumulative impacts would be moderate to major, adverse, localized and regional, short to long-term impacts of which Alternative D would contribute a small amount.

Cave Resources

ISSUES

Issues regarding cave resources identified through public and internal scoping include

- NPS has a duty to protect natural resources, including cave and karst resources, within the park
- With regard to caves and cave resources, the balance of visitor access versus resource protection should be more on protection because impacts are made more serious due to their non-renewable and irreplaceable nature, and climbers and cavers need to respect the environment more than the typical backpacker or day-hiker
- Small changes in the sizes of bat colonies can be amplified and lead to greater population declines if numbers fall below levels necessary to raise roost temperatures to critical levels needed for healthy growth of young
- Access to caves will increase when canyoneering and river assisted backcountry travel increase due to the wider scope of potential trails and travel through breaks in the Muav and Redwall.
- Increase in cave use can lead to cave impacts from human waste
- Trespass in caves occurs on a regular basis along certain corridors and the extent of this problem is unknown
- While a majority of visitors are conscientious about protecting cave and paleontological resources, a small percentage ignore park regulation and engage in acts that are destructive to the resources

DESIRED CONDITIONS

The overall desired condition for cave resources in Grand Canyon is that the integrity of caves and cave and karst processes are maintained. Cultural, biological, and paleontological, geological, and hydrological components associated with cave and karst features are unimpaired. Park management encourages high-quality caves and karst scientific research, provides for cave and karst system education, outreach, and recreation, and recognizes these features' cultural significance to tribes associated with Grand Canyon.

METHODOLOGY

To analyze effects of alternatives on cave resources, staff compiled all available information on known current and potential visitor use based on the Alternatives, and compared this against locations of known caves and areas where caves are likely to be found. Additionally, potentials for resource damage were compared against levels of inventory data available, and types of paleontological, biological, mineralogical, and cultural materials known to exist within caves. Proximity analyses were performed on these datasets to quantify how many of these sites were located in zones of greater or lesser potential impact based on levels of overlap with current or potential future visitor use patterns.

Tools Used to Analyze Effects to Caves

A profile of impacts on cave resources was developed based on site investigations and review of existing literature. The significance of cave impacts was determined through consideration of topography and cave localities for each alternative.

INTENSITY DEFINITIONS

Impacts specific to caves and cave resources are characterized for each Alternative based on the intensity definitions presented below. Additionally, each alternative was evaluated to determine whether effects would be direct or indirect. Methodology for how the determination of impact intensity, context, and duration for a specific Impact Topic then relates to Cumulative Impact analysis is presented in Chapter 4, Methodology.

Intensity

Negligible Any changes to cave resources, including mineral deposits, fossils, geologic features or human artifacts that would not be measurable or perceptible.

Minor Any changes to cave resources, including mineral deposits, fossils, geologic features, or human artifacts that would be measurable but slight, would not compromise the value of the feature, and would be possible to reverse or mitigate. Beneficial effects would be measurable but slight and would result in increased stability to individual cave and paleontological features.

Moderate Any changes to cave resources, including mineral deposits, fossils, geologic features, or human artifacts, that would be measurable, perceptible, and of consequence to the value of the feature, but the impact might be possible to reverse or mitigate. Beneficial effects would be measurable and would contribute to an increase in the stability of resource features.

Major Any changes to cave resources, including mineral deposits, fossils, geologic features, or human artifacts, that would be measurable, of severe consequence to the value of the feature, and impossible to reverse or expensive to mitigate. Beneficial effects would be measurable and would result in major stabilization of the resource.

Context

Localized Impacts would be restricted to specific resource sites.

Regional Impacts would occur to several specific resource sites within a management zone, Grand Canyon National Park, or the greater Grand Canyon region. This could also include impacts to a site that has regional significance in that it contains unique artifacts, species, or geologic formations.

Duration

Short-term Impacts occur within one year. Cave resources return to pre-disturbance condition within the next year.

Long-term Impacts accumulate over multiple years, and do not return to pre-disturbance condition within one year

ASSUMPTIONS

Assumptions that specifically relate to the alternatives presented in this document and their effects on cave resources are as follows

- Although most cave resources are restricted to a set of geological settings, the area evaluated for cave impacts includes the entire park
- Impacts would vary depending on specific resource and their sensitivity to timing issues. For example, certain cave resources (bats) would be more susceptible to impacts during spring and summer months due to roosting and maternity needs, and fall and winter because of greater physiological needs in cooler weather. Large groups have disproportionately greater impacts on cave resources than small groups. Impacts in staging areas and activities near the mouths of caves are larger for groups over size six, and within caves larger groups spread out more which can bring them closer to roosting areas where impacts are greatest (Mann et al. 2002)
- User nights and group nights available for commercial use will fill more consistently that non-commercial user and group nights, and commercial small groups are larger than non-commercial small groups
- Given that most true caves are found in the Redwall limestone layer of the canyon's strata, the accessibility of caves is further restricted by those layers cliffy structure
- The number of visitors who visit caves annually is a small percentage of those who enter the backcountry, and most who do visit caves are generally conscientious about protecting cave and paleontological resources
- Variables that increase the number of users in an area (e.g., group size, trip length, number of groups, user discretionary time, etc.) contribute to the vulnerability of cave and paleontological resources in that area. However, all variables must be evaluated together
- Caves located in the Corridor and Threshold Zones will on average show more impacts due to greater numbers of visitors
- Because there is not data directly addressing the difference in impacts between commercially guided hikes and non-commercial trips, it is assumed that all individuals will affect cave resources including paleontological, mineralogical, biological, and archaeological resources in the same way regardless of trip type. Although commercial clients tend to be less experienced and knowledgeable about good backcountry practices, the presence of trained guides should decrease inadvertent damage
- Impacts to caves and cave resources are generally long-term or permanent, although mitigation measures may be employed that can lessen these impacts. For example, while the gating of

Stanton's cave has been effective in mitigating visitor impacts, it is considered a last resort mitigation, given the cost and the aesthetic consequence. Impacts on gated caves are always negligible regardless of Alternative because they are not accessible to recreational backcountry users

- Backcountry user groups with more individuals and more time to explore an area are more likely to encounter cave resources

IMPACT ANALYSIS

A review of the Grand Canyon cave resources spatial datasets and cave database shows over 350 locations within the study area. However, this is likely only a small fraction of the caves within the park, as the vast majority of the cave-forming units (Redwall limestone and Muav limestone) have been surveyed for caves. Of the documented caves in the park database, only 46 have been inventoried using the park-developed protocol. Fewer than 20 have had a full Visitor Impact Mapping protocol completed, in which baseline conditions are recorded to gage the level of impact over time.

POTENTIAL DAY AND OVERNIGHT USE IMPACTS TO CAVE RESOURCES

Because many of the Backcountry Management Plan impact topics involve some aspect of day hiking and/or camping (day and overnight use), this section is used as a reference for potential impacts to cave resources, from day hikers and campers when these activities are mentioned in the sections that follow

Caves provide a cool, shady environment which is attractive to backcountry users during the high visitation seasons (May - September). In spring and fall, when weather is cooler and precipitation makes water more available, backcountry itineraries are often longer increasing the chances of encounters with caves. Because of this, caves and paleontological resources which are farther from established trails are more vulnerable during these seasons. However, impacts to caves have been noted in areas where day use predominates, indicating that longer itineraries are not necessary for visitor impacts to occur.

When day- and overnight visitors in the backcountry encounter and enter caves, they can have adverse impacts on cave biological resources. In caves with bats, disturbance can cause individuals to become active, and burn energy unnecessarily. In spring, this interfered with breeding and rearing of young (Reiter 2004); in winter, it can cause hibernating bats to burn fat reserves, decreasing their chances of survival (Thomas 1995). Humans have also been identified as a possible vector for the introduction of the fungi (*P. destructans*) associated with White Nose Syndrome which has caused catastrophic declines in bat populations throughout the eastern U.S. (Blehert et al. 2009). Increased visitation is also associated with changes to cave microflora, and the development and proliferation of biofilms that have adverse impacts on cultural and mineral resources, as well as native microflora (Jurado et al. 2009, Jurado et al. 2010, Saiz-Jimenez et al. 2011). The potential impacts if visitation on cave invertebrates is unknown, primarily because of the lack of inventory work to identify and conduct taxonomical work on troglobionts in the park, but undescribed species and genera of crickets, centipedes, and beetles have recently been discovered in caves of an adjacent NPS unit (Peck and Wynne 2013), suggesting that there is high diversity of invertebrate species that utilize the cave environments.

Visitor impacts can also include physical damage to the geological resources. Broken cave formations, compaction of sediments, damage to cave surfaces from abrasion and rubbing, deposition of lint, alteration of water quality and hydrology have been documented in caves where visitation is allowed and in those that have been accessed illegally. Vandalism, trash accumulation, and the removal and rearrangement of fossils and mineral resources are also known to occur as a result of cave visitation. Furthermore, increasing use of previously unvisited areas will facilitate the development of trails and awareness of cave and karst resources.

ALTERNATIVE A

Alternative A would continue existing management practices, resulting in current trends in visitor use and recreation opportunities. Impacts to cave resources under Alternative A would be from recreational uses with varying levels of impact.

Climbing Management

Climbing occurs on overnight backpacking and day use trips, and also in backcountry areas accessed from river trips. The number of park visitors engaging in climbing activities is unknown. Based on locality of climbing routes and similar equipment used for both climbing and to access caves, there is the potential to impact cave resources. Under Alternative A, minor to moderate, adverse, localized, short and long-term impacts would continue to occur to cave resources.

Canyoneering Management

Canyoneering is an emerging use for which little data about use levels and impacts exists. There is currently no group size or number limits in place for these activities unless it is part of an overnight backpacking itinerary. In this case, a permit is required and group size limits are based solely on the backcountry Use Area in which it takes place. However access to and use of canyoneering routes has the potential to impact caves. Canyoneering activities are focused on cliffs and wash bottoms where caves entrances can be found (see *Potential Day and Overnight Use Impacts to Cave Resources*). . Minor to major, adverse, localized, short and long-term impacts would continue to occur to caves if current management continues.

Human Waste Management

The current strategy for human waste management has negative impacts on cave resources in the backcountry. In high Use Areas without toilet facilities there are potential indirect impacts through the percolation of contaminated groundwater into the aquifers that supply water to caves and karst systems. Minor to major, adverse, localized, short and long-term impacts would continue to occur to caves.

River Assisted Backcountry Travel

Current management of RABT uses a five-mile limit on any river travel associated with a backcountry permit. No day use for river travel is permitted. Group sizes and number limits are based on the limits in the backcountry Use Areas in which the rest of the itinerary occurs. Six of the 32 canyoneering routes in Grand Canyon described in a recent book (Martin 2013) which require RABT for completion would be disallowed under the 5-mile limitation (36.7 Mile Canyon, Tatahatso Wash, Cork Spring Canyon, Fern Glen Canyon, Willow Canyon and Stairway Canyon). The increased use of RABT has led to recreationists accessing areas that were previously more difficult without access from a river trip, but little or no data on use levels or impacts are available. Although impacts to caves during river travel is expected to be negligible, users in previously unvisited areas could discover cave localities through increased access to remote sites each year. This in turn could act as an attractive nuisance and promote unauthorized access to caves. Minor to major, adverse, localized, short and long-term impacts would continue to occur to caves.

Administrative Use

Administrative use includes actions such as resource management, maintenance, visitor protection, visitor education, development of a cave management plan, and research. Administrative users are subject to the same overnight permit requirements as other users, and the overall impacts to caves are similar. Management actions create impacts to caves which are addressed in separate compliance documents and subject to specific mitigations that minimize adverse impacts. Similarly, research permits are subject to review and approval by park management, and include mitigations that minimize adverse impacts and ensure resource protection to the greatest extent possible. As a result of actions including mitigation,

development of a caves management plan, visitor education and research, negligible to moderate, beneficial, localized to regional, short to long-term impacts would continue to occur to caves. Negligible to major, adverse, localized to regional, short to long-term impacts could occur to caves in cases where rescue operations were performed.

National Park Service and Cooperating Association Programs
NPS and cooperator programs are subject to the same overnight permit requirements as other users, and have no day use limits. Day use, such as interpretive talks that enter the backcountry, have similar impacts to those caused by regular day users; however, the impacts tend to be lesser because the on-site group leaders are required to provide basic Leave No Trace technique guidance and be available to alert participants if resource concerns are observed. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to caves when they are encountered.

Commercial Overnight Backpacking
Commercial backpacking trips are subject to the same overnight permit requirements as other backcountry users. The CUAs identify guide qualifications, including training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry and cave access policies, there should be fewer impacts to caves relative to impacts expected from their clients travelling alone. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to caves.

Commercial Day Hiking
Commercial day hiking trips are subject to group size limits, guide-to-client ratios, and guide qualifications requirements. The latter include training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry and cave access policies, there should be fewer impacts to caves when commercial guides are present. Commercial day hiking is currently limited to the upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails, so impacts are limited spatially. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to caves.

Maximum Group Size for Overnight Backpacking
Current management allows both small (1-6 persons) and large (7-11 persons) groups in each Use Area, and the number per area is based on management zone objectives. Large groups and small groups are assumed to affect areas differently, as large groups tend to spread out more and have disproportionately large impacts on resources. Minor to major, localized, short and long-term adverse impacts on caves from visitors have been documented.

Deer Creek/Tapeats Creek Complex
The current number of groups per night in this overall complex of 5 Use Areas is 12, including large groups. Due to the proximity of some cave localities to the campsites, impacts to caves have occurred. Minor to major, adverse, localized, short and long-term impacts would continue to occur to caves.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Impacts to cave resources from groups in these Use Areas are similar to those in other Use Areas with at-large camping. Due to the proximity of some caves to campsites, caves impacts have occurred. Minor to major, adverse, localized, short and long-term impacts would continue to occur to caves.

Cumulative Impacts
Cumulative impacts on cave resources were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The most

significant actions that have affected, and would continue to affect, cave resources in the backcountry areas of the park are the management of river- and backcountry recreational users.

River runners, RABT participants, canyoneers and backcountry hikers have the potential to access caves at several sites along the river through side canyons. This contributes to moderate adverse impacts, both direct through visitation and indirect through the development of trailing to localities which increases attractiveness and availability. Administrative river trips, although mostly limited to group sizes of 16 or less, contribute to adverse impacts to caves in side canyons. Cumulatively, the effects of Alternative A, when combined with these other past, present, and reasonably foreseeable actions, are major, adverse, regional, short to long-term, and seasonal to year-round. Alternative A makes a large contribution to these overall adverse impacts because a majority of the adverse impacts are caused by backcountry visitors.

Conclusion
Under Alternative A, minor to major, adverse, local, short and long-term effects to cave resources would result from users who enter caves while on backcountry itineraries or day hikes and degrade the resources through direct contact (e.g., breakage or removal) or through indirect means such as reducing the quality of water in caves and disturbing cave-dwelling bats.

Minor to major, beneficial, localized, short and long-term impacts would result from administrative actions for mitigation and restoration (e.g., trail obliteration), or those which limit unauthorized access to caves.

Cumulative impacts would be major, adverse, regional, and short to long-term of which Alternative A would contribute a large amount because backcountry users are the source of most impacts to cave resources.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Elements common to all action alternatives to manage backcountry resources are described in this section, along with their potential impacts to cave resources. Some specific activities that occur in the backcountry impact caves, with varying levels of results.

Climbing Management
Under all action alternatives, there would be an increase in minimum impact climbing education, a system for monitoring use levels, and a framework for assessing the use of anchors, all of which would help protect caves. Minor, beneficial, localized, short and long-term impacts would occur to caves.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for resource protection implemented at specific locations
- Climbing Management Plan development (separate NEPA would be completed)

When survey or other data indicates that climbing is having an adverse impact on cave resources, one or more of these actions could be implemented. Information from day use permits would let managers know where problems may be arising, and changes to use levels would reduce impacts to cave resources. Minor to moderate, beneficial, localized, short and long-term impacts would occur to caves.

Canyoneering Management
Under all action alternatives, there would be an increase in minimum impact education, a system for monitoring use levels, and a framework for assessing the use of anchors, all of which would help protect caves by better informing management and fostering an educated user group. Minor, beneficial, localized, short and long-term impacts would occur to caves.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for resource protection implemented at specific locations

When survey or other data indicate that canyoneering is contributing to adverse impacts to cave resources, day use permitting, education about cave access policies and use limits for specific locations could be implemented. These would further protect cave resources by informing management and reducing visitation levels. Minor to moderate, beneficial, localized, short and long-term impacts would occur to caves.

Use Area Management
The proposed Use Area management actions would reduce or minimize recreation impacts to caves. Along the Hermit Trail, there are limited potential sites for at-large camping, and the installation of a designated site would concentrate use in the one area that already has impacts from camping. The decrease in group number at Granite Rapids would bring use levels into alignment with the size of that area, its multiple uses. The redefinition of Use Areas in the Deer Creek/Tapeats Complex would align Use Areas and campsites with current use patterns which result in the creation of user-defined campsites and social trails. Minor to moderate, beneficial, localized, short and long-term impacts would occur to caves.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

When survey and other data indicate that use levels, as measured by group size and number in use areas, are contributing to negative impacts to caves, one or more of these actions could be implemented. These actions are designed to adjust use levels to the capacity and sensitivity of the resources in the area. Minor to moderate, beneficial, localized, short and long-term impacts would occur to caves.

Human Waste Management
Implementation of a human waste carry-out program in the River Zone and the requirement for commercially guided trips to carry out waste in Use Areas without toilets would help minimize impacts to caves. Negligible to minor, beneficial, localized, short and long-term impacts would occur to cave resources.

Management Actions Potentially Implemented through Adaptive Management

- Replace existing toilets

- Install primitive toilets
- Remove existing toilets
- Implement seasonal or year-round waste carry-out in Use Areas

When survey or other data indicate that human waste disposal in backcountry areas is causing contamination of caves and karst resources, one or more of these actions would be implemented. Replacing, installing, or removing backcountry toilets would allow managers to keep waste contained. Carry-out programs would prevent deposition of wastes in areas that connect to caves and karst resources. Negligible to minor, beneficial, localized, short and long-term impacts would occur to cave resources.

River-assisted Backcountry Travel
The implementation of day use permits for day RABT trips and implementation of a maximum group size would help minimize impacts to caves by providing information about accessed areas and travel patterns of RABT trips which would be used to inform management decisions in the future. Minor, beneficial, localized, short and long-term impacts would occur to caves.

Administrative Use
No changes from Alternative A are proposed. Therefore there would be no change in impacts to soils from Alternative A. Negligible to moderate, beneficial, localized to regional, short to long-term impacts would occur to caves when mitigation actions, development of a caves management plan, and visitor education and research occur. Negligible to major, adverse, localized to regional, short to long-term impacts could occur to caves in cases where rescue actions were performed.

Guided Services (NPS, Cooperative Association, Commercial)
Authorizations for guided services all include stipulations on group size, guide to client ratios, management zone limits, vehicle length limits, and descriptions of non-authorized activities. All these stipulations would help protect cave resources. Current levels of activity would remain the same or may increase; therefore, negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, there would be no change in maximum group size in Corridor and Threshold Zones and impacts in those Zones would be the same as under Alternative A. In Primitive and Wild Zones and two Use Areas in the Threshold Zone (South Bass Trailhead, Point Sublime), only small groups (1 - 6 users) would be allowed. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, they represent nearly a quarter of the user nights in those areas. By excluding large groups from these areas, the number of individuals in these Use Areas would be reduced and impacts from large groups would be eliminated, lowering the potential for damage to caves and cave resources. Minor to moderate, adverse, localized, short and long-term impacts would occur to caves.

River Assisted Backcountry Travel
Management of River Assisted Backcountry Travel (RABT) under Alternative B divides the river corridor into 31 segments, four of which are closed to RABT use. Segments are defined by tributary canyons at their upper and lower boundaries and the network of trails and routes they connect. River travel necessary for overnight backcountry itineraries would be permitted within a segment. River travel for day use is allowed in segments within Marble Canyon (river mile 5.0 to 61.7) and in the segments between Grapevine Canyon and the Phantom Ranch Boat Beach and between the bottom of Horn Creek Rapid and the top of Granite Rapid. One of the 32 Grand Canyon canyoneering routes requiring RABT described in Martin's (2013) would be disallowed under Alternative B because its start and end points are in different RABT segments. The river portion of the National Canyon route begins at RM 164 and ends at RM167; the change from RABT segment 21 to 22 happens at RM 165 at Tuckup Canyon. All five routes disallowed under Alternative A, however, would be allowed under Alternative B.

RABT is an emerging activity for which there is little or no data on use levels or impacts to caves and cave resources. However, most of the anticipated impact would be in the canyons on routes associated with RABT, rather than from the river travel (see *Potential Day and Overnight Use Impacts on Cave Resources*). Increased recreation in areas previously inaccessible also has the potential to create new trails and therefore, acting as an attractive nuisance and providing access to caves. Under Alternative B, minor to major, adverse, localized, short and long-term impacts would occur to caves.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would be allowed in Corridor and Threshold Zones, with a limited number of nights allowed in adjacent Primitive Zone Use Areas when part of a larger itinerary. The rules for distribution of user-nights would result in commercial trips occupying 11.6% and 11.5% of all user-nights in Corridor and Threshold areas, respectively, and 4.4% of user-nights in Primitive Zone areas. No commercial overnight backpacking would be allowed in Wild Zone Use Areas. Based on the assumption of no difference between commercial and non-commercial users, the higher percentage of Corridor and Threshold users in commercial trips (11.6% vs. 9.7% and 11.5% vs. 9.4%, respectively,) no change in impact is expected from current management practices. If contracts and CUAs have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease, even though commercial groups are larger than non-commercial groups. The decrease in commercial user-nights in Primitive and Wild Zone areas from 9.2% to 4.4% and from 1.7% to 0% respectively is expected to decrease impacts to caves because it would decrease use and opportunities to interact with caves overall. Negligible to major, adverse, localized, short and long-term impacts would occur to caves.

Commercial Day Hiking
Commercial day hiking trips would be similar to Alternative A; trips would be limited to the six areas where they are currently only recommended. Trips would be subject to guide-to-client ratios and identify guide qualifications, which include training in Leave No Trace techniques, park rules and regulations, and basic overview of resource protection and trail etiquette. The maximum group size would be 11 persons including guides. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to caves. Under adaptive management, the number of commercial day hikes per day per trail may be established, which would further protect cave resources by reducing the number of day users in the areas near caves. Negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Deer Creek/Tapeats Complex
Under Alternative B, the total number of groups within the complex would decrease from 12 to 10, the use zones would be refined from 5 to 4, and no large groups would be permitted. These actions would lead to 13% fewer people in the complex at one time on average: 12% fewer in spring and 15% fewer in

months of August, September and October. This would have beneficial impacts to caves located in the area by decreasing the total number of users in the vicinity of caves. By excluding large groups from these areas, impacts of large groups would be eliminated (see *Potential Day and Overnight Use Impacts to Caves*). Minor to major, adverse, localized, short and long-term impacts would occur to caves.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative B, these three areas would continue to be managed as Primitive Zones. Rather than two small and one large group allowed in each per night, three small groups would be allowed. The current campsite sizes are sufficient for small groups, but the larger groups exploring larger areas would tend to create more impacts and damage to caves as described above (see *Potential Day and Overnight Use Impacts to Caves*). Minor to major, adverse, localized, short and long-term impacts would occur to caves.

Cumulative Impacts
Cumulative impacts on caves were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. These would be the same as those described under Alternative A, and would be the same as under Alternative A. Cumulatively, the effects of Alternative B on caves, when combined with past, present, and reasonable foreseeable future actions would be major, localized, adverse, year-round, and short to long-term. Alternative B would contribute a medium amount to these impacts.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized and both short and long-term impacts to cave resources would result from the increased number of canyoneering routes accessed using RABT under Alternative B, and the likely increase in users in proximity to cave resources with equipment necessary to explore them.

Minor, beneficial, localized, short to long-term impacts would result from reduced group size in Primitive and Wild Zones, a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts.

Cumulative impacts would be major, adverse, short and long-term, and localized of which Alternative B would contribute a medium amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C, the maximum group size for all four zones would be the same as under Alternative A. Therefore, impacts to caves would be the same as under Alternative A. Minor to major, adverse localized, short-and long-term impacts would occur to caves.

River Assisted Backcountry Travel
Alternative C divides the river corridor into 11 sections, on average about 29.5 miles long and defined by reasonable entry and exit points. Under this alternative, three segments (Lees Ferry to 5 mile draw. Phantom Boat Beach to Horn Creek and Tapeats Creek to Fishtail Canyon) would be closed to RABT use. RABT trips would be limited to one river section per trip or two river sections if they occur on non-consecutive days. None of the 32 Grand Canyon canyoneering routes requiring RABT described by Martin (2013) would be disallowed under Alternative C; all five of the routes disallowed under Alternative A would be permitted under Alternative C. Increased recreation in areas previously

inaccessible also has the potential to create new trails and therefore, acting as an attractive nuisance and providing access to caves.

RABT is an emerging activity for which there is little data on use levels or impacts. However, most of the anticipated impact would be to caves encountered in tributary canyons on routes associated with RABT, rather than from the river travel itself. Visitation and trail creation in previously unvisited areas through increased access to remote sites each year would increase the likelihood that cave localities would be discovered. Minor to major, adverse, localized, short and long-term impacts would occur to caves.

Commercial Overnight Backpacking
Under Alternative C, commercial overnight backpacking would be allowed in Corridor and Threshold and Primitive Zones. The rules for distribution of user-nights would result in commercial trips occupying 9.6% of the total overnight backcountry use permitted. Under this alternative, there would be proposed caps on group use. There would be an overall increase of 16% in commercial group-nights versus Alternative A, including 19% increase in the Corridor Zone, a 50% increase in the Threshold Zone and a 15% decrease in primitive zone. No commercial overnight backpacking would be allowed in Wild Zone Use Areas, decreasing impacts to caves in those areas. Based on the assumption of no difference between commercial and non-commercial users, no change is expected from current management practices. If contracts and CUAs have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease even though commercial groups are, on average, larger than private groups. Negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Commercial Day Hiking
Commercial day hiking trips would be similar to Alternatives A and B, but there would be two additional longer hikes added, Bright Angel Trail to Indian Garden and South Kaibab Trail to Skeleton Point. The trips would remain subject to guide-to-client ratios and identify guide qualifications, which should include training in Leave No Trace techniques, park rules and regulations, and basic overview of resource protection and trail etiquette. The group size would be 11 persons including guides, with a second guide required for trip with 8 or more clients. With qualified and educated guides familiar with Grand Canyon backcountry and park regulations, there would be fewer impacts to caves. Under adaptive management, the number of commercial day hikes per day per trail may be established, which would further protect cave resources by decreasing the number of users in areas with cave resources. Negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Corridor Zone Camping
Under Alternative C, there would be the addition of one small campsite at Indian Garden, four small and one large campsite at Cottonwood Campground, and the creation of two small campsites at Roaring Springs, opening that area to overnight use. The creation of campsites at Roaring Springs would lead to an increase in social trailing and potential damage to caves because there would be more visitors with more time to explore in an area with known cave resources. Minor to major, adverse, localized, long-term impacts would occur to caves.

Deer Creek/Tapeats Complex
Under Alternative C, the total number of groups within the complex would decrease from 12 to 11, the use zones would be refined from 6 to 5, with the elimination of Lower Tapeats, the addition of Bonita, and the splitting of Surprise Valley between Upper Tapeats and Deer Creek areas. Large groups would still be permitted. The total users in the Deer Creek/Tapeats Creek Complex would decrease by 1.2%, with 19.1% and 14.6% decreases In March and April and 34.7% and 10.3% decreases in August and September. Fewer people in the complex at one time would have beneficial impacts to caves. The removal of the Lower Tapeats Creek Use Area from camping would be beneficial due to the proximity of

some cave localities to those campsites. Minor to major adverse, localized, short and long-term impacts to caves would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance and Cottonwood Creek Use Areas would convert from Primitive to Threshold. Designated campsites may be established and a backcountry toilet could be considered in the future; both actions would have a negative impact on cave resources through the increased probability of introduction of human waste to karst systems. Three small and one large group would be allowed in each Use Area, with the large groups increasing the potential for campsite expansion and damage to nearby caves. Cremation Use Area would have a portion with designated camping with a maximum group size of 11. Minor to major, adverse, localized, short and long-term impacts would occur to caves.

Cumulative Impacts
Cumulative impacts on caves were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. These would be the same as under Alternative A, and would have the same impact as under Alternative A. Cumulatively, the effects of alternative C on caves, when combined with past, present, and reasonable foreseeable future actions would be major, localized, adverse, year-round, and short to long-term. Alternative C would contribute a large amount to these impacts.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, local short and long-term impacts to cave resources would result from the increase in visitors near known cave resources near Roaring Springs with the creation of campsites in the area. Minor to major adverse short and long-term impacts would also result from the potential introduction of human waste into karst systems from toilets in the Hance, Cottonwood, and Cremation Use Areas.

Negligible to minor, beneficial, localized, short to long-term impacts would result from a decrease in number of groups in the Deer Creek/Tapeats Creek Complex, minimum impact education for climbing, canyoneering, RABT users, Implementation of adaptive management would also contribute to these beneficial impacts.

Cumulative impacts would be major adverse, short and long-term, and localized to regional of which Alternative C would contribute a large amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, there would be no change to group size in the Corridor Zone. Large groups (7 – 11 users) would be excluded from backcountry Use Areas in the Wild, Primitive, and Threshold Zones. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, and 7% of group nights in the Threshold Zone, they represent nearly a quarter of the user nights in those areas. By excluding large groups from the park's more remote areas, there would be beneficial change in impacts to caves because of the reduced probability of users encountering cave resources. Minor, adverse, localized, short and long-term impacts would occur to caves.

River Assisted Backcountry Travel
Management of RABT under Alternative D would restrict travel to an 11 mile limit, which relaxes the current 5 mile restriction. Four river sections would be closed to RABT under this alternative. Two of the 32 Grand Canyon canyoneering routes requiring RABT described in a recent book (Martin 2013) would

be disallowed under Alternative D, as opposed to the five disallowed under Alternative A. Both the Fern Glen Canyon and Willow Canyon routes require a RABT segment longer than 11 miles to complete. RABT is an emerging activity for which there is little or no data on use levels or impacts. However, half the routes described in a recent book on canyoneering in Grand Canyon (Martin 2013) require a RABT segment to complete. Although impacts to caves during river travel is not expected to be occur, this use could lead to trail creation in previously unvisited areas through increased access to remote sites each year which increases the likelihood that cave localities would be discovered. Increased recreation in areas previously inaccessible also has the potential to create new trails and therefore, attract more users and provide access to caves. Minor to major, adverse, localized, short and long-term impacts would occur to caves as more routes open up.

Commercial Overnight Backpacking
Under Alternative D, commercial overnight backpacking would only be allowed in Corridor Zone. Contracts and CUAs would have education requirements for Leave No Trace and other best backcountry practices, therefore impacts of these groups are expected to be no different from non-commercial users even though they tend to be larger. Negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Commercial Day Hiking
Commercial day hiking trips would be limited to only 3 trail sections in the Corridor Zone under Alternative D and Tanner, Grandview and Hermit Trail commercial day hikes would be eliminated. They would be subject to guide-to-client ratios and there would be guide qualifications, including training in Leave No Trace techniques, park regulations, and basic overview of resource protection and trail etiquette. The group size would remain 11 persons including guides. With qualified and educated guides familiar with Grand Canyon backcountry, there would be less possibility of impacts to caves. Under adaptive management, the number of commercial day hikes per day, per trail may be established, which would further protect cave resources. Negligible to minor, adverse, localized, short and long-term impacts would occur to caves.

Deer Creek/Tapeats Complex
Under Alternative D, the total number of groups within the complex would decrease from 12 to 8, the use zones would be refined from 5 to 4, and no large groups would be permitted. These actions would lead to a reduction of 11% of groups using the area and 18% fewer people in the complex at one time, which would have beneficial impacts to caves. Fewer users in the areas of caves would create a lower probability of encounters with cave resources and no impacts from large groups. The removal of the Lower Tapeats Creek Use Area from camping would be beneficial due to the proximity of some cave localities to the campsites. Minor to moderate, adverse, localized, short and long-term impacts would occur to caves.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative D, these three areas would continue to be managed as Primitive Zones, but would allow three small groups rather than the current allowance of two small plus one large group. The elimination of large groups would result in no change in the number of groups-nights, but an overall reduction of 10% to 11% in users year-round and essentially the same reduction (10 - 12%) in spring and post-monsoon season. The current campsite sizes are sufficient for small groups, but larger groups expand campsite impacts and increase the potential for encounters with and damage of nearby caves. Minor to major, adverse, localized, short and long-term impacts would occur to caves.

Cumulative Impacts
Cumulative impacts on caves were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. These would be the

same as under Alternative A, and the impacts would be the same as under Alternative A. Cumulatively, the effects of alternative D on caves, when combined with past, present, and reasonable foreseeable future actions would be major, localized, adverse, year-round, and short to long-term. Alternative D would contribute a medium amount to these impacts.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to major, adverse, localized, short to long-term impacts to cave resources would result from the increase in RABT segment length to a maximum of 11 miles. This increase would allow exploration of more routes to caves.

Minor, beneficial, localized impacts to cave resources would occur because of the decrease in numbers and group size allowed outside the Corridor Zone, the Deer Creek/Tapeats Creek complex, and the Hance, Cottonwood, and Cremation Use Areas; minimum impact education provided to climbing, canyoneering, and RABT users and the monitoring of their numbers and distribution to inform management via the permitting process. Implementation of adaptive management would contribute to these beneficial impacts.

Cumulative impacts would be major, adverse, short and long-term, and localized to regional of which Alternative D would contribute a medium amount.

Vegetation

ISSUES

Issues regarding vegetation identified through public and internal scoping include

- NPS has a duty to protect natural resources, including vegetation, within the park
- Management of visitor use should be done in ways which reduce or eliminate the spread of invasive exotic plant species
- Effective monitoring of visitor use levels and visitor impacts should be used to inform a strategy which adapts management to trends in the backcountry
- Impacts to vegetation resulting from emerging recreation practices which increase visitation in previously inaccessible areas should be anticipated
- Management of visitor use should minimize impacts on existing vegetation resources, especially rare or important species and communities, up to and including the closure of trails and areas where impacts are greatest
- There is a need to restore vegetation in areas where roads are not designated for vehicle use or are converted to trails
- Backcountry users do not always realize they are causing impacts to vegetation or those impacts are inadvertent

DESIRED CONDITIONS

The desired condition of vegetation in Grand Canyon National Park's backcountry is that of a suite of naturally sustained native plant communities in which exotic species are rare and have little effect on local and ecosystem processes. The diversity of native vegetation arises from the influences of many intersecting gradients of environmental variation that are caused by natural processes that would occur in the absence of human intervention (NPS 2006). Species richness and plant productivity vary among habitats, reflecting the diversity of natural disturbance regimes, moisture, temperature, soil conditions, insolation rates and other organizing influences of natural origin. The variability found in species'

genotypes are protected through naturally occurring ecological processes. Selected vegetation resources, both species and communities, are monitored to ensure availability for current use and use by future generations.

METHODOLOGY

The general process for assessing impacts is discussed earlier in this chapter. To analyze the effect of each Alternative on vegetation resources, staff compiled all available information on visitor use and vegetation in the backcountry including formally collected data from NPS, USGS, and academic cooperators, information from published works, and personal communication with resource specialists. From this pool, the best available data for species locations, past documentation and studies of impacts, and the most recent research for species and plant communities in the park were assembled. Maps of documented cultural and natural resources and focal points for visitor backcountry use (campsites, trails, routes, and attraction sites), including data on use intensity, were used to identify areas of resource concern where concentrations of sensitive resources overlapped with visitor Use Areas. The impact analysis was based on the interaction of context, duration, timing, and intensity of visitor impacts, which were defined using resource-specific intensity definitions.

INTENSITY DEFINITIONS

Effects on vegetation are characterized for each alternative based on the intensity definitions presented below. Additionally, each alternative was evaluated to determine whether effects would be direct or indirect. For intensity, the impacts to vegetation could be negligible, minor, moderate, or major, and they could be beneficial or adverse. Impacts were measured against pre-established thresholds to determine the impact intensity.

Intensity

Negligible Impacts to individual plants or plant communities would have no measurable or perceptible effect on size, viability, integrity, interrelationships, or function of the plant community.

Minor Impacts to individual plants or plant communities would be measurable or perceptible but would not affect the size, viability, integrity, interrelationships, or function of the plant community. There could be slight but measurable changes in number, density, or cover of exotic plants. For adverse impacts, any mitigation necessary to offset adverse impacts would be minimal and effective.

Moderate Impacts to plant communities would be measurable and perceptible and would affect the overall size, viability, integrity, interrelationships, or function of the plant community. There could be apparent and measurable changes in number, density, or cover of exotic plants. For adverse impacts, mitigation to offset adverse impacts would be extensive, but most likely successful.

Major Impacts to plant communities would be substantial, highly noticeable, and have the potential to become permanent. They would affect the overall size, viability, integrity, interrelationships and/or function of the plant community. For adverse impacts, the abundance of exotic plants could become equal to or greater than native plants, mitigation to offset adverse impacts would be extensive, and success would not be guaranteed.

Context

Localized Impacts occur only in limited areas such as campsites, attraction sites, along routes and trails, and areas near water sources such as seeps, springs and creeks. Impacts affect individual plants or small patches within plant communities.

Regional Impacts are spread across multiple Use Areas up to park-wide. Regional impacts affect substantial portions of the range of the population or species within Grand Canyon National Park.

Duration

Short-term Impacts to an individual plant or community would last for periods ranging from less than a growing season to less than one year.

Long-term Impacts to an individual plant or community would last more than one year or result in permanent change.

Timing

Impacts to vegetation could occur year-round, but the plants are most sensitive during times of germination and emergence from dormancy. For most perennial species and winter annuals, this occurs early in the spring. The germination of summer annuals is tied to monsoonal rain which arrives in late summer and continues through the early fall.

ASSUMPTIONS

Assumptions that specifically relate to the alternatives and their effect on vegetation are:

- The time period evaluated for this plan is twenty years.
- The areas with the greatest potential for impacts includes trails, lunch stops, attraction sites, campsites, roads and natural road corridors and areas accessible to hikers, canyoneers and packrafters.
- The greatest impacts on vegetation resources by recreational use take place in the first years of use. After trails and barren cores are established, the rate of change in condition generally will drop rapidly.
- User-nights and group-nights available for commercial use will fill more consistently than those available for non-commercial use, and commercial small groups are larger than non-commercial small groups.
- Large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of barren cores in campsites.
- Not all impacts on vegetation resources in backcountry areas are from hikers and backpackers; many areas are accessible to river runners hiking from the Colorado River. However, impacts from use by the two groups are considered to be identical.
- Mitigation measures to achieve ecological restoration in some areas might not be attainable, and the goal of the mitigation measures may be to simply disguise the impacts or to revegetate areas without achieving true restoration of the biological and physical properties present prior to impact.
- Impacts to vegetation occur year-round, but plants are most sensitive during times of germination and emergence from dormancy. For most perennial species and winter annuals, this occurs early in the spring. For summer annuals, this occurs from late summer through early fall.

IMPACT ANALYSIS

Potential Day- and Overnight Use Impacts to Vegetation

The trampling of vegetation has three initial effects: abrasion of vegetation (plants are crushed, sheared off, or uprooted), abrasion of soil organic layers, and compaction of soil (Hendee et al. 1990). Trampling of and damage to vegetation occurs when hikers use campsites and attraction areas, create new trails (social trailing), explore beyond campsite margins, seek comfortable areas (usually shade) to rest, seek privacy when depositing waste, and expand campsite boundaries. Campsite cores are areas devoid of vegetation (0% cover) compared to 60% cover in adjacent, undisturbed areas (Cole 1986). In areas where trails are unmarked or unmaintained, hikers create new trails, damaging vegetation and increasing topsoil compaction (Tomko and Karpiscak 1974). A cycle is created in which erosion of existing trails and camping pads leads users to create new ones; on the new areas, trampling leads to a loss of vegetation and increased soil compaction and a new round of soil erosion (Phillips and Phillips 1976).

Since soils and vegetation are highly interconnected, an impact to one often leads to an impact to the other. For plants, trampling leads to reduced vigor, cover and reproduction, and changes in species composition (Liddle 1975). The compaction and disturbance of soils by humans can lead to erosion and loss of organic matter, thereby diminishing plant growth potential and the health and survival of vegetation resources (Cole 1986, Hendee et al. 1990). Negative impacts on vegetation decrease the ability of plant roots and soil microbes to create nutrient rich soils in this arid environment. In general, social trail impacts include the direct and indirect impacts described above, and most often lead to the complete loss of the vegetation and surface litter that existed prior to trail creation.

The dynamics of recreation impacts on vegetation are not strictly linear, and the strategy of designating campsites is used to accommodate greater use levels. The first 100 boot impacts have a much higher impact than those which come later. Low levels of use often cause disproportionately large impacts and vegetation loss (Cole and Monz 2004). Most damage to vegetation occurs in the earliest stages of recreational use; once trails and barren cores are established, little change comes from continued use at the same level (Cole 1986). Barren cores of campsites and trails where mineral soils have been exposed and vegetation lost do not degrade as rapidly with further use, but recovery from damage which occurs quickly can take more than 5 years of rest before recovery is complete (Cole 1986, Cole 2004). In Use Areas with heavy use, designation of campsites focuses the damage to a few small areas in an effort to contain the impacts and protect surrounding vegetation and soils.

The magnitude of recreation impacts depends on many factors including total numbers of recreationists, group size, duration of stay, and type and seasonality of use. Higher numbers of total visitors leads to damage to vegetation and noncompliance with the park's backcountry permit requirements (Hendee et al. 1990). When large groups use medium or small sized campsites, people searching for privacy when sleeping denude native vegetation at the periphery of established sites thereby expanding the campsite. Parties that stay longer at sites are more likely to develop them by trimming vegetation and arranging rocks and wood (Washburne and Cole 1983), and have more time to explore nearby attractions, increasing both the area of possible impact and the probability of impacts. Desertscrub vegetation is especially susceptible to recreational damage because the periods of highest use in these habitats coincides with the periods of greatest plant activity. Desert species are typically dormant during summer and winter. Germination, flowering, and fruiting in Grand Canyon occur during the spring and early summer, or post-monsoon months (Phillips et al. 1987) when most backcountry use takes place. At backcountry campsites accessible by vehicles, impacts from vehicles are much greater than those from hiking activities.

The ability of a particular area to sustain human impacts often depends on the type of vegetation and its condition. Many hikers seek out trails and attraction sites in riparian habitats in shady canyon bottoms or near water. Riparian vegetation is rare in Grand Canyon (1.2% of all vegetation; Kearsley et al. 2015),

extremely variable temporally, influenced by many environmental variables and is sensitive to human impacts (Grand Canyon Wildlands Council 2002). Recreation activity at springs, which damages vegetation, increases erosion, and allows exotic species to establish, may be the most significant threat to spring ecosystems (Spence 2004). At the opposite end of the spectrum, the desert vegetation is also very susceptible to long-term recreation impacts because productivity is very low in these habitats (Cole 1990). Desert adaptations like thorns and thick, succulent leaves appear to promote resistance to trampling (Cole 1986), but once plants are trampled, recovery is very slow (Bowers et al. 1995). If climate change scenarios that predict long-term reductions in precipitation for the southwestern U.S. (e.g., Bates et al. 2008) are borne out, the ability of vegetation to recover would be further reduced.

Recreation impacts to vegetation also include the introduction of exotic plant species along trails and routes which serve as invasion corridors (Tyser and Worley 1992, Potito and Beatty 2005). Trampling and erosion of soils provides opportunities for establishment of exotics which are often transported on recreationist's shoes, clothing, or equipment. Exotics can directly affect native vegetation by changing the composition of communities or via increasing susceptibility to fire (D'Antonio and Vitousek 1992, Crawford 2003, Jurand et al. 2013). Recreationists attempting to help with managing exotics by uprooting known invasive plants, such as the camelthorn, can actually stimulate bud growth on the rhizome, spread seeds, and encourage spread (Brock 2005). In addition, continual trampling can favor the most resilient species, which in Grand Canyon are often invasive exotic plants.

Backcountry activities can have negative impacts on vegetation beyond trampling. To keep small mammals and other nuisance wildlife out, backpackers often hang food bags and gear on vegetation and anchor their tents around it or stake very close to stems and roots. Because campers tend to use established tent sites, the same plants are affected over and over again, leading to damage over time. When campers shift to other plant anchors, the cumulative effect becomes larger than an individual plant. In a similar way, the use of trees and shrubs as anchor points on canyoneering routes will likely create long-term impacts in canyon bottoms and climbing routes. Over time, successive use could lead to damage to trunks and roots (Nuzzo 1995, Kelly and Larson 1997, Wood et al. 2006).

ALTERNATIVE A

Alternative A would continue existing management practices, resulting in the continuation of current trends in visitor use and recreation opportunities. The most noticeable impact to vegetation under Alternative A is from overall use in the park's backcountry. Most activities that occur in the backcountry impact vegetation in some way, with the level of impact varying.

Backcountry Management Zones

There are currently four different management zones that help define recreation opportunities in Grand Canyon's backcountry (Corridor, Threshold, Primitive, and Wild). Under Alternative A, Grand Canyon's backcountry would continue to be managed using these four zones. There is currently designated camping at the end of backcountry roads at South Bass trailhead, Ruby Point, Signal Hill, Point Sublime, Swamp Point and Fire Point. Vegetation in those designated areas is already impacted and impacts from use would continue (see *Potential Day and Overnight Use Impacts to Vegetation)*; however, the designation of sites slows the expansion of damage outside of those areas through campsite creep. There is currently no vehicle limit in these campsites, which contributes to direct impacts to soils through compaction and associated vegetation damage when drivers maneuver in crowded parking areas. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to vegetation if current management practices continue.

Climbing Management
Rock climbing occurs on overnight backpacking and day use trips, and also in backcountry areas accessed from river trips. The number or park visitors engaging in climbing activities is unknown. Access to and use of climbing routes has the potential to impact vegetation (see *Potential Day and Overnight Use Impacts to Vegetation)*. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to vegetation as a result of continuing current management.

Canyoneering Management
Canyoneering is an emerging use for which little data about use levels and impacts exists. However access to and use of canyoneering and climbing routes has the potential to impact vegetation. Increasing use of previously unvisited areas would facilitate the spread of exotic plant species (Potito and Beatty 2005). Canyoneering activities are focused on cliffs and wash bottoms where rare vegetation types are found. Even though wet and xeroriparian vegetation accounts for less than 1.5% of Grand Canyon's area, an analysis of canyoneering routes in a recently published book (Martin 2013) shows that routes are in riparian vegetation for nearly 40% of their length, on average. Both canyoneering and technical climbing often make use of vegetation for anchoring which has negative effects on individuals and, over time, local populations (Nuzzo 1995, Kelly and Larson 1997). There are currently neither group size nor user limits in place for these activities unless it is part of an overnight backpacking itinerary. In this case, a permit is required and group size limits are based solely on the backcountry Use Area in which it takes place. The nature and character of impacts are described in *Potential Impacts from Day and Overnight Use to Vegetation.* These impacts would continue to be negligible to minor, adverse, localized, short and long-term if current management practices continue.

Extended Day Hiking and Running Management
In general, trail width in the cross-canyon corridor is sufficient to accommodate this use without people having to move into undisturbed vegetation. However, there are currently no limits on numbers of groups or group size for this type of use, so congestion can occur, causing impacts to vegetation when either trail runners or the users they encounter must step off the trail (see *Potential Day and Overnight Use Impacts to Vegetation*). General trail etiquette and minimum impact techniques should be utilized, but there is currently no consistent method for dissemination of information to these users. Continuing current management of extended day hiking and running would result in negligible to minor, adverse, localized, short and long-term impacts continuing to occur to vegetation.

Tuweep Day Use Management
The number of vehicles and people at one time are limited by the 1995 General Management Plan, but there are insufficient durable surfaces to accommodate current use levels. The results have been constant direct and indirect impacts on vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). Negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to vegetation if current management at Tuweep continues.

Use Area Management
In the decades since the establishment of Use Areas and management zones by the 1988 Backcountry Plan, it has been determined that there are Use Areas which cannot support their planned use levels. For example, some campsite areas are too small for large groups which results in a continuous expansion of barren cores and damage to vegetation by users looking for space to camp, cook, or dispose of waste. In other areas, users have not been able stay on itinerary due to difficult topography. Often these users have camped in spots outside of designated campsites and damage vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). Currently there is no protocol for altering the numbers of groups or sizes of groups when impacts from backcountry users are undesirable. Continuing without altering use levels in these Use Areas would produce minor to moderate, localized, short and long-term adverse impacts to vegetation.

Human Waste Management
The current strategy for human waste management has negative impacts on vegetation in the backcountry. In high use areas without toilet facilities (e.g., Granite Camp), there are direct impacts to native vegetation through cat-hole production, and indirect impacts through ground disturbance which can also lead to the spread and promotion of exotic plant species. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to vegetation if current management of human waste continues.

River Assisted Backcountry Travel
Current management of RABT uses a five-mile limit on any river travel associated with a backcountry permit. No day use for river travel is permitted. Group size and number limits are based on the limits in the backcountry Use Areas in which the itinerary occurs. Six of the 32 canyoneering routes in Grand Canyon described in a recent book (Martin 2013) which require RABT for completion are disallowed under the 5-mile limitation (36.7 Mile Canyon, Tatahatso Wash, Cork Spring Canyon, Fern Glen Canyon, Willow Canyon and Stairway Canyon). The remaining routes which require packrafting traverse through riparian vegetation for 38% of their length, on average, even though riparian vegetation represents less than 2% of all areas in the park. The increased use of RABT has led to recreationists accessing areas that were previously more difficult to without access from a river trip. Impacts to vegetation during river travel is expected to be negligible. Impacts from the overland portion of these routes is described in *Potential Day and Overnight Use Impacts to Vegetation)*. If current management of canyoneering continues, negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to vegetation.

Administrative Use
Administrative use includes resource management, maintenance, visitor protection, visitor education, and research. Administrative users are subject to the same overnight permit requirements as other users, and the overall impacts to vegetation are similar (see *Potential Day and Overnight Use Impacts to Vegetation)*. However, some administrative use (e.g., invasive plant control, vegetation monitoring) requires access outside of established trails and campsites. Administrative users would be educated in Leave No Trace protocols and would minimize impacts to the extent possible. Beneficial impacts include invasive plant removal, site restoration, increased baseline knowledge of plant distribution (including rare plants), and overall protection of vegetation resources. Management actions themselves create negligible to minor, adverse, localized, and short to long-term impacts to vegetation, which are subject to specific mitigations that minimize adverse impacts. Management actions also create minor to major, beneficial, localized to regional, short to long-term impacts. Similarly, research permits are subject to review and approval by park management, and include mitigations that minimize adverse impacts and ensure resource protection to the greatest extent possible.

National Park Service and Cooperating Association Programs (Non-commercial Services)
NPS and cooperating association programs are subject to the same overnight permit requirements as other users, and have no day use limits. Day use, such as interpretive talks that enter the backcountry, have similar impacts to those caused by regular day users (see *Potential Day and Overnight Use Impacts to Vegetation*). However, the impacts tend to be reduced because the on-site group leaders are required to provide basic Leave No Trace technique guidance and be available to alert participants if resource impacts are observed. Continuation of these practices would result in negligible to minor, adverse, localized, short and long-term impacts to vegetation.

Commercial Overnight Backpacking
Commercial backpacking trips are subject to the same overnight permit requirements as other backcountry users and the impacts to vegetation would be similar (see *Potential Day and Overnight Use Impacts to Vegetation)*. The CUAs identify guide qualifications, including training in Leave No Trace

techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, fewer impacts to vegetation would occur. Negligible to minor, adverse, localized, short and long-term impacts from commercial overnight use would continue to occur to vegetation if current management practices continue.

Commercial Day Hiking
Commercial day hiking trips are granted through CUAs which recommend destinations and routes (upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails) but which currently do not limit numbers of groups per day per trail segment, nor is there a limit on the number of CUAs. The CUAs specify group size limits, guide-to-client ratios, and guide qualifications requirements. The latter include training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to vegetation. The nature and character of these impacts are described in *Potential Day and Overnight Use Impacts to Vegetation.* Continuing current management of commercial day use would cause negligible to minor, adverse, localized, short and long-term impacts to continue to occur to vegetation.

Commercial Backcountry Vehicle Tours (Tuweep)
Under current management, up to 10 trips per day are allowed for commercial transportation tours to Tuweep. These groups are not expected to have a major impact on vegetation because commercial tours are currently permitted on park roads open to private vehicles outside of proposed Wilderness areas. Impacts to vegetation from vehicles and visitors are described in *Potential Day and Overnight Use Impacts to Vegetation*. Negligible to minor, adverse, localized short and long-term impacts to vegetation would continue to occur under current management of vehicle tours.

Maximum Group Size for Overnight Backpacking by Zone
The current group size limits for all zones are small (1-6 persons) and large (7-11 persons) for each Use Area, and the number per area is based on management zone objectives. The impacts of both small and large groups in corridor and threshold areas tend to occur in established campsites where vegetation loss and damage has occurred for years (see *Potential Impacts of Day and Overnight Use to Vegetation*). If current distribution of groups in Use Areas continues, negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to vegetation.

Backcountry Roads, Trails, and Routes
Designated roads and trails have experienced vegetation loss for decades, with varying levels depending on use. These access areas, particularly roads, have also been vectors for import and transport of exotic plant species. There has been vegetation recovery and restoration on some of the roads that have been closed, primarily passive with some active restoration on segments of a handful of former roads (e.g., Cape Solitude, Cape Final) resulting in beneficial impacts. Other impacts to vegetation from road, trail and route use are described in *Potential Day and Overnight Use Impacts to Vegetation.* Negligible to moderate, localized, short-term adverse impacts would continue to arise from spread of exotics, trampling and removal during construction and maintenance, and negligible to moderate beneficial, localized, short and long-term impacts would continue to occur to vegetation through passive and active restoration if current practices continue.

Tuweep Facilities
The campground, overlook parking, roads, and toilets at Tuweep and the overlook have been in use for decades, and impacts to vegetation have already occurred (see *Potential Day and Overnight Use Impacts to Vegetation*). Under Alternative A, minor, adverse, localized, year-round impacts would continue to occur to vegetation.

Corridor Zone Camping
The 56 small and 4 large campsites at Indian Gardens, Phantom Ranch, and Cottonwood are well-established and have been maintained for decades. The initial vegetation loss occurred during campsite creation. Campsite impacts to vegetation continue to occur (see *Potential Day and Overnight Use Impacts to Vegetation)*, but the extent of possible further damage is somewhat limited by overall campground boundaries and the hardened condition within the campsites. Under current management of Corridor Zone camping, negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to vegetation.

Deer Creek/Tapeats Creek Complex
The current number of groups per night in this overall complex of 5 Use Areas is 12, including large groups. The impacts to vegetation from the groups in this complex are similar to that in other Use Areas (see *Potential Day and Overnight Use Impacts to Vegetation)*. Continuing current management of use in the Complex would cause negligible to moderate, adverse, localized, short and long-term impacts to occur to vegetation.

Deer Creek Narrows
Climbing and rappelling into Deer Creek Narrows is currently prohibited per the Superintendent's Compendium. This prohibition protects the limited number of plants that grow in that area. Continuing the prohibition would produce negligible to minor, beneficial, localized, short and long-term impacts to vegetation.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
The impacts to vegetation from the groups in these Use Areas are similar to that in other Use Areas with at-large camping where resources cannot support use levels (see *Potential Day and Overnight Use Impacts to Vegetation)*. Negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to vegetation if current management of these Use Areas continues.

Cumulative Impacts
Cumulative impacts on vegetation were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The most significant actions that have affected, and would continue to affect, vegetation resources in the backcountry areas of the park are the operation of Glen Canyon Dam, management of river-running, fire management, trespass wildlife, and stock use. Regulation of flow levels in the mainstem of the Colorado River has completely changed the composition of native riparian plant communities (Collier et al. 1996) and facilitated the spread of invasive exotic plant species. River runners inadvertently carry seeds of exotic species into side canyons and other backcountry areas exaggerating adverse impacts of their natural spread. Fire management actions in rim forests and woodlands create both beneficial and adverse impacts through in the alteration of rim community structure (NPS 2009a) and the introduction of exotics (Crawford 2003). Trespass ungulates have caused major adverse changes in rim and inner canyon vegetation for decades (Bennett et al. 1977, Ruffner et al. 1977). Since 2000, bison have been damaging high elevation springs and meadows, creating trails through other vegetation on the north rim and facilitating the spread of exotic species (Minard 2003a, Minard 2003b). Stock use is confined to trails, roads, and specified campsites; however, their presence in the backcountry negatively impacts vegetation through the spread of exotic plant species both in their forage and on their bodies. The presence of exotic plant species on neighboring lands, including on private and non-NPS administered lands, provides a seed source for the spread of exotic plant species in the park. Cumulatively, Glen Canyon Dam, neighboring lands, fire management activities, river recreation management, and the spread of exotic plant species have major, adverse, localized to regional, long-term, year-round effects on vegetation. Alternative A would contribute a small amount to this impact.

Conclusion
Under Alternative A, moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and include: vegetation trampling, soil compaction, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species. Beneficial impacts from vegetation recovery on closed roads and other administrative actions would be negligible.

Cumulative impacts to vegetation would be adverse, major, localized to regional, long-term, and year-round of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Elements common to all action alternatives to manage backcountry resources are described in this section, along with their potential impacts to vegetation resources. Most activities that occur in the backcountry impact vegetation in some way, with the level of impact varying. One of the primary themes throughout the common to all action alternatives elements is the concept of adaptive management (included in climbing through human waste management elements below).

Backcountry Management Zones
Two new zones would be created under all action alternatives: the Road Natural Zone and the River Zone. The Road Natural Zone includes trailheads and trailhead designated campsites as well as the road corridors themselves. The designation of camping sites and limitations on number of groups and vehicles would minimize damage to vegetation outside of those areas (see *Potential Impacts of Day and Overnight Use on Vegetation*). The River Zone includes camping beaches and the pre-dam high water zone used by both river runners and backpackers. Regulated flows from Glen Canyon dam have altered this ecosystem, affecting beach capacity, riparian vegetation, and upland desert scrub resource conditions. Recreational use has further impacted vegetation resources on trails and in camps and attraction sites (see *Potential Impacts of Day and Overnight Use on Vegetation*). The creation of this new zone would help protect vegetation resources from further damage to the greatest extent possible by integrating management of use by both river-runners and hikers. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Climbing Management
Rock climbing occurs on overnight backpacking and day use trips, and also in backcountry areas accessed from river trips. The number or park visitors engaging in climbing activities is unknown. Impacts to vegetation can occur to cliff species like *Peucephyllum schottii* and to plants at staging areas, but more impacts are likely during approach and camping activities. Under all action alternatives, there would be an increase in minimum impact climbing education, a system for monitoring use levels, and a framework for assessing the use of anchors, which would have to minor, beneficial, localized short-and long-term impacts on vegetation.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Develop use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
- Develop Climbing Management Plan (separate NEPA would be completed)

When surveys and other data indicate climbing activities are creating undesirable impacts to vegetation, one or more of these actions could be implemented. Any restrictions on the numbers of people participating in this activity, seasonally or year round, would have beneficial impacts on vegetation. Access routes to climbing locations and camping associated with climbing would be lessened and direct vegetation impacts would be reduced. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Canyoneering Management
Under all action alternatives, there would be an increase in minimum impact climbing education, a system for monitoring use levels, and a framework for assessing the use of anchors, all of which would help protect vegetation. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Develop use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change maximum overnight group size (decrease or increase)
- Implement seasonal or permanent restrictions for Natural and/or Cultural Resource protection at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites

When surveys or other data indicate that canyoneering is associated undesirable impacts to vegetation, one or more of these actions could be implemented. Permitting would inform management where impacts are likely to develop, and reducing the number and sizes of groups in problem areas would decrease impacts to vegetation. Negligible to minor, beneficial, local, short and long term impacts would occur to vegetation.

Extended Day Hiking and Running Management
The implementation of a day use permit system along with minimum impact and trail etiquette education would protect vegetation by allowing monitoring of use levels and patterns and creating a better educated group of users. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Establish daily use limits by trail
- Designate specific days for group or individual events
- Adopt policy for other trails

When survey and other data indicate undesirable impacts are occurring to vegetation as a result of extended day hiking and running, one or more of these actions could be implemented. Limiting groups size or total number of people participating in this activity would reduce impacts on vegetation and result in negligible to minor, beneficial, localized, short and long term impacts to vegetation.

Tuweep Day Use Management
The implementation of a visitor information and education system about day use and camping would help minimize impacts to vegetation, and limitation of commercial stock use to a single trip per day would reduce the number of stock animals and impacts from them on vegetation. Minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Management Actions Potentially Implemented through Adaptive Management

- Implement day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designate specific days for group events

When survey and other data indicate significant impacts to vegetation are resulting from day use activities at Tuweep, one or more of these actions could be implemented. These actions would further protect vegetation by allowing the monitoring and adjustments to use levels and vehicle impacts. As a result, minor, beneficial, localized, short and long term impacts would occur to vegetation.

Use Area Management

NPS has identified several Use Areas where visitor use is adversely impacting vegetation resources and user education has not improved conditions. All action alternatives propose adding a designated site along the Hermit Trail where user-created sites and social trails are proliferating and decreasing the number of groups allowed at Granite Rapids which cannot support current user group numbers while the recently restored riparian area recovers and develops into a more natural vegetative state. Minor, beneficial, localized, short and long-term impacts would occur to vegetation from these actions.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Create variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Implement seasonal or permanent closures at specific locations

When survey and other data indicates that vegetation resources are being adversely impacted by backcountry users, one or more of these actions could be implemented. With these changes, there would be fewer illegal campsites and social trails proliferating and beneficial impacts to vegetation as closed sites are allowed to recover. As a result, negligible to minor, beneficial, localized short and long term impacts to vegetation would occur to vegetation.

Human Waste Management

The implementation of a human waste carry-out program at backcountry sites in the River Zone and the requirement for commercially guided trips to carry out waste in Use Areas without toilets would result in beneficial impacts to vegetation by reducing cat-holing and associated social trailing. Minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Management Actions Potentially Implemented through Adaptive Management

- Replace existing toilets
- Install primitive toilets
- Remove existing toilets
- Implement seasonal or year-round waste carry-out in Use Areas

When surveys or other data indicate that human waste management is causing undesirable damage to vegetation resources, one or more of these actions could be implemented. These actions would all protect vegetation resources. As a result, minor, beneficial, localized, short and long-term impacts would occur to vegetation.

River-assisted Backcountry Travel
The implementation of day use permits for 1-day RABT trips and implementation of a maximum group size would help minimize impacts to vegetation. The requirement that the watercraft be hiked in and out as part of the itinerary would prevent disturbance to vegetation by users stashing equipment. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Administrative Use
No changes are proposed from Alternative A. Therefore there would be no change in impacts to vegetation by Administrative Use compared to Alternative A.

NPS and Cooperating Association Programs (Non-commercial Services)
All authorized services are subject to stipulations including overall capacity and use limits, permit requirements, group size and trip itineraries, safety, and environmental regulations. These requirements would help protect vegetation resources. Group size for NPS-led interpretive services is currently unlimited and would remain the same. Other programs, such as Environmental Education Program's overnight trips, may increase, but with standard permit requirements, would not be different than general overnight use (see *Potential Day and Overnight Use Impacts to Vegetation*). Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Overnight Backpacking
Under all action alternatives, most commercial use would be through contracts with a limited number of CUAs, both of which would identify guide qualifications for training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to vegetation. Under all action alternatives, there also would be no commercial use in the wild zone, but those user nights would be available to non-commercial users without guides. Depending on group sizes and skill levels of users, this could lead to more or less damage to vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). Caps on group sizes and other elements of commercial overnight backpacking would vary among action alternatives. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation, varying among action alternatives.

Commercial Day Hiking
Under all action alternatives, commercial day hiking would be prohibited in the Wild Zone which creates a small beneficial effect on the vegetation based on the limited use there. CUAs could be limited by adaptive management, which would further protect vegetation by restricting the number of day users in the backcountry. Specific locations of permissible commercial day hiking would vary by Alternative. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation, varying among action alternatives.

Commercial Backcountry Vehicle Tours (Tuweep)
Under all action alternatives, group size would be limited to 15 people including guides. Vehicle length limits would be the same as under Alternative A. The number of trips per day would vary by individual action alternatives, and under some there could be a reduced number of tours and potential impacts. Negligible to minor, adverse, localized short and long-term impacts to vegetation would occur to vegetation, varying among action alternatives.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, there would be no change in group sizes in the Corridor and Threshold Zones compared to Alternative A. Therefore impacts to vegetation would be the same in these Zones: Negligible to minor, adverse, localized, short and long-term impacts would continue to occur. In Primitive and Wild Zone areas and two Use Areas in the Threshold Zone (South Bass Trailhead and Point Sublime), large groups (7 – 11 users) would be excluded , Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, they represent nearly a quarter of the user nights in those areas. Furthermore, more than 75% of large group activity takes place during the spring and after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage (see *Potential Day and Overnight Use Impacts to Vegetation*). There would be other beneficial impacts to vegetation from changes implemented under Common to All Action Alternatives. Overall, negligible to minor, adverse to beneficial, localized, short and long-term impacts would occur to vegetation under Alternative B.

River Assisted Backcountry Travel
Management of RABT under Alternative B divides the river corridor into 31 segments, four of which would be closed to RABT use. Segments are defined by tributary canyons at their upper and lower boundaries and the network of trails and routes they connect. River travel necessary for overnight backcountry itineraries would be permitted within a segment. River travel for day use would be allowed in segments within Marble Canyon (river mile 5.0 to 61.7), in the segments between Grapevine Canyon and the Phantom Ranch Boat Beach, and between the bottom of Horn Creek Rapid and the top of Granite Rapid. One of the 32 Grand Canyon canyoneering routes described in Martin's (2013) description of RABT routes (National Canyon) would be disallowed under Alternative B because its start and end points are in different RABT segments. The river portion of the National Canyon route begins at RM 164 and ends at RM167; the change from RABT segment 21 to 22 happens at RM 165 at Tuckup Canyon.

RABT is an emerging activity for which there is little or no data on use levels or impacts. However, the anticipated impacts would be to vegetation in the canyons on routes associated with RABT, rather than from the river travel (see *Potential Day and Overnight Use Impacts to Vegetation* and discussion in Alternative A). Increased recreation in areas previously inaccessible also has the potential to introduce exotic species (Crawford 2003). Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would be allowed in Corridor and Threshold Zones, with a limited number of nights allowed in adjacent Primitive Zone Use Areas when part of a larger itinerary. The rules for distribution of user-nights would result in commercial trips occupying 10.9% and 10.6% of all user-nights in Corridor and Threshold areas, respectively, and 4.4% of user-nights in Primitive Zone areas. Based on the assumption of no difference between impacts of commercial and non-commercial users, the higher percentage of Corridor and Threshold users in commercial trips (11.6% vs. 9.7% and 11.5% vs. 9.4%, respectively), no change is expected from current management practices, but commercial parties tend to be larger than private groups (5.1 vs 3.3 users). If contracts and CUAs have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease. The decrease in commercial user-nights in Primitive and Wild Zone areas from 9.2% to 4.4% and from 1.7% to 0% respectively is expected to decrease impacts to vegetation with

beneficial results. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Day Hiking
There would be no change in commercial day hiking compared to Alternative A. Therefore, impacts to vegetation from commercial day hiking would be the same as those under Alternative A: negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial transportation tours are expected to have limited impact on vegetation because they are currently permitted only on park roads open to private vehicles outside of proposed Wilderness areas. Alternative B proposes to limit tours to two per day, with the possibility of one substituted stock trip per day. By decreasing the total number of trips from 10 per day to two per day and the total possible users per day from 150 to 30, the potential impacts would decrease, but the effect would be minor if stock use regulations are adhered to and if vehicles and stock are confined to roads. Negligible to minor, adverse, localized, short-term changes would occur to vegetation.

Backcountry Roads, Trails and Routes
Alternative B proposes to upgrade several unmaintained routes on the south and north rims to Wilderness trails. Cape Solitude, Francois Matthes, Walhalla Glades and Tiyo Point trails would change management from unmaintained routes on old roadbeds to Class 1 (minimal/undeveloped) Wilderness trails. Alternative B also allows for the restoration, active or passive, of approximately 18 miles of other former roadbeds such as Komo Point and Ariel Point trails. Because channeling use to a single trail would reduce multiple and braided trailing, and because trail impacts drop off within very short distances from the trail, impacts to vegetation resources would be reduced (see *Day and Overnight Use Impacts to Vegetation*). Negligible to moderate, adverse and beneficial, localized, short and long-term impacts would occur to vegetation.

Tuweep Facilities
Under Alternative B, overlook parking would be re-located closer to the campground as recommended in the park General Management Plan. The overlook restroom would be removed and the Vulcan's Throne Road would be converted to trail. By allowing vegetation in the overlook area and former Vulcan's Throne Road to recover, the expected impacts of these actions on plants would be beneficial, localized, minor to moderate, and short to long-term. The removal of the overlook restroom was considered but dismissed as an impact topic for vegetation resources. Negligible to moderate, adverse and beneficial, localized, short and long-term impacts would occur to vegetation.

Corridor Zone Camping
Under Alternative B, campsites at Indian Garden and Bright Angel Campgrounds would remain the same. There would be the addition of 4 small campsites at Cottonwood Campground which would increase the number of users in the area with extra time in camp and potentially increase impacts to vegetation locally (see *Potential Day and Overnight Use Impacts to Vegetation*). Roaring Springs would remain a day use only area. The construction of additional campsites would cause a direct loss in vegetation at a limited spatial scale, but the impact would be limited because they would be placed in already disturbed locations. Other impacts would continue to occur as described in Alternative A. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Deer Creek/Tapeats Creek Complex
Under Alternative B, the total number of groups within the complex would decrease from 12 to 10, the use zones would be refined from 5 to 4, and no large groups would be permitted. These actions would lead to 13% fewer people in the complex at one time on average: 12% fewer in spring and 15% fewer in

months of August, September and October, which would have beneficial impacts to vegetation. The removal of the Lower Tapeats Creek Use Area from camping would allow the soils and vegetation at that site, which are heavily impacted, to recover. The current campsite sizes are sufficient for small groups, but the larger groups expanded campsite impacts and damage to vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). More than 75% of large group activity takes place during the spring and after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage. By excluding large groups from these areas, damage to vegetation at and beyond the periphery of established campsites would be slowed. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Deer Creek Narrows
Climbing and rappelling into Deer Creek Narrows is currently prohibited through a temporary closure in the superintendent's compendium that is reviewed annually. Under Alternative B, the closure would become permanent. This closure would protect the limited number of plants that grow in that area and mosses and algae growing on the travertine deposits directly in the waterfalls. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative B, these three areas would continue to be managed as Primitive Zones. Rather than two small and one large group allowed in each per night, three small groups would be allowed. The current campsite sizes are sufficient for small groups, but the larger groups have expanded campsite impacts and damaged vegetation (see *Day and Overnight Use Impacts to Vegetation*). Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Cumulative Impacts
Cumulative impacts on vegetation were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions listed in Table 4.1. The cumulative impacts are described in Alternative A and would be the same as under Alternative A. Cumulatively, the effects of Alternative B on vegetation, when combined with the other past, present, and reasonably foreseeable actions, would be major, adverse, localized to regional, long-term, and year-round. Alternative B would contribute a small amount to this effect.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species.

Minor, beneficial, regional long-term impacts would result from decreases in group size in Primitive and Wild Zones, decrease in number of groups in Granite and Deer Creek/Tapeats Creek Complex, vegetation recovery on closed roads, and active site restoration.

Cumulative impacts to vegetation would be major, adverse, localized to regional, long-term, and year-round of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative C, group sizes would remain the same as in Alternative A, and therefore, impacts to vegetation would be the same as in Alternative A: negligible to minor, adverse to beneficial, localized, short and long-term.

River Assisted Backcountry Travel

Alternative C divides the river corridor into 11 RABT sections, on average about 29.5 miles long and defined by reasonable entry and exit points. Under this alternative, three segments (Lees Ferry to 5 mile draw. Phantom Boat Beach to Horn Creek and Tapeats Creek to Fishtail Canyon) would be closed to RABT use. RABT trips would be limited to one river section per trip or two river sections if they occur on non-consecutive days. Five more of the 32 Grand Canyon canyoneering routes requiring RABT described by Martin (2013) are allowed under Alternative C versus Alternative A, thereby increasing the geographic scope of impacts.

RABT is an emerging activity for which there is little or no data on use levels or impacts. However, most of the anticipated impact would be to resources in the tributary canyons on routes associated with RABT, rather than from the river travel itself (see *Impacts of Day and Overnight Use to Vegetation*). Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Overnight Backpacking

Under Alternative C, commercial overnight backpacking would be allowed in Corridor and Threshold and Primitive Zones. The rules for distribution of user-nights would result in commercial trips occupying 9.6% of the total overnight backcountry use permitted. Under this alternative, there would be proposed caps on group use. There would be an overall increase of 16% in commercial group-nights versus Alternative A, including 19% increase in the Corridor Zone, a 50% increase in the Threshold Zone and a 15% decrease in primitive zone. No commercial overnight backpacking would be allowed in Wild Zone Use Areas, decreasing impacts to vegetation in those areas, but opening up those areas to non-guided trips and shifting use and associated impacts (see *Day and Overnight Use Impacts to Vegetation*) into other management zones. If contracts and CUAs have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation, with negligible to minor, localized short to long-term adverse impacts where use increases.

Commercial Day Hiking

Commercial day hiking trips would be similar to Alternative A, but there would be two additional longer hikes added, Bright Angel Trail to Indian Garden and South Kaibab Trail to Skeleton Point. These additions would expand the geographic scope of impacts. The trips would remain subject to guide-to-client ratios and identify guide qualifications, which would include training in Leave No Trace techniques, park rule and regulations, and basic overview of resource protection and trail etiquette. The group size would be 11 persons including guides, with a second guide required for trips with 8 or more clients. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to vegetation. Under adaptive management, the number of commercial day hikes per day per trail may be established, which would further protect vegetation resources. Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Backcountry Vehicle Tours (Tuweep)

Commercial transportation tours are expected to have limited impact on vegetation because they are currently permitted only on park roads open to private vehicles outside of proposed Wilderness areas. Alternative C proposes to limit tours to three per day, with the possibility of one substituted stock trip per

day. By decreasing the total number of trips from 10 per day to three per day and the total possible users per day from 150 to 45, the potential impacts would decrease (see *Day and Overnight Use Impacts to Vegetation*). Negligible to minor, adverse, localized, short-term changes would occur to vegetation.

Backcountry Roads, Trails and Routes
Alternative C proposes to upgrade several unmaintained routes on the south and north rims to Wilderness trails. Eremita Mesa, Cape Solitude, Francois Matthes Point, Walhalla Glades, Komo Point, and 12 miles of Kanab Plateau ranch roads would change management from unmaintained routes on old roadbeds to Class 1 (minimal/undeveloped) Wilderness trails. Use of the trails would result in localized and minor to moderate negative impacts (see *Potential Day and Overnight Use Impacts to Vegetation*), but because use would be channeled to a single trail (vs. multiple and braided trails) and because trail impacts drop off within very short distances from the trail (Phillips and Phillips 1976), vegetation resources would be protected. Under this alternative, 140 miles of active and/or passive restoration would occur, providing beneficial impacts to vegetation resources.

The Boundary Road and the Pasture Wash Road on the South Rim would be open to vehicle and bicycle access, which would open the areas to more potential use and could lead to new adverse impacts to vegetation in those areas (see *Day and Overnight Use Impacts to Vegetation*). Pull-offs and turn-around sites would likely develop, adversely impacting both soils and vegetation, and the construction required to bring the Boundary Road up to standards would likely result in areas being damaged during pull-offs and turn-arounds. Opening Tiyo Point road to stock use would also lead to adverse impacts to vegetation through the greater impacts of stock on trails (Wilson and Seney 1994) and the potential for introducing exotic species via feed and dung. Overall, negligible to moderate, adverse to beneficial, localized, short and long-term impacts would occur to vegetation.

Tuweep Facilities
Under Alternative C, management of Tuweep facilities would be the same as under Alternative A, and impacts to vegetation would be the same as under Alternative A: moderate, adverse, localized, short and long-term.

Corridor Zone Camping
Under Alternative C, there would be the addition of one large campsite at Indian Garden, four small and one large campsite at Cottonwood Campground, and the initiation of overnight use at Roaring Springs by the creation of two small campsites in that area, all of which would lead to increased impacts on vegetation. The construction of campsites in all areas would cause a direct and permanent loss in vegetation. Other impacts would continue to occur as described in Alternative A (see *Day and Overnight Use Impacts to Vegetation*). Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Deer Creek/Tapeats Creek Complex
Under Alternative C, the total number of groups within the complex would decrease from 12 to 11, the use zones would be refined from 6 to 5, with the elimination of Lower Tapeats, the addition of Bonita, and the splitting of Surprise Valley between Upper Tapeats and Deer Creek areas. Large groups would still be permitted. The total users in the Deer Creek/Tapeats Creek Complex would decrease by 1.2%, with 19.1% and 14.6% decreases in March and April and 34.7% and 10.3% decreases in August and September, which are important months for plant germination and seed production. Fewer people in the complex at one time would have beneficial impacts to vegetation (see *Day and Overnight Use Impacts to Vegetation*). The removal of the Lower Tapeats Creek Use Area from camping would allow the soils and vegetation at that site, which are heavily impacted, time to recover. The current campsite sizes are sufficient for small groups, but the larger groups expand campsite impacts and damage to vegetation. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation, with

minor, adverse impacts from large groups and minor, localized short and long-term beneficial impacts from reduced numbers of people and groups in the area.

Deer Creek Narrows
Climbing and rappelling into Deer Creek Narrows would be allowed. Plants are often used as anchors, and are inadvertently damaged through climbing activities. Mosses grow on the travertine deposits in waterfall areas where rappelling takes place. The limited number of plants that grow in that area would be directly impacted. There would be a minor to moderate, adverse, localized, long-term impacts to vegetation.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance and Cottonwood Creeks would convert from Primitive to Threshold, which would allow for establishment of designated campsites and the possible installation of a toilet; both actions would help protect vegetation resources. Group sizes and numbers permitted would not change, with the large groups continuing the potential for campsite expansion and damage to nearby vegetation (see *Day and Overnight Use Impacts to Vegetation*). The western part of Cremation Use Area would have designated camping with a maximum group size of 11. The clearing of the designated campsite would lead to a small scale loss of vegetation, but could lead to future vegetation protection as camping impacts are focused on that one site. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Cumulative Impacts
Cumulative impacts on vegetation were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described Alternative A, and would be the same as in Alternative A. Cumulatively, the effects of Alternative C on vegetation, when combined with the other past, present, and reasonably foreseeable actions, would be major, adverse, localized to regional, long-term, and year-round. Alternative C would contribute a small amount.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, moderate, adverse, regional, long-term impacts to vegetation would result from general recreational use and include vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs and Indian Garden, use of stock on the Tiyo Point trail, creation and maintenance of the Boundary Road, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species.

Minor, beneficial, regional, long-term impacts would result from vegetation recovery on closed roads and active site restoration.

Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, large groups (7 – 11 users) would be excluded from backcountry Use Areas in the Wild, Primitive, and Threshold Zones). Large groups would only be allowed in the Corridor Zone. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, and 7% of group nights in the Threshold Zone, they represent nearly a quarter of the user nights in those areas. Furthermore, more than 75% of large group activity takes place in the spring or after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage. Under this alternative,

there would be the fewest number of groups in the period of time when plants are most vulnerable to damage. By excluding large groups from the park's more remote areas, damage to vegetation at and beyond the periphery of established campsites would be minimized. In the Corridor Zone, the group sites are established and are of the size that is appropriate to accommodate large groups. In those areas, most of the damage to vegetation has already occurred. Negligible to minor, localized long-term, adverse impacts to vegetation would occur in Corridor Zone campsites and minor, beneficial, localized, long-term impacts would occur in the other zones.

River Assisted Backcountry Travel
Management of River Assisted Backcountry Travel (RABT) under Alternative D would restrict on-river travel to 11 miles, which relaxes the current 5 mile restriction and four river sections would be closed to RABT use. Two of the 32 canyoneering routes requiring RABT described in a recent book (Martin 2013) would be disallowed under Alternative D, versus six which are disallowed under Alternative A. Both Fern Glen Canyon and Willow Canyon routes require a RABT segment longer than 11 miles to complete. RABT is an emerging activity for which there is little or no data on use levels or impacts. However, most of the anticipated impact would be to resources in the canyons on routes associated with RABT, rather than from the river travel (see *Potential Impacts of Day and Overnight Use on Vegetation*). Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Overnight Backpacking
Under Alternative D, commercial overnight backpacking would be allowed only in Corridor Zone under concession contracts and a limited number of CUAs. Based on the assumption of no difference between commercial and non-commercial users, the higher percentage of Corridor users in commercial trips would not lead to changes in impacts from current management practices. The decrease in commercial user-nights in other zones would not lead to changes in impacts because other groups would still be occupying those areas. Although those groups could not have a trained and skilled leader aware of Leave No Trace type techniques to minimize damage to vegetation, users in Threshold, Primitive and Wild Zone Use Areas have generally learned these techniques through experience and non-commercial groups are, on average, smaller by two users (3.3 vs 5.1 per group). Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Day Hiking
Under Alternative C, commercial day hiking trips would be limited to 3 of the six trail sections currently recommended, decreasing the geographic scope of impacts from these users. They would be subject to guide-to-client ratios and identify guide qualifications, which would include training in Leave No Trace techniques, park rules and regulations, and basic overview of resource protection and trail etiquette. The maximum group size would remain 11 persons including guides. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). Negligible to minor, adverse, localized, short and long-term impacts would occur to vegetation.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative D, commercial transportation tours would be limited to a single trip per day, including stock use. The reduction from up to 10 tours per day and 150 users per day would decrease impacts to vegetation resulting by these tours (see *Day and Overnight Use Impacts to Vegetation*). The trip limit and consideration of stock use in that limit, combined with the group size limit and vehicle length limit, would help protect vegetation resources. With those changes imposed, there could be a negligible to minor, beneficial, localized, short-term impacts.

Backcountry Roads, Trails, and Routes
Alternative D proposes similar changes to backcountry roads and trails as Alternative A. The differences are in the conversion of Cape Solitude Trail (12.4 miles) to Class 1 Wilderness Trail, and the inclusion of North Rim roads and Kanab Plateau roads in the Road Natural Zone. Active or passive restoration would occur on the Cape Solitude Trail and vehicle and group size limits on the backcountry roads would limit impacts to vegetation. Negligible to moderate, adverse to beneficial, localized, short and long-term impacts would occur to vegetation.

Tuweep Facilities
Under Alternative D, overlook parking would be re-located closer to the campground as recommended in the park General Management Plan. The overlook restroom would be removed and the Vulcan's Throne Road would be converted to a trail. By allowing vegetation in the overlook area and former Vulcan's Throne Road to recover, the expected impacts on plants would be beneficial, localized, minor to moderate, and short to long-term. The removal of the overlook restroom was considered but dismissed as an impact topic for vegetation resources. Negligible to moderate, adverse and beneficial, localized, short and long-term impacts would occur to vegetation.

Corridor Zone Camping
Under Alternative D, campsites at Indian Garden, Bright Angel and Roaring Springs campgrounds would remain the same. There would be the addition of 2 small campsites at Cottonwood Campground. The construction of campsites would cause a direct loss in vegetation at a limited spatial scale, but the impact would be limited by their placement in already disturbed locations. The addition of up to 12 more users in the Cottonwood campground per night would increase the potential for damage to vegetation as these users have time to explore the area (see *Potential Day and Overnight Use Impacts to Vegetation*). Other impacts would continue to occur as described in Alternative A. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Deer Creek/Tapeats Creek Complex
Under Alternative D, the total number of groups within the complex would decrease from 12 to 8, the use zones would be refined from 5 to 4, and no large groups would be permitted. These actions would lead to a reduction of 11% of groups using the area, 18% fewer users in the area each year, and no campsite expansions by large groups which would have beneficial impacts to vegetation (see *Potential Day and Overnight Use Impacts to Vegetation*). The removal of the Lower Tapeats Creek Use Area from camping would allow the soils and vegetation at that site, which are heavily impacted, time to recover. In this complex, more than 82% of large group activity takes place in the spring or after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage. Overall, more than 83% of all activity takes place during this period. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Deer Creek Narrows
Climbing and rappelling into Deer Creek Narrows is currently prohibited, but under Alternative D, the closure would become permanent. This closure would protect the limited number of plants that grow in that area and the mosses present on the travertine parts of the falls. This alternative would also limit use of the patio area to one river trip at a time. Negligible to minor, beneficial, localized, short and long-term impacts would occur to vegetation.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative D, these areas would continue to be managed as Primitive Zones, but three small groups rather than the currently allowed two small plus one large group would be allowed. The elimination of large groups would result in no change in the number of groups-nights, but an overall reduction of 10% to 11% in users year-round and essentially the same reduction (10 - 12%) in spring and

post-monsoon use when plants are most active. The current campsite sizes are sufficient for small groups, but the larger groups expanded campsite impacts and damage to vegetation as described in *Potential Day and Overnight Use Impacts to Vegetation*. Negligible to moderate, adverse, localized, short and long-term impacts would occur to vegetation.

Cumulative Impacts
Cumulative impacts on vegetation were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described under Alternative A. The impacts of these actions would be the same as under Alternative A. Cumulatively, the effects of Alternative D on vegetation, when combined with the other past, present, and reasonably foreseeable actions, would be major, adverse, localized to regional, long-term, and year-round. Alternative D would contribute a small amount.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional, short to long-term impacts to vegetation would result from general recreational use and would include vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species.

Minor beneficial, regional long-term impacts would result from decreases in group size, some Use Area changes, vegetation recovery on closed roads, invasive plant management, vegetation inventory, and active site restoration.

Cumulative impacts would be adverse, major, localized to regional, long-term, and year-round of which Alternative D would contribute a small amount.

Wildlife

ISSUES

Issues regarding wildlife identified through public and internal scoping include

- There is a need to protect native wildlife in NPS policy and through other legal requirements.
- Impacts to wildlife should be expected from emerging recreation practices, including canyoneering and river-assisted backcountry travel, which increase visitation in previously inaccessible areas.
- Wildlife resources should be monitored for impacts of visitor use to inform management actions.
- The NPS should consider closing areas experiencing excessive impacts.
- Impacts of human disturbance include avoidance of an area, abandonment of a nest or den site, flushing of animals, behavior modifications and habituation to humans, injury or possibly mortality, and increased exposure to predation.
- Most disturbances result from just the presence of humans, especially when they attempt to photograph or view wildlife.
- Visitor impacts include changes in the behavior of wildlife species such as habituation to humans and the creation of unnatural aggregations.
- Disturbance from visitors is cumulative across all backcountry uses, including boating, hiking, and swimming.
- Management of visitor use should reduce or eliminate the disturbance of native wildlife species, especially rare or important species and communities, up to and including the closure of trails and areas where impacts are greatest.

DESIRED CONDITIONS FOR WILDLIFE

The overall desired condition for wildlife in Grand Canyon is

> Grand Canyon's large size, relatively unfragmented and diverse habitat, and range of elevations and associated climates make it a valuable wildlife preserve. Effects of natural processes dominate human influences, and wildlife resources are in the condition that would occur in the absence of human intervention (NPS 2006). Species richness and productivity vary greatly among habitats, reflecting natural disturbance regimes and diverse conditions of moisture, temperature, soil development, and other organizing influences arising from organic causes. Wildlife resources unimpaired for present and future generations, and the natural range of genetic variability protected through perpetuation of naturally occurring evolutionary processes.

METHODOLOGY

The general process for assessing impacts is discussed earlier in this chapter. To analyze the effect of each alternative to wildlife, staff compiled all available information on visitor use and wildlife in the backcountry including formally collected data from NPS, USGS, and academic cooperators, information from published works, and personal communication with resource specialists. From this pool, the best available data for species locations, past documentation and studies of impacts, and the most recent research for species and wildlife communities in the park were assembled. The distribution of wildlife resources and focal points for visitor backcountry use (campsites, trails, routes, and attraction sites), including data on use intensity, were used to identify areas of resource concern where concentrations of sensitive resources overlapped with visitor use. The impact analysis is based on the interaction of context, duration, timing, and intensity of impacts, which are defined using resource-specific intensity definitions.

INTENSITY DEFINITIONS

Effects on wildlife are characterized for each alternative based on the intensity definitions presented below. For intensity, the impacts to wildlife could be negligible, minor, moderate, or major, and they could be beneficial or adverse.

Intensity

Negligible — Impacts to wildlife (individuals, populations or communities) would have no measurable or perceptible effect on size, viability, integrity, interrelationships, or function of the wildlife community.

Minor — Impacts to wildlife (individuals, populations or communities) would be measurable or perceptible but would not affect the size, viability, integrity, interrelationships, or function of the wildlife community. Among adverse impacts, there could be slight but measurable increases in the number, density, or populations of exotic wildlife or decreases in native species. For adverse impacts, any mitigation necessary to offset adverse impacts would be minimal and effective.

Moderate — Impacts to wildlife (individuals, populations or communities) would be measurable and perceptible and would affect the overall size, viability, integrity, interrelationships, or function of the wildlife community. Among adverse impacts there could be apparent and measurable increases in the number, density, or populations of exotic wildlife or decreases in native species. For adverse impacts, mitigation to offset adverse impacts would be extensive, but most likely successful.

Major — Impacts to wildlife (individuals, populations, or communities) would be substantial and highly noticeable. They would affect the overall size, viability, integrity, interrelationships and/or function of the wildlife community. For adverse impacts, the abundance of exotic wildlife could become equal to or greater than native wildlife. Mitigation to offset adverse impacts would be extensive, and success would not be guaranteed.

Context

Localized — Impacts occur only in limited areas such as campsites, attraction sites, along routes and trails, and areas near water sources such as seeps, springs and creeks. Impacts affect individual wildlife or small populations within wildlife communities.

Regional — Impacts are spread across multiple Use Areas up to park-wide. Regional impacts affect substantial portions of the range of the population or species within Grand Canyon National Park.

Duration

Short-term — Impacts to an individual, population, or community would last for periods of less than one year.

Long-term — Impacts to an individual, population, or community would last more than one year or result in permanent change.

ASSUMPTIONS

Assumptions that specifically relate to the backcountry management alternatives and their effect on wildlife are

- Large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas.
- User nights and group nights available for commercial use will fill more consistently than those available for non-commercial use, and commercial small groups tend to be larger than non-commercial small groups.
- Generally, visitor use across the entire park is highest during the spring and fall seasons, with highest use on the rims occurring during summer.
- Impacts could occur year-round, but wildlife are most sensitive during times of breeding, nesting and raising offspring. For most species this occurs in the spring and progresses into the summer with independence of most species offspring achieved by the early fall.

IMPACT ANALYSIS

Potential Day and Overnight Use Impacts to Wildlife

Because many of the Backcountry Management Plan impact topics involve some aspect of day hiking and/or camping (day and overnight use), this section is used as a reference for potential impacts to wildlife species, by general taxonomic groups, from day hiking and camping when these activities are mentioned in the sections that follow.

Reptiles and Amphibians: Potential adverse effects to reptiles and amphibians from proposed BCMP Alternatives include modification or loss of habitat or habitat components, disturbance and displacement, and direct loss of individuals. Habitat effects may vary between reptiles and amphibians, and depend on

the dominant vegetation types, location, and time of year. Many amphibians live in mesic habitat and use riparian sites having moist vegetative litter. Amphibian species, such as the Arizona tiger salamander, Rocky Mountain toad, or canyon tree frog show little evidence of seasonal movement away from moist breeding areas. Many of these species use burrows to escape drying effects of summer heat. Some reptiles, such as many lizards and snakes, prefer open, early successional habitats, but are also drawn to springs or other water sources at some point. Indirect adverse effects would include loss of streamside vegetation resulting in sedimentation increases and increased water temperatures as thermal cover is removed. Increases in sedimentation from ephemeral drainages may result in loss of downstream pool habitat for species such as frogs that use deeper pools for breeding and escape habitat. Campsites could lead to indirect effects also; campers that remove standing and/or down woody material could make a more open habitat condition, resulting in warmer, drier conditions inhospitable to most amphibians and many reptiles. Also, amphibians' moist, permeable skin and eggs increase vulnerability to direct adverse impacts such as heat, and indirect adverse impacts such as sedimentation, pH changes, and microhabitat drying (Stebbins and Cohen 1995). Recreational use can result in the direct destruction of vegetation through uprooting or crushing of plants, causing reduction of plant cover, leaf biomass, and invertebrates that reptiles and amphibians feed on. The use of motorized vehicles and bicycles on roads and approved trails creates a more intense but brief form of these same types of disturbance. Removal of vegetation and low trophic level organisms at and near campsites decreases natural food supply and can result in a trophic cascade within the reptile and amphibian communities. Reduced food availability post-disturbance could also have negative impacts on lizard and snake populations; however, primary prey species tend to rapidly increase after disturbances. Soil compaction in sites and on maintained or social trails reduces populations of soil invertebrates and can affect how water moves and is retained. Disturbance from hikers could also cause local, direct, adverse impacts when species move to avoid backcountry users, although these movements are typically of very short-term duration. Other species, such as the Great Basin spadefoot toad and tortoise, may disperse from breeding habitat (water) to forage and seek summer habitat if water is unavailable. Using acoustic cues to detect approaching people may give slow-moving animals a head start when fleeing. Effects are dependent on vegetation type and would still result in stress, disruption of activities and use of energy reserves to escape or hide. Wetlands may provide refuge from people, but breeding activities by aquatic species may be interrupted by the presence of people in the water. Impacts to reptiles and amphibians also occur from occasional opportunistic collecting or harassment by recreationists. Direct human contact, especially handling, can result in stress, injury, or mortality of an individual. Tadpoles and juvenile amphibians in springs and tributaries may be trampled by recreationists during the spring and summer, and aquatic habitat may be permanently disrupted.

Avifauna:
Important elements of bird habitat are subject to impact from proposed BCMP alternatives. The primary drivers of bird abundance and diversity are the availability of cover, nesting habitat, and food. The structure and complexity of the environment is known to be a determinant of bird species diversity (Hammitt and Cole 1987). Research in the park has shown that breeding bird density is correlated with the density of vegetation, measured by total vegetation volume, in riparian habitats along the river (Kearsley et al. 2003). Along the Colorado River, removal or modification of the New High Water Zone riparian vegetation by recreationists is an ongoing source of impacts to avifauna. The creation of campsites and social trails has impacted enough area to have a measurable negative impact on avian species abundance, richness, and diversity (Brown and Jalbert 2003). In upland campgrounds environmental structure and complexity are usually reduced, which can decrease species diversity (Hammitt and Cole 1987), although other research found an equal split between bird species positively and negatively associated with campgrounds (Blakesley and Reese 1988).

Impacts of recreation on bird communities would depend on season, species residence, habitat and nesting preferences, and species-specific responses to particular types of disturbances. During breeding season, activity may disrupt breeding and reduce recruitment, whereas the same activities later in the year would

have little effect. Birds in Grand Canyon breed in a wide variety of habitats, ranging from open areas to densely vegetated forests and woodlands, and the effects of recreation-caused loss of canopy cover would depend on species present. Some studies have shown short-term, minor effects of noise on raptors (Lamp 1987), and that ground-based noise from hikers and users of motor vehicles on roads would affect raptors more than similar levels of noise from aircraft (Frazer et al. 1985, Grubb and King 1991). One study determined that the abundance of 11 of 12 bird species was lower in areas of high recreation intensity than in areas less frequented by visitors (Van der Zande et al. 1984). However, the density of people in the study (8 to 37 per hectare) would likely only occur at the attraction sites and in developed corridor campsites and trails within Grand Canyon. Scavenging birds are often attracted to heavily used areas because trash and food are exposed. Unnatural congregations of scavengers can bring peregrine falcons and other avian predators. Conversely, recreation in nesting, foraging and roosting habitats can displace other species.

Mammals (bats): (addressed under cave resources section and special status species section)

Mammals (small):
Small mammal habitat requirements include several elements subject to impacts from recreational use. For most small mammals, trees are of minor importance but the shrub and grass layers provide forage, foraging habitat and shelter. Woody debris, whether driftwood in riparian habitats or downed trees in forests and woodlands, creates shelter and provides resources for their insect prey. Burrowing mammals prefer intact soils and may be displaced when human activity and grazing compacts soils beyond preferred density limits.

Backcountry recreation affects small mammal populations via both direct and indirect impacts. Direct impacts include injury, mortality, and stress resulting from handling, removal or displacement of habitat, or displacement of young or nursing females from nursery areas. Indirect impacts can include 1) disruption of foraging or breeding behavior 2) reduced parental attentiveness to young 3) soil compaction at campsites and trails affecting burrows of some small mammals 4) use of driftwood for campfires or woody debris for camp “furniture”, temporarily reducing habitat for small mammals at some locations 5) feeding unsuitable food to animals, particularly rock squirrels, producing habituated individuals and unnatural aggregations in frequently used camp and attraction sites.

Impacts will vary by species and will depend on seasonality and type of recreation. Species associated with forest edges tend to be more prevalent around campgrounds, near overlooks, and other more-open areas and forest-edge habitats. Chipmunks and tree squirrels, which forage in trees and bushes, would experience adverse impacts from loss of structural components. In river campsites, species that forage and shelter in driftwood piles may be negatively affected when recreationists remove wood to make fires or other structures. Disturbance and displacement during breeding and nursing periods are likely to have greater impacts on populations than at other times. Users of motorized recreation and bicycles in approved parts of the backcountry create more intense, but brief, forms of these same types of disturbances and can, due to the speed of the vehicles, caused increased mortality to small mammals. In general, declines in rodent populations following disturbance are short in duration due to their high reproductive potential.

Mammals (carnivore): Potential adverse effects to carnivores from proposed BCMP implementation include direct disturbance and displacement of the carnivores and indirect effects through disturbance and/or attraction of their prey (see ungulate and small mammal sections). With large home ranges, carnivores are likely to be impacted by backcountry users in a variety of habitats, but will also likely move to follow shifts in prey populations and avoid human contact. Impacts of habitat degradation adjacent to camping areas and attraction sites will be reduced by these large and mobile animals dispersing to undisturbed areas.

Recreational activities affected by BCMP alternatives could have direct and indirect impacts on carnivores. The noise and activity from recreationists in home range areas will increase stress and cause the direct displacement of animals. Increased prey species in or near campsites (see small mammal section) could cause shifts in foraging. Carnivores that burrow (e.g., badgers, long-tailed weasels) could be temporarily displaced from preferred burrows by users. The consistent presence of humans in camps and attraction sites will effectively eliminate them as suitable habitat during those periods when they are occupied. The greater speed of users in motor vehicles and bicycles in approved parts of the backcountry would increase the likelihood of adverse impacts to carnivores in those areas. The loss of vegetation by clearing of shrubs and damage to trees can result in the loss of some hiding cover. Direct disturbance to large mammals from noise and the presence of humans would also result in minor to moderate, short-term, adverse impacts.

Mammals (ungulate): Mule deer, bighorn sheep and elk use a variety of habitats in and adjacent to Grand Canyon. A few areas such as Kanab Creek and Nankoweap, however, do contain concentrations of bighorn, deer, and their associated predators, and habitat disturbance can be observed that is directly related to use levels. Modification of habitat characteristics important to these species, including removal and damage to shrubs and herbs tends to be localized. Similarly, the noise and activity of humans causes ungulates to avoid camping areas, attraction sites, and trails where these disturbances are concentrated.

Potential adverse effects to ungulates from proposed BCMP implementation include direct and indirect impacts, and these will vary with animal species and age. Bighorn sheep are the most susceptible to disturbance and could experience a slight decline, depending on impact severity and timing and whether lambing areas were affected. Anecdotal observations on river trips (Grand Canyon wildlife files) indicate that adult bighorn and deer seldom react to observations of boats, but young-of-the-year react vigorously and unpredictably. Researchers studied the reaction of mountain sheep approached by humans and noted increased heart rates and flight responses (MacArthur et al. 1982). Reduced foraging efficiency and maternal care resulting from interactions with recreational activities during mating season may slightly adversely affect bighorn populations by reducing reproductive success, but data have not been collected to verify this relationship. Despite degradation of habitat immediately adjacent to camping areas, these highly mobile ungulates are capable of dispersing to undisturbed areas and spend relatively little time in the vicinity of camps. The presence of humans in these camps for extended periods effectively eliminates them as suitable habitat during those periods, but ungulates could make use of these areas shortly after the departure of humans. Backcountry users in motor vehicles and on bicycles in backcountry areas where those are permitted have a greater chance of startling, flushing, and causing mortality to ungulates. A variety of studies on ungulates have shown that this group is relatively flexible with respect to habitat use when confronted with disturbance. When regularly presented with a disturbance on a scheduled basis deer, elk and sheep avoid areas when noise is present and return when the disturbance subsides (Van Dyke et al. 1986, Edge and Marcum 1985, Leslie and Douglas 1980).

ALTERNATIVE A

Alternative A continues existing management practices, resulting in current trends in resource conditions and visitor opportunities. Current management includes

Backcountry Management Zones

The 1988 Backcountry Management Plan defined four management zones (Corridor, Threshold, Primitive, and Wild) to better guide backcountry management actions and provide opportunities for a wide variety of backcountry experiences. Although zoning in and of itself does not have an impact on wildlife, the use within these zones does and is discussed here. Currently all zones provide for day use and overnight camping (see *Day and Overnight Use Impacts to Wildlife* section). Additionally, the

Threshold and Primitive Zones contain roads that are currently open for visitor use.

The Corridor Zone is managed to accommodate high visitation levels. The Corridor Zone is the smallest of the backcountry management zones, representing less than 2% of park area. It serves to focus potential impacts to wildlife within a very well defined area instead of occurring park-wide. However, the associated high levels and consistent use of this zone for both day hiking, stock use, and camping means that most wildlife within this zone experience disturbance and some degree of habitat alteration at developed sites and along trails; probably to the point that some species and many individuals no longer choose areas within the Corridor Zone (e.g., campsites, rest houses, and along trails) for breeding or nesting. The presence of high quantities of human food at certain sites within the Corridor Zone has also likely led to increased populations and congregations of some species (e.g., rock squirrels). This zone also accommodates mule/stock use, which many wildlife species react negatively too (e.g., are disturbed or displaced). Moderate, adverse, localized, short to long-term impacts would occur to wildlife as a result of continuing current management.

The Threshold Zone is managed for moderate to high use levels and is slightly larger than the Corridor Zone, comprising about 8% of park area. Camping is both at-large (dispersed) and at designated sites. Potential impacts to wildlife from camping, such as disturbance and habitat alteration, can occur throughout the zone depending on the level of dispersed camping. Administrative use of helicopters in the Threshold Zone is mainly for emergency response and toilet maintenance. The time helicopters are present in the Threshold Zone is far below 5% of daylight hours. The consistent presence of human food at designated campsites within this zone could lead to increased populations and congregations of some wildlife, but the allowance of dispersed camping should reduce the potential for wildlife congregations. Because day use occurs along established trails, potential impacts to wildlife occur within a very well defined area instead of potentially occurring throughout the zone. The moderate to high use of this zone for both day hiking and camping means that most wildlife within this zone are likely to experience some disturbance and some degree of habitat alteration at campsites and immediately adjacent to trails. Even though all assemblages of native species are likely present within this zone, the level of disturbance is probably high enough that some individuals no longer choose areas within this zone (e.g., campsites, near trails) for breeding or nesting. Impacts to wildlife from visitor use of the roads within this zone include the possible mortality of some species (reptiles, small mammals, and avifauna) directly from the vehicles on the access roads and at the campground/trailhead parking areas. Negligible to moderate, adverse, localized, short to long-term impacts would occur to wildlife as a result of continuing current management.

The Primitive Zone is managed for low to moderate use and encompasses approximately 25% of the park's area. Camping is at-large, although certain camp areas have been defined to address resource impacts. Because camping is dispersed (typically) impacts to wildlife from camping (e.g., disturbance, habitat alteration) can occur throughout the zone depending on the level of dispersed camping. The administrative use of helicopters is almost entirely for emergency operations, and is extremely rare. The presence of human food at any defined campsites within this zone likely leads to increased populations and congregations of some wildlife, but the allowance and prevalence of dispersed camping likely reduces the potential for wildlife congregations. Trails into the Primitive Zone are defined, but are more distant from developed areas. Because day use occurs along established trails, potential impacts to wildlife from hiking occur within a very well defined area instead of potentially occurring throughout the zone. The low-to-moderate use of this zone for both day hiking and camping means that most wildlife within this zone probably experience a low level of disturbance and are seldom displaced. Impacts to wildlife from visitor use of the roads within this zone include the possible mortality of some species (reptiles, small mammals, and avifauna) directly from the vehicles on the access roads and at the campground/trailhead parking areas. Negligible to minor, adverse, localized, short-term impacts would occur to wildlife as a result of continuing current management.

The Wild Zone represents more than half of the park's area, is more remote than the Primitive Zone, and is managed for solitude (low use). Camping is at-large; therefore impacts to wildlife from camping (e.g., disturbance, habitat alteration) can occur throughout the zone depending on the level of dispersed camping. The administrative use of helicopters is almost entirely for emergency operations, and is extremely rare. Trails are unimproved, and route-finding is often required. Because day use and backcountry travel within this zone does not rely on established trails, potential impacts to wildlife from hiking may occur throughout the zone. However, the low use and undeveloped nature of this zone means that most wildlife within this zone probably experience a very low level of disturbance or none at all and are seldom displaced. Continuation of current management would result in negligible, adverse, localized, short-term impacts to wildlife.

Climbing Management

Recreational rock climbing occurs within the park during overnight backpacking and day trips, yet there is uncertainty in number of visitors engaging in climbing, the timing, and preferred climbing locations. Permits are required for overnight backpacking trips, but not for day trips associated with this activity. Depending on the location, climbing has the potential to impact wildlife through disturbance and possible displacement at sites that receive high levels of use. If climbing occurs during the breeding season for birds that nest or roost on preferred climbing strata (e.g., peregrine falcons), then the birds could be disturbed to the point that they abandon nesting. However, this has not been documented in Grand Canyon. In addition to climbing itself, travelling to rock climbing sites via established trails (or cross country) and the act of camping (designated or dispersed) can disturb wildlife, impact habitat, and result in habituation and unnatural congregations of animals (see *Potential Day and Overnight Use Impacts to Wildlife* section above). Negligible to minor, adverse, localized, short-term impacts would occur to wildlife as a result of continuing current management.

Canyoneering Management

Canyoneering does occur within the park during overnight backpacking and day trips, and preferred routes have been identified in various canyoneering guide books (e.g., Martin 2013), yet the number of visitors engaging in canyoneering is uncertain and Grand Canyon does not currently have a park-specific policy for managing canyoneering. Permits are required for overnight backpacking trips, but not for day trips associated with this activity. Depending on the location, canyoneering has the potential to impact wildlife through disturbance, possible displacement and habitat alteration at sites that receive high levels of use. One unique aspect of canyoneering, when compared to typical hiking or rock climbing, is that many canyoneering routes contain water (seeps and springs) that people must walk, wade, or swim through. Because of the dry environment of the Grand Canyon, water is an attractant for mammals, birds, reptiles, and amphibians. Canyoneering routes that traverse water have the potential to disturb and displace all of these species and may even result in mortality of those species that are not able to move out of the water quickly (e.g., amphibians). In addition, if canyoneering occurs during the breeding season for any of these species then they could be disturbed to the point that they abandon breeding attempts and nesting. In addition to canyoneering itself, travelling to canyoneering sites via established trails (or cross country) and the act of camping (designated or dispersed) can disturb wildlife, impact habitat, and result in habituation and unnatural congregations of animals (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor to moderate, adverse, localized, short to long-term impacts would occur to wildlife as a result of continuing current management.

Extended Day Hiking and Running Management

Extended day hiking or running such as rim-to-river or rim-to-rim occurs primarily on Corridor Zone trails, and to a lesser extent on other backcountry trails. Under current management, there are no day use permits, policies, or limits on this activity. The activity occurs year-round, however use substantially increases during spring and fall months, with the highest use coinciding with the North Rim's opening

(May 15) and closing (October 15). The primary impact to wildlife from this activity is disturbance and possible displacement from areas near the Corridor trails due to the presence of people and associated elevated activity and noise levels. There is also litter associated with this activity, and it is possible that some wildlife could be impacted through ingestions of litter and/or attraction to food associated with the litter. The large numbers of people running single file along the corridor trail could, at brief times, form an effective barrier to movement for some species. This activity also occurs during pre-dawn and post-dusk hours when wildlife is often more active and nocturnal species are present that a typical day hiker would not encounter. It is also possible, although not documented, that some smaller species (e.g., invertebrates) could be trampled due to the pace of the runners and their decreased ability to see and react to animals in the trail at night (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor to moderate, adverse, localized, short-term impacts would occur to wildlife as a result of continuing current management.

Administrative Use
All administrative activities in Wilderness are required to evaluate activities and methods through the minimum requirement analysis (MRA) and administrative users generally obtain backcountry overnight permits. However, administrative use can either be within or in addition to existing overnight permits within an area. Depending on the MRA, most administrative use would involve hiking and overnight use impacts (see *Potential Day and Overnight Use Impacts to Wildlife* section). There is a potential for increased wildlife impacts if areas are overbooked for administrative use or if spike camps are established. Some administrative use includes the use of helicopters which is discussed under Backcountry Management Zones earlier in this section. Helicopter flights impact wildlife through noise disturbance. Continuing current administrative use would create moderate, adverse, localized, short-term impacts to wildlife.

Commercial Overnight Backpacking
Commercially guided backpacking trips are granted through a CUA that allows qualified guides to lead overnight backcountry trips. The commercial use is included in use limits set for all Use Areas in the backcountry, including the corridor campgrounds. Therefore it does not add to the current number of overnight backpacking limits. Currently, commercial trips account for approximately 9% of the total overnight backpacking use. Potential impacts to wildlife from these programs would be similar to those discussed in the *Potential Day and Overnight Use Impacts to Wildlife* section with regards to hiking and camping. Group size is generally larger for commercial groups and as noted in the Assumptions section these groups have greater impacts on wildlife. Negligible to minor, adverse, localized, short-term impacts would occur to wildlife as a result of continuing current practices of overnight backpacking.

Commercial Day Hiking
Commercially guided day hiking trips are granted through a CUA and have a maximum of 11 persons including guides. The CUAs identify recommended locations and hike destinations, but under current management, there are no limits on number of hikes allowed per day per trail, no limit on number of day-hiking CUAs, and day hiking CUA holders are not currently required to report on use, including number of visitors, number of trips and locations visited. The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. However, the inability of Grand Canyon to regulate the number of day hike CUAs leaves the possibility for high levels of use within the designated areas and associated high potential for disturbance and displacement of wildlife (see *Potential Day and Overnight Use Impacts to Wildlife* section). Continuing current commercial day hiking practices would create minor, adverse, localized, short-term impacts to wildlife.

Maximum Group Size for Overnight Backpacking by Zone
The maximum group size limit for Corridor, Threshold, Primitive and Wild Zones is 11 persons. Use

limits are described in terms of small groups (1-6 persons) or large groups (7-11 persons) for each Use Area. The number of small and large groups for each Use Area is based on management zone objectives, and capacity of destination camp areas (see Table 2.14d). Large groups and small groups are assumed to affect areas differently (see Assumptions section). Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor, adverse, localized, short-term impacts would occur to wildlife as a result of continuing to allow the current arrangement of group sizes and numbers in backcountry use areas.

Backcountry Roads, Trails, and Routes
Closure of public roads, or conversion to hiking trails, have beneficial impacts to the wildlife due to the removal of mortality causing machines, and also less associated disturbance from people because they no longer access many of the areas that the roads served. Keeping backcountry roads, trails and routes in their current configuration will produce minor, beneficial, localized, long-term impacts to wildlife.

Tuweep Facilities
Alternative A would continue current management. Therefore, the parking lot and toilet at Toroweap Overlook would remain in the current state. The Vulcans Throne Road would continue to provide vehicle access to the rim (2.4 miles). Impacts to wildlife from visitor use at Tuweep include disturbance, displacement, and possible mortality of some species from the vehicles on the access road and at the campground/trailhead, hikers on the trails, and camping (see *Potential Day and Overnight Use Impacts to Wildlife* section). Impacts would be minor, adverse, short to long-term, and localized as a result of continuing current management of Tuweep facilities.

Corridor Zone Camping
Corridor Zone camping is available in three campgrounds: Indian Garden has 15 small and 1 large campsites, Bright Angel Campground has 31 small and 2 large campsites, and Cottonwood Campground has 11 small and 1 large campsites. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor, adverse, localized, short to long-term impacts would continue to occur to wildlife as a result of maintaining current numbers and sizes of Corridor Zone campsites.

Deer Creek/Tapeats Creek Complex
The total number of groups per night in the complex is 12 and includes some large groups (see Chapter 2). Potential impacts to wildlife from overnight use are addressed in the *Day and Overnight Use Impacts to Wildlife* section. The presence of large groups within this complex increases the potential for disturbance and displacement of wildlife due to the presence of more people at the sites. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Allowing both large and small groups in the Complex in their current configuration would allow minor, adverse, localized, short to long-term impacts to continue to occur to wildlife.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
At-large camping in these three use areas and the mix of small and large groups (see Chapter 2) would have an impact on wildlife. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor, adverse, localized, short to long-term impacts would occur to wildlife.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have the potential to contribute to cumulative impacts on wildlife. Past actions including fire management, overflights management, maintenance/construction projects, vegetation/habitat restoration, river management, and Glen Canyon dam operations have resulted in adverse impacts to wildlife including modification or loss of habitat or habitat components, disturbance and displacement, and direct loss of individuals. These impacts are moderate, adverse, long-term and regional.

Present and foreseeable future actions overlap with some past actions and include fire management, overflights, maintenance and/or construction projects, vegetation/habitat restoration projects, Colorado River management and associated visitor use, and habitat changes along the river due to dam operations. Ongoing fire management activities, focused on fuel reduction and restoration of fire as an ecological process, can have both beneficial and adverse impacts to wildlife. NPS and adjacent land managers including the U.S. Forest Service conduct fire management activities each year. Fire has been a natural part of the ecosystem, but suppression activities over a number of years have resulted in an unnatural fire regime and changes to vegetation and wildlife habitat. Bringing fire back to the system will have long-term beneficial impacts to wildlife. Air tour overflights impact wildlife through disturbance and possible displacement of wildlife. These air tours occur using both airplanes and helicopters and have an adverse effect on wildlife. Maintenance and construction including road maintenance and repair and replacement of the trans-canyon water pipeline impact wildlife. Impacts from these activities include noise disturbance from mechanized equipment and helicopters and increased human presence in the backcountry. Vegetation management, particularly removal of exotic species such as tamarisk, has occurred in Grand Canyon for several years and will continue to occur. Removal of tamarisk is an adverse impact to wildlife habitat.

Other present and reasonably foreseeable future projects on the adjacent Kaibab National Forest with potential to impact wildlife habitats or wildlife species addressed by this plan include implementation of a Forest Plan that includes timber sales, noxious weed control, grazing, recreation (hunting and camping), and travel management. Other planned or potential non-federal actions adjacent to the park include water development projects on tribal or private lands, air tour operations, and uranium mining.

Cumulative effects to wildlife from past, present, and reasonably foreseeable future actions discussed above are moderate, adverse, short to long-term, and regional. Alternative A would contribute a small amount to this adverse impact.

Conclusion
Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts would result from the majority of backcountry use by visitors continuing to occur in the spring, summer and fall and from current patterns of the administrative use of helicopters in the backcountry. Under some conditions impacts from habitat modification at campsites, and disturbance or displacement from camping would be observable and measurable. Conversely, campsites, rest houses, and high use trails could also attract and habituate certain species of wildlife. In addition, disturbance and displacement along high use trails would be observable.

Minor, beneficial, localized, short and long-term impacts would result from administrative restoration activities, continued closure and restoration of former roads, and educational programs from NPS and partner organizations.

Cumulative impacts would moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Potential impacts to wildlife species from elements common to all action alternatives to manage backcountry resources are described below.

Backcountry Management Zones
The action alternatives propose two new backcountry management zones: Road Natural and River (see Chapter 2 for descriptions). Each zone recognizes unique recreation opportunities (e.g., rim camping, river running) and actions required to protect resources and manage visitor use. Impacts on wildlife by zone would be the same as Alternative A, negligible to moderate, adverse, short to long-term, and localized.

Proposed Road-Natural Zone
Impacts to wildlife from visitor use within the Road-Natural Zone include the possible mortality of some species (reptiles, small mammals, and avifauna) directly from the vehicles on the access roads and at the campground/trailhead parking areas. There would be some disturbance and displacement of wildlife from hikers on the trails, bicycling, stock use and vehicle based camping. There would also be some disturbance and displacement of wildlife from hikers and overnight backpackers entering the backcountry via trailheads accessible through the Road-Natural Zone (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor, adverse, localized, long-term impacts would occur to wildlife.

Day use limits, designated camping with vehicle limits and maximum lengths, and group size limits should serve to help control the level of impacts to wildlife in the Road-Natural Zone. In addition, the fact that the roads are generally unmaintained and unpaved without major improvements should deter high speeds and reduce the total level of use throughout the year. The presence of interpretive signs within this zone can allow for education of Leave No Trace practices and minimizing resource damage and wildlife interactions and disturbance. Although limited in this zone, NPS ranger patrols and a backcountry permit requirement should help with visitor compliance to regulations. Minor, beneficial, localized, long-term impacts would occur to wildlife.

Proposed River Zone
The River Zone overlaps with portions of all four backcountry management zones. Therefore, impacts to wildlife from visitor use within the River Zone are likely to be similar to those described within that section for hiking and camping, such as wildlife disturbance and habitat alteration (see *Potential Day and Overnight Use Impacts to Wildlife* section). The consistent presence of human food and waste at campsites within this zone has led to increased populations and congregations of some wildlife and increased habitat degradation at popular campsites. Because use in this zone occurs along the river, and the river serves as attractant for wildlife (water), there is likely a higher potential for direct human-wildlife interaction throughout the zone. Negligible, adverse, localized, long-term impacts would occur to wildlife.

Climbing Management
All action alternatives propose implementing a monitoring framework that tracks climbing activity on overnight itineraries through the backcountry permitting process, field surveys, employing Minimum Impact Climbing Education, and not allowing motorized equipment (e.g., power drills) in Wilderness. Prohibiting power drills and implementing Minimum Impact Climbing Education would have minor, beneficial, localized, short- and long-term beneficial effects on wildlife.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations

    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
- Climbing Management Plan development (separate NEPA would be completed)

When annual surveys and other data indicate that nest and roosting sites or lambing areas are being lost or nests are being abandoned in areas where climbing is occurring during the breeding season, one or more of the above actions could be implemented. Identifying areas where climbing is occurring during day use would help wildlife managers identify potential threats to wildlife. Seasonal restrictions around breeding and nesting/young-rearing periods would eliminate disturbance during a critical wildlife life stage. Reductions in group size and the number of groups by day or season would also serve to lessen potential disturbance to wildlife species. Impacts from adaptive management action would be negligible to minor, beneficial, localized, and short-term.

Canyoneering Management
All action alternatives propose implementing a monitoring framework that tracks canyoneering activity on overnight itineraries through the backcountry permitting process and field surveys, employing Minimum Impact Climbing Education, and confirming that motorized equipment is not allowed (e.g., power drills) in Wilderness. In addition it proposes to limit canyoneering maximum group size to six persons. Prohibiting power drills, limiting group size, and implementing Minimum Impact Climbing Education would have minor, beneficial, localized, short- and long-term beneficial effects on wildlife.

Management Actions Potentially Implemented through Adaptive Management
- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites

When annual surveys and other data indicate that nest and roosting sites or lambing areas are being lost or nests are being abandoned in areas where canyoneering is occurring during the breeding season, one or more of the above actions could be implemented. Requiring permits that identify canyoneering routes during day use would help wildlife managers identify potential threats to sensitive wildlife species (or areas - e.g., nesting, lambing sites). Seasonal restrictions around breeding and nesting/young-rearing periods would eliminate disturbance during a critical life stage. Reductions in climbing group size would also serve to lessen potential disturbance to wildlife species. Impacts from adaptive management actions would be minor, beneficial, localized, and short-term.

Extended Day Hiking and Running Management
All action alternatives propose implementing a day use permit for extended day hiking and/or running in defined areas, with day use permits available online and at a nominal cost. Additionally, Minimum Impact and Trail Etiquette Education Programs would be implemented. Implementation of these management actions would have beneficial impacts to most wildlife species; however, they would be negligible.

Management Actions Potentially Implemented through Adaptive Management
- Establish group size limits

- Daily use limits by trail
- Designated days for group or individual events
- Adopt policy for other trails

When monitoring and other data indicate that extended day hiking and running are causing undesirable disturbance and displacement of wildlife, one or more of the adaptive management actions could be implemented. Having a day use permit for extended day hiking and/or running in defined areas would serve to help monitor when and where high use was occurring in relation to wildlife species. Limiting group size and overall daily numbers by trail section and/or limiting use to specific days would limit the disturbance to wildlife in these areas. These actions would result in minor, beneficial, localized short to long-term impacts to wildlife.

Tuweep Day Use Management
All action alternatives propose providing more visitor information and education on day use and overnight use at Tuweep, using roadside signs, and local and regional visitor centers. Creating better-informed visitors through signage and education would have beneficial effects on most wildlife in the Tuweep area; however, these impacts are expected to be negligible.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

If monitoring or other data indicate that day use in the Tuweep area is causing undesirable levels of displacement, disturbance, or mortality, one or more of the adaptive management actions could be implemented. Having a day use permit and reservation system would serve to limit high use by limiting visitation to only those people that had a reservation. Limiting the number of vehicles per party would also serve to lessen potential disturbance and mortality to wildlife species near the access road. Negligible to minor, beneficial, localized short to long-term impacts would occur to wildlife.

Use Area Management
The NPS has identified specific Use Areas where visitor use patterns have adversely impacted park resources, adaptive management actions including education and site restoration efforts have not shown long-term solutions, and additional management actions may be needed to improve resource health while continuing to allow visitor use in the backcountry. All action alternatives in this plan propose specific management actions to address resource impacts and analyze potential management actions to allow NPS managers flexibility to address resource and visitor experience impacts that arise in the future. Changes in Use Area boundaries, use limits, camping designations, and permanent or seasonal closures are tools that managers may need to prevent resource degradation. For example:

- Establish a new designated campsite along the Hermit Trail to provide an option for hikers permitted for Hermit and Monument Creek Use Areas. Overall use limits would not increase
- Decrease use limits at Granite Rapids from three to two groups
- Redefine Use Areas in Deer Creek/Tapeats Creek Complex is defined as the Deer Creek and Tapeats Creek areas including Esplanade (AY9) Use Area combined with the newly delineated Deer Creek (AX7), Upper Tapeats/Thunder River (AW7), and (AW9) Use Areas. The northern section of the former Surprise Valley (AM9) Use Area would become part of Deer Creek and Upper Tapeats/Thunder River Use Areas. The newly delineated Bonita Use Area would become an at-large Use Area including the Tapeats Creek delta and area along the Colorado River to Deer Creek Use Area boundary (see Map 2.7)

These actions would have beneficial impacts to most wildlife species in the areas affected. Decreasing the number of groups in a Use Area would be beneficial, because generally the fewer people in the backcountry the less chance for disturbance to wildlife. Designating campsites has the benefit of confining potential impacts to a specific area. Allowing more dispersed camping has the benefit of reducing the potential to attract wildlife to a particular site. Variable seasonal use limits and seasonal or permanent closures at specific locations would also benefit wildlife by decreasing disturbance. Impacts from these actions would be minor, beneficial, localized, and short to long-term.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

If monitoring or other data indicate that overnight use in specific Use Areas is causing undesirable levels of displacement, disturbance, or mortality to wildlife, one or more of the adaptive management actions could be implemented. These actions would have minor, beneficial, localized, long-term effects on wildlife for reasons described above.

Administrative Use

No changes are proposed for administrative use; therefore impacts would be the same as those described under Alternative A for administrative overnight and day use and administrative helicopter flights. Moderate, adverse, localized, short-term impacts would occur to wildlife from administrative use.

Cumulative Impacts

Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion

Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone

The maximum group size limit for Corridor and Threshold Zones would be 11 persons; both large and small groups would continue to be allowed. Primitive and Wild Zone use limits would be a maximum of 6 persons, or small groups only

Under Alternative B, there would be no change to management of the Corridor and Threshold Zones compared to Alternative A. Therefore, impacts to wildlife would be the same for the Corridor and Threshold Zones as those stated in Alternative A: minor, adverse, and short-term. Actions to limit Primitive and Wild Zone group size to a maximum of 6 persons, or small groups only, would be beneficial to wildlife because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). However, even though only small groups would be allowed within the Primitive and Wild

Zones, the total number of groups in these zones annually would only be slightly less (<1% reduction) than currently allowed. The change would result in a 10% reduction in user-nights in these zones. Minor, beneficial, localized, long-term impacts would occur to wildlife.

Commercial Overnight Backpacking
The majority of commercially guided backpacking trips would be granted through a limited number of concession contracts. Contracts would be generally issued for a ten year period. CUAs would continue to be authorized for companies doing a small number (1-2) of trips per year. Commercial use caps would be established for the Corridor Zone campgrounds, Threshold Zone Use Areas, and Primitive Zone Use Areas (see Table 2.14c). The projected commercial use would be 9.6 % of the total overnight backcountry use.

The ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife (see *Potential Day and Overnight Use Impacts to Wildlife* section). Having long-term concession contract also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. With these benefits, adverse impacts to wildlife would be less than those described for Alternative A. Impacts would be negligible to minor, adverse, localized, and long-term.

Commercial Day Hiking
There would be no change from Alternative A in the management of commercial day hiking. Therefore, impacts from commercial day hiking would be the same as those described in Alternative A: minor, adverse, localized, and short to long-term.

Tuweep Facilities
As described in the 1995 General Management Plan, which recommended removing the parking lot and toilet at Toroweap Overlook and establishing a parking area and appropriate facilities along the road proximate to the campground and/or Saddle Horse Canyon Trail, under Alternative B, the existing road would be converted to a pedestrian trail although visitors with disabilities and service vehicles would be allowed to drive to the rim. The Vulcans Throne Road would be converted to a trail (2.4 miles) and parking area established at the road junction. The campground capacity would remain the same as described in Alternative A. The nature and size of potential impacts to wildlife from trail use, both day use and overnight, and camping are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. The impacts of actions related to Tuweep Facilities under Alternative B would be negligible to minor, adverse, localized long-term.

Backcountry Roads, Trails, and Routes
Alternative B would establish approximately 30 miles of Wilderness trails on the South Rim and North Rim in the proposed Wilderness (see Chapter 2). Impacts to wildlife from this conversion would be beneficial overall; as the proposed trails (Class 1 Wilderness Trail) would no longer be accessible to vehicles associated with administrative use (e.g., fire management), and would therefore be less likely to experience disturbance and possible wildlife mortality from vehicles . The nature and size of potential impacts to wildlife from trail use, both day use and overnight, are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. The intensity of these impacts related to backcountry roads, routes, and trails would be minor, beneficial, localized, short to long-term impacts would occur to wildlife.

Corridor Zone Camping
Up to four small campsites would be added to Cottonwood Campground. More campsites at Cottonwood Campground would increase the potential for disturbance and displacement of wildlife due to the

presence of more people (up to 24 more per night) at that site. The nature and character of potential impacts to wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. These impacts would be minor, adverse, localized, long-term impacts would occur to wildlife.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. These impacts would be the same as under Alternative A: moderate, adverse, short to long-term, and regional. Cumulatively, the effects of Alternative B on wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, and regional. Alternative B would contribute a small amount to this adverse effect.

Conclusion
Under Alternative B, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from administrative use helicopter flights, continued high visitor use in the Corridor Zone, construction activities associated with increased campsite numbers in the Corridor Zone, and an approximate increase of 3% in overnight users in the Corridor Zone.

Minor, beneficial, localized, short and long-term impacts would come from conversion, closure and restoration of former backcountry roads and the Toroweap Overlook road, reductions in group sizes in the Deer Creek/Tapeats Creek Complex and other Use Areas, reductions in group sizes for Primitive and Wild Zones and for all climbing, canyoneering and RABT use, overall slight decrease (1%) in overnight backcountry users, training requirements for commercial guides, and Leave No Trace education for hikers, canyoneers, and day users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have minor, beneficial local and long-term impacts on wildlife.

Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Group sizes would remain the same as Alternative A. Therefore, impacts to wildlife would also be the same as A, minor, adverse, localized, and short-term.

Commercial Overnight Backpacking
The majority of commercially guided backpacking trips would be granted through a limited number of concession contracts. Commercial use caps under Alternative C for the Corridor Zone campgrounds would be lower than Alternative B and D; and caps in the Threshold Zone Use Areas, and Primitive Zone Use Areas are higher than Alternative B (see Table 2.14c). The projected commercial use would be 9.6% of the total overnight backcountry use.

The incorporation of caps within the different zones means that there would be fewer total commercial overnight backpacking groups in the backcountry (with none in the Wild Zone), and fewer large groups altogether compared to what is currently allowed. The ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife (see *Potential Day and Overnight Use Impacts* to Wildlife section). Having

long-term concession contract also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. Negligible to minor beneficial, localized, short to long-term impacts would occur to wildlife.

Commercial Day Hiking
Alternative C would allow commercial day hiking in the locations described in Alternative A and would add two additional hikes that allow for longer distances; Bright Angel Trail to Indian Garden, and South Kaibab Trail to Skeleton Point.

The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. Most of the designated locations already receive high use from the public (non-commercial), so the addition of the two new longer hikes would likely be similar, and add a small amount to, what is already occurring along these corridor trails. Similar to Alternative A, minor, adverse, local, short to long-term impacts would occur to wildlife.

Backcountry Roads, Trails, and Routes
Alternative C would establish approximately 49 miles of Wilderness trails on the South Rim and North Rim in the proposed Wilderness, and would open Tiyo Point for stock use, and the non-wilderness Boundary Road for vehicle use. Impacts to wildlife could result from both the presence of vehicles on the Boundary road and the activities associated with preparing the Boundary road for vehicle use. Commercial stock use would be managed in accordance with the 2010 Mule Operations and Stock Use EA, and potential wildlife impacts include an increased interaction between wildlife and stock. Minor, adverse, localized, short and long-term impacts would occur to wildlife. Impacts from day- and overnight use associated with these roads, trails, and routes are described in the Potential Day and Overnight Use Impacts to Wildlife section.

Some impacts to wildlife from this conversion would be beneficial; the proposed trails (Class 1 Wilderness Trail) would no longer be accessible to vehicles associated with administrative use (e.g., fire management), and would therefore be less likely to experience disturbance and possible wildlife mortality from vehicles. Minor, beneficial, localized, short and long-term impacts would occur to wildlife.

Tuweep Facilities
Management of Tuweep Facilities would be the same as under Alternative A. Therefore, impacts would be the same as Alternative A: minor, adverse, short to long-term and localized.

Corridor Zone Camping
Corridor Zone camping capacity would increase relative to current levels by adding one additional campsite at Indian Garden, four small and one large campsite at Cottonwood and establishing two small campsites at Roaring Springs. More campsites at Bright Angel and Cottonwood Campgrounds, and new sites at Roaring Springs would increase the potential for disturbance and displacement of wildlife due to the presence of more people, and especially larger groups at Bright Angel and Cottonwood. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate are of large groups. The nature and character of impacts to wildlife from Corridor Zone campers are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. These impacts would be moderate, adverse, localized, long-term impacts would occur to wildlife.

Deer Creek/Tapeats Creek Complex
The total number of groups per night in the complex would be 11 (see Chapter 2). Potential impacts to wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts to Wildlife*

section. Although overall there would be one less group allowed within this complex compared to Alternative A, the presence of large groups within this complex would increase the potential for disturbance and displacement of wildlife due to the presence of more people at the sites. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Minor, adverse, localized, long-term impacts would occur to wildlife.

Deer Creek Narrows
Under Alternative C, there would be unrestricted access to the Deer Creek Narrows. Although the Deer Creek narrows area is small in scope, keeping this area open with unrestricted access would likely have adverse impacts to any wildlife that occupy the narrows. There would be the continued potential for these species or their habitat to be trampled by hikers and climbers within the narrows. Negligible to minor, adverse, localized, long-term impacts would occur to wildlife.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. These impacts would be the same as under Alternative A: moderate, adverse, short to long-term, and regional. Cumulatively, the effects of Alternative C on wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, and regional. Alternative C would contribute a medium amount to this adverse effect.

Conclusion
Under Alternative C, including the actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance from administrative use helicopter flights, interactions between stock and wildlife on the Tiyo Point trail, construction of large campsites and increased numbers of users in the Corridor Zone, and construction activities and increased traffic on the Boundary Road. An overall increase of 5% for overnight use in the backcountry would occur under this alternative, with impacts described in the Potential Day and Overnight Use Impacts to Wildlife section.

Minor, beneficial, localized, short and long-term impacts would come from closures of some backcountry roads and restoration in those areas, Leave No Trace and etiquette education for climbers, canyoneers, RABT users, extended day hikers and clients of the NPS, its cooperators and commercial guides. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well.

Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative C would contribute a medium amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
The maximum group size limit for Corridor Zone would be 11 persons; both large and small groups would be allowed. Threshold, Primitive and Wild Zone use limits would be a maximum of 6 persons, or small groups only.

Under Alternative D, there would be no changes in management of group size and numbers in the Corridor Zone Use areas. Therefore, impacts to wildlife from these proposed actions would be the same

for the Corridor Zone as those stated in Alternative A: adverse, minor and short-term. Actions to limit Threshold, Primitive and Wild Zone group size to a maximum of 6 persons, or small groups only, would be beneficial to wildlife because large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts* to Wildlife section). However, even though only small groups would be allowed within the Threshold, Primitive and Wild Zones, the total number of groups in these zones annually would only be slightly less (<1% reduction) than is currently allowed. User nights would be reduced by 8.0 to 8.5% across the three zones. Negligible to minor, beneficial, localized, long-term impacts would occur to wildlife.

Commercial Overnight Backpacking
The majority of commercially guided backpacking trips would be granted through a limited number of concession contracts. The projected commercial use would be 10.2 % of the total overnight backcountry use.

The ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife (see *Potential Day and Overnight Use Impacts* to Wildlife section). The incorporation of caps within the different zones means that there would be no commercial overnight backpacking groups in the backcountry within the Threshold, Primitive and Wild Zones, and fewer large groups altogether (in the Corridor) compared to what is currently allowed. Actions to eliminate Threshold, Primitive and Wild Zone commercially guided backpacking trips could be beneficial to wildlife because there could be fewer people using these zones. However non-commercial backpackers could still utilize the maximum number of permits allowed within these zones. Having long-term concession contracts also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. Negligible to minor, beneficial, localized, short and long-term impacts would occur to wildlife.

Commercial Day Hiking
Commercial day hiking trips would be limited to the Corridor Zone: Bright Angel Trail to 3-Mile Rest House, South Kaibab Trail to Cedar Ridge, and on the North Kaibab Trail to Supai Tunnel.

The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. The overall decrease in the number of trails that this activity is allowed on could be beneficial to wildlife due to fewer people being present on those trails, however most of the removed trail segments already receive very high use from the public (non-commercial). Negligible to minor, beneficial, localized, long-term impacts would occur to wildlife.

Tuweep Facilities
The same changes would occur as those described for Alternative B and therefore impacts would be the same. Negligible to minor, adverse, localized long-term impacts would occur to wildlife.

Corridor Zone Camping
Corridor Zone camping would continue to be available in three campgrounds with two additional campsites at Cottonwood Campground. More campsites at Cottonwood Campground would increase the potential for disturbance and displacement of wildlife due to the presence of more people. However, the addition of small groups probably has less impact on wildlife, because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. . The nature and character of impacts to wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts*

to Wildlife section. Impacts from Corridor Zone camping would be minor, adverse, localized, and long-term.

Deer Creek/Tapeats Creek Complex
The total number of groups per night in the complex would be eight (see Chapter 2), with no large groups allowed. Fewer campsites within this complex would decrease the potential for disturbance and displacement of wildlife due to the presence of fewer people at that site. It would also be beneficial to wildlife because large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). Overall group nights would be reduced by 12% in the complex, and user nights would be reduced by 18% relative to Alternative A. The nature and character of impacts to wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. Negligible to minor, localized, short and long-term beneficial impacts would occur to wildlife.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Hance Creek (BE9), Cottonwood Creek (BG9) and Cremation (BJ9) Use Areas would continue to be managed as Primitive Zones with a maximum group size of 6. The number of groups per night would be 3 small for each Use Area. Smaller groups would be beneficial to wildlife because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. Even though large group users represent more than a quarter of user-nights in these Use Areas, removing large groups would result in only a 10% reduction in user nights. This in turn leads to greater potential of impacts to wildlife within the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Wildlife* section). The size and nature of impacts to wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts to Wildlife* section. These impacts would be negligible to minor, localized short and long-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A. The impacts of these actions would be the same as under Alternative A. These impacts are moderate, adverse, short to long-term, and regional. Cumulatively, the effects of Alternative D on wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, and regional. Alternative D would contribute a small amount to this adverse effect.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor, adverse, localized, short and long-term impacts would result from disturbance caused by administrative use helicopter flights, continued use of some backcountry roads, construction associated with increasing campsite numbers in the Corridor Zone and increased numbers of overnight users in those areas.

The impacts of overnight use are described in the Potential Day and Overnight Use Impacts to Wildlife Section. Minor, beneficial, localized, short and long-term impacts would occur due to the prohibition of large groups outside the Corridor Zone, including the Deer Creek/Tapeats Creek Complex, the lack of vehicles on the Vulcans Throne Road, and Minimum Impact and etiquette education for extended day hikers, canyoneers, climbers and RABT users. When impacts of backcountry use on wildlife (e.g., abandonment of nest sites, roosting sites, or foraging areas, unnatural aggregations of scavengers, etc.) exceeds acceptable levels, actions implemented under adaptive management would have beneficial impacts on wildlife as well.

Cumulative impacts would be moderate, adverse, regional, and short to long-term of which Alternative D would contribute a small amount.

Special Status Plant Species

ISSUES

Issues regarding special status plant species identified through public and internal scoping include

- There is a need to protect native species in NPS policy and through other legal requirements
- Protection of ecological resources, including plants and animals should be the NPS's first priority
- Impacts to species resulting from emerging recreation practices which increase visitation in previously inaccessible areas should be anticipated
- Natural resources (plants and animals) should be monitored for impacts
- The NPS should consider closing areas experiencing excessive impacts
- Canyoneering and river-assisted backcountry travel are relatively recent recreational activities that will increase hiker presence in some otherwise undisturbed areas (e.g., social trailing)
- Management of visitor use should be done in ways which reduce or eliminate the disturbance of native species (balancing visitor access and resource protection)
- Management of visitor use should minimize impacts to special status species, especially rare or important species and communities, up to and including the closure of trails and areas where impacts are greatest

DESIRED CONDITIONS

The desired condition of vegetation in Grand Canyon National Park's backcountry is that they are components of a suite of naturally sustained native plant communities in which exotic species are rare and have little effect on local and ecosystem processes. Native plant species listed as endangered under the Endangered Species Act are protected and monitored, and rare and endemic species and rare plant communities are monitored to ensure protection and availability for future generations. The variability found in species' genotypes are protected through naturally occurring ecological processes.

METHODOLOGY

To analyze the effect of each alternative on special status plant species, staff compiled locality data from all known herbarium collections and all informal documentation for known rare and endemic species. These localities and focal points for visitor backcountry use (campsites, trails, routes, and attraction sites), including data on use intensity, were used to identify areas of resource concern where concentrations of sensitive resources overlapped with visitor Use Areas. Effects on special status plant species are characterized for each alternative based on the intensity definitions presented below.

INTENSITY DEFINITIONS

Negligible Special status species would not be affected, or the effects would be at or below the level of detection.

Minor Impacts to special status species would be perceptible or measurable, but the severity and timing of changes to parameter measurements are not expected to be outside the natural range of variability and are not expected to have effects on populations of sensitive species. Adverse impacts would be outside critical periods.

Moderate Impacts to special status species would be perceptible and measurable, and the severity and timing of changes to parameter measurements are expected to be sometimes outside the natural range of variability. For adverse impacts, populations of sensitive species might have small to moderate declines, but they would be expected to rebound to pre-impact numbers. A species would not be at risk of being extirpated from the park. Some impacts might occur during key time periods.

Major Impacts to special status species would be measurable, and the severity and timing of changes to parameter measurements are expected to be outside natural variability for extended periods; changes within natural variability might be long-term or permanent. For adverse impacts, populations of sensitive species might have large declines, with population numbers significantly depressed. In extreme cases, a species might be at risk of being extirpated from the park, and key ecosystem processes like nutrient cycling might be disrupted, or habitat for any species might be rendered not functional. Substantive impacts would occur during key time periods.

Context

Localized Impacts would occur in a part of a habitat or range, such as a single campsite, spring, or side canyon.

Regional Impacts would affect a widespread area of suitable habitats or the range of the population or species within Grand Canyon National Park, such as widespread among suitable tributaries or expanses of connected habitats.

Duration

Short-term Impacts to an individual or habitat area would last from one day up to one year. Short-term impacts to a population would last up to one year.

Long-term Impacts would be greater than one year. Long-term impacts to a population would be longer than one year.

ASSUMPTIONS

Assumptions that specifically relate to the alternatives and their effect on vegetation are

- The areas with the greatest potential for impacts includes trails, attraction sites, campsites, roads, natural road corridors and areas accessible to hikers, canyoneers and packrafters
- Large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of barren cores in campsites, attraction sites and in areas used for staging activities such as climbing
- User-nights available for commercial use will fill more consistently than those available to the public in general. Commercial groups will be, on average, larger than private parties
- Not all impacts on vegetation resources in backcountry areas are from hikers and backpackers; many areas are accessible to river runners hiking from the Colorado River. However, impacts from use by the two groups are considered to be identical and additive
- Mitigation measures to achieve ecological restoration in some areas might not be attainable, and the goal of the mitigation measures may be to simply disguise the impacts or to revegetate areas without achieving true restoration of the biological and physical properties present prior to impact

- The current knowledge of special status plant species distribution is based solely on herbarium plant specimen collection and some field inventory and monitoring; other populations could be found in the future as more inventories are completed
- Impacts can occur year-round, but generally plant species in Grand Canyon National Park are most sensitive during the spring and late summer (monsoon), when germination, growth, flowering and fruiting occur.

IMPACT ANALYSIS

Potential Day and Overnight Use Impacts to Special Status Plant Species

Because many of the Backcountry Management Plan impact topics involve some aspect of day hiking, camping, stock use, vehicles, and bicycles, impacts of these activities are described in this section then referred to when these activities are mentioned in the sections which follow.

The direct impact of backcountry use on plants is trampling; individuals are crushed, sheared off, or uprooted. Impacts occur when hikers use campsites and attraction areas, create new trails (social trailing), explore beyond campsite and trail margins, seek comfortable areas (usually shade) to rest, seek privacy when depositing waste, and expand campsite boundaries. Similar impacts occur when vehicles, bicycles, and stock go outside the boundaries of established roads, trails and parking lots. Indirect impacts include effects on plant vigor and reproduction when trampling compacts the soil, abrades organic layers, and grinds leaf litter. These indirect impacts interfere with natural mulching, nutrient cycling, infiltration of water and nutrients into the soil, and the functioning of the soil microbial community (Cole 1986, Hendee et al. 1990).

The magnitude of recreation impacts depends on many factors, including total numbers of recreationists, group size, duration of stay, and type and seasonality of use. Higher numbers of total visitors leads to greater levels of damage (Hendee et al. 1990). When large groups use attraction sites and medium or small sized campsites, people searching for privacy when sleeping expand the periphery of established sites and trails, thereby expanding the campsite (Cole 1986). Parties that stay longer at sites have more time to explore nearby attractions, increasing both the area of possible impact and the probability of impacts. Germination, flowering, and fruiting in Grand Canyon occur during the spring and early summer, or post-monsoon months (Phillips et al. 1987) when most backcountry use takes place. At backcountry campsites accessible by vehicles, impacts from vehicles are much greater than those from hiking activities.

Some recreational activities will not directly affect special status plant species, but may have impacts related to getting to and from the activity. On-the-water portions of river-assisted backcountry travel (RABT), rappelling during canyoneering and the on-rock parts of rock climbing will have few effects on plant species. However, in order to access the unique portions of their itineraries, users taking part in these activities will pass through the backcountry. Often, the areas traversed are little visited primarily because, without the development of small and lightweight watercraft or specialized climbing hardware, it would be very difficult to get in or out of the localities where the activity takes place. Because it is the earlier uses that lead to greater impacts, the rising popularity of these activities will likely lead to disproportionately large impacts.

ALTERNATIVE A

Alternative A would continue existing management practices, resulting in current trends in visitor use and recreation opportunities. The most noticeable impact to special status plant species under Alternative A is from overall use in the park's backcountry. Most activities that occur in the backcountry impact vegetation in some way, with the level of impact varying.

Backcountry Management Zones
There are currently four different management zones that help define recreation opportunities in Grand Canyon's backcountry (Corridor, Threshold, Primitive, and Wild). Under Alternative A, Grand Canyon's backcountry would continue to be managed using these four zones. There is currently designated camping at South Bass trailhead, Ruby Point, Signal Hill, Point Sublime, Swamp Point and Fire Point. One population of *Chylismia confertifolia* is known from an area near designated camping areas at Tuweep. Otherwise no populations of special status plant species are known from areas within 100 meters of those campsites, although some may exist. Negligible to minor, localized, short and long-term adverse impacts would continue to occur if management continues to be based on current Management Zones.

Climbing Management
Rock climbing occurs on overnight backpacking and day use trips, and also in backcountry areas accessed from river trips. The number or park visitors engaging in climbing activities is unknown. Access to and use of climbing routes has the potential to impact individuals and populations of special status plants species (see *Potential Day and Overnight Use Impacts to Special Status Species*). Negligible to minor, adverse, localized, short and long-term impacts would continue to occur if current management of climbing continues.

Canyoneering Management
Canyoneering is an emerging use for which little data about use levels and impacts exists. However access to and use of canyoneering and climbing routes has the potential to impact individuals and populations of special status species (see *Potential Day and Overnight Use Impacts to Special Status Species*). Canyoneering activities are focused on cliffs and wash bottoms where habitats supporting endemic species occur. An analysis of canyoneering routes in a recently published book (Martin 2013) shows that seven of the 64 routes intercept populations of *Flaveria macdougalii* and *Argemone arizonica*. There are currently no limits on group size or user numbers for these activities unless they are part of an overnight backpacking itinerary. In that case, a permit is required and group size limits are based solely on the backcountry Use Area in which it takes place. If current management of canyoneering activities continues, negligible to minor, adverse, localized, short and long-term impacts would occur to species encountered.

Extended Day Hiking and Running Management
In general, trail width in the cross-canyon corridor is sufficient to accommodate this use without people having to move into undisturbed vegetation. However, there are currently no limits on numbers of groups or group size for this type of use, so congestion can occur, causing impacts to individuals and populations when either trail runners or the users they encounter must step off the trail. Populations of *A. arizonica* are known from areas adjacent to the North Kaibab Trail which is part of rim-to-rim hikes. General trail etiquette and minimum impact techniques should be utilized, but there is currently no consistent method for dissemination of information to these users. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to these plant species if current management continues.

Tuweep Day Use Management
The number of vehicles and people at one time are limited by the 1995 General Management Plan, but there are insufficient durable surfaces to accommodate current use levels. The results have been constant direct and indirect impacts on plants. Only *Chylismia confertifolia* is known to occur in the Tuweep management area; a population is known to exist within 200m of the end of the Tuweep road where it could be encountered by users on foot. If current management of day use continues at Tuweep, negligible to moderate, adverse, localized, short and long-term impacts would continue occur to special status plant species.

Use Area Management
Since the establishment of Use Areas and management zones by the 1988 Backcountry Plan, it has been determined that there are Use Areas which cannot support their intended levels of use. Some designated campsites are too small for large groups. , In other areas with adequate designated campsites, users have not been able stay on itinerary due to difficult topography. As a result, these users have camped in illegal spots where plants are damaged as spots are cleared out (see *Potential Day and Overnight Use Impacts to Special Status Species*). Currently there is no strategy for altering the intensity of use (numbers of groups, sizes of groups) when impacts from backcountry users exceed limits of acceptable change. Minor to moderate, localized, short and long-term adverse impacts would continue to occur to special status species if current use area management continues.

Human Waste Management
The current strategy for human waste management has negative impacts to plants when individuals are destroyed or disturbed by trampling and digging. However, no known populations of special status species occur within 100m of designated backcountry campsites where toilet facilities are not available. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur when users encounter populations outside of campsites during waste disposal if current management practice continues.

River Assisted Backcountry Travel
Current management of RABT uses a five-mile limit on any river travel associated with a backcountry permit, but no limits on numbers or sizes of trips. No day use for river travel is permitted. Group sizes and number limits for RABT associated with overnight itineraries are based on the limits in the backcountry Use Areas in which the rest of the itinerary occurs. The increased use of RABT has led to recreationists accessing areas that were previously unvisited except from river trips (see *Potential Day and Overnight Use Impacts to Special Status Species*), but little or no data on use levels or impacts are available. . Six of the 32 canyoneering routes in Grand Canyon described in a recent book (Martin 2013) which require RABT for completion would be disallowed under the 5-mile limitation (36.7 Mile Canyon, Tatahatso Wash, Cork Spring Canyon, Fern Glen Canyon, Willow Canyon and Stairway Canyon). Collections of endemic species *Silene rectiramea*, *Chylismia confertifolia*, and *Flaveria macdougalii* have been made on three of these disallowed routes, but other populations of *F. macdougalii* are known from other RABT routes. If current management of RABT continues, negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to these populations.

Administrative Use
Administrative use includes resource management, maintenance, visitor protection, visitor education, and research. Administrative users are subject to the same overnight permit requirements as other users, and the overall impacts to plant species are similar. However, some administrative use (e.g., invasive plant control, vegetation monitoring) requires access outside of established trails and campsites (see *Potential Day and Overnight Use Impacts to Special Status Species*). Impacts of administrative users would be minimized to the extent possible through education in leave no trace and locations of special status plant species. Beneficial impacts include invasive plant removal, site restoration, increased baseline knowledge of plant distribution (including rare plants), monitoring and trend analysis for special status plants, and overall protection and restoration of vegetation resources, including special status plant species. Management actions create negligible to major, beneficial and adverse, localized to regional, short to long-term impacts to special status plant species, which are addressed subject to specific mitigations that minimize adverse impacts. Similarly, research permits are subject to review and approval by park management, and include mitigations that minimize adverse impacts and ensure resource protection to the greatest extent possible. Overall, negligible to major, beneficial and adverse, localized to regional, short to long-term impacts to vegetation would continue to occur to vegetation under current management.

National Park Service and Cooperating Association Programs (Non-commercial Services)
NPS and cooperator programs are subject to the same overnight permit requirements as other users, and have no day use limits. Day use, such as interpretive talks that enter the backcountry, have similar impacts to those caused by regular day users (see *Potential Day and Overnight Use Impacts to Special Status Species*). However, the impacts tend to be lower because the on-site group leaders are required to provide basic Leave No Trace technique guidance and be available to alert participants if resource concerns are observed. Negligible to minor, adverse, localized, short and long-term impacts would continue occur to special status plant species if current management of these programs continues.

Commercial Overnight Backpacking
Commercial backpacking trips are subject to the same overnight permit requirements as other backcountry users and the impacts to vegetation would be similar (see *Potential Day and Overnight Use Impacts to Special Status Species*), although commercial trips are, on average larger (5.1 users vs. 3.3 users). The CUAs identify guide qualifications, including training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. Populations of three endemics (*Silene rectiramea*, *Argemone arizonica*, and *Flaveria macdougalii* are known from areas adjacent to trails where commercial backpacking commonly occurs. With qualified and educated guides familiar with Grand Canyon backcountry and its special status plant species, fewer impacts to special status species would occur. If current management of Commercial backpacking continues, negligible to minor, adverse, localized, short and long-term impacts would continue to occur to special status species.

Commercial Day Hiking
Commercial day hiking trips are subject to group size limits, guide-to-client ratios, and guide qualification requirements. The latter include training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to vegetation. Commercial day hiking is currently limited to the upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails. Populations of *Argemone arizonica* are known from areas adjacent to the North Kaibab Trail where commercial day hiking occurs. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur to these populations if current management of commercial day hiking continues.

Commercial Backcountry Vehicle Tours (Tuweep)
Under current management, up to 10 trips per day are allowed for commercial transportation tours. These groups are not expected to have a major impact on special status species because commercial tours are currently permitted on park roads open to private vehicles outside of proposed Wilderness areas. However, a population of *Chylismia confertifolia* is known from an area adjacent to the end of the Tuweep Road. Clients on tours who wander off trails may cause damage to individual plants. Negligible to minor, adverse, localized short and long-term impacts to special status plant species would continue to occur if current management of backcountry vehicle tours continues.

Maximum Group Size for Overnight Backpacking by Zone
The current groups sizes (small = 1-6 persons, large = 7-11 persons) and the number of groups per area is based on management zone objectives. The impacts of both small and large groups in Corridor and Threshold Zones tend to occur in already disturbed areas where vegetation loss and damage has occurred for years and vegetation loss or alteration has already occurred (see *Potential Day and Overnight Use Impacts to Special Status Species*). Larger groups are more likely to disturb larger areas (Hendee et al. 1990). In Grand Canyon, plant mortality has been found to be equally severe in high- and low-use core areas (Cole 1986). No populations of special status plant species are known to occur within 100m of designated or established backcountry campsites, but several occur adjacent to trails traversed by users.

Negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to special status plants if the current practice of allowing all group sizes in all Management Zones continues.

Backcountry Roads, Trails, and Routes
Currently designated roads and trails have been impacted for decades by recreationists seeking access to trailheads and rim campsites and vistas, with varying levels depending on use and setting (see *Potential Day and Overnight Use Impacts to Special Status Species*). These access areas, particularly roads, have also been vectors for exotic plant species. There has been vegetation recovery and restoration, primarily passive, on some of the roads that have been closed, with some active restoration on segments of a few former roads (e.g., Cape Solitude, Cape Final) resulting in beneficial impacts. Known populations of *Astragalus cremnophylax* occur within 200m of former roads by Cape Final, and others may be close to old roads but undetected at this time. Negligible to moderate, adverse to beneficial, localized, short and long-term impacts would continue to occur if current management of backcountry roads, trails and routes continues.

Tuweep Facilities
The number of vehicles and people at one time are limited by the 1995 General Management Plan, but there are insufficient durable surfaces to accommodate current use levels. The results have been constant direct and indirect impacts on plants. Only *Chylismia confertifolia* is known to occur in the Tuweep management area; a population is known to exist within 200m of the end of the Tuweep road. If current management of Tuweep facilities continues, negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to special status plant species.

Corridor Zone Camping
The 56 small and 4 large campsites at Indian Gardens, Phantom Ranch, and Cottonwood are well-established and have been maintained for decades. Impacts to special status species would have occurred during campsite creation. Subsequent loss and damage would have occurred as visitors expanded campsite boundaries and created social trails within campgrounds (see *Potential Day and Overnight Use Impacts to Special Status Species*). Known populations of the endemic A*rgemone arizonica* occur throughout the upper end of the North Kaibab Trail and in the area of Roaring Springs and impacts would be somewhat limited by overall campground boundaries. Maintaining current campsites in the Corridor would continue to produce negligible to minor, adverse, localized, short and long-term impacts.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
The impacts to vegetation from the groups in these Use Areas are similar to that in other Use Areas with at-large camping with large groups and difficult itineraries (see *Potential Day and Overnight Use Impacts to Special Status Species*). Typical access to the Hance Creek and Cottonwood Creek areas is via sections of the Grandview Trail which passes three localities from which *Silene rectiramea* has been collected, two of which are immediately adjacent to the trail. Continuing current camping configurations in these use areas would continue to produce negligible to minor, adverse, localized, short and long-term impacts.

Cumulative Impacts
Cumulative impacts on special status plant species were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The most significant actions that have affected, and will continue to affect, vegetation resources in the backcountry areas of the park are the operation of Glen Canyon Dam, management of river-running, fire management, trespass wildlife, and stock use. Regulation of flow levels in the mainstem of the Colorado River has completely changed the composition of native riparian plant communities (Collier et al. 1996) and facilitated the spread of invasive exotic plant species. River runners create adverse impacts when they trample plants in tributaries that are otherwise difficult to access, and inadvertently carry seeds of exotic species into side canyons and other backcountry areas exaggerating impacts of their natural spread. . Fire

management actions in rim forests and woodlands create both beneficial and adverse impacts through in the alteration of rim community structure (NPS 2009a) and the introduction of exotics (Crawford 2003). Trespass ungulates have caused major adverse impacts to rim and inner canyon plants for decades (Bennett et al. 1977, Ruffner et al. 1977). Since 2000, bison have been damaging high elevation springs and meadows, creating trails through other vegetation on the north rim and facilitating the spread of exotic species (Minard 2003a, Minard 2003b). Stock use is confined to trails, roads, and specified campsites; however, their presence in the backcountry impacts plants through the spread of exotic plant species both in their forage and on their bodies. The presence of exotic plant species on neighboring lands, including on private and non-NPS administered lands, provides a seed source for the spread of exotic plant species in the park. When special status species are present, management actions are taken to minimize potential impacts. The known populations are limited, resulting in the potential for fewer overall impacts; however, current knowledge is based on herbarium collections and baseline inventories, which are incomplete. Cumulatively, Glen Canyon Dam, fire management, neighboring lands, the spread of exotic plant species, and wildlife and stock use have moderate, adverse, localized to regional, long-term, year-round effects on special status plant species. Alternative A would contribute a small amount to these impacts.

Conclusion
Under Alternative A, minor to moderate, adverse, regional, short-to long-term impacts to special status plant species would result from general recreational use and include vegetation trampling, soil compaction, campsite expansion, trail creation, and direct damage to special status plants.

Negligible to minor, beneficial, localized, long-term impacts would result from passive restoration on closed roads.

Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Elements common to all action alternatives to manage backcountry resources are described in this section, along with their potential impacts to special status plants. Activities that occur in the backcountry which impact special status species in some way, do so based on localities of individual populations, with the level of impact varying. One of the primary themes throughout the common to All Action Alternatives elements is the concept of adaptive management.

Climbing Management
Under all action alternatives, there would be an increase in minimum impact climbing education and a system for monitoring localities and use levels, which would help protect vegetation in general. Negligible to minor, beneficial, localized, short and long-term impacts would occur to special status species.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Develop use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
- Develop Climbing Management Plan (separate NEPA would be completed)

When surveys and other data indicate that climbing is having negative effects on special status species, like the population of *Silene rectiramea* near the route used to access the Shiva Temple climb one or more of these actions could be taken. Limiting the number of people accessing a climbing route with special status plants would benefit the plants. Negligible to minor, beneficial, localized, short and long-term impacts would occur to special status species.

Canyoneering Management
Under all action alternatives, there would be an increase in minimum impact climbing education and a system for monitoring use locations and levels which would inform management of potential trouble areas as they develop. Negligible to minor, beneficial, localized, short and long-term impacts would occur to special status plant species.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Develop use limits for specific locations
  - Restrict number of groups by day or season (overnight and day use)
  - Change maximum overnight group size (decrease or increase)
- Implement seasonal or permanent restrictions for Natural and/or Cultural Resource protection at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites

When surveys and other data indicate that canyoneering is leading to impacts on populations of special status species, one or more of these actions would be taken. These would allow further protection of vegetation if necessary. *Chylismia confertifolia*, *Flaveria macdougalii*, *Argemone arizonica* and *Siliene rectiramea* all occur on or near seven canyoneering routes described in a recent book (Martin 2013) on Grand Canyon routes (Ribbon Falls, Cranberry/Fishtail, Matkatamiba/Panameta, National, Cove Canyon, Willow/Fern Glen, and Tuckup Canyon routes). Limiting the number of people accessing some of these locations would protect special status species plants; therefore minor to moderate, beneficial, localized, short and long-term impacts would occur to these species.

Extended Day Hiking and Running Management
In general, trail width in the cross-canyon corridor is sufficient to accommodate this use without users having to move off-trail. However damage can occur when large groups encounter other groups and either trail runners or the users they encounter must step aside. Collections of the endemic *Argemone arizonica* have been made all along the North Kaibab Trail in the vicinity of Ribbon Falls and Roaring Springs. The implementation of a day use permit system for monitoring the timing or levels of use and accompanying minimum impact and trail etiquette education would help protect plants from these occasional impacts. Negligible to minor, beneficial, localized, short and long-term impacts would occur.

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Establish daily use limits by trail
- Designate specific days for group or individual events
- Adoption of policies for other trails

When surveys or other data indicate that trail runners and rim-to-rim users are having impacts on special status plants, one or more of these actions could be taken to provide further protection if needed. Limiting the number of day users would likely limit damage to special status plan species. Negligible to minor, beneficial, localized, short and long-term impacts would occur.

Tuweep Day Use Management
Initial impacts to special status plant species on the roads, trails, campsites, and parking areas of Tuweep has already occurred. Only the endemic *Chylismia confertifolia* occurs in the Use Area; it has been collected within 200m of the end of the Toroweap Road. The implementation of a visitor information and education system about day use and camping would help minimize further impacts. Negligible to minor, beneficial, localized, short and long-term impacts would occur.

Management Actions Potentially Implemented through Adaptive Management

- Implement day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designate specific days for group events

When surveys or other data indicate that Tuweep day use patterns are having negative impacts on *Chylismia* or other special status species, one or more of these actions would be taken to provide further protection. Because these actions would be implemented to protect special status plant species or other resources, they would result in negligible to minor, beneficial, localized, short and long-term impacts.

Use Area Management
The proposed Use Area management actions would reduce or minimize recreation impacts to some special status plant species. Along the Hermit Trail, there are limited potential sites for at-large camping, and the installation of a designated site would concentrate use in the one area that already has impacts from camping. The decrease in group number at Granite Rapids would bring use levels into alignment with the size of that area, its multiple uses, and the need for the recently restored area to recover and develop into a more natural vegetative state. The redefinition of Use Areas in the Deer Creek/Tapeats Complex would align Use Areas and campsites with current use patterns which result in the creation of user-defined campsites and social trails. With the changes, there would be fewer illegal campsites and impacts to special status species. Negligible to minor, beneficial, localized, short and long-term impacts would occur to special status plant species.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Create variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Implement seasonal or permanent closures at specific locations

When surveys or other data indicate that group sizes or numbers in particular Use Areas is having negative impacts on special status species, one or more of these actions would be implemented to reduce impacts to plants. Because these actions would be implemented to reduce impacts to special status plant species or other resources, negligible to minor, beneficial, localized, short and long-term impacts would occur.

River-assisted Backcountry Travel
Limitation of maximum RABT group size to six and monitoring use via the permitting process would help minimize impacts to special status species by informing management of locations and levels where this activity is taking place and by decreasing impacts from large groups. Negligible to minor, beneficial, localized, short and long-term impacts would occur.

Administrative Use
No changes are proposed in Administrative use from Alternative A. Therefore, there would be no change in impacts to special status species from Alternative A.

NPS and Cooperating Association Programs (Non-commercial Services)
All authorized services are subject to stipulations including overall capacity and use limits, permit requirements, group size and trip itineraries, safety, and environmental regulations. All these would help protect special status plant species. Group size for NPS-led interpretive services is currently unlimited and would remain the same. Other programs, such as Environmental Education Program's overnight trips, may increase, but with the same requirements as other backcountry permits. Impacts from these would not differ from general overnight use. Negligible to minor, adverse, localized, short and long-term impacts would occur.

Commercial Overnight Backpacking
Commercial backpacking trips are subject to the same overnight permit requirements as other backcountry users and the impacts to special status plant species would be similar. Under all action alternatives, most commercial use would be based on contracts, plus a limited number of CUAs. Contracts and CUAs would have requirements for reporting use, which would benefit special status species by informing management of use levels in areas where these species occur. There would also be guide qualifications including education in Leave No Trace and minimum impact practices, and park regulations which would help minimize client impacts on special status species when encountered. There would be no commercial use in the wild zone, but those user nights would be available to non-commercial users without guides. There would be caps on commercial groups per night by management zone which vary by alternative, and the Use Area changes would vary among Alternatives. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species, with impacts varying among action alternatives.

Commercial Day Hiking
Commercial day hiking trips are subject to group size limits, guide-to-client ratios, and guide qualifications requirements. The latter include training in Leave No Trace techniques, park regulations, and a basic overview of resource protection and trail etiquette. With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to special status species. Commercial day hiking is currently recommended for the upper segments of the Bright Angel, South Kaibab, North Kaibab, Hermit, and Grandview trails where known populations of *Silene rectiramea* and *Argemone arizonica* occur. Under the common to all Alternatives, there would be monitoring for impacts of unlimited CUAs, and actions possible under adaptive management would include limiting numbers and seasonality, which would further protect special status plant species. Negligible to minor, adverse, localized, short and long-term impacts would occur as described under individual action alternatives.

Commercial Backcountry Vehicle Tours (Tuweep)
The group size would be limited to 15 people including guides, the same as under Alternative A. The vehicle lengths would also be the same as Alternative A. The trip number per day would vary by individual action alternatives, and under some there could be a reduced number of tours and potential impacts. *Chylismia confertifolia* is the only known special status species within the Tuweep area. Negligible to minor, adverse, localized short and long-term impacts would occur to special status plant species.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B there would be no change in group sizes in the Corridor and Threshold zones compared to Alternative A. Therefore impacts to special status plant species would be the same there. Negligible to minor, adverse, localized, short and long-term impacts would continue to occur.

In the primitive and Wild Zones, and in two use areas in the Threshold zone that currently permit large groups (South Bass Trailhead and Point Sublime), large groups (7 – 11 users) would be prohibited. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, they represent nearly a quarter of the user nights in those areas. Furthermore, more than 75% of large group activity takes place in the spring or after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage. All known populations of the endemics *Flaveria macdougalii* and *Chylismia confertifolia* occur in Primitive and Wild Zones in the Park. Roughly 60% of the collections of the endemic *Silene rectiramea,* 77% of the known populations of the endangered *Astragalus cremnophylax* and 20% of the collection localities of the endemic *Argemone arizonica* are from Primitive and Wild Zones. By excluding large groups from these areas, damage to these species would be minimized. Negligible to minor, beneficial, localized, short and long-term impacts would occur to special status plant species.

River Assisted Backcountry Travel
Management of RABT under Alternative B divides the river corridor into 31 segments, four of which are closed to RABT use. Segments are defined by tributary canyons at their upper and lower boundaries and the network of trails and routes they connect. River travel necessary for overnight backcountry itineraries would be permitted within a segment. River travel for day use is allowed in segments within Marble Canyon (river mile 5.0 to 61.7), in the segments between Grapevine Canyon and the Phantom Ranch Boat Beach and between the bottom of Horn Creek Rapid and the top of Granite Rapid. One of the 32 canyoneering routes which require RABT described in a recent book (Martin 2013) would be disallowed under Alternative B because its start and end points are in different RABT segments. The river portion of the National Canyon route begins at RM 164 and ends at RM167; the change from RABT segment 21 to 22 happens at RM 165 at Tuckup Canyon. RABT is an emerging activity for which there is little or no data on use levels or impacts. However, most of the anticipated impact would be to resources in the canyons on routes associated with RABT activities (see *Potential Day and Overnight Use Impacts to Special Status Species*). For example, half the routes described Martin (2013) requires a RABT segment to complete. Five of these (Olo Canyon, National Canyon and Matkatamiba/Panameta Canyons and Cove Canyon encounter known populations of the endemic *Flaveria macdougalii*. The recommended access to Vishnu Creek includes trails which pass by three known localities of the endemic *Silene rectiramea*. Negligible to moderate, adverse, localized, short and long-term impacts would continue to occur to these species. The closure of three additional river segments (Boat beach to Horn Creek, Granite to Boucher, and Tapeats to Fishtail) would not affect any known populations of special status species, but the disallowing of the National Canyon route based on starting/ending RABT points would have negligible to minor, beneficial, localized, short to long-term impacts on *Flaveria macdougalii*.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would be allowed in Corridor and Threshold Zones, with a limited number of nights in adjacent Primitive Zone Use Areas. The rules for distribution of

user-nights would result in commercial trips occupying 11.6% and 11.5% of all user-nights in Corridor and Threshold areas, respectively, and 4.4% of user-nights in Primitive Zone areas. Roughly 80% of the collections of the endemics *Argemone arizonica* and *Ericameria arizonica* are from areas within 200m of trails and campsites in Corridor and Threshold Zone Use Areas, as are 40% of the collections of *Silene rectiramea*. Based on the assumption of no difference between commercial and non-commercial users, the higher percentage of Corridor and Threshold users in commercial trips (11.6% vs. 9.7% and 11.5% vs. 9.4%, respectively,) no change is expected from current management practices. If CUAs and concession agreements have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to decrease. The decrease in commercial user-nights in Primitive and Wild Zone areas from 9.2% to 4.4% and from 1.7% to 0% respectively is expected to decrease impacts to vegetation because of the smaller sizes of non-commercial groups. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species.

Commercial Day Hiking
There would be no change in commercial day hiking compared to Alternative A. Therefore, impacts to vegetation from commercial day hiking would be the same as those under Alternative A: negligible to minor, adverse, localized, short and long-term impacts would occur.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial transportation tours are not expected to have large impacts on special status plant species because they are currently permitted on park roads open to private vehicles outside of proposed Wilderness areas, and only one special status species, *Chylismia confertifolia*, occurs in the Tuweep Road Natural Area. Alternative B proposes to limit tours to two per day, with the possibility of one substituted stock trip per day. By decreasing the total number of trips from 10 per day to two per day and the total possible users per day from 150 to 30, the potential impacts would decrease. Negligible to minor, adverse, localized, short-term changes would occur to this species.

Tuweep Facilities
Under Alternative B, overlook parking would be re-located closer to the campground as recommended in the park General Management Plan. By reducing traffic in the overlook area and former Vulcan's Throne Road, the expected impacts of these actions on the population of *Chylismia confertifolia* would be beneficial, localized, minor to moderate, and short to long-term.

Corridor Zone Camping
Under Alternative B, campsites at Indian Garden and Bright Angel Campgrounds would remain the same. There would be the addition of 4 small campsites at Cottonwood Campground. The addition of campsites would cause a direct loss in vegetation at a limited spatial scale. No special status species have been collected where the new campsites would be created, but new campsites would allow more users to spend more time around Bright Angel Creek where *Argemone arizonica* has been collected. Other impacts would continue to occur as described in Alternative A. Negligible to moderate, adverse, localized, short and long-term impacts would occur to special status plant species. Alternative B would contribute a small amount to these impacts.

Cumulative Impacts
Cumulative impacts on special status plant species were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The cumulative impacts are described in Alternative A and would be the same as under Alternative A. Cumulatively, Glen Canyon Dam, fire management, neighboring lands, the spread of exotic plant species, and wildlife and stock use have moderate, adverse, localized to regional, long-term, year-round effects on special status plant species.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational use including vegetation trampling, soil compaction, addition of up to four campsites at Cottonwood, trail creation, and direct damage to vegetation.

Minor, beneficial, localized, long-term impacts would result from decreases in group size in Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area.

Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C there would be no change in maximum group sizes in Management Zones from Alternative A, and the impacts to special status plants would be the same as under Alternative A. Negligible to moderate, adverse, localized long-term impacts would occur to special status plant species.

River Assisted Backcountry Travel
RABT is an emerging activity for which there is little or no data on use levels or impacts. However, most of the anticipated impact would be to resources in the canyons on routes associated with RABT, rather than from the river travel. For example, half the routes described in a recent book on canyoneering in Grand Canyon (Martin 2013) require a RABT segment to complete. Five of these (Olo Canyon, National Canyon and Matkatamiba/Panameta Canyons and Cove Canyon) encounter known populations of the endemic *Flaveria macdougalii*. The recommended access to Vishnu Creek includes trails which pass by three known localities of the endemic *Silene rectiramea*. Alternative C divides the river corridor into 11 sections, averaging about 29.5 miles long and defined by reasonable entry and exit points. Three of the sections (Lees Ferry to 5 mile draw, Boat Beach to Horn Creek, and Tapeats to Fishtail) would be closed to RABT use. RABT trips would be limited to one river section per trip or two river sections if they occur on non-consecutive days. None of the 32 Grand Canyon canyoneering routes described in a recent book (Martin 2013) would be disallowed under Alternative C because none of them have start and end points in different RABT segments. Five are disallowed under Alternative A based on 5-mile limits. None of the additional five RABT routes allowed under Alternative C have known populations of special status plant species, although some may exist undetected. Negligible, adverse, localized, short and long-term impacts would occur to these species.

Commercial Overnight Backpacking
Under Alternative C, commercial overnight backpacking would be allowed in Corridor and Threshold and Primitive Zones. The rules for distribution of user-nights would result in commercial trips occupying 9.6% of the total overnight backcountry use permitted. Under this Alternative, there would be proposed caps on commercial group use. There would be an increase in user nights on commercial backpacking trips in the corridor and threshold areas and a decrease in primitive areas. No commercial overnight backpacking would be allowed in Wild Zone Use Areas. Based on the assumption of no difference between commercial and non-commercial users, no change is expected from current management practices. If contracts and CUAs have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species.

Commercial Day Hiking
Commercial day hiking trips would be similar to Alternative B, but there would be two additional longer hikes added, Bright Angel Trail to Indian Garden and South Kaibab Trail to Skeleton Point. These additions would expand the geographic scope of impacts. The trips would remain subject to guide-to-client ratios and identify guide qualifications, which would include training in Leave No Trace techniques, park rule and regulations, and basic overview of resource protection and trail etiquette. The group size would be 11 persons including guides, with a second guide required for trip with 8 or more clients. There are known populations of *A. arizonica* known along the North Kaibab Trail. No populations of special status species are known to occur along the extra sections of the South Rim trails, although some may exist undetected. With qualified and educated guides familiar with Grand Canyon backcountry, impacts to special status species would be minimal. Under adaptive management, the number of commercial day hikes per day per trail may be established, which would provide further protection. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial backcountry vehicle tours are not expected to have large impacts on special status plant species because they are currently permitted on park roads open to private vehicles in what would be Road Natural Areas. Alternative C proposes to limit tours to three per day, with the possibility of one substituted stock trip per day. By decreasing the total number of trips from 10 per day to three per day and the total possible users per day from 150 to 45, the potential impacts to the population of *Chylismia confertifolia* would decrease. Negligible to minor, adverse, localized, short-term impacts would occur to special status plant species.

Backcountry Roads, Trails, and Routes
Alternative C proposes to upgrade several unmaintained routes on the south and north rims to Wilderness trails. Eremita Mesa, Cape Solitude, Francois Matthes Point, Walhalla Glades, Komo Point, and 12 miles of Kanab Plateau ranch roads would change management from unmaintained routes on old roadbeds to Class 1 (minimal/undeveloped) Wilderness trails. The Tiyo Point Trail would be converted to a Class 4 Wilderness trail and stock use would be allowed. Under this alternative, 1.8 miles of active and/or passive restoration would occur with the conversion of the Eremita Mesa Trail from Class 2 to Class 1 Wilderness trail. The Boundary Road on the South Rim and the Pasture Wash road would be improved and open to vehicle and bicycle access, which would open the areas to more potential use and could lead to new impacts to vegetation in those areas. Pull-offs and turn-around sites would be likely to develop. Equipment necessary to improve the Boundary Road could affect plants and soils beyond the limits of the road. No populations of special status plant species are known to occur along these trails and roads, although unknown populations may exist. Stock use on the Tiyo Point Trail and increased vehicle use on the Boundary Road would increase the spread of exotic plants in the watersheds below these areas. Negligible, adverse, localized short and long term impacts would occur to plants from stock use, construction, and road improvements, and negligible to moderate beneficial, localized, short and long-term impacts would occur to plants from the channeling of use to single trails.

Tuweep Facilities
Under Alternative C, management of Tuweep facilities would be the same as under Alternative A, and impacts to vegetation would be the same as under Alternative A. There is a population of the endemic *Chylismia confertifolia* at the end of the Tuweep Road where it could be impacted by visitors. Negligible to moderate, adverse, localized, short and long-term impacts would occur to this species.

Corridor Zone Camping
Under Alternative C, there would be the addition of one large campsite at Indian Garden, four small and one large campsite at Cottonwood Campground, and the creation of two small campsites at Roaring

Springs, opening that area to overnight use. The creation of campsites at Roaring Springs would lead to an increase in social trailing and increased time spent in the area. The campsite construction would not have an adverse effect on known populations of special status plants, but it would lead to more users and more time spent exploring an area with many populations of the endemic *Argemone arizonica*. Other impacts would continue to occur as described in Alternative A. Negligible to moderate, adverse, localized, short and long-term impacts would occur.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance and Cottonwood Creeks would convert from Primitive to Threshold Zones. Designated campsites may be established and a toilet could be considered in the future; both actions would help protect plants related to impacts from trampling and cat-holing. Three small and one large group would be allowed in each Use Area, with the large groups increasing the potential for campsite expansion and damage to nearby vegetation. Cremation would have a portion with designated camping with a maximum group size of 11. No known populations of special status plant species occur in these Use Areas, but the Grandview Trail, most commonly used access for Hance and Cottonwood areas, has two known populations of *Silene rectiramea* adjacent to it and third occurs nearby. Negligible to minor, adverse, localized, long-term impacts would occur.

Cumulative Impacts
Cumulative impacts on special status plant species were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The cumulative impacts are described in Alternative A and would be the same as under Alternative A. Cumulatively, Glen Canyon Dam, fire management, neighboring lands, the spread of exotic plant species, and wildlife and stock use have moderate, adverse, localized to regional, long-term, year-round effects on special status plant species. Alternative C would contribute a small amount to these impacts.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational use and include: vegetation trampling, soil compaction, addition of up to eight campsites at Cottonwood, Roaring Springs, and Indian Garden, trail creation, and direct damage to vegetation.

Negligible, beneficial impacts would result from a decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area.

Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, large groups (7 – 11 users) would be excluded from backcountry Use Areas in the Wild, Primitive, and Threshold Zones and would only be allowed in the Corridor Zone. Although large groups account for only 7 to 10% of group nights in Wild and Primitive Zones, and 7% of group nights in the Threshold Zone, they represent nearly a quarter of the user nights in those areas. Furthermore, more than 75% of large group activity takes place in the spring and after summer rains, when plants are breaking dormancy or germinating and are most vulnerable to damage. Over 97% of known populations of the endangered *Astragalus cremnophylax* and the endemics *Flaveria macdougalii*, *Chylismia confertiflora*, and *Silene rectiramea* occur are in Threshold, Primitive and Wild Zone areas, as are 20% of the collections of *Argemone arizonica* and *Ericameria arizonica*. By excluding large groups from these

areas, impacts to these species would be minimized. Minor, adverse and beneficial, localized, short and long-term impacts would occur to special status plant species.

River Assisted Backcountry Travel
Management of RABT under Alternative D would restrict on-river travel to a 11 mile limit, a relaxation of the current 5 mile limit. Four river sections would be closed to all RABT use under this alternative: Lees Ferry to 5 Mile Draw, Boat Beach to Horn Creek, Tapeats Creek to Fishtail Creek, and Diamond Creek to the downstream Grand Canyon Boundary. Two of the 32 Grand Canyon canyoneering routes requiring RABT described in a recent book (Martin 2013) would be disallowed under Alternative D. Both Fern Glen Canyon and Willow Canyon routes require a RABT segment longer than 11 miles to complete. Alternative A disallows three additional routes with RABT sections between 5 and 11 miles long. Half the routes described in a recent book on canyoneering in Grand Canyon (Martin 2013) require a RABT segment to complete. Five of these (Olo Canyon, National Canyon, Matkatamiba Canyon, Panameta Canyon and Cove Canyon encounter known populations of the endemic *Flaveria macdougalii*, and there is a high probability that the exit from the Cork Spring route does as well. The recommended access to Vishnu Creek includes trails which pass by three known localities of the endemic *Silene rectiramea*. Negligible to moderate, adverse, localized, short and long-term impacts would occur to special status plant species.

Commercial Overnight Backpacking
Under Alternative D, commercial overnight backpacking would only be allowed in Corridor Zone. Roughly 80% of the collections of the endemics *Argemone arizonica*, and *Ericameria arizonica* are from areas within 200m of trails and campsites in Corridor Zone Use Areas. Based on the assumption of no difference between commercial and non-commercial users, the higher percentage of Corridor users in commercial trips would not lead to changes from current management practices. If CUAs and concession agreements have education for Leave No Trace and other best backcountry practices required, then impacts would be expected to be decrease with commercial use. The decrease in commercial user-nights in other zones would not lead to changes in impacts because other groups would still be occupying those areas. Although those groups could not have a trained and skilled leader aware of Leave No Trace techniques to minimize damage to special status plant species, users in Threshold, Primitive and Wild Zone Use Areas have generally learned these techniques through experience and non-commercial groups tend to be smaller than commercial groups. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species.

Commercial Day Hiking
Commercial day hiking trips would be limited to 3 of the currently allowed 6 trail sections in the Corridor Zone under Alternative D. They would be subject to guide-to-client ratios and identify guide qualifications, which would include training in Leave No Trace techniques, park rule and regulations, and basic overview of resource protection and trail etiquette. The group size would remain 11 persons including guides. Along the three allowed trail segments lie known populations of *Argemone arizonica* (North Kaibab Trail) and *Ericameria arizonica* (S. Kaibab Trail). With qualified and educated guides familiar with Grand Canyon backcountry, there would be fewer impacts to special status plant species. No commercial day use would occur on Grandview Trail where populations of the endemic *Silene rectiramea* are known. Negligible to minor, adverse, localized, short and long-term impacts would occur to these species.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative D, commercial backcountry vehicle tours would be limited to a single trip per day, including stock use. Impacts to the population of *Chylismia confertiflora* near the end of the Toroweap Road are expected to be low because commercial transportation tours are currently permitted only on roads outside of proposed Wilderness areas. However, the limit to one trip per day and consideration of

stock use in that limit, combined with the group size limit and vehicle length limit, would help protect this population by reducing the probability of encounters by commercial clients. With those changes imposed, negligible to minor, adverse, localized, long-term impacts would occur to special status plant species.

Backcountry Roads, Trails, and Routes
Alternative D proposes the same changes to backcountry roads and trails as Alternative A except that the Cape Solitude Trail would be converted from a Class 2 Wilderness trail to a Class 1 Wilderness trail. No special status species are known to occur along the Cape Solitude trail, although as-yet undiscovered populations may occur. Negligible to minor, adverse to beneficial, localized, short and long-term impacts would occur to special status plants encountered.

Tuweep Facilities
Under Alternative D, overlook parking would be re-located closer to the campground as recommended in the park General Management Plan. The Vulcan's Throne Road would be converted to trail and parking moved to an area off the Toroweap Road. Negligible adverse, localized long-term impacts would occur to special status species. By reducing traffic in the overlook area and former Vulcan's Throne Road, the expected impacts of these actions on the population of *Chylismia confertifolia* would be beneficial, localized, minor to moderate, and short to long-term.

Corridor Zone Camping
Under Alternative D, campsites at Indian Garden, Bright Angel and Roaring Springs campgrounds would remain the same as Alternative A. There would be the addition of 2 small campsites at Cottonwood Campground. The construction of campsites would cause direct impacts to plants at a limited spatial scale, further limited by their placement in already disturbed locations within the site. There are known populations of the endemic *Argemone arizonica* up Manzanita Creek near the campsites, and other populations and species may be in the area. Greater numbers of users nearby with longer times to explore the area could lead to more encounters and greater impacts. Other impacts would continue to occur as described in Alternative A. Negligible to minor, adverse, localized, short and long-term impacts would occur to special status plant species.

Cumulative impacts
Cumulative impacts on special status plant species were determined by combining the impacts of this alternative with other past, present, and reasonably foreseeable future actions, as described in Table 4.1. The cumulative impacts are described in Alternative A and would be the same as under Alternative A. Cumulatively, Glen Canyon Dam, fire management, neighboring lands, the spread of exotic plant species, and wildlife and stock use have moderate, adverse, localized to regional, long-term, year-round effects on special status plant species. Alternative D would contribute a small amount to these impacts.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status plant species would result from general recreational use and include: vegetation trampling, soil compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species.

Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area.

Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.

Special Status Wildlife Species

ISSUES

Issues regarding special status species wildlife identified through public and internal scoping include

- There is a need to protect native species in NPS policy and through other legal requirements
- Impacts to species resulting from emerging recreation practices which increase visitation in previously inaccessible areas should be anticipated
- Natural resources (plants and animals) should be monitored for impacts
- The NPS should consider closing areas experiencing excessive impacts
- Disturbances by humans can directly and indirectly affect terrestrial wildlife, including: avoidance of an area, abandonment of a nest or den site, flushing of animals, behavior modifications and habituation to humans, injury or possibly mortality, and increased exposure to predation
- Disturbances tend to be a direct result of the presence of humans, especially when they attempt to photograph or view wildlife
- The presence of boats on the river, hikers in the side canyons, and swimmers in tributaries can disturb nearby wildlife
- Canyoneering and river-assisted backcountry travel are relatively recent recreational activities that will increase hiker presence in some otherwise undisturbed areas Management of visitor use should reduce or eliminate the disturbance of special status wildlife
- Management of visitor use should minimize impacts to special status species, especially rare or important species and communities, up to and including the closure of trails and areas where impacts are greatest

DESIRED CONDITIONS

Its large size, relatively unfragmented and diverse habitat, and range of elevations and associated climates have made Grand Canyon a valuable wildlife preserve. The effects of natural processes dominate human influences and the park's wildlife resources are in the condition that would occur in the absence of human intervention (NPS 2006). Species richness and productivity vary greatly among habitats, reflecting natural disturbance regimes and the diverse conditions of moisture, temperature, soil development and other organizing influences arising from organic causes. Wildlife resources are unimpaired for present and future generations and the natural range of genetic variability is protected through the perpetuation of naturally occurring evolutionary processes. Wildlife species listed as endangered under the Endangered Species Act are protected and monitored. Extirpated species are actively restored within the park in accordance with species specific recovery plans. Non-native species are managed and/or eliminated to reduce competition with native wildlife and reduce impacts to native vegetation.

METHODOLOGY

The general process for assessing impacts is discussed earlier in this chapter. To analyze the effect of each Alternative on wildlife, staff compiled all available information on visitor use and wildlife in the backcountry including formally collected data from NPS, USGS, and academic cooperators, information from published works, and personal communication with resource specialists. From this pool, the best available data for species locations, past documentation and studies of impacts, and the most recent research for species and wildlife communities in the park were assembled. Information on documented cultural and natural resources and focal points for visitor backcountry use (campsites, trails, routes, and attraction sites), including data on use intensity, were used to identify areas of resource concern where

concentrations of sensitive resources overlapped with visitor Use Areas. The impact analysis was based on the interaction of context, duration, timing, and intensity of visitor impacts, which were defined using resource-specific intensity definitions.

INTENSITY DEFINITIONS

Effects on special status species wildlife are characterized for each alternative based on the intensity definitions presented below. For intensity, the impacts to special status species wildlife could be negligible, minor, moderate, or major, and they could be beneficial or adverse.

Negligible Impacts to species (individuals or communities) would have no measurable or perceptible effect on size, viability, integrity, interrelationships, or function of the plant or wildlife community.

Minor Impacts to species (individuals, populations or communities) would be measurable or perceptible but would not affect the size, viability, integrity, interrelationships, or function of the plant or wildlife community. There could be slight but measurable changes in number, density, or populations of exotic species. For adverse impacts, any mitigation necessary to offset adverse impacts would be minimal and effective.

Moderate Impacts to species (individuals, populations or communities) would be measurable and perceptible and would affect the overall size, viability, integrity, interrelationships, or function of the plant or wildlife community. There could be apparent and measurable changes in number, density, or populations of exotic species. For adverse impacts, mitigation to offset impacts would be extensive, but most likely successful.

Major Impacts to species (individuals, populations, or communities) would be substantial, highly noticeable, and have the potential to become permanent. They would affect the overall size, viability, integrity, interrelationships and/or function of the plant or wildlife community. For adverse impacts, the abundance of exotic species could become equal to or greater than native species, mitigation to offset impacts would be extensive, and success would not be guaranteed.

Context

Localized Impacts occur only in limited areas such as campsites, attraction sites, along routes and trails, and areas near water sources such as seeps, springs and creeks. Impacts affect individual organisms or small populations within plant or wildlife communities.

Regional Impacts are spread across multiple Use Areas up to park-wide. Regional impacts affect substantial portions of the range of the population or species within Grand Canyon National Park.

Duration

Short-term Impacts to an individual, population, or community would last for periods of less than one year.

Long-term Impacts to an individual, population, or community would last more than one year or result in permanent change.

ASSUMPTIONS

Assumptions that specifically relate to the management Alternatives and their effect on wildlife are

- Large groups and small groups are assumed to affect areas differently. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas.
- User nights and group nights available for commercial use tend to fill up more than those available for non-commercial use, and small commercial groups tend to be larger than small non-commercial groups.
- Impacts can occur year-round, but wildlife are most sensitive during times of breeding, nesting and raising offspring. For most species this occurs in the spring and progresses into the summer with independence of most species offspring achieved by the early fall.

IMPACT ANALYSIS

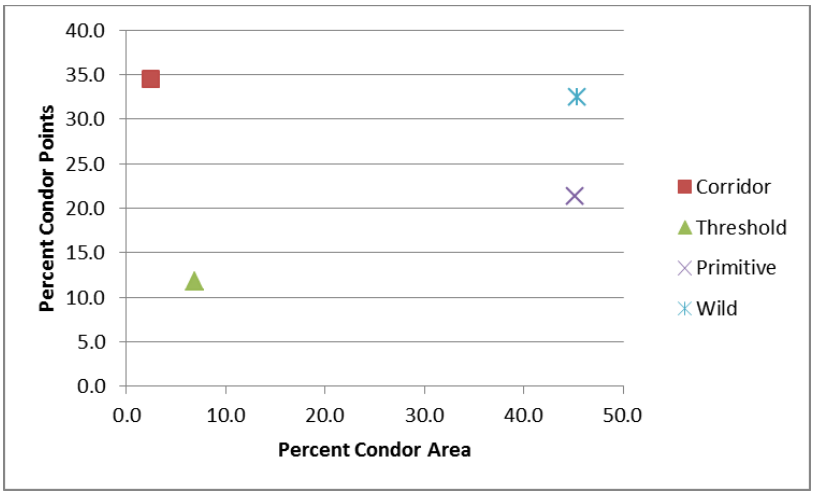
Potential Day and Overnight Use Impacts to Special Status Species

Because many of the Backcountry Management Plan impact topics involve some aspect of day hiking and/or camping (day and overnight use), this section is used as a reference for potential impacts to special status wildlife species from day hiking and camping when these activities are mentioned in the sections that follow.

California Condor (threatened)

The biggest threat to condor recovery continues to be the ingestion of lead from hunter harvested game outside of Grand Canyon National Park, which accounts for 50% of the known deaths of California condors in Arizona and Utah (Southwest Condor Review Team 2012). Because Grand Canyon does not allow hunting as a recreational activity in the backcountry, or anywhere else within the park boundaries, this threat does not originate from here. While there are no studies specifically addressing condor reactions to noise and disturbance from recreational activities, the main concern with California condors is potential attraction to and contact with humans and ingestion of garbage. This species is extremely vulnerable throughout the year because of its long nesting period (6+ months), small population size and slow reproductive rate (one chick every other year). Condors are naturally curious and it is not uncommon for them to be seen frequenting areas of high human activity, such as the Grand Canyon Village on South Rim. In fact, while the Corridor Zone (the zone nearest the Grand Canyon Village) comprises only 2.5% of the general condor use area of Grand Canyon, approximately 35% of the condor GPS locations occur within this zone (Figure 4.1). Condors also utilized the Wild Zone (32%) quite often, but were spread over a much larger area.

Figure 4.1 Percentage of each Management Zone in general condor use area (all areas east of Tuckup Canyon).



Noise and activity associated with recreational activities has the potential to attract condors to campsites and resting places along trails (e.g., overlooks), and can increase the potential for interaction between condors and humans. Condor/human conflicts have occurred at river campsites, and numerous encounters between hikers and California condors have been reported since condors were released in 1996 (NPS 2006a). Impacts occur when humans approach, feed, or harass these curious birds. The condors are attracted to a variety of trash left behind by recreationists, and can be harmed if they ingest these items. Condor contact with humans would be of concern if the birds became habituated to humans. Recreationists encounter and attempt to interact with condors more frequently during the summer months, but adverse encounters have occurred in winter. Increased human use in the park could affect roosting condors and displace individuals, especially early in the morning and late in the afternoon when the lack of thermals would require birds to expend greater energy in search of new roost sites. Mitigation measures to educate hikers about condor concerns, and to cease activities if condors are present, would reduce potential disturbance from recreational activities on the birds.

The most likely place where recreationist could be close to a condor nest is within the upper reaches of Marble Canyon, where several well used and known canyoneering routes exist. There are currently no established campsites within ¼ mile of any known condor nest sites, although three campsites are within ½ mile. Nest sites change and could occur in close proximity to trails and campsites in the future. Nesting habitat is generally limited to Inner Canyon cliffs and caves very high up on Redwall limestone rock faces, lessening the potential for direct impacts (noise and disturbance) from humans and making it easy for recreationists to avoid areas of known and potential condor nesting sites due to vertical separation. Although their preferred roosting habitat is rock cliffs, snags, and stands of live conifers, condors also scavenge and roost along the Colorado River and its tributary canyons (Osborn 2003), where some recreational activity occurs as well (e.g., canyoneering and day hiking from the river). There are very few designated park trails (one) that currently come within 1/4 of any known condor nests.

Mexican Spotted Owl (threatened)

The primary threat cited for Mexican spotted owl (MSO) recovery throughout the range is large-scale habitat loss, primarily through catastrophic stand-replacement wildfire. Threats from predation, disease, parasites and starvation, accidents, and potential interactions of threat factors with climate change are considered comparatively minor (USFWS 2012). Because current MSO surveys and research to date have not documented MSOs roosting or nesting within the park's forested habitat, large-scale catastrophic stand-replacement wildfire are less of a threat to the continued persistence of the species within Grand

Canyon. However, the loss of these habitats through fire or development could lessen the ability of canyon dwelling MSOs to forage and disperse.

Potential threats cited specifically for the Colorado Plateau Ecological Management Unit (EMU) of the MSO focus more on recreational impacts, road building, and overgrazing. Because the park does not allow grazing within its boundaries those impacts are not considered here. Habitat alteration, as the result of recreational activities, may force adults to relocate to nearby habitat, but displaced adults may not be able to establish breeding territories if suitable territory locations are already occupied. Potential impacts from noise and disturbance caused by humans during recreational activities and due to the presence of roads and trails are discussed below and referenced for the various impact topics associated with each Alternative when appropriate.

Responses to noise disturbance vary with intensity, timing and context. MSO may respond to infrequent, low intensity noises by flushing, but will return after the disturbance is gone (Delaney et al. 1999, Swarthout and Steidl 2001, Swarthout and Steidl 2003). More consistent, louder noises (> 69 decibel, approximately twice the level of conversational voices), closer to nests are more disruptive, and cause birds to flush more than 60% of the time (Delaney et al. 1999, Pater et al. 2009). These disturbances can put nestlings at risk by increasing their exposure to predation and heat-related stress. Disturbances at night may have greater impact because audio communication is critical to MSO social structure and birds use sound to locate and capture prey (Payne 1971, Martin 1986, Norberg 1987, Frid and Dill 2002). Activities in steep, narrow canyons where MSO roost and nest in Grand Canyon would also have greater impacts because these habitats lack visual barriers and echoing sounds carry farther.

Recreational impacts to MSO take place during both camping and hiking. Much of the impacts of recreational use will be from activities in campsites. Four of the 18 designated campsites in backcountry Use Areas are within ¼ mile of a MSO Protected Activity Center (PAC). Eleven PACs had at least 2 user-created at-large campsite within a ¼ mile buffer (average = 12, range = 2 - 30).

Beyond campsites, impacts from use will mostly occur on routes, trails, and roads. Construction and maintenance activities cause disturbance over a limited time, but fragment habitats and can alter foraging and movement patterns (USFWS 2012). Although PACs may contain one or more trail segments, MSO are generally tolerant of hikers more than 24 meters away, and do not flush or alter their behavior when hikers are more than 55m away (Swarthout and Steidl 2001). Individual flushed by hikers will return after the disturbance is gone. Because most recreational trail use occurs during the daylight hours, and MSOs are typically active at night (dark), there is a high degree of temporal separation. In Grand Canyon, 13 PACs (28%) contain one or more trail segments, but only one of these includes a nest site. In spite of this proximity, this PAC is the only one in the park to have fledged more than 2 birds in more than one year. This situation is similar to MSO studied in Zion National Park, where high human visitation in close proximity to MSO did not seem to inhibit their nest/roost site choices or their reproduction (Hockenbary 2011), though it is not known whether these particular MSOs have simply become used to human activity or if MSOs in Zion NP are not bothered by human activity (NPS 2007b).

<u>Guidelines to lessen impacts to Mexican spotted owls</u>

Within a PAC, disturbance is defined as the presence of 1 -12 people; group sizes exceeding 12 people should not be allowed. In areas where nest and roost sites are not identified, human disturbance should be limited to ≤2 disturbances per hour (averaged over a 24 hour period) throughout the PAC. Where nest and roost sites are known, disturbance should be limited to ≤2 disturbances per hour (averaged over a 24 hour period) within line of sight of the nest/roost sites. In some cases, disturbances may be avoided by routing trails and recreational uses outside of PACs through signing in order to designate zones free from human disturbances during critical periods.

Below are some suggested guidelines to minimize potential impacts to MSOs from recreationally generated noise and disturbance (from USFWS 2012). The following guidelines apply to PACs during the breeding season, (1 Mar - 31 Aug):

1) Construction of new facilities or expansion of existing facilities should not take place in PACs during the breeding season. If the work must occur during the breeding season (e.g., safety) use all measures possible to avoid potential effects on MSOs (e.g., use least disruptive machinery; timing of the project to minimize disturbance).
2) Managers should assess the presence and intensity of currently allowed (permitted and non-permitted) recreational activities in existing PACs and potential habitat. The assessment should include distance, frequency, duration, and source of the disturbance. If recreational activity is determined to be a problem then limit human activities during the breeding season.
3) Seasonal closures of specifically designated recreational activities (e.g., rock climbing, canyoneering) should be considered where disturbance to breeding MSOs seems likely.
4) Conduct education through signing, interpretation events, access permitting, or other information sources to inform the public of proper and legal behaviors when encountering MSOs.

Southwestern Willow Flycatcher (endangered); Western Yellow-billed Cuckoo (threatened); Yuma Clapper Rail (endangered)

The southwestern willow flycatcher (SWFL), western yellow-billed cuckoo (YBCU), and Yuma clapper rail (YUCR) have been known to use riparian habitats close to or along the Colorado River in Grand Canyon, the YUCR data is neither recent nor site specific. Threats to all three species that are beyond the scope of this Plan include loss of habitat due to changes in river flows due to managed water deliveries from Glen Canyon Dam and Boulder Dam. All riparian habitat along the Colorado river in Grand Canyon is subject to natural successional processes that reduce habitat value for these species over time unless natural or human induced restorative events (e.g., scouring floods) occur. For both SWFL and YBCU, the degradation of natural cottonwood-willow riparian habitat as a result of the invasion by salt cedar (Tamarix spp.) is a major problem over much of their range, even though there is evidence that SWFL can utilize stands of tamarisk for nesting (Sogge et al. 2005).

Potential recreational impacts to SWFL, YBCU, or YUCR would result from noise and disturbance, and/or habitat alterations in the river/riparian habitat which constitutes the species' potential, suitable, and existing breeding areas. River recreation and backpacker use of the river corridor is highest during the summer months when the breeding seasons for all three species occur. Noise and disturbances would displace breeding individuals, reduce nesting success and potentially cause population declines. Habitat alteration from new trail creation or campsite expansion would negatively impact all these species. The use of established trails and campsites should help lessen potential impacts. YUCR begin breeding in March and end in July, SWFL breed May-July and the YBCU starts breeding in late June through August. Packrafting could impact some shoreline habitat via trampling and cause some noise disturbance. Habitat alteration, as the result of recreational activities, may force adults to relocate to nearby habitat, but displaced adults may not be able to establish breeding territories if suitable territory locations are already occupied.

Bald and Golden Eagles (Bald and Golden Eagle Protection Act)

Although bald eagles do not nest in the Grand Canyon they do occur in the park as migrants and winter residents from fall until early spring. During the winter, their distribution is negatively correlated with levels of recreational activity (Brown and Stevens 1997). Impacts are likely greatest in the upper reaches of Marble Canyon from Lees Ferry to Soap Creek where day use by anglers and overnight use by hikers is highest. Impacts of backpackers and canyoneers is likely reduced because their activities focus on side canyons while bald eagles use the mainstem Colorado River for foraging and roosting. The presence of

users in camps and on beaches in the mainstem results in displacement and changes in behavior (Brown and Stevens 1997). The effects of recreational activities on eagles are probably limited to individual birds and do not occur on a population scale.

Compared with bald eagles, golden eagles typically forage and utilize more open habitats and are not heavily associated with riparian habitat types or rivers. In the southwest, golden eagle nests are typically located on cliff ledges or tops. In 2002 and 2003 Grand Canyon wildlife staff conducted nest surveys and found two within Grand Canyon; at South Canyon near the mouth of the canyon, and at river mile 114 R on the east side in the Supai layer. These nests were in cliff faces (not associated with tight canyon areas) along the main river corridor in the cliff bands. It is assumed that camping near golden eagles and noise impacts the species, with effects similar to bald eagles (minor behavioral changes). Human disturbances (e.g., rock climbing) very near a nest could cause nesting disruption or abandonment. The effects of recreational activities on golden eagles are probably limited to individual birds and do not occur on a population scale.

Peregrine Falcon (post-delisting monitoring plan)
Peregrine falcon populations in the Grand Canyon remained stable or increased slightly from 1988 to 1999 (Ward 2000). While there are peregrine nest sites in the areas of potential concern (hiking trails and canyoneering routes) the nesting and foraging behavior of the species will limit negative impacts from recreation. They nest on cliff ledges which creates vertical separation from hikers. They next in open areas in which they can capture prey from the air, and so avoid canyoneering routes, which are focused on slot canyons. There are currently 10 established backcountry trails and 13 known canyoneering routes that come within ¼ mile of known peregrine falcon eyries. Therefore, while trail hiking and canyoneering trips would likely be in the same general areas or canyon systems as peregrine nest sites, their proximity to one another would be distant (vertical separation) and not likely negatively affect peregrine nest success and foraging ability. Noise levels could indirectly affect peregrines, causing them to temporarily leave an area. Falcons may be disturbed by backcountry activities while nesting or foraging, but they would be able to return to the activity once the disturbance was gone, or they would relocate to a less disturbed area (Lamp 1987). Rock climbing on open cliff faces poses a threat to peregrine falcons (Ratcliffe 1993). Nesting peregrine falcons are intolerant of excessive human disturbance; they may abandon a nesting site during courtship and move to another ledge or cliff if possible. In the few cases where reproductive success was evaluated, reproductive parameters were sometimes affected, but not to a large degree. Frazer et al. (1985) and Grubb and King (1991) reported that nesting raptors were more sensitive to ground-based activities compared to aircraft. In Zion National Park, areas with known nest sites are closed to visitor use at the beginning of nesting season. If a nest site is not used, the area is opened to visitor use. In areas where the nest sites are used the areas are closed until the young falcons have fledged (NPS 2007b).

Mammals, Bats

Cave, Crevice and Mine associated bat species
Grand Canyon does not have a current plan that addresses the management and use of caves, and there is no current data to indicate the level of recreational use of caves within the park. However, it is known that caves along the river corridor are visited by river trips and caves outside the river corridor that are easily accessible (e.g., Horseshoe Mesa) are visited by day hikers and backpackers. The main potential impact to bats from cave use is possible disturbance of roosting or hibernating cave dwelling bat species. Habitat modification and human disturbance in caves where bats are present in maternity colonies or are hibernating can have adverse, long-term, moderate and in some cases major impacts. While vandalism and direct aggression toward roosting bats definitely occur and can cause large amounts of damage, even responsible cave visitors may unknowingly cause harm to roosting bats simply by being present. Repeated disturbance at a roost site may cause bats to abandon the roost and move into a less favorable

alternative roost. Disturbance during hibernation can wake the bats, causing them to burn stored fat and perhaps preventing them from being able to survive the winter (Thomas 1995). Population declines could be accelerated if numbers at maternity colonies are not sufficient to raise roost temperatures to the levels needed for healthy growth of young (Reiter 2004). Human visitation in some caves can also cause changes in the micro-climate of the cave due to lights, increased humidity, and management structures (Mann et al. 2002). These direct and indirect disturbances by human visitors have been well documented in Stantons Cave, Bat Cave, and in cave research in Marble Canyon (Billingsley et al. 1997, Leslie 2003). The installation of bat gates at Stantons Cave and Rampart Cave has successfully reduced visitor impacts to bats.

Forest associated species

The bat species associated with forests are less likely to be directly impacted by recreational activities, when compared to cave species. The primary concern for the forest species is loss of roost trees and degradation of foraging habitat. Studies have shown that forest bats typically switch roosts often during the maternity season, suggesting they may require multiple tree roosts. Bats may switch roosts to avoid disturbance or predation (Kunz 1982) to acquaint young with possible future roost sites (O'Shea and Vaughan 1977), to respond to shifts in prey availability, or to respond to changing roost conditions (Lewis 1995). Recreational activities around campsites, attraction sites, and canyoneering routes near trees could potentially disturb these species, especially removal of bark or cutting of trees for firewood.

Mammals, Ungulate, Desert Bighorn Sheep

Across Grand Canyon, bighorn sheep and backcountry users are selecting the same resources: water and shade. In the park, bighorns are widely distributed across a large deep canyon bisected by a perennial river. Preliminary information from marked animals suggest that females captured along the river remain within 300 vertical meters of the river year-round whereas males move much higher to forage after the breeding season is over. One of the largest observed concentrations of females during peak lambing season (roughly February and March) occurs in the Muav Gorge between Deer Creek and Kanab Creek. This area overlaps with the popular Deer Creek / Tapeats Creek complex. Conversely, male bighorns routinely access areas in the higher Supai and Esplanade formations, probably searching for more nutritious winter forage. This may make them better able to avoid backcountry users in the mainstem area, but sheep that inhabit dry areas on the Tonto Platform with sparsely distributed water may consistently be competing with backcountry users to gain access to preferred seeps, springs, and creeks.

Potential adverse effects to bighorn sheep from proposed BCMP implementation include both direct and indirect disturbance, leading to temporary and/or long-term displacement of bighorn sheep. When disturbed, bighorn will move to alternate sites, especially if humans appear suddenly and approach directly (Papouchis et al. 2001, Buckley 2004, Steven et al. 2011). Sheep experiencing infrequent, low level disturbance may simply return to their activities once users leave an area. Stress from long term disturbance leads changes in physiology and reproductive rates, and can lead to abandonment of an area (Belanger and Bedard 1990, Semeniuk et al. 2009, Marechal et al. 2011, Burger, 1995, Orams 2002). The impacts of energetic losses from increased movement and decreased foraging time resulting from disturbance (MacArthur et al. 1982) in Grand Canyon would be greater because 80% of individuals tested have carried one or both strains of bacteria responsible for pneumonia outbreaks responsible for population declines seen elsewhere in the US (Gross et al. 2000, Cassirer and Sinclair 2007, Schommer and Woolever 2008). Cumulative effects of human disturbance have been implicated in the and extirpation of bighorns in the Pusch Ridge Wilderness, Arizona (Etchberger et al. 1989), the San Gabriel Mountains, California (Graham 1971), and in some areas of southeastern Utah (King 1985). Human disturbance was also a primary factor prompting the listing of the California peninsular population of desert bighorn sheep (*O. c. cremnobates*) as an endangered population (USFWS 1999).

ALTERNATIVE A

Backcountry Management Zones

The 1988 Backcountry Management Plan defined four management zones (Corridor, Threshold, Primitive, and Wild) to better guide backcountry management actions and provide opportunity for a wide variety of backcountry experiences. Currently all zones provide for day use and overnight camping (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Additionally, the Threshold and Primitive Zones contain roads that are currently open for and receive visitor use. Generally, the timing of visitor use, regardless of zone, is highest during spring, summer, and fall seasons.

The Corridor Zone (57% of user-nights) is managed to accommodate high visitation levels. The Corridor Zone is the smallest of the backcountry management zones, representing less than 2% of park area. It serves to focus potential impacts within a very well defined area instead of occurring park wide. However, the associated high levels and consistent use of this zone for both day hiking, stock use, and camping means that special status wildlife within this zone experience disturbance and some degree of habitat alteration at developed sites and along trails; probably to the point that individuals of some species no longer choose areas within the Corridor Zone (e.g., near campsites, rest houses, and along trails) for breeding or nesting (see *Potential Day and Overnight Use Impacts to Special Status Species* section). The presence of high quantities of human food at certain sites within the Corridor Zone has also likely led to increased populations and congregations of some prey species (e.g., rock squirrels, other rodents) that could attract Mexican spotted owls and eagles. This zone also has extensive stock use, which many special status wildlife species react negatively too. Currently there are 4 MSO PACs located primarily within the corridor zone. While the corridor zone comprises only a fraction of the general condor Use Area in the park (2.5%), almost 35% of recent condor locations from GPS data were within this zone; indicating high use and possible preference of this zone for condors. Minor, adverse, localized, long-term impacts would continue to occur to special status wildlife under current management (ALL).

The Threshold Zone (22% of user-nights) is managed for moderate-to-high use levels and is slightly larger than the Corridor Zone, comprising about 8% of park area. Camping is both at-large (dispersed) and occurs at designated sites. Potential impacts to special status wildlife from camping, such as disturbance and habitat alteration, can occur throughout the zone depending on the level of dispersed camping (see *Potential Day and Overnight Use Impacts to Special Status Species* section). The consistent presence of human food at designated campsites within this zone could lead to increased populations and congregations of some wildlife, but the allowance of dispersed camping should reduce the potential for large wildlife congregations. Because day use occurs along established trails, potential impacts to special status wildlife occur within a very well defined area instead of potentially occurring throughout the zone. The moderate-to-high use of this zone for both day hiking and camping means that most special status wildlife within this zone are likely to experience some disturbance and some degree of habitat alteration at campsites and immediately adjacent to trails. Even though all assemblages of native species are likely present within this zone, the level of disturbance is probably high enough that individuals of some special status wildlife species no longer choose areas within this zone (e.g., campsites, near trails) for breeding or nesting. Although the potential is very low, impacts to special status wildlife from visitor use of the roads within this zone include possible mortality of some species (raptors, sheep, bats) directly from the vehicles travelling on the access roads. Currently there are 2 MSO PACs located primarily within the threshold zone. The threshold zone comprises only a small portion of the general condor Use Area in the park (~7%), yet 12% of recent condor locations from GPS data are within this zone; indicating moderate use and slight preference of this zone for condors. Negligible to minor, adverse, localized, long-term impacts would continue to occur to special status wildlife under current management (ALL).

The Primitive Zone (18% of user-nights) is managed for low-to-moderate use and encompasses approximately 25% of the park's area. Camping is at-large, although certain camp areas have been

defined to address resource impacts. Because camping is mostly at-large impacts to special status wildlife from camping can occur throughout the zone depending on the level of dispersed camping (see *Potential Day and Overnight Use Impacts to Special Status Species* section). The presence of human food at any defined campsites within this zone likely leads to increased populations and congregations of some prey wildlife, but the prevalence of dispersed camping likely reduces the potential for large wildlife congregations. Trails into the Primitive Zone are defined, but are more distant from developed areas. Because day use occurs along primarily established trails, potential impacts to special status wildlife from hiking occur within a very well defined area instead of throughout the zone. The low-to-moderate use of this zone for both day hiking and camping means that most special status wildlife within this zone probably experience a low level of disturbance and are seldom displaced. Although the potential is very low, impacts to special status wildlife from visitor use of the roads within this zone include possible mortality of some species (raptors, sheep, bats) directly from the vehicles travelling on the access roads. Currently there are 22 MSO PACs located primarily within the primitive zone. The primitive zone comprises almost half of the general condor Use Area in the park (45%), yet 21% of recent condor locations from GPS data are within this zone; indicating generally less use of this zone for condors. Negligible, adverse, localized, long-term impacts would continue to occur to special status wildlife under current management (ALL).

The Wild Zone (3% of user-nights), represents more than half of the park's area, and is more remote than the Primitive Zone and managed for solitude (low use). Camping is at-large, therefore impacts to special status wildlife from camping can occur throughout the zone depending on the level of dispersed camping (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Trails are unimproved, and route-finding is often required. Because day use and backcountry travel within this zone does not rely on established trails, potential impacts to special status wildlife from hiking may occur throughout the zone. However, the low use and undeveloped nature of this zone means that most special status wildlife within this zone either experience a very low level of disturbance or none at all, and are seldom displaced. Currently there are 19 MSO PACs located primarily within the wild zone. The wild zone comprises almost half of the general condor Use Area in the park (45%), yet 33% of recent condor locations from GPS data are within this zone; indicating generally less use of this zone for condors indicating moderate use and more preference of this zone for condors compared to the primitive zone. Negligible, adverse, localized, long-term impacts would continue to occur to special status wildlife under current management (ALL).

Climbing Management

Recreational rock climbing occurs within the park during overnight backpacking and day use trips, yet there is uncertainty about the number of visitors engaging in climbing and the timing, and locations. Permits are required for overnight backpacking trips but no special permit is required to include climbing in an itinerary, and no permits are required for day trips associated with this activity. Depending on the location, climbing has the potential to impact special status wildlife through disturbance and possible displacement. If climbing occurs during the breeding season for special status birds (February-September) that nest or roost on preferred climbing strata (e.g., cliffs), then the birds could be disturbed to the point that they abandon nesting. However, climbing is not known to occur in high use patterns and nest abandonment has not been documented. Climbing during the bird breeding season would be most likely to impact peregrine falcons and golden eagles, and to a lesser degree condors, Mexican spotted owls, and bats. There are 12 MSO PAC boundaries that are within ¼ mile of identified climbing/summit routes. However, all of these routes do not come within ½ mile of any identified MSO nest or roost sites. Only 3identified climbing routes are within ¼ mile of known peregrine falcon nests and 2 are that close to condor nests. In addition to climbing itself, travelling to rock climbing sites and the act of camping can disturb special status wildlife, impact habitat, and result in habituation and unnatural congregations of animals (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Continuing current management of climbing would continue to create negligible to minor, adverse, localized, short-

term impacts to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Canyoneering Management
Canyoneering occurs within Grand Canyon during overnight backpacking and day use trips, and preferred routes have been identified in various canyoneering guide books (e.g., Martin 2013). The number of visitors engaging in canyoneering is uncertain and Grand Canyon does not currently have a park-specific policy for managing canyoneering. Permits are required for overnight backpacking trips but no special permit is required to include canyoneering in an itinerary, and no permits are required for day trips associated with this activity. Depending on the location, canyoneering has the potential to impact special status wildlife through disturbance, possible displacement and habitat alteration at sites that receive high levels of use. One unique aspect of canyoneering, when compared to typical hiking or rock climbing, is that many canyoneering routes contain water (seeps and springs) that people must walk, wade, or swim through. At Grand Canyon, water attracts special status wildlife species that rely on these water sources. Currently there are 12 identified canyoneering routes that intersect with 13 (28%) known MSO PACs, and most of these routes occur within ¼ mile of preferred MSO nest/roost sites.

In addition to canyoneering itself, travelling to canyoneering sites via established trails (or cross country) and the act of camping (designated or dispersed) can disturb wildlife, impact habitat, and result in habituation and unnatural congregations of animals (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Minor to moderate, adverse, localized, long-term impacts would continue to occur to special status wildlife if current management of canyoneering continues (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Extended Day Hiking and Running Management
Extended day hiking or running such as rim-to-river or rim-to-rim occurs primarily within the Corridor Zone trails, and to a lesser extent on other backcountry trails. Under current management, there are no restrictions on this activity other than the requirement for a Special Use Permit for groups of more than 30. The primary impact to special status wildlife from this activity is disturbance and possible displacement from areas near the Corridor trails due to the presence of people and associated elevated activity and noise levels. The elevated amounts of litter associated with this activity may result in some special status wildlife ingesting more litter or being attracted to prey associated with the litter (e.g., MSO, eagles, condors). Large numbers of people running single file along the corridor trail increases levels of disturbance and, at brief times, could create an effective barrier to movement for some species like desert bighorn sheep. This activity occurs during pre-dawn and post-dusk hours when wildlife is often more active and nocturnal species like MSO that a typical day hiker would not encounter are present (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Minor, adverse, localized, short-term impacts would continue to occur to special status wildlife if current management of extended day hiking continues (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Administrative Use Management
Administrative use of the backcountry includes resource management, maintenance, visitor protection, visitor education, and research. All administrative activities in Wilderness are required to evaluate activities and methods through the minimum requirement analysis (MRA). Administrative users with overnight itineraries must obtain backcountry permits. However, administrative use can either be within or in addition to existing overnight permits within an area. Depending on the MRA, most administrative use would involve hiking and overnight use impacts (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Administrative use of helicopters for emergencies and maintenance occurs primarily in the Corridor Zone, and in this zone use only rarely exceeds 5% of daylight hours. There is a potential for increased wildlife impacts if areas are overbooked for administrative use or if

spike camps are established. Under current administrative use rules, negligible, adverse, localized, short-term impacts would continue to occur to special status wildlife (ALL).

Additionally, administrative use such as resource management and restoration activities, or visitor education and law enforcement could have beneficial impacts to wildlife. Under current administrative use rules, minor to moderate, beneficial, localized, long-term impacts would continue to occur to special status wildlife (ALL).

Commercial Overnight Backpacking
Commercially guided backpacking trips are granted through CUAs that allow qualified guides to lead overnight backcountry trips. The commercial use is included in use limits set for all Use Areas in the backcountry, including the corridor campgrounds. Therefore they do not add to the current number of overnight backpacking limits. Currently, commercial trips account for approximately 9% of the total overnight backpacking use. Potential impacts to special status wildlife from these programs would be similar to those discussed in the *Day and Overnight Use Impacts to Special Status Species* section with regards to hiking and camping. Continuing current management of commercial overnight backpacking would continue to produce negligible, adverse, localized, short-term impacts to special status wildlife (ALL).

The incorporation of overnight use levels into current limits and the ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace special status wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Continuing current management of commercial overnight backpacking would continue to produce negligible, beneficial, localized, short-term impacts would continue to occur to special status wildlife (ALL).

Commercial Day Hiking
Commercially guided day hiking trips are granted through CUAs and have a maximum of 11 persons including guides. The CUAs recommend locations and hike destinations, but under current management, there are no limits on number of hikes allowed per day per trail, no limit on number of day-hiking CUAs, and day hiking CUA holders are not currently required to report on use, including number of visitors, number of trips and locations they visited. However, the inability of Grand Canyon to regulate the number of day hike CUAs leaves the possibility for high levels of use within the designated areas and associated high potential for disturbance and displacement of wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Minor, adverse, localized, short-term impacts would continue to occur to special status wildlife under current management rules (ALL).

The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. Minor, beneficial, localized, short-term impacts would continue to occur to special status wildlife under current management rules (ALL).

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial transportation tours to Tuweep, including jeeps and vans, are granted through CUAs. There are currently six CUAs, and each is allowed to conduct two trips per each weekday, and one trip per each weekend day, with each trip is limited to 15 persons. Current daily limits at Tuweep, established to provide an uncrowded and primitive experience set a maximum of 30 vehicles or 85 visitors at one time including commercial tours. Impacts to special status wildlife from visitor use at Tuweep include disturbance and displacement from hikers on the trails, and camping (see *Potential Day and Overnight Use Impacts to Special Status Species* section), and disturbance, displacement, and possible mortality from the vehicles on the access road. Continuing current management would continue to produce minor,

adverse, localized, short-term impacts to special status wildlife (only golden eagles, peregrine falcons, bats, and desert bighorn sheep).

Backcountry Roads, Trails, and Routes
Grand Canyon's backcountry trails and routes in Inner Canyon and rim areas total approximately 400 miles. In addition, approximately 140 miles of former roads in proposed Wilderness have been closed under the Superintendent's Compendium since 1993 and used as public trails or for administrative purposes. These closures were described in the Wilderness recommendation (NPS 1993). Some former road segments have been identified as trails on public maps, and many are not maintained. Closure of public roads, or conversion to hiking trails, have beneficial impacts to the special status wildlife because vehicles are prohibited and fewer people are willing to access many of the areas that the roads served. Minor, beneficial, localized, long-term impacts would continue to occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

However, there would still be potential of vehicles on roads (Kanab Pt., Tuckup Pt., Range Road, W-1, W-4) and disturbance, displacement, and possible mortality from the vehicles on these access roads. Negligible, adverse, localized, long-term impacts would continue to occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Corridor Zone Camping
Corridor Zone camping is available in three campgrounds. Indian Garden has 15 small and 1 large campsites, Bright Angel Campground has 31 small and 2 large campsites, and Cottonwood Campground has 11 small and 1 large campsites. Large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas. This in turn leads to greater potential of disturbance of special status wildlife within the immediate area of large groups, even though use is highest and impacts are greatest in the Corridor Zone (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Minor, adverse, localized, short to long-term impacts would continue to occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Hance Creek and Cottonwood Creek, Primitive Zone Use Areas, allow at-large camping for two small groups and 1 large group per night in each area. Most of the users tend to camp near the most reliable water sources in the Use Areas (Hance Creek and Cottonwood Creek). These Use Areas surround Horseshoe Mesa, a Threshold Zone Use Area. Backpackers often create itineraries that travel through these Use Areas to access areas beyond. Cremation, a Primitive Zone Use Area allows at-large camping for two small groups and one large group per night. Cremation is adjacent to the Corridor Zone and is accessible along the Tonto Trail to the east of the South Kaibab Trail. Many Corridor Zone hikes include this Use Area in the trip itinerary. Overnight backpackers create impacts typical of large and small groups in these areas (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Continuing current management of these Use Areas would produce minor, adverse, localized, short to long-term impacts to special status wildlife (ALL).

Cumulative Impacts
Past, present, and reasonably foreseeable future actions have the potential to contribute to cumulative impacts on wildlife (see Table 4.1). Currently implemented Grand Canyon actions include fire management, overflights, limited maintenance and/or construction within designated Wilderness (e.g., road maintenance, repair and replacement of trans-canyon water pipeline), vegetation/habitat restoration projects, and management of river recreation and the visitor use and habitat changes along the river associated with the operation of Glen Canyon Dam. Each of these projects is managed in ways which minimize adverse impacts to natural resources, and each project receives environmental review under NEPA prior to implementation.

Past, present, and reasonably foreseeable future projects on the Kaibab National Forest with potential to impact wildlife habitats or special status wildlife species addressed by this plan are implementation of a Forest Plan that includes fire management, timber sales, noxious weed control, grazing, recreation (including hunting and camping), and travel management. These planned projects also fall under NEPA purview and contain measures to avoid or minimize adverse impacts to special status wildlife and habitats. Effects should be minimal and local. Other planned or potential non-federal actions adjacent to the park include water development projects on tribal or private lands, air tour operations, and uranium mining.

Cumulative effects to special status wildlife from past, present, and reasonably foreseeable future actions (noted above) would vary in intensity from minor to moderate depending on the habitats and species affected. These actions could result in increased wildlife disturbance and some habitat alteration during certain activities, but effects would be local and short-term. Beneficial impacts to wildlife habitat from some fire treatments generally would be minor, beneficial, and short-term. Overall, the effects of Alternative A on special status wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be regional adverse, short to long-term, seasonal to year-round, and moderate. Alternative A would contribute a small amount to these impacts.

Conclusion
Under Alternative A, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from the majority of backcountry use continuing to occur in the spring, summer and fall. Impacts from habitat modification at campsites, and disturbance or displacement from camping would occur. Campsites, rest houses, and high use trails could also attract and habituate certain species of special status wildlife and disturbance and displacement along high use trails would occur.

Cumulative effects would be moderate, adverse, regional to localized, adverse, short to long-term, seasonal to year-round of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones
Approximately 94% of the park is proposed for Wilderness designation. The four Zones designated by the 1988 BCMP (Corridor, Threshold, Primitive, and Wild) are within Grand Canyon's Wilderness. A large portion of the Colorado River corridor is also included in proposed Wilderness. This plan/DEIS proposes two new backcountry management zones: Road Natural and River (see Chapter 2 for descriptions). Each Zone recognizes unique recreation opportunities (e.g., rim camping, river running) and actions required to protect resources and manage visitor use. Impacts to special status wildlife would be the same as described in Alternative A, negligible to minor, adverse, localized, short-term impacts.

Climbing Management
All action alternatives propose implementing a monitoring framework to track climbing activity through the backcountry permitting process and field surveys, educating visitors in Minimum Impact Climbing Education, and not allowing motorized equipment (e.g., power drills) in Wilderness. Depending on location and timing, climbing can impact special status wildlife through disturbance and possible displacement at sites that receive high levels of use. There are 12 MSO PAC boundaries that are within ¼ mile of identified climbing/summit routes but none of the routes are within ½ mile of any identified MSO nest or roost sites. In addition, only 3 identified climbing/summit routes are within ¼ mile of known peregrine falcon nests and 2 are that close to condor nests. Implementation of minimum impact climbing techniques and not allowing motorized equipment would result in negligible to minor, beneficial,

localized, short-term impacts to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Management Actions Potentially Implemented through Adaptive Management

- Day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
- Climbing Management Plan development

When surveys or other data indicate that climbing is negatively affecting sensitive wildlife species, one or more of these actions could be implemented. A Climbing Management Plan would help wildlife managers identify potential threats to sensitive wildlife species (nesting, lambing sites) and track trends that could lead to negative impacts. Seasonal restrictions around breeding and nesting/young-rearing periods would eliminate disturbance during a critical wildlife life stage. Reductions in group size and the number of groups by day or season would also serve to lessen potential disturbance to wildlife species. Negligible to minor, beneficial, localized, short-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Canyoneering Management

Canyoneering occurs within Grand Canyon during overnight backpacking and day use trips. All action alternatives propose limiting canyoneering groups to six persons, implementing a monitoring framework that tracks canyoneering activity through the backcountry permitting process and field surveys, educating visitors in Minimum Impact Climbing Education, and not allowing motorized equipment (e.g., power drills) in Wilderness. Depending on the location, canyoneering has the potential to impact wildlife through disturbance, possible displacement and habitat alteration at sites that receive high levels of use. One unique aspect of canyoneering, when compared to typical hiking or rock climbing, is that many canyoneering routes contain water that people must walk, wade, or swim through. Because water attracts special status wildlife routes that traverse water have the potential to disturb and displace these species Desert bighorn sheep that aren't along the Colorado River often rely on springs and seeps found along canyoneering routes for fresh water. Currently there are 12 identified canyoneering routes that intersect with 13 (28%) known MSO PACs, and more may exist in unsurveyed side canyons. Most of these routes occur within ¼ mile of preferred nest/roost sites. Minor, beneficial, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Management Actions Potentially Implemented through Adaptive Management

- Day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites

If survey or other data indicate canyoneering is having adverse impacts on special status wildlife, one or more of these actions could be taken. Requiring permits that identify canyoneering routes would help

wildlife managers identify potential problem areas. Seasonal restrictions around breeding and nesting/young-rearing periods would eliminate disturbance during a critical wildlife life stage. Reductions in group size would also serve to lessen potential disturbance to wildlife species. Minor to moderate, beneficial, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Extended Day Hiking and Running Management
All action alternatives propose implementing a day use permit for extended day hiking and/or running in defined areas, with no limit on the number of permits issued during the initial implementation phase. Additionally, Minimum Impact and Trail Etiquette Education Programs would be implemented. Minor, beneficial, localized, short-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Daily use limits by trail
- Designated days for group or individual events
- Adopt policy for other trails

When survey or other data indicate trail runners and extended day hikers are having adverse impacts on special status wildlife, one or more of these actions could be taken. Having a day use permit for hiking and/or running in defined areas would serve to help monitor when and where high use was occurring in relation to wildlife species. Utilizing Minimum Impact and Trail Etiquette Education Programs, reductions in group size, and daily use limits by trail would also serve to lessen potential disturbance to wildlife species. Negligible to minor, beneficial, localized, short-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, and bald eagles).

Commercial Day Hiking
Commercially guided day hiking trips would be granted through CUAs and would have a maximum of 11 persons including guides. The CUAs would specify trails and hike destinations. The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. However, the park does not regulate the number of day hiking CUAs, creating the possibility for high levels of use within the designated areas and associated potential for disturbance and displacement of wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species* section). All action alternatives propose no commercial day hiking in the Wild Zone and mandating one guide for groups of up to six clients and two for groups of eight or nine clients. Removing commercial day hiking services from the Wild Zone may result in less human presence, and hence less wildlife disturbance within that zone. Minor, beneficial, localized, short-term impacts would occur to special status wildlife (ALL).

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone

There would be no change from Alternative A in the maximum group size in Corridor and Threshold Zones and no change in impacts from Alternative A in those Zones. In Primitive and Wild Zone Use Areas, only small groups would be allowed. The number of total permits per night for each Use Area would be the same as Alternative A with the exception of those Use Areas in the Deer Creek/Tapeats Creek Complex, and at Granite Rapids as described in Common to All Action Alternatives (see Table 2.14d, Overnight Use Limits, Group Number, and Group Size by Use Area and Zone). Actions to limit Primitive and Wild Zone group size to small groups, would be beneficial to special status wildlife because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas leading to greater potential of impacts in the immediate area of large groups (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Even though only small groups would be allowed within the Primitive and Wild Zones, the total number of groups in these zones annually would only be slightly less (<1% reduction). However, the change would result in a 10% reduction in user-nights overall. Negligible, beneficial, localized, long-term impacts would occur to special status wildlife (ALL).

Commercial Overnight Backpacking

The majority of commercially guided backpacking trips would be granted through a limited number of ten-year concession contracts, although two-year CUAs would continue to be authorized for companies doing a small number (1-2) of trips per year. For concessioners, 100% of commercial trips described would be available for permitting one year in advance. CUA holders would obtain permits in the same manner as non-commercial users by making reservations up to four months in advance. Each CUA would be limited to one permit per week and no more than 100 group nights per year. CUA holders could charter additional trips with contract holders. The projected commercial use would be 9.6 % of the total overnight backcountry use.

These commercial trips would be incorporated into current limits. The ability of guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace special status wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species*). Having long-term concession contract also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. Negligible to minor, beneficial, localized, long-term impacts would occur to special status wildlife (ALL).

Commercial Day Hiking

Same as Alternative A except destinations would be limited to areas now recommended. Commercially guided day hiking trips would be granted through CUAs. Guided day hikes have a maximum 11 persons including guides. The CUAs specify allowable locations and hike destination on Bright Angel, South Kaibab, North Kaibab, Hermit, Grandview, and Tanner Trails.

The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb status wildlife. Most of the designated locations already receive moderate to high use from the non-commercial users. Negligible, beneficial, localized, short to long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Backcountry Roads, Trails and Routes

Grand Canyon's backcountry trails and routes in Inner Canyon and rim areas total approximately 400 miles. There would be no changes to the inner canyon trails and routes. Alternative B would establish

approximately 30 miles of Class 1 Wilderness trails on the South and North Rims in proposed Wilderness (see Chapter 2). Impacts to special status wildlife from this conversion would be beneficial overall; as the proposed trails would no longer be accessible to vehicles associated with administrative use, and would therefore be less likely to experience disturbance and possible wildlife mortality from vehicles. Potential impacts to special status wildlife from trail use, both day use and overnight, are addressed in the Day and Overnight Use Impacts to Special Status Species section. Minor, beneficial, localized, short to long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Corridor Zone Camping
Corridor Zone camping would continue to be available in three campgrounds. Four small campsites would be added at Cottonwood Campground. Potential impacts to special status wildlife from overnight use are addressed in the *Potential Day and Overnight Use Impacts to Special Status Species*. More campsites at Cottonwood Campground would increase the potential for disturbance and displacement of special status wildlife due to the presence of up to 24 more people per night at that site. Minor, adverse, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Cumulative Impacts
Past, present, and reasonably foreseeable future actions that have the potential to contribute to cumulative impacts on special status wildlife (see Table 4.1) would be the same as those described in Alternative A and would have the same impacts as described in Alternative A.

Cumulative effects to special status wildlife from past, present, and reasonably foreseeable future actions (noted above) would vary in intensity from minor to moderate depending on the habitats and species affected. The effects of Alternative B on special status wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be regional adverse, short to long-term, seasonal to year-round, and moderate. Alternative B would contribute a small amount to these impacts.

Conclusion
Under Alternative B, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification and disturbance from the addition of up to four campsites at Cottonwood.

Impacts would be somewhat reduced when compared to Alternative A from decreased group size in Primitive and Wild Zones, decrease in group number and size in Deer Creek/Tapeats Creek Complex, and reduced number groups in the Granite Use Area. Adaptive management under all action alternatives would also benefit special status wildlife.

Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C, maximum group size for all Management Zones would be the same as under Alternative A and would have the same impact on special status wildlife species as under Alternative A. Negligible, adverse, localized, short-term impacts would occur to special status wildlife (ALL).

Commercial Overnight Backpacking
The majority of commercially guided backpacking trips would be granted through a limited number of concession contracts. Contracts are generally issued for a ten year period. CUAs are issued for a two-year period and would continue to be authorized for companies doing a small number (1-2) of trips per year. Commercial use caps for the Corridor Zone campgrounds are lower than Alternative B and D; and caps in the Threshold Zone Use Areas, and Primitive Zone Use Areas are higher than Alternative B (see Table 2.14c). The projected commercial use would be 9.6% of the total overnight backcountry use. The ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Having long-term concession contracts also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. Negligible to minor, beneficial, localized, short to long-term impacts would occur to special status wildlife (ALL).

Commercial Day Hiking
Alternative C would allow commercial day hiking in locations described in Alternative A and would add two additional hikes that allow for longer distances; Bright Angel Trail to Indian Garden, and South Kaibab Trail to Skeleton Point. The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. Most of the designated locations already receive high use from the public (non-commercial), so the addition of the two new longer hikes would likely be similar, and negligibly additive to, what is already occurring along these corridor trails. Negligible, adverse, local, short to long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Backcountry Roads, Trails, and Routes
Grand Canyon's backcountry trails and routes in Inner Canyon and rim areas totals approximately 400 miles. There would be no changes to the inner canyon trails and routes. Alternative C establishes approximately 49 miles of Class 1 Wilderness trails on the South and North Rims in proposed Wilderness, opens Tiyo Point for stock use, and the non-wilderness Boundary Road would be open to the public. Potential wildlife impacts include the presence and use of vehicles on the Boundary road, and the construction activities associated with preparing the Boundary road for vehicle use. Commercial stock use would be managed in accordance with the 2010 Mule Operations and Stock Use EA, and potential wildlife impacts include an increased interaction between wildlife and stock. Minor, adverse, localized, short and long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Impacts to wildlife from conversion of former roads to Class 1 Wilderness trails would be beneficial because the proposed trails would no longer be accessible to vehicles associated with administrative use (e.g., fire management), and would therefore be less likely to experience disturbance vehicles. Minor, beneficial, localized, short and long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Corridor Zone Camping
Corridor Zone camping would increase from Alternatives A and B by adding 1 additional campsite at Indian Garden, 4 small and 1 large campsite at Cottonwood and establishing 2 small campsites at Roaring Springs. More campsites at Bright Angel and Cottonwood Campgrounds, and new sites at Roaring Springs would increase the potential for disturbance and displacement of wildlife due to the presence of more people, and more large groups at Bright Angel and Cottonwood. Potential impacts to special status wildlife from overnight use are addressed in the *Day and Overnight Use Impacts to Special Status Species*

section. Moderate, adverse, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Deer Creek/Tapeats Creek Complex
The total number of groups per night in the complex would be 11 (see Chapter 2). Although overall there would be 1 less group allowed within this complex compared to Alternative A, large groups within this complex would increase the potential for disturbance and displacement of wildlife due to the presence of more people at the sites and the disproportionately greater impacts from large groups (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Minor, adverse, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Cumulative Impacts
Past, present, and reasonably foreseeable future actions have the potential to contribute to cumulative impacts on wildlife (see Table 4.1) would be the same as those described in Alternative A and would have the same impacts as described in Alternative A

Cumulative effects to special status wildlife from past, present, and reasonably foreseeable future actions (noted above) would vary in intensity from minor to moderate depending on the habitats and species affected. The effects of Alternative C on special status wildlife, when combined with the other past, present, and reasonably foreseeable actions, would be regional adverse, short to long-term, seasonal to year-round, and moderate. Alternative C would contribute a small amount to these impacts.

Conclusion
Under Alternative C, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, regional and localized, short and long-term impacts to special status wildlife species would result from continued backcountry use including canyoneering, disturbance or displacement from camping, habitat modification an disturbance from the addition and use of up to eight campsites in the Corridor Zone.

A reduction of adverse impacts would occur in the Deer Creek/Tapeats Creek Complex and Granite Use Area where number of groups would be decreased compared to Alternative A. Adaptive management under all action alternatives would also benefit wildlife.

Cumulative effects would be moderate, adverse, regional to localized, short to long-term, seasonal to year-round of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
There would be no change from Alternative A in the maximum group size for overnight backpacking in the Corridor Zone and the impacts in the Corridor Zone would be the same as in Alternative A. Threshold, Primitive and Wild Zone Use Areas would allow small groups only. The number of total permits per night for each Use Area would be the same as Alternative A with the exception of those Use Areas in the Deer Creek/Tapeats Creek Complex, and at Granite Rapids as described in Common to All Action Alternatives (see Table 2.14d).

Limiting Threshold, Primitive and Wild Zone group size to a maximum of 6 persons would be beneficial to wildlife because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas (see *Potential Day and Overnight Use Impacts to Special Status Species*). Even though only small groups would be allowed within the Threshold, Primitive and Wild Zones, the

total number of groups in these zones annually roughly the same as in Alternative A(<1% reduction). User nights would be reduced by 8.0 to 8.5% across the three zones. Negligible, adverse, localized, short-term impacts would occur to special status wildlife (ALL).

Commercial Overnight Backpacking
The majority of commercially guided backpacking trips would be granted through a limited number of ten-year concession contracts. CUAs would continue to be authorized for companies doing a small number (1-2) of trips per year. CUAs are issued for a two-year period. Commercial use would be permitted in the Corridor Zone only. For concessioners, 75% of commercial trips would be available for permitting one year in advance. The remaining 25% would be available to CUA holders and concessioners four months in advance which is the same time that the non-commercial public is applying for permits. CUA holders could charter additional trips with contract holders. The projected commercial use would be 10.2 % of the total overnight backcountry use. These groups would be incorporated within current use limits. The ability of the backpacking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Actions to eliminate commercial groups in Threshold, Primitive and Wild Zone Use Areas could be beneficial to wildlife because there could be fewer people using these zones because commercial small groups tend to be larger than non-commercial small groups. However non-commercial backpackers could still utilize the maximum number of permits allowed within these zones. Having long-term concession contracts also allows the park to stipulate the amount and types of resource protection education that is being disseminated by the commercial guides, and take action for non-compliance. Negligible, beneficial, localized, long-term impacts would occur to special status wildlife (ALL).

Commercial Day Hiking
Commercially guided day hiking trips would be granted through CUAs with a maximum of 11 persons including guides, and the same client/guide ratio as described in Alternative A. The commercial hiking trips would be limited to the Corridor Zone and prohibited outside the areas of Bright Angel Trail to 3-Mile Rest House, South Kaibab Trail to Cedar Ridge, and on the North Kaibab Trail to Supai Tunnel. The ability of the day hiking guides to provide education about park resources and how to minimize impacts typically makes these activities less likely to disturb or displace wildlife. The overall decrease in the number of trails that this activity is allowed on could be beneficial to wildlife due to fewer people being present on those trails, however most of the removed trail segments already receive very high use from non-commercial users. Negligible, beneficial, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Commercial Backcountry Vehicle Tours
One trip per day would be allowed if a stock use trip was not being conducted. Each trip would be limited to 15 persons, and vehicle used must be 22 feet or less. Impacts to special status wildlife from commercial transportation tours to Tuweep include disturbance and displacement of some species from the vehicles on the access road and at the campground/trailhead, and from day hikers on the trails (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Reducing the number of daily trips to one per operator would serve to reduce potential impacts to wildlife. Minor, adverse, localized, short-term impacts would occur to special status wildlife (only golden eagles, peregrine falcons, bats, and desert bighorn sheep).

Backcountry Roads, Trails, and Routes
There would be no changes to the inner canyon trails and routes. Alternative D is most similar to Alternative A, whereby the unmaintained routes would be managed as untrailed areas in old roadbeds (see Chapter 2). Similar to Alternatives B and C, primitive roads within the Road-Natural Zone would provide access to trailheads, campsites and overlooks in accordance with Grand Canyon's Final Wilderness

Recommendation (1980, updated in 2010). Unmaintained routes are likely to only receive very low use, due to the fact that they would not be maintained or identified on park maps as trails. However, these unmaintained routes would still periodically be used for administrative access (i.e., fire management), subjecting wildlife to infrequent periodical disturbance due to vehicles. Negligible, adverse, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Corridor Zone Camping
Corridor Zone camping would continue to be available in three campgrounds with 2 additional campsites at Cottonwood Campground. . More campsites at Cottonwood Campground, would increase the potential for disturbance and displacement of wildlife due to the presence of more people. However, the addition of small groups probably has less impact on wildlife, because large groups tend to spread out more and have greater impacts at and beyond the perimeter of campable areas *(*see *Potential Day and Overnight Use Impacts to Special Status Species*). Minor, adverse, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Deer Creek/Tapeats Creek Complex
The total number of groups per night in the complex would be eight with no large groups in any of the use areas. Overall group nights would be reduced by 12% in the complex, and user nights would be reduced by 18% relative to Alternative A. Fewer campsites within this complex would decrease the potential for disturbance and displacement of wildlife because fewer people are present. It would also be beneficial to wildlife because large groups which tend to spread out more and have greater impacts at and beyond the perimeter of campable areas (see *Potential Day and Overnight Use Impacts to Special Status Species* section). Negligible to minor, beneficial, localized, long-term impacts would occur to special status wildlife (ALL except southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail).

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Hance Creek (BE9), Cottonwood Creek (BG9) and Cremation (BJ9) Use Areas would continue to be managed as Primitive Zones with a maximum of three groups of six or fewer in each Use Area. Removing large groups would be beneficial to wildlife because they tend to spread out more and have greater impacts at and beyond the perimeter of campable areas (see *Potential Day and Overnight Use Impacts to Special Status Species*). Even though large group users represent more than a quarter of user-nights in these Use Areas, removing large groups would result in only a 10% reduction in user nights. Minor, adverse, localized, short to long-term impacts would occur to special status wildlife (ALL).

Cumulative Impacts
Past, present, and reasonably foreseeable future actions that have the potential to contribute to cumulative impacts on wildlife (see Table 4.1) would be the same as under Alternative A and would have the same impacts as under Alternative A. Cumulative effects to wildlife from past, present, and reasonably foreseeable future actions (noted above) would vary in intensity from minor to moderate depending on the habitats and species affected. Overall, the effects of Alternative D on special status wildlife species, when combined with the other past, present, and reasonably foreseeable actions, would be regional adverse, short to long-term, seasonal to year-round, and moderate. Alternative D would contribute a small amount to these impacts.

Conclusion
Under Alternative D, including actions described under Impacts of Elements Common to All Action Alternatives, minor to moderate, adverse, localized to regional, short to long-term impacts to special status wildlife species would result from general recreational use and include: vegetation trampling, soil

compaction, addition of up to two campsites at Cottonwood, trail creation, and direct damage to vegetation. Adverse impacts would also result from the import and spread of exotic plant species.

Minor, beneficial, localized, long-term impacts would result from decreases in group size in Threshold, Primitive and Wild Zones, and decrease in number of groups in Deer Creek Tapeats Creek Complex and Granite Use Area.

Cumulative impacts would be adverse, moderate, localized to regional, long-term, year-round of which Alternative D would contribute a small amount.

Cultural Resources

Archaeological Resources

ISSUES

Issues related to archaeological resources identified through public and internal scoping and tribal consultation include

- Visitation and camping has resulted in adverse effects to archaeological resources in designated and at-large camps, rest areas, and attraction sites
- Visitor access can disturb site features, artifact distributions, and the original layout (design) of site elements. Visitation may diminish overall site integrity through changes in vegetation and soil compaction or trailing through site deposits. Many archaeological resources are collocated with backcountry camps and rest areas leading to inadvertent disturbance of archaeological materials
- Camping in or adjacent to archaeological resources affects site integrity and resource stability by trailing (social trails) between locations, use of illegal campfires within site boundaries, depositing human waste and trash on sites, camping on site features, and modifying architectural features by building camp furniture using site elements
- At-large campsites in or adjacent to archaeological sites impact site integrity and resource stability by disturbing site surfaces, displacing in-situ (in-place) cultural materials such as artifacts, structure elements, or cultural deposits such as trash concentrations
- Maintenance activities on historic trails may lead to removal of historic trail features and could result in removal of cultural deposits when archaeological sites are located in or adjacent to trails
- Maintenance activities on dirt roads or reopening previously closed roads have potential to damage archaeological sites in or adjacent to road alignments. Expanding parking areas in specific locations has potential to diminish NRHP integrity of archaeological sites directly through disturbance during construction activities or indirectly by altering the site or the site setting
- Grand Canyon's Traditionally Associated Tribes acknowledge the undeveloped landscape of the Grand Canyon including rim lands, the inner canyon, and the river corridor as a Traditional Cultural Property (TCP). Natural processes, healthy ecosystems, diverse native plant and animal populations, stable archaeological sites, and natural quiet are all important aspects of the TCP. Noise, congestion, crowding, and area overuse may impact some or all of these important environmental aspects and the tribal values associated with archaeological sites within the TCP

DESIRED CONDITIONS

Archaeological resources will be managed to preserve them for future generations. Cultural resource management will be implemented consistent with legislative and regulatory provisions, policies, and procedures. Research about, and stewardship of, cultural resources will be carried out only after adequate planning and consultation with interested or affected individuals, groups, and other outside entities. Cultural resources management will employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental disturbances, and other threats. Management practices will not compromise NRHP integrity and eligibility (NPS 2006).

Archaeological resources will be managed in place (*in situ*) and in a manner that maintains NRHP eligibility and integrity. Preservation treatments include proactive measures that protect resources from vandalism and looting, and maintain or improve archaeological site condition by limiting damage due to human or environmental disturbances. Data recovery actions will be taken in the context of planning, consultation, and decision making. Preservation treatments and data recovery activities will be conducted within the scope of an approved research design. Archaeological research will use nondestructive methods of testing and analysis whenever possible. Information about archaeological resources will be incorporated into interpretive, educational, and preservation programs without inappropriate dissemination of site location data or dissemination of information considered sensitive by Traditionally Associated Tribes. Artifacts and specimens recovered from archaeological resources, along with associated records and reports, will be maintained together in archaeological records and museum collections. Archaeological sites will be maintained in their current conditions or improved (NPS 2006).

METHODOLOGY

In accordance with the Advisory Council on Historic Preservation's regulations for implementation of §106 (36 CFR Part 800, Protection of Historic Properties), effects of the Alternatives were identified and evaluated by first identifying the Area of Potential Effect (APE) (Chapter 1's BCMP project area) and reviewing the Archaeological Site and Ethnographic Resource databases, academic literature, geographic information system data (GIS), Tribal monitoring reports, and NRHP records (Grand Canyon Cultural Resources files). All archaeological sites under consideration for this plan (known and future discovered sites) are listed on, or eligible for listing on the NRHP.

The Grand Canyon Archaeological Site database includes documentation for 2,679 archaeological sites located in the BCMP Project Area. Of these known sites, 1,807 (67.4%) have monitoring data that includes site condition and recorded disturbance mechanisms of human and environmental origins. There are 842 sites lacking current condition or recorded disturbance mechanisms, and four project area sites listed as destroyed (no longer retain deposits or features). Sites lacking condition data and information on disturbance mechanisms or those documented as destroyed would generally have impacts similar to documented sites as shown in Table 4.4. For purposes of this plan/DEIS, Geographic Information System (GIS) location data including archaeological site datums and boundary files located 20 meters or less from roads, routes, trails, parking areas, and campsites were considered in conjunction with monitoring data. Archaeological sites located in proposed and existing Use Areas were reviewed. Site condition, disturbance levels, current disturbance types, and recommended mitigations were reviewed as part of this analysis. Table 4.4 shows instances of common visitor –related disturbances recorded at archaeological sites. Site condition monitoring and inventories in the backcountry are ongoing and new site discoveries and information about archaeological site conditions are expected to increase through the life of this plan.

Protocols for site condition monitoring (Dierker 2011) are used to standardize field and data entry procedures as they relate to NRHP-eligible properties. All sites included in this analysis are eligible for

listing on the NRHP under Grand Canyon's Multiple Properties Nomination for Prehistoric and Historic Resources (NPS 1984a) or were determined eligible through individual determinations by Grand Canyon and the Arizona State Historic Preservation Office (SHPO) or the Keeper of the NRHP (Grand Canyon site records).

To analyze effects of each alternative, all available information for archaeological resources was reviewed in the site and ethnographic databases, research literature, tribal monitoring reports, and geospatial data (GIS). Impact analysis is based on intensity, context, and duration of potential impacts.

Adverse effects to archaeological resources occur when an undertaking directly or indirectly alters characteristics of an archaeological site that qualifies it for inclusion on the National Register. Reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative also need to be considered (36 CFR Part 800.5 (a) (1), Assessment of Adverse Effects; referred to as Section 106 below). Examples of adverse effects include physical destruction or damage; alteration not consistent with the Secretary of the Interior's Standards; change in use or physical features of a property's setting; visual, atmospheric, or audible intrusions; or neglect resulting in deterioration. Alteration or destruction of an archaeological site is an adverse effect, even when such effects are the result of recovery of archaeological data. In the case of an adverse effect determination, a Memorandum of Agreement or a Programmatic Agreement will be executed among the NPS, applicable state or tribal historic preservation offices and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR Part 800. A "no adverse effect" determination means that while an effect may have been identified, it is at a level that would not diminish any characteristics that qualify the property for NRHP inclusion.

INTENSITY DEFINITIONS

Effects specific to archaeological resources are characterized for each alternative based on the intensity definitions presented below. The intensity definitions incorporate a NHPA Section 106 determination of effect for archaeological resources.

Intensity

Negligible There would be no measurable change. Depletion or displacement of site elements resulting in diminishment of the integrity of sites would be barely perceptible. Under Section 106 there would be no adverse effect.

Minor Adverse: Effects would be detectable, but overall resource integrity would be undiminished. Effects such as trailing or artifact displacement would be measurable; defining elements would be unchanged. Defining features, characteristics, or any aspect of integrity that contributes to eligibility for NRHP listing would not be affected or jeopardized. Under Section 106 there would be no adverse effect.

Beneficial: Effects would be detectable, but overall resource integrity would be undiminished. Effects such as trailing or artifact displacement would be measurable; defining elements would be unchanged. Defining features, characteristics, or any aspect of integrity that contributes to eligibility for NRHP listing would not be affected or jeopardized. Under Section 106 there would be no adverse effect.

Moderate Adverse: Effects would result in loss of overall integrity, but NRHP eligibility would not be jeopardized. Effects could include measurable changes to character-defining elements, and could contribute to increased site instability. Effects would require mitigations such as eroding sediment stabilization. Under Section 106 there would be an adverse effect.

Beneficial: Effects would be measurable and could contribute to increased stability of site landscape (e.g., stabilization of eroding sediments; reduction in trailing; and reduction of trampling outside established trails). Under Section 106 there would be no adverse effect.

Major — Adverse: Effects could result in loss of overall integrity and significant change to character-defining elements to extent site would no longer be eligible for NRHP listing. Effects could include, among others, structure destabilization, artifact assemblage depletion, and archaeological context loss. Under Section 106 there would be an adverse effect[52].

Beneficial: Measureable effects would result in stabilization of site features, artifact assemblages, and sediments (elimination of trailing, artifact displacement, and trampling outside established trails). Under Section 106 there would be no adverse effect.

Context

Localized — Effects identified at a specific archaeological site.

Regional — Effects to several specific archaeological resources in a management zone, setting or geographic location.

Duration

Short-term — Impact undetectable within five years because resource mitigated to pre-disturbance condition or appearance. Example: brush-out trails so foot traffic is no longer evident across an archaeological site.

Long-term — Impact results in archaeological site condition change which mitigation could not return to pre-disturbance condition or appearance. Example: defacing a rock art panel or removing surface artifacts.

ASSUMPTIONS

Assumptions specifically related to the alternatives and their effects on archaeological resources are a result of long-term site condition monitoring throughout the park (Grand Canyon site files and records).

- The greater the number of user days (total number of people/year), the greater the likelihood of degradation to archaeological sites when sites are located in or adjacent to camp areas or are attraction sites such as locations open for interpretation and visitation, with maintained trails and access, and locations that receive regular hiker use (day and/or overnight users)
- Attraction sites show adverse effects from visitation such as artifact displacement and social trailing leading to erosion of site deposits. These effects are often cumulative from river and backcountry users, and are more evident in visitor areas where the two user groups overlap
- Corridor and Threshold Zone archaeological sites show higher levels of impact because roads and maintained trails improve access to these zones resulting in higher visitor numbers
- Archaeological sites with overhangs are more vulnerable to camping impacts due to the shade and protection they provide from adverse weather conditions. Such locations were frequently used during the prehistoric and historic periods for shelter, work locations, and other activities and are popular camping spots today

[52] If adverse effect determination, a Programmatic Agreement or Memorandum of Agreement would be executed among the NPS, applicable state or tribal historic preservation offices and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFS 800.6(b) before the ROD for this EIS is signed.

- Concessioner/NPS partnerships may lead to increased resource stewardship as NPS resource staff work to educate guides on site etiquette practices

IMPACT ANALYSIS

The most noticeable effect to archaeological resources from recreational use in backcountry areas would be from continued visitation to sensitive archaeological resources. Visitor disturbances have been recorded in archaeological sites in all management zones and Use Areas. Camping and foot traffic create compacted surfaces that can impede vegetation growth and divert water flow into channels that further erode sediments. These disturbances have the potential to destabilize or remove sediments containing cultural materials. Visitors have disturbed archaeological structures by removing materials from walls and using those materials to make "camp furniture" such as seating, wind screens, and tables. Collecting and piling artifacts, artifact theft, trash, and human waste disposal are other disturbances that result from visitation. Table 4.3 lists backcountry camping locations where archaeological and other cultural resources are co-located.

A small number of park visitors intentionally disregard federal laws and park regulations, engaging in destructive acts on cultural resources. Some actions, such as pot hunting and graffiti, can instantly alter a site's character-defining elements.

Table 4.3 Campsites Located in or Adjacent to Archaeological Resource Locations[1]

Location Designated Backcountry Campsites	Comment
Deer Creek (Threshold Zone)	More than one location
Upper Tapeats (Threshold Zone)	More than one location
Fire Point (Primitive Zone)	More than one location
Point Sublime (Threshold Zone)	
South Bass Trailhead (Primitive Zone)	Multiple sites
Signal Hill (Threshold Zone)	
Hermit Creek (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
Monument Creek (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
Cedar Springs (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
Salt Creek (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
Horn Creek (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
Horseshoe Mesa (Threshold Zone)	Multiple instances of archaeological site and campsite co-occurrence
At-large campsites	125 culturally sensitive locations co-occur with at-large campsites

[1] Data from Foti et al. (2006) and Grand Canyon Archaeology GIS data layers.

Table 4.4 Most Common Human-caused Disturbances to Archaeological Resources

Disturbance Type	Instances
Hiker/Visitor Use/Visitation (refers to activities that occur from visitation and visitor use such as social trailing, collectors piles, and structural modification)	293
Social Trails	181
Theft/Looting/Unauthorized Collection	130
Vandalism (such as graffiti and purposeful destruction of constructed features)	98
Trail construction/Use/Maintain (includes 13 researcher trails) disturbing archaeological contexts	96
Camping	92
Artifact displacement (creation of artifact piles)	73

Disturbance Type	Instances
Roads	72
Structural Modification (disturbance of architectural features)	32

Documentation of disturbances, site condition, and treatment recommendations are found in the Grand Canyon archaeological sites database and the Grand Canyon archaeology lab paper records and reports. Photographic documentation and long-term photographic replication of sites also document changes and disturbances to archaeological resources as a result of human and non-human disturbances.

Visitation to archaeological sites has been documented as a disturbance (see Table 4.5), and results in associated disturbances such as social trailing and soil compaction. Direct effects in camp areas include vegetation loss (which may exacerbate erosion), barren core areas development, illegal campfires, and improper disposal of human waste and food and paper waste (Foti et al. 2006). Monitoring (Grand Canyon Archaeological Site Database, Foti et al. 2006) shows disturbances to cultural sites include archaeological feature alteration (including architectural features and ground deposits such as trash middens), graffiti, artifact displacement, and other disturbances (see Table 4.5). Camping, regardless of group size, has the potential to adversely affect archaeological resources when camps are located in or near archaeological sites. Camp site documentation (see Table 4.3, Foti et al. 2006, Grand Canyon Cultural Resource GIS data layers) shows 137 cultural sites are located in or near designated and frequently used at-large camp areas.

Large group size (7-11 people) at camps and attraction areas has greater potential to inadvertently disturb archaeological sites (Foti et al. 2006). Large groups have the potential to damage known or unidentified archaeological sites when hikers establish campsites on site features. Increasing numbers of campsites in certain areas, or building new campsites along certain trails, affects archaeological resources leading to loss of site integrity and National Register of Historic Places (NRHP) eligibility

ALTERNATIVE A

This alternative is the no-action alternative and would continue existing management practices. Visitor opportunities would be retained. The most noticeable effects to archaeological resources from backcountry use would be from continued visitation to sensitive archaeological sites and continued use of some roads and trails. Visitation, while often well intentioned, has led to damage in a number of fragile sites in the backcountry (Table 4.4).

Backcountry Management Zones

Establishment of management zones is a tool managers use to structure planning and resource priorities. Table 4.5 shows the current condition of recorded archaeological sites in each management zone. Variables such as group size, number of user nights, and campsite location all contribute to determining overall cultural resource accessibility and vulnerability.

Table 4.5 Recorded Archaeological Site Condition by Management Zone[3]

Management Zone	Sites in Good Condition	Sites in Fair Condition	Sites in Poor Condition
Corridor (75)	42 (56%)	32 (43%)	1 (1%)
Threshold (378)	282 (75%)	78 (21%)	18 (4%)
Primitive (816)	614 (75%)	165 (20%)	37 (5%)
Wild (538)	406 (75%)	106 (20%)	26 (5%)

[3] Data from the Grand Canyon Archaeological Site Files and GIS data layers for sites with known conditions and disturbances. Based on current backcountry management zones

Under this alternative no change in backcountry management would occur and archaeological site disturbances would be expected to continue at current levels. Disturbances in management zones occur from recreational use and associated trailing, artifact displacement, structural modification, graffiti, vandalism, and from camping within archaeological site boundaries. Under Alternative A, impacts to archaeological resources would be moderate to major, adverse, regional, and both short and long-term. Mitigation measures identified in Chapter 2 including preservation maintenance, stabilization or repair of damaged features, data recovery (planned research, documentation, or excavation), removal of graffiti, and would be implemented to decrease these adverse impacts.

Climbing Management
Disturbance from trailing across sites leading to climbing locations and removal or piling of artifacts in archaeological sites could continue to occur from this activity. Some climbing locations are located adjacent to areas where archaeological features are located including granaries, caches, and cliff dwellings. Effects to archaeological resources from climbing would be minor to moderate, adverse, regional, and long-term.

Canyoneering Management
As it is currently allowed, canyoneering results in adverse effects to archaeological resources. Canyoneering in locations where archaeological sites are located has resulted in visitor-related disturbances including trailing through archaeological sites and the creation of collection piles. Canyoneering routes occur in side canyons, sometimes in areas with water, where there are often archaeological resources within the same vicinity. Under Alternative A there would continue to be no day use limit or permit size restriction allowing for unlimited use and access. Effects to archaeological resources would be moderate to major, adverse, regional, and long-term. Mitigation measures similar to those listed under Backcountry Management Zones above would decrease these major, adverse impacts.

Tuweep Day Use Management
Day use at Tuweep has resulted in disturbances to archaeological resources by visitation and vehicular traffic. Documented disturbances to archaeological sites in the Tuweep area include social trailing, soil compaction, ground disturbance from road and toilet construction, and illegal wood collection in or adjacent to archaeological site boundaries. The current road location bisects at least one archaeological site. Under Alternative A, current management would continue, and therefore the effects would be minor to moderate, adverse, regional and long-term.

Use Area Management
The administrative process of Use Area management does not affect any aspect, feature or the character of archaeological resources. However, impacts do occur within Use Areas similar to those described for management zones. As stated above, impacts to archaeological resources include trailing, artifact displacement, structural modification, graffiti, vandalism, and from camping within archaeological site boundaries. Effects to archaeological resources would be moderate to major, adverse, regional, and both short and long-term.

Human Waste Management
Disturbances to archaeological resources resulting from human waste management include the location of toilets within or adjacent to archaeological resources and subsequent trail development leading to the toilet locations. These locations adversely affect site integrity by damaging archaeological deposits directly through toilet construction and trail development within site boundaries. Cat holes (Foti et al. 2006) affect archaeological resources directly through ground disturbance. Continuation of current management would result in effects that would be moderate to major, adverse, regional, and both short and long-term.

Arizona Trail
Placement of the existing trail was designed to avoid direct effects by keeping the trail out of archaeological sites. Indirect effects that have been observed to archaeological resources adjacent to the Arizona Trail include barren cores, artifact displacement, improper waste disposal, structure modification, and social trailing. Currently, hiking and stock use are allowed on all three trail segments – South Rim, Inner Canyon (South and North Kaibab Trails), and North Rim. Bicycling is allowed on the South Rim segment only. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and short-term.

Bicycling
Bicycling in the backcountry would continue to be limited to park roads open to private vehicles. While not as great as disturbance caused by motor vehicle use, bicycle use directly affects archaeological resources located on the K5, K37, Fire Point, W4, and W1 on North Rim, the Bass Trail, Havasupai Point, Rowe Well, and W1B roads on South Rim where these road alignments run through archaeological site boundaries. Impacts that have been observed to archaeological resources adjacent to these and other roads open to bicyclists include artifact displacement, improper waste disposal, structure modification, and social trailing; however, there would continue to be little bicycle use, which would decrease these impacts. The impacts of continuing current management would be minor, adverse, regional and short-term.

River-assisted Backcountry Travel (RABT)
RABT under current management has resulted in the caching of rafts in archaeological sites and crowding at popular river camps. Impacts include artifact displacement, structure modification, and improper waste disposal within archeological site boundaries. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and short and long-term.

Administrative Use
Under current management, administrative use can result in disturbances to archaeological resources. Documented disturbances include road and trail work where alignments pass through archaeological site boundaries or when sites are adjacent to such infrastructure. Maintenance activities can result in a loss of site matrix and displacement or destruction of artifacts and features. Research can result in trailing, barren cores and vegetation disturbance within site boundaries. Continuation of current management would result in effects that would range from minor to moderate, adverse, localized and both short and long-term. Some effects would be beneficial such as when archaeological sites are stabilized or trails are constructed to avoid disturbances to archaeological sites and deposits. Such effects would be short and long-term, regional, minor to moderate beneficial.

NPS and Cooperating Association Programs (Non-commercial Services)
Archaeologists from NPS would continue to regularly participate in training and working on field sessions with cooperators. Training sessions would include backpacking and car camping-based trips where "Leave No Trace" ethics would be emphasized. Approximately two Grand Canyon Field Institute (GCFI) hands-on archaeology classes would continue to be run by Grand Canyon cultural resource staff each year in cooperation with GCFI staff. These classes would be managed to avoid adverse effects to archaeological resources and used as a springboard to teach "Leave No Trace" ethics and practices. GCFI would continue to hold annual seminars to train guides prior to the field season. Under current management, groups participating in GCFI trips are sometimes large and disturbances from sessions where NPS staff are not present have been documented. Camping within archaeological sites has been observed and some of the same disturbances noted for large groups, such as social trailing, have also been observed. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and both short and long-term. Continuation of resource stewardship messaging that

occurs with NPS participation and during seminars would be beneficial and would help mitigate disturbances.

Commercial Overnight Backpacking
Effects have been documented where archaeological sites and camps and attraction sites co-occur. Commercial backpacking would continue to account for approximately 9% of overall backpacking in the park. Vandalism including graffiti and disturbance of objects, and artifact theft has also been documented within sites located in the backcountry, although this has not been directly linked to commercial services. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and both short and long-term.

Commercial Day Hiking
Commercial day hiking does not reduce the potential for disturbance to archaeological resources. Monitoring has shown visitor disturbances to archaeological resources where overnight use is prohibited and is evidence that day users do cause disturbances to archaeological resources. Disturbances that have been observed include human waste and food disposal, trampling, artifact displacement, graffiti, and social trailing. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and short-term.

Commercial Bicycling
Commercial bicycling in the backcountry is limited to park roads that are open to motorized vehicles. While smaller than the disturbance caused by motor vehicle use, current bicycle use directly affects archaeological sites located on the K5, K37, Fire Point, W4, and W1 on the North Rim, the Bass Trail, Havasupai Point, Rowe Well, and W1B roads on the South rim where these alignments run through archaeological site boundaries. Indirect effects that have been observed to archaeological resources adjacent to these and other roads open to bicyclists include barren cores, artifact displacement, improper waste disposal, structure modification, and social trailing. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and short-term.

Commercial Backcountry Vehicle Tours (Tuweep)
Alternative A would continue to allow a maximum of two commercial backcountry vehicle tours to Tuweep per day per operator (the maximum potential number of tours is 10/day). Under current management, documented disturbances to area archaeological sites include damage from existing road and road maintenance when archaeological sites are within or in close proximity to road alignments. Archaeological sites within or adjacent to road beds are subjected to long-term disturbance from repeated use and road maintenance activities. Under this alternative, archaeological sites would continue to be disturbed by this use, in particular by vehicular traffic. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and both short and long-term.

Maximum Group Size for Overnight Backpacking by Zone
Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring at campsite locations. Extremely impacted campsites tend to have large barren core areas and show vegetation damage, social trailing, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites show instances of archaeological feature alteration, graffiti, and artifact displacement. Campsite placement, whether the camps are large or small, often causes disturbances to archaeological resources. Continuation of current management would result in effects that would be moderate to major, adverse, regional and short-term. Mitigation measures similar to those listed under Backcountry Management Zones above would decrease these major, adverse impacts.

Backcountry Roads, Trails, and Routes
Hundreds of miles of backcountry trails, routes, and roads occur in the park. A number of these trails, routes, and old fire roads are located adjacent to, or pass through, archaeological sites. Current monitoring data shows a range of visitor-related disturbances along these travel corridors including camping within site boundaries, structural modification and artifact displacement, social trailing, and soil compaction. Continuation of current management would result in effects that would be moderate to major, adverse, regional and both short and long-term.

Tuweep Facilities
Under current management, archaeological sites in the Tuweep area are showing adverse effects from visitor use and vehicular traffic. There are numerous sites located adjacent to or directly in the road bed leading to the overlook and campground and other archaeological sites are located within the campground adjacent to campsites. Documented impacts include, social trailing into archeological sites, artifact displacement, soil compaction, ground disturbance from road and toilet construction in or adjacent to site boundaries, and illegal wood collection resulting in indirect effects to archaeological sites. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and long-term.

Deer Creek/Tapeats Creek Complex
Currently, there are documented disturbances in some Use Areas as a result of visitation and camping in archaeological sites but these effects exist irrespective of Use Area boundaries and reflect visitor use in general. Identified disturbances include artifact displacement and structure modification, barren cores within sites from camping, trailing through sites, improper waste disposal and artifact collecting. Continuation of current management would result in effects that would be minor to moderate, adverse, regional and both short and long-term.

Deer Creek Narrows
Archaeological sites located along the Deer Creek narrows have been disturbed by visitor use resulting in trailing, soil compaction, vegetation disturbance, and vandalism. Tribal monitoring (Hualapai 2001 and 2013, Southern Paiute Consortium 1999-2011) describe disturbances to the vegetation resulting from people rappelling through the narrows and Deer Creek Falls. Vegetation removal and bolts and climbing gear installation to facilitate rappelling have diminished aspects of integrity of setting, materials, and feeling of this site (Brennan et al. 2012). The temporary closure of this area is protecting this area from further damage, therefore continuation of current management would result in minor, beneficial, localized and long-term impacts.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under current management, there are established trails with at-large camping areas. Trails and many at-large camps pass through, or are located within, or adjacent to, archaeological sites. Documented Disturbances include social trails, unauthorized artifact collecting, artifact displacement, structural modification, and soil compaction. Continuation of current management would result in similar impacts. These impacts would be minor to moderate, adverse, regional and both long and short-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have the potential to contribute to cumulative impacts on archeological resources. Past actions including fire management (prescribed and wild fires), maintenance/construction projects, river management and Glen Canyon Dam operations, and other park undertakings have resulted in adverse effects including direct and indirect damage to archaeological resources from trailing, digging, removal or burial of artifacts and features, fire damage on combustible or fire-sensitive objects. Impacts to archaeological resources from these activities and actions are moderate, adverse, localized and regional, and long-term.

Present and foreseeable future actions overlap with some past and actions and include fire management, road improvements, and site rehabilitation project. Ground disturbance in several of these projects has prompted mitigation of archaeological sites through excavation, an adverse effect on these resources. Disturbances are moderate adverse, localized, and both short and long-term.

Cumulative, effects to archeological resources, from past, present, and reasonably foreseeable actions discussed above, would result in major, adverse, long-term, regional impacts on archaeological resources. Alternative A would contribute a medium amount to this adverse impact. Under Section 106 there would be an adverse effect to archaeological resources.

Conclusion
Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would result from use of the backcountry and resultant human disturbances including trailing through archaeological sites, camping on sites, displacement of artifacts and modification of structures, theft of artifacts, graffiti, campfires, inappropriate campsite creation and management within and adjacent to archaeological sites, and improper human waste management. Continued use of the backcountry under Alternative A has the potential for continued and increasing impacts from visitor use, improper waste management and other unpermitted activities.

Cumulative impacts would be major, adverse, regional, and long-term of which Alternative A would contribute a medium amount. Under Section 106 there would be an adverse effect to archaeological resources.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Climbing Management
As described under Alternative A, climbing has the potential to impact archaeological resources from trailing across sites leading to climbing locations and removal or piling of artifacts in archaeological sites. Some climbing locations are located adjacent to areas where archaeological features are located including granaries, caches, and cliff dwellings. Because climbing would continue at levels similar to the No Action alternative, under all action alternatives, impacts would be the same as A, minor to moderate, adverse, regional, and long-term.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease from current)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites

Use of a permit system to track climbing activity would enable resource managers to prioritize monitoring and mitigation measures of archaeological resources in areas of higher use. Implementation of a permit system to track use would have a negligible, beneficial, regional, long-term effect on archaeological resources. Restrictions meant to protect sensitive resources would reduce the potential for visitor effects in archaeological resources that are too sensitive or vulnerable to withstand visitation. Any opportunities to reduce the number of visitors and group size in sensitive areas would have a beneficial effect on archaeological resources. These impacts would be negligible, beneficial, long-term, and regional. Changes in group size have the potential to reduce disturbances from camping including the creation of

barren cores and archaeological site disturbances. Any opportunities to reduce the number of visitors and group size in sensitive areas would have a beneficial effect on archaeological resources. Overall impacts from adaptive management actions would have minor, beneficial, long-term and regional impacts on archaeological resources.

Canyoneering Management
As described in Alternative A, canyoneering would impact archaeological resources from trailing through archaeological sites and the creation of collection piles. Canyoneering routes occur in side canyons, sometimes in areas with water, where there are often archaeological resources within the same vicinity. Under all action alternatives, group size for this activity would be limited to 6 people per group and overnight permits would indicate which groups are participating in canyoneering. These actions would lessen adverse impacts when compared to Alternative A. Impacts to archaeological resources would be minor, adverse, regional, and long-term.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites

Use of a permit system to track Use Areas would have the same beneficial impacts as described above for climbing. These impacts would be negligible, beneficial, long-term, and regional. Restrictions to protect sensitive resources would be similar to those described above for climbing but would be more beneficial because there are generally more archaeological resources in canyons where canyoneering is taking place. These impacts would be minor, beneficial, long-term, and regional.

Again, as described for climbing, limits on group size would reduce disturbances from camping including the creation of barren cores and archaeological site disturbances. These impacts would be negligible, beneficial, long-term, and regional. Conversely, an increase in group size would have minor, adverse, long-term regional impacts. Finally, increased inventory and condition assessment monitoring that would occur as part of the adaptive management program, would increase the knowledge of the types of visitor disturbances in areas where canyoneering activities and archaeological resources co-occur. Any opportunities to expand knowledge of site location and condition within the park would improve NPS understanding of park resources. Overall impacts from adaptive management actions would have minor, beneficial, long-term and regional impacts on archaeological resources.

Tuweep Day Use Management
Disturbances to Tuweep area archaeological resources would occur, especially those in the campground, in the campground access road, the Tuweep access road, and in or along trails include disturbances from social trailing, soil compaction and ground disturbance from road or trail maintenance in or adjacent to site boundaries. These effects would be minor to moderate adverse, regional, and long-term.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

Day use permits or a reservation system would reduce the potential for overcrowding and the potential for visitor disturbances to archaeological sites from development of barren cores and camping within site boundaries. Implementation of a permit system to track use would have a beneficial effect on archaeological resources. These impacts would be negligible, beneficial, long-term, and regional. Restrictions on the number of vehicles per party at overlooks and campsites could reduce inadvertent damage to archaeological resources from parking in vegetated areas and archaeological sites and driving through archaeological sites. Vehicle restrictions are expected to have a beneficial effect on archaeological resources. Designating days for group events could have beneficial effects if restrictions included information of resources and specified event locations. These impacts would be negligible, beneficial, long-term, and regional.

Use Area Management
Specific management actions associated with Use Area management that could be implemented in the future and could impact archaeological resources are described below

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

As discussed previously, a decrease in the number of groups and/or seasonal use levels would have beneficial effects on archeological resources. Conversely, the increase in number of groups and/or the increase in use on a seasonal basis would have adverse effects on archeological resources. Having more dispersed at-large camping, would have the potential to cause adverse disturbance to archaeological resources if improper practices by users occur. Dispersed and increased at-large camping is expected to result in adverse effect on archaeological resources. These impacts would be minor to moderate, regional and long-term. Redefining Use Area boundaries would help track use in popular locations such as Deer Creek and Tapeats. This would have the effect of enabling resource managers to prioritize monitoring and mitigation activities in higher Use Areas. Any opportunity to track use in the backcountry is expected to have a beneficial effect on archaeological resources. Impacts to archaeological resources would be negligible, beneficial, long-term and regional.

Human Waste Management
Human waste has been documented as a disturbance in some archaeological sites and is a long-standing problem impacting park backcountry resources and visitors. A variety of methods are currently used in the backcountry including carry-out systems and toilet facilities in both Wilderness and non-wilderness settings. Placement of toilets within or adjacent to archaeological resources has the potential to cause major adverse impacts to the property's integrity by damaging archaeological deposits. Cat holes (Foti et al. 2006) adversely affect archaeology sites through ground disturbance.

Management Actions Potentially Implemented through Adaptive Management

- Replacement of existing toilets at existing sites
- Removal of primitive toilets
- Installation of primitive toilets at other sites
- Seasonal or year-round human waste carry-out requirement for specific areas or zones
- Seasonal or year-round human waste carry-out requirement for all areas or zones

Replacement of existing toilets in existing locations would continue to have adverse effects to the archeological site integrity and would be moderate, adverse, long-term and localized. Replacement of existing toilets outside of archaeological site boundaries would have the beneficial effect of reducing the effects to site integrity. These impacts would be moderate, beneficial, long-term and regional. Removal of toilets in the backcountry would have the beneficial effect of reducing the impact to sites where toilets occur within or adjacent to site boundaries. These impacts would be minor, beneficial, long-term and regional.

Arizona Trail
Under all action alternatives, bicycling would be allowed on the North Rim section of the Arizona Trail. In addition, a flexible permitting system would be implemented for through-hikers (hiking the entire trail from Mexico to Utah border). The permitting system is not expected to impact archaeological resources. Bicycling could have an effect on archaeological resources from overnight camping along the trail when at-large camp areas are in or near archaeological sites. Effects would be the same as those described for Alternative A, minor to moderate, adverse, regional, and short-term.

Bicycling
Backcountry bicycle use would be limited to park roads open to motorized vehicles. Bicycle use would be prohibited in the Inner Canyon and proposed Wilderness areas, unless in a non-wilderness road corridor. Bicycle use can have similar disturbances as those described in motor vehicle use and day use activities including disturbance and displacement of archaeological site features and artifacts within and adjacent to trails and roads. Effects from overnight use by bicyclists would be similar to overnight backpacking, but at lower use levels. Effects to archaeological resources would be minor to moderate, adverse, regional and short and long-term.

River-assisted Backcountry Travel
While RABT would continue at similar levels to current management, distribution and locations of restrictions are described in the action alternatives. Packrafts have been abandoned in archaeological sites, and unpermitted use (users not obtaining a backcountry permit) at popular camping locations has resulted in users setting up camp in archaeological sites. RABT has had minor, adverse, regional effects to archaeological resources along the Colorado River. Implementation of mitigations including education and permitting of this activity would improve the ability to manage archaeological resources by tracking use by location and focusing condition assessment monitoring in higher use areas as well as teaching visitors proper site etiquette practices. Implementation of these mitigations would reduce impacts to minor, adverse, short-term, and regional.

Administrative Use
Administrative activities would continue at similar levels and could result in disturbances to archaeological resources. Documented disturbances include road and trail work when alignments pass through archaeological site boundaries or when sites are adjacent to such infrastructure. Maintenance activities could result in a loss of site matrix and displacement or destruction of artifacts and features. Research activities could result in trailing, barren cores and vegetation disturbance within site boundaries. Effects range from minor to moderate, are adverse, regional and both short and long-term.

Some effects are beneficial such as when archaeological sites are stabilized or trails are constructed to avoid disturbances to archaeological sites and deposits. Such effects would be beneficial, minor to moderate, short and long-term, and regional.

NPS and Cooperative Association Programs (Non-commercial Services)
NPS-led interpretive services include day hikes with unlimited group size would occur. Overnight trips would be led by the Environmental Education program on a limited basis. Grand Canyon Field Institute programs would be reviewed annually by NPS staff to assure that course material is appropriate and in keeping with the NPS mission. These programs would not add to established overnight quotas or day use numbers. Disturbances to archaeological resources from these groups would be minor to moderate, adverse, regional and both short and long-term.

NPS-led programs would have beneficial effects due to educational and resource stewardship opportunities and messages provided by NPS staff. Resource stewardship messaging that would occur with NPS participation and during seminars would be beneficial and could help mitigate disturbances.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Both large (7-11 people) and small (1-6 people) groups would be allowed in the Corridor and Threshold Zones. Primitive and Wild Zone use limits would be capped at six people (small groups only). The total number of permits per night would be the same as Alternative A for each Use Area with the exception of Deer Creek/Tapeats and Granite as described in Elements Common to All Alternatives.

Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring to archaeological sites within, or adjacent to, campsite locations. Overnight backpacking can result in disturbances to archaeological resources where camps, attraction sites and archaeological sites co-occur. Impacts resulting from the implementation of Alternative B could include barren core areas, vegetation damage, social trailing, illegal fire use, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites could result in instances of archaeological feature alteration, graffiti, and artifact displacement. Because there is documentation to suggest that-larger groups can result in more extensive disturbances (Foti et al. 2006:12) to campsites and cultural resource areas, capping group size has the potential to have beneficial effects but because the actual number of permits is not different from Alternative A it is assumed that effects would be similar. Impacts to archaeological resources would be moderate to major, adverse, regional and long-term.

River-assisted Backcountry Travel
Under Alternative B RABT would be managed through the establishment of 31 river sections delineated by river mile. RABT equipment would be carried out, thereby reducing potential disturbances to archeological sites. Education and permitting of this activity would improve the ability to manage archaeological sites by tracking use by location and implementing condition assessment monitoring in higher use areas as well as teaching visitors proper site etiquette practices through the permitting process. Minor, adverse, regional and short-term effects would occur to archaeological resources.

Commercial Overnight Backpacking
Commercially guided overnight backpacking would be authorized primarily through contracts, as opposed to CUAs that are currently used. Contracts allow for qualified guides to lead groups on overnight

trips into the backcountry within the Corridor, Threshold, and Primitive Zones. Specific caps would apply to Corridor, Threshold and Primitive Use Areas with no commercial use in Wild Zone Use Areas. Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring to archaeological sites within, or adjacent to, campsite locations. As discussed under Maximum Group Size for Overnight Backpacking above, this activity can result in impacts such as barren core areas, vegetation damage, social trailing, illegal fire use, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites could result in instances of archaeological feature alteration, graffiti, and artifact displacement. The ability of guides to provide an educational component (e.g., proper etiquette) about park resources is expected to minimize effects to archaeological resources. Commercial operating requirements (see Appendix) and site stewardship education is expected to have minor, beneficial, long-term, regional effects to archaeological resources for commercial overnight backpacking services. Minor, adverse, regional, short-term effects would occur to archaeological resources.

Commercial Day Hiking
Commercial companies would be able to guide clients to specified locations on Bright Angel, South and North Kaibab, and Hermit and Grandview. Group size would be limited to 11 people including guides. Specified turn-around points along commercial day hiking routes would reduce effects to archaeological resources discussed under Alternative A. Effects would be minor, adverse, regional, and short-term.

Commercial Backcountry Vehicle Tours (Tuweep)
Up to two tours per day total would occur compared to the maximum of 10 per day under Alternative A. Effects to archaeological resources from social trailing and soil compaction, archaeological feature alteration (including architectural features and ground deposits), graffiti, artifact displacement, and other disturbances would still occur, but at lower levels than under Alternative A. Impact to archaeological sites would be minor, adverse, regional, short-term.

Backcountry Roads, Trails, and Routes
Under Alternative B, approximately 30 miles of former roads would be converted to Class I Wilderness trails (route often indistinct, requiring route finding and minimal improvements), and the Eremita Mesa Trail would continue to be an unmaintained route as in Alternative A . Each of these roads/trails are located along or pass through archaeological sites. Minor, long-term, localized, beneficial effects to archaeological resources would result from retaining Eremita Mesa Trail as an unmaintained route which may passively limit use along the alignment and would result in negligible to moderate, beneficial, regional, long-term effects on archaeological resources.

Activities necessary to maintain Cape Solitude, Tiyo Point, Francois Matthes Point, and Walhalla Glades routes may result in minor to moderate, regional, short and long-term adverse effects to cultural sites as a result of ground-disturbing activities for trail development and maintenance and visitor use where these routes pass through culturally sensitive areas.

Tuweep Facilities
Alternative B would move the Toroweap Overlook parking closer to the campground as recommended in the 1995 GMP and convert Vulcan's Throne Road to a trail using the existing area at the junction with the main road as parking and turn-around area. Moving the overlook parking area to the campground would require careful planning to avoid archaeological resources. Impacts to archaeological resources would be negligible to minor, beneficial, regional, and short to long-term.

Deer Creek/Tapeats Creek Complex
Alternative B would reduce the total number of groups for these Use Areas compared to Alternative A, and convert large groups to all small groups. These Use Areas are highly desirable and could frequently

result in visitors off itinerary. Impacts form the use of backcountry toilets, trails, and campsites in archaeological sites would be similar to those described for Management Zones under Alternative A including trailing, artifact displacement, structural modification, graffiti, vandalism, and camping within archaeological site boundaries. Impacts as a result of implementing Alternative B would be minor to moderate, adverse, short and long-term, and regional.

Deer Creek Narrows
Alternative B would implement a permanent restriction on entry into the Deer Creek Narrows, similar to what is described in the Superintendent's Compendium (NPS 2013g) and would increase education about the importance of this location to the park's Traditionally Associated Tribes and appropriate site behavior. The bolts and climbing gear would also be removed from the Narrows. This closure would result in minor, beneficial, localized, long-term impacts.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Alternative B would decrease group size (6 people per group maximum) compared to Alternative A because these are Primitive Zone Use Areas and under this alternative only small groups would be allowed in the Primitive Zone. Archaeological disturbances could include unauthorized artifact collection, structural modification, human waste disposal in site boundaries and soil compaction. Impacts would be less than Alternative A because the smaller groups would reduce the potential for creation of larger barren cores and additional disturbances to archaeological resources. Continued site use would result in minor, adverse, regional, short and long-term effects.

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional and long-term.

Cumulatively, the effects of Alternative B on archeological resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional and long-term. Alternative B would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to archaeological resources.

Conclusion
Including impacts from elements Common to All Action Alternatives, moderate to major, adverse, regional, short-term impacts to archaeological resources would result from implementation of Alternative B, as a result of road and trail use and maintenance activities, at-large and designated camps located in, or adjacent to, archaeological site boundaries.

Minor, beneficial, regional, short and long-term impacts would result from reductions in group size in Primitive and Wild Zone, closures of culturally-sensitive areas, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of archaeological site National Register eligibility.

Cumulative impacts would be major, adverse, long-term, and regional of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone

The maximum group size limit for Corridor, Threshold, Primitive and Wild Zones would be 11 people, allowing for both large and small groups and is the same as current condition. Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring at campsite locations. Overnight backpacking can result in disturbances to archaeological resources where camps, attraction sites and archaeological sites co-occur. Impacts resulting from implementation of Alternative C could include barren core areas, vegetation damage, social trailing, illegal fires, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites could result in instances of archaeological feature alteration, graffiti, and artifact displacement. There is documentation to suggest that-larger groups have larger impact (NPS 2005a). Impacts under Alternative C would be moderate to major, adverse, localized, and long-term.

River-assisted Backcountry Travel

Under Alternative C RABT would be managed through the establishment of 11 river sections for river travel delineated by river mile. Similar to Alternatives A and B, archeological site impacts result from abandoning gear at or near sensitive sites and camping in in sensitive cultural locations. Regulation of this activity as described for Alternative C may provide a means to monitor use. Education and permitting of this activity is expected to improve the ability to manage archaeological sites by tracking use by location and implementing condition assessment monitoring in higher use areas as well as teaching visitors proper site etiquette practices through the permitting process. Effects would be minor, adverse, regional and short-term.

Commercial Overnight Backpacking

As described for Alternative B, commercially guided overnight backpacking would be authorized primarily through contracts, as opposed to CUAs that are currently used. Use limits would apply to all management zones. Alternative C would allow for a lower number of commercial opportunities in the Corridor when compared to all other alternatives. However, it would allow the greatest number of opportunities in the Threshold and Primitive Zones. The projected commercial use would be 9.9% of total overnight backpacking in the park. Impacts under this alternative would be similar to those described under Alternative B, including barren core areas, vegetation damage, social trailing, illegal fire use, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites could result in instances of archaeological feature alteration, graffiti, and artifact displacement. The ability of guides to provide an educational component (e.g., proper etiquette) about park resources is expected to minimize effects to archaeological resources. Commercial operating requirements (Appendix F) and site stewardship education is expected to have minor, beneficial, long-term, regional effects to archaeological resources for commercial overnight backpacking services. Minor, adverse, regional, short-term effects would occur to archaeological resources.

Commercial Backcountry Vehicle Tours (Tuweep)

Up to three trips per day Monday-Friday and two per day on Saturday and Sunday would be allowed under Alternative C, compared to 10 per day under Alternative A. Trip size would be limited to 15 people with vehicle size restrictions to minimize effects to unimproved roads and limited parking areas. Limiting the number of tours each day, along with the number of passengers and vehicle size would result in minor to major beneficial effects to archaeological resources. Examples of adverse effects to archaeological resources as a result of this activity include social trailing and soil compaction, archaeological feature alteration (including architectural features and ground deposits), graffiti, artifact displacement, and other disturbances (see Table 4.4). The effects of this activity would be minor, adverse, regional, short and long-term.

Backcountry Roads, Trails, and Routes
Under Alternative C, approximately 50 miles of former roads would be converted to Class I Wilderness trails (route often indistinct, requiring route finding and minimal improvements), and the Tiyo Point Trail would be converted to Class 4 (highly developed) to accommodate stock use. The Boundary Road would be open to public use, providing access to the Pasture Wash area. Each of these trails and roads are located along or pass through archaeological sites.

Activities necessary to develop and maintain Eremita Mesa, Cape Solitude, Francois Matthes Point, and Walhalla Glades trails would have minor to moderate, regional, short and long-term adverse effects to cultural sites as a result of ground-disturbing activities for trail development and maintenance and visitor use where these routes pass through culturally sensitive areas. Development and maintenance of the Class 4 Tiyo Point Trail would result in minor to moderate, adverse, localized, short and long-term impacts to cultural sites as a result of trail development and maintenance and stock use. Opening the Boundary Road would result in moderate to major, regional, short and long-term adverse effects to archaeological resources from maintenance work necessary to improve the road for safe vehicle travel and by increasing vehicle traffic in this highly sensitive resource area.

Tuweep Facilities
Under Alternative C, the parking lot at Toroweap Overlook would remain in its current state and location. Impacts would be the same as those described for Alternative A, minor to moderate, adverse, regional and long-term.

Deer Creek/Tapeats Creek Complex
Alternative C would reduce the total number of overnight groups from 12 (current) to 11, compared to Alternative A. These Use Areas are highly desirable and could frequently result in visitors off itinerary. Reducing the number of groups is expected to reduce adverse impacts to archaeological resources. Disturbances from overnight use in these areas could include social trails, unauthorized artifact collecting, structural modification, illegal fires, and soil compaction. Effects of this use would be result in minor to moderate, adverse, regional, long-term impacts.

Deer Creek Narrows
Alternative C would allow unrestricted access to the Narrows and increased visitor education about site importance to Traditionally Associated Tribes and appropriate site behavior. Impacts to this area would be the same as described under Alternative A. These adverse impacts would continue and would be minor to moderate, adverse, localized, and short and long-term.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Alternative C would convert Hance Creek and Cottonwood Creek areas from Primitive to Threshold Zone allowing for consideration of toilets and designation of camping areas. Disturbances in Use Areas as discussed throughout this section occur as social trails, unauthorized artifact collecting, structural modification, human waste disposal, illegal fires, and soil compaction. Toilet placement would be carefully considered to avoid impacts to archaeological resources from ground disturbance associated with toilet installation and from access trails to toilet locations. Use of established campsites and toilet facilities could result in minor, beneficial, localized, short and long-term effects to archaeological resources. However, overnight use by larger numbers of hikers and backpackers in these areas would result in minor to moderate, adverse, regional, short and long-term effects.

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional and long-term.

Cumulatively, the effects of Alternative C on archeological resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional and long-term. Alternative C would contribute a medium amount to this adverse effect. Under Section 106 there would be an adverse effect to archaeological resources.

Conclusion
Including impacts from elements common to all action alternatives, moderate to major adverse, regional, short and long-term impacts to archaeological resources would result from implementation of Alternative C as a result of road and trail use, toilet construction, and maintenance activities and at-large or designed camps located in, or adjacent to, archaeological site boundaries.

Minor to moderate, beneficial, regional, long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of archaeological site National Register eligibility.

Cumulative impacts would be major, adverse, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to archaeological resources.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone

The maximum group size limit for the Corridor Zone would be 11, but in Threshold, Primitive and Wild Zones only small groups would be allowed (maximum of 6 people). As discussed under other alternatives, overnight backpacking can result in disturbances to archaeological resources where camps, attraction sites and archaeological sites co-occur. Impacts resulting from implementation of Alternative D could include barren core areas, vegetation damage, social trailing, illegal fires, and litter and human waste within the camp areas. Archaeological sites within, or in close proximity to, designated and at-large campsites could result in instances of archaeological feature alteration, graffiti, and artifact displacement. There is documentation to suggest that-larger groups have larger impact (NPS 2005a). Therefore, due to the smaller group sizes, impacts under Alternative D would be less than other alternatives and would be moderate, adverse, localized, and long-term.

River-assisted Backcountry Travel
Under Alternative D, RABT would be managed through an 11 mile limit on travel. Similar to other alternatives, archeological site impacts result from abandoning gear at or near sensitive sites and camping in in sensitive cultural locations Regulation of this activity as described for Alternative D may provide a means to monitor use. Education and permitting of this activity is expected to improve the ability to manage archaeological sites by tracking use by location and implementing condition assessment monitoring in higher use areas as well as teaching visitors proper site etiquette practices through the permitting process. Effects would be minor, adverse, regional and short-term.

Commercial Overnight Backpacking
Under this alternative, commercial use would be limited to the Corridor Zone, increasing commercial use in this zone compared to Alternatives B and C. Commercial use is expected to be 10.2% of the total overnight use. No commercial overnight use would be permitted outside of the Corridor Zone, which could protect resources from unintended disturbance from visitation and camping. Overall, impacts to archaeological resources are expected to be similar to Alternatives B and C. These impacts would be minor, adverse, regional, and long term.

Commercial Backcountry Vehicle Tours (Tuweep)
One trip per day would be allowed as long as stock use is not being conducted at the same time. Trip size would be limited to 15 people with vehicle size restrictions to minimize effects to unimproved roads and limited parking areas. Limiting the number of tours each day, along with the number of passengers and vehicle size, would result in minor to major beneficial effects to archaeological resources. Some impacts to archaeological resources would occur from social trailing and soil compaction, archaeological feature alteration (including architectural features and ground deposits), graffiti, and artifact displacement, Other disturbances as described in Alternative A would still occur, however, with reduced use compared to Alternative A, they are expected to be minor, adverse, regional, and short-term.

Backcountry Roads, Trails, and Routes
Under Alternative D, the Cape Solitude Trail would be converted to a Class 1 trail and the remaining roadbeds described in Alternative A would be retained as unmaintained routes and allowed to recover naturally. Effects of retaining these unmaintained trails and roads, while providing access through non-wilderness road corridors would be minor, beneficial, regional, and short and long-term.

Tuweep Facilities
Alternative D would implement the actions described in Alternative B including moving the Toroweap Overlook parking closer to the campground and converting Vulcan's Throne Road to a trail. As described under Alternative B, impacts to archaeological resources would be negligible to minor, beneficial, regional, and short to long-term.

Deer Creek/Tapeats Creek Complex
Alternative D would reduce the total number of overnight groups from 12 (current) to eight, compared to Alternative A. These Use Areas are highly desirable and could frequently result in visitors off itinerary. Reducing the number of groups is expected to reduce adverse impacts to archaeological resources. Disturbances from overnight use in these areas could include social trails, unauthorized artifact collecting, structural modification, illegal fires, and soil compaction. Effects of this use would be result in minor, adverse, regional, long-term impacts.

Deer Creek Narrows
Alternative D would implement a permanent restriction on entry into the Narrows as described in the Superintendent's Compendium (NPS 2013g) and restricts visitation at "The Patio" to one river trip at one time. Reduction of the number of people at one time in the Deer Creek narrows and closure of the narrows to rappelling would result in minor beneficial effects to archaeological resources.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Alternative D would change large groups to small groups (maximum of 6 people) in each Use Area as opposed to Alternative A which allows both small and large (7-11 people) in these Use Areas. As previously discussed effects to archaeological resources include unauthorized artifacts collection, structural modification, artifact displacement, and soil compaction at archaeological. Smaller group size, and fewer people would be beneficial compared to Alternative A by reducing the potential for creation of larger barren cores and additional disturbances associated with camping in archaeological sites. However, continued visitation to areas with relatively high concentrations of archaeological resources would result in minor, adverse, regional, short and long-term.

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional and long-term.

Cumulatively, the effects of Alternative D on archeological resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional and long-term. Alternative D would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to archaeological resources.

Conclusion
Under Alternative D and common to all action alternative elements, moderate to major, adverse, regional, short-term impacts would result from continued disturbances to archaeological resources as a result of road and trail use and maintenance activities and at-large or designated camps located in, or adjacent to, archaeological site boundaries. These effects may be reduced by small group sizes in Threshold, Primitive, and Wild use zones.

Minor to moderate, beneficial, regional, short and long-term impacts would result from reductions in the numbers of groups visiting areas at one time, implementation of an adaptive management process for climbing, canyoneering, human waste management and use area management, and implementation of other mitigation measures that promote preservation of archaeological site National Register eligibility.

Cumulative impacts would be major, adverse, regional, and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to archaeological resources.

Historic Structures

ISSUES

Issues related to historic structures identified through public and internal scoping include

- Visitor access and use can disturb historic structures, especially those that are more remote and not regularly maintained by the NPS. A number of historic structures are co-located with backcountry camps and rest areas or are along popular trails and have been disturbed by vandalism (graffiti and destruction of architectural elements), use of structural elements to make seats and other “camp furniture”, campfires, human waste disposal, and littering
- Maintenance activities on backcountry roads have potential to damage character-defining features of those resources (headwalls and culverts for example)
- Maintenance activities on backcountry trails have potential to damage character-defining features of those resources (parapet walls and stone trail tread for example)

DESIRED CONDITIONS

Historic structures would be managed to preserve them for future generations. Cultural Resource management would be implemented consistent with legislative and regulatory provisions, policies, and procedures. Research about, and stewardship of, historic structures would be carried out only after adequate planning and consultation with interested or affected individuals, groups, and other outside entities. Historic structures management would employ the most effective concepts, techniques, and equipment to protect the structures against vandalism, fire, overuse, deterioration, and other threats without compromising the elements that make the property eligible for listing on the National Register of Historic Places. Cultural Resources are managed to maintain NRHP integrity and eligibility (NPS 2006).

METHODOLOGY

A historic structure is a constructed work created to serve some human activity. The historic structures of the Grand Canyon backcountry include buildings, fire towers, tree towers, bridges, tunnels, roads and their features, trails and their features, mine adits and shafts, tramways, rock alignments, fences, ovens, exhibits, telephone and telegraph lines, mine workings and equipment, check dams, and ruins of all structural types such as foundation walls and chimneys (NPS 28 Cultural Resource Management Guidelines). Many of the historic structures in the Grand Canyon backcountry are listed or have been determined eligible for listing on the National Register of Historic Places. Other historic structures would be documented during the life of this plan. Structures not currently evaluated for National Register eligibility would be evaluated on an ongoing basis and would be treated as eligible until such evaluations are completed.

There are 195 known historic structures in Grand Canyon's backcountry (NRHP database, List of Classified Structures (LCS), and Grand Canyon Cultural Resource files). These structures are listed, have been determined eligible for listing, or are pending evaluations for listing on the NRHP. Historic structures that have not been evaluated for their NRHP status will be treated as eligible while such evaluations are being completed.

As a rule, sites in backcountry settings are not actively used or adaptively reused because they are in remote settings and not routinely maintained. Those that are actively used are still being used for their historic purposes, such as the resthouses along the Bright Angel Trail or the Mary Colter Cabins at Phantom Ranch. A few structures have been adaptively reused as interpretive centers or search and rescue caches (Indian Garden). Historic buildings located in the backcountry are managed to ensure long-term preservation. Structures would be maintained in current conditions or improved (NPS 2006). Table 3.10 lists many of the historic structures listed, or eligible for listing, on the NRHP. Though prehistoric structures are often considered under the heading for historic structures for many management purposes, they were considered under the analysis of archaeological and ethnographic resources for this plan and are not included in this section for further analysis.

The National Park Service LCS Program (NPS 2013j) has established condition criteria for historic structures of all types. Condition assessments are conducted every five years and reported to regional and national offices. Individual historic resources are evaluated for inclusion on the NRHP on an ongoing basis as funding allows. Historic structures condition assessments provide information on contributing features and discuss maintenance methods that should be followed and materials that should be used to maintain the National Register integrity and eligibility of particular properties.

Protocols for site condition monitoring (Dierker 2011) were used to standardize field and data entry procedures as they relate to NRHP-eligible properties. All sites included in analysis are eligible for NRHP listing under Grand Canyon's Multiple Properties Nomination for Prehistoric and Historic Resources (NPS 1984a) or were determined eligible through individual determinations by Grand Canyon and the Arizona SHPO or the NRHP Keeper (Grand Canyon site records).

To analyze effects of each alternative, all available information for historic buildings in the area of potential effect was reviewed in the Grand Canyon Archaeological Site Database, LCS, and Grand Canyon cultural GIS data layers. Impact analysis was based on intensity, context, and duration. When a Historic Property character-defining element that qualifies it for NRHP is directly or indirectly altered, it is considered an adverse effect under Section 106. Adverse effect also includes cumulative effects, from other undertakings and from actions farther removed in distance or later in time (36 CFR Part 800.5, Assessment of Adverse Effects). In the case of an adverse effect determination, a Memorandum of Agreement would be executed among the NPS, applicable state or tribal historic preservation offices and,

if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR. A no adverse effect determination means that while an effect has been identified, it would not diminish any cultural resource characteristic that qualify it for NRHP inclusion.

INTENSITY DEFINITIONS

Effects specific to historic structures are characterized for each alternative based on the intensity definitions presented below. The intensity definitions incorporate a NHPA Section 106 determination of effect for historic structures.

Intensity

Negligible There would be no measureable change. Depletion or displacement of elements of integrity would be barely perceptible or would not occur. Under Section 106 there would be no adverse effect.

Minor Adverse: Effects would be detectable but overall resource integrity would be undiminished. A building's defining features, characteristics, or aspects of integrity that contribute to NRHP eligibility would be unaffected and un-jeopardized. Effects such as a broken window would be measurable. Under Section 106 there would be no adverse effect.

Beneficial: Effects would be measurable resulting in increased stability to character-defining features. Under Section 106 there would be no adverse effect.

Moderate Adverse: Effects would result in loss of overall integrity, but would not jeopardize structure's NRHP eligibility. Effects would include measurable change to character-defining elements and contribute to increased structure instability. Effects would require mitigations. Under Section 106 there would be an adverse effect.

Beneficial: Effects would be measurable and contribute to increased stability of character-defining features. Under Section 106 there would be no adverse effect.

Major Adverse: Effects to a structure or structures would result in loss of overall integrity and significant change to character-defining elements to the extent the structure would no longer be eligible for continued NRHP listing. Under Section 106 there would be an adverse effect[53].

Beneficial: Measureable effects would result in preservation of character-defining feature(s). Under Section 106 there would be no adverse effect.

Context

Localized Effects identified at a specific historic structure.

Regional Effects to several structures in a management setting, management zone, or geographic location.

[53] If adverse effect determination, a Programmatic Agreement or Memorandum of Agreement would be executed among the NPS, applicable state or tribal historic preservation offices and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFS 800.6(b) before the ROD for this EIS is signed.

Duration

Short-term Effects that in five years are no longer detectable as historic structure is mitigated to pre-disturbance condition or appearance. Example: replace broken windows following Secretary of Interior's Standards for Historic Preservation (USDOI 1995).

Long-term Effects result in change to a historic structure's condition where mitigation would not result in returning location to pre-disturbance condition or appearance. Example: alteration to structure's exterior not in accordance with the Secretary of Interior's Standards for Historic Preservation.

ASSUMPTIONS

Assumptions specifically related to alternatives, and their effect on historic structures, are based on monitoring observations, baseline condition data, and documentation of structures through the LCS program and the park's Vanishing Treasures program.

- Proximity of roads, trails, rest areas, and campsites, to historic structures increases likelihood of adverse effects from access and use
- Visitor effects have been noted in areas where overnight use is prohibited; therefore, visitor effects occur to sensitive resources even in day use areas

IMPACT ANALYSIS

Historic structures are impacted by recreational use in the park's backcountry. The most frequently disturbed aspects of integrity of these structures that may affect NRHP eligibility are materials, workmanship, and design. Camping in or adjacent to historic structures may impact structure integrity and resource significance by using construction materials in illegal campfires, using structural elements to build camp furniture such as seating areas, tables, and windscreens, depositing human waste and trash on sites, and camping on, or within, site features. In addition, attraction sites show adverse effects from visitation such as graffiti and human waste disposal. Visitation, while often well intentioned, has led to effects to a number of sensitive sites in the backcountry.

ALTERNATIVE A

Extended Day Hiking and Running Management

Rim-to-rim activities and extended day hiking and running are currently unregulated and would continue unregulated under Alternative A. Restroom facilities are not historic and though heavily used during these kinds of activities help reduce adverse effects from human waste disposal at historic rest houses located along the Bright Angel Trail. Disturbances to the Cross-canyon Corridor's historic structures include normal wear and tear caused by visitor use. The primary structures affected include the rest houses along the Bright Angel Trail, the Cantina in Phantom Ranch, the black and silver bridges across the Colorado River, and bridges across Bright Angel Creek, the Bright Angel Trail, North and South Kaibab Trails, the Colorado River Trail, and small-scale landscape features in the corridor. Continuation of current management would result in effects that would be minor adverse, regional, and long-term.

Tuweep Day Use Management

As currently conducted, management of day use at Tuweep has resulted in some disturbance to an historic structure in the Tuweep campground. There are no historic structures in the vicinity of the Toroweap Overlook or along the route to Vulcan's Throne. The historic structures concentrated within the ranger station complex are not affected by management activities at the present time. Current road and trail maintenance activities help preserve the rustic character of this backcountry area. Continuation of current

management would result in effects to historic structures that would be minor to moderate, adverse, localized, and long-term.

Human Waste Management
Disturbances to historic structures related to human waste management result from waste disposal within backcountry historic structures (e.g., Pasture Wash Ranger Station Barn, Santa Maria Springs Rest House and other rest houses). Some facilities which served as toilets in the past, but have since been closed because they do not meet current health standards, have been broken into and used for waste disposal (e.g., Santa Maria Springs outhouses, Kanabownits Cabin outhouse). Under Alternative A, impacts to historic structures would be minor to moderate adverse, regional, and short and long-term.

Administrative Use
Documented disturbances from administrative use include maintenance activities that diminish the integrity of character-defining features of structures, buildings, roads and trails. Continuation of current management would result in minor to moderate, adverse, regional, short and long-term impacts to historic structures.

Maximum Group Size for Overnight Backpacking by Zone
Under current management, the maximum group size is 11 persons. Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring at campsite locations. Effects have been documented from overnight camping activities in areas that allow both large and small groups. Vandalism (graffiti and structural damage), human waste disposal, littering, and campfires have been documented to some backcountry historic structures, although this has not been directly linked to group size, however the potential for adverse impacts is greater as group size increases. Continuation of current management would result in minor to moderate, adverse, regional, short and long-term impacts to historic structures.

Commercial Overnight Backpacking
Commercial backpacking is permitted in the same manner as non-commercial backpacking, and currently approximately 9% of the overall backcountry use is commercial. Commercial use authorizations are unlimited and use occurs in all zones including areas with historic structures such as Bass Camp, Boucher's cabin, and Grandview Mine Historic District. Impacts have been documented from overnight camping activities. Vandalism (graffiti and structural damage), human waste disposal, littering, and campfires have been documented to some backcountry historic structures, although this has not been directly linked to commercial services in the past. Continuation of current management would result in minor adverse, regional, short and long-term effects to historic structures.

Commercial Day Hiking
Under current management, commercial day hiking is authorized by CUA and maximum group size is 11 including guides. Commercial hiking occurs in limited areas including trails and destinations that include historic structures such as, Three-mile Resthouse and the Santa Maria Springs Resthouse and Outhouse. While impacts are the same as unregulated day hiking use; authorized commercial use includes requirements for waste management. Continuation of current management would result in minor, adverse, regional, short and long-term effects to historic structures.

Backcountry Roads, Trails, and Routes
Hundreds of miles of backcountry trails, routes, and roads exist in the park. Many of these trails, routes, and old fire roads are historic. There are no changes to road and trail classifications under this alternative. Current use results in normal wear and tear of these historic roads and trails, and continuation of current management would result in minor, adverse, regional, short, and long-term effects to historic structures.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (Table 4.1) have the potential to contribute to cumulative impacts on historic structures. Past actions including fire management, construction, and maintenance activities have resulted in adverse effects including direct and indirect damage to these resources through dismantling of constructed features. Visitor use of historic structures has resulted in vandalism (graffiti and structural damage), human waste disposal issues, littering, and campfire use. These impacts are minor to moderate, adverse, regional and long-term.

Present and foreseeable future actions overlap with some past actions and include fire management, maintenance activities and the replacement of the transcanyon pipeline. Maintenance and fire management activities can diminish the integrity of character-defining features of structures (including roads and trails). These activities would continue to result in minor to moderate adverse, localized and regional, short and long-term effects to historic structures.

Cumulative effects to historic from past, present, and reasonably foreseeable future actions discussed above are moderate, adverse, localized and regional, short and long-term. Alternative A would contribute a small amount to the adverse impacts. Under Section 106 there would be an adverse effect to the historic structures.

Conclusion
Under Alternative A, minor to moderate, adverse, localized and regional, short and long-term impacts to the historic structures would result from would result from visitor use disturbances including vandalism (graffiti and structural damage), human waste disposal, littering, and campfires.

Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a small amount. Under Section 106, there would be an adverse effect to historic structures.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Extended Day Hiking and Running Management
Impacts to historic structures from this activity would be similar to Alternative A. Beneficial effects from implementation of a day use permit system and potential adaptive management actions would reduce impacts to historic structures from increased education. High day use levels would, however, continue to result in minor adverse, regional, and long-term effects to historic structures.

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Daily use limits by trail
- Designated days for group or individual events
- Adopt policy for other trails

Establishment of group size limits and daily use limits by trail would have beneficial impacts on historic resources by minimizing the use on historic trails and of historic features in the cross-canyon corridor. These beneficial impacts would be minor, short to long-term and localized.

Tuweep Day Use Management
As described in Alternative A, Tuweep day use has resulted in some disturbance to an historic structure in the Tuweep campground and under all alternatives impacts to this structure would be minor to moderate, adverse, localized, and long-term.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party

A day use permit or reservation system would reduce the potential for overcrowding and therefore the potential for visitors to inadvertently displace historic structure elements. Restrictions on the number of vehicles per party to reduce crowding from vehicles at each camp location would reduce inadvertent damage to historic structure elements from improper parking and driving. Overall these actions would result in minor to moderate, beneficial, localized, short and long-term effects to historic structures.

Human Waste Management

Implementation of a solid human waste carry-out system by commercial guides in areas without toilets, and carry-out in all River Zone camp areas without toilets would reduce the potential for impact from deposition of human waste within historic structures. This action would result in minor to moderate, beneficial, regional, short and long-term effects to historic structures.

Management Actions Potentially Implemented through Adaptive Management

- Replacement of existing toilets at existing sites
- Removal of primitive toilets
- Installation of primitive toilets at other sites
- Seasonal or year-round human waste carry-out requirement for specific areas or zones
- Seasonal or year-round human waste carry-out requirement for all areas or zones

Placement of toilet facilities in non-river backcountry areas where there is heavy day use (Hermit Trail for example) could reduce human waste disposal within historic structures such as the Santa Maria Rest House. Implementation of human waste carry out requirements for areas with historic structures would also reduce impacts. Overall, these actions would result in minor to moderate, beneficial, localized and regional, short and long-term effects to historic structures.

Administrative Use

As described in Alternative A, disturbances from administrative use has included maintenance activities that diminish the integrity of character-defining features of structures, buildings, roads and trails. Impacts would be similar to Alternative A, however with the implementation of a Minimum Requirement Analysis; disturbances to historic structures could be reduced or eliminated in wilderness areas, and would result in minor to moderate, adverse, localized and regional, short and long-term impacts to historic structures.

Cumulative Impacts

Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion

Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone

Both large (7-11 people) and small (1-6 people) groups would be allowed in the Corridor and Threshold Zones. Primitive and Wild Zone use limits would be capped at six people (small groups only). As discussed earlier in this section, disturbances to historic structures, including backcountry trails and roads, include normal wear and tear caused by backcountry activities. Impacts have been documented from overnight camping activities including vandalism (graffiti and structural damage), human waste disposal, littering, and campfires. Beneficial effects from smaller groups would affect areas such as Bass Camp and Boucher cabin, however the potential effects from larger group size would continue to result in minor to moderate, minor to moderate, adverse, localized and regional and short and long-term impacts to historic structures.

Commercial Overnight Backpacking

Commercially guided overnight backpacking trips would be authorized through concession contracts and a limited number of CUAs. As discussed in Common to all Alternatives, commercial guides would be required to adhere to specific environmental protection requirements and resource stewardship training (Appendix F). It is expected that these requirements would benefit the visitors seeking guided trips as well as enhance resource stewardship. Commercial use, when compared to overall use, would be similar to Alternative A; however it would not be allowed in Wild Zone use areas and limited to specific Primitive Zone use areas, including some with historic structures. Impacts from overnight use would be similar to impacts described for Alternative B, Maximum Group Size. Commercial use limitations under Alternative B would result in minor adverse, regional and long-term impacts from overall use, and minor beneficial, localize and regional, long-term effects from guide training and educational requirements.

Commercial Day Hiking

Commercial hiking would be allowed to specified locations on Bright Angel, South and North Kaibab, and Hermit and Grandview Trails. Impacts would be slightly reduced when compared to Alternative A because locations would be limited beyond what is currently allowed and would result in negligible to minor, adverse, regional, and short-term impacts to historic structures.

Backcountry Roads, Trails, and Routes

Under Alternative B, Eremita Mesa Trail would continue to be managed as an unmaintained route, and Cape Solitude, Tiyo Point, Francois Matthes Point, and Walhalla Glades would be managed as Class I Wilderness trails. Activities necessary to develop and maintain the Class 1 trails would result in minor, regional, short and long-term adverse effects to these routes as a result of maintenance activities and changes to the historic character and integrity of these formers roadbeds.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A, minor to moderate, adverse, localized and regional, short and long-term.

Cumulatively, the effects of Alternative B on historic structures, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative B would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to historic structures.

Conclusion

Under Alternative B and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances

including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from smaller group size in Primitive and Wild zones and guide requirements would have minor, localized, and long-term effects on historic structures.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone

Similar to Alternative A, the maximum group size limit for all management zones would be 11; therefore impacts would be the same as Alternative A, minor to moderate, adverse, regional, short and long-term.

Commercial Overnight Backpacking

Commercially guided overnight backpacking trips would be authorized through contracts and limited number of CUAs. Commercial use levels are highest under Alternative C (10%) and increase in Threshold and Primitive Zone use areas compared to Alternative A, and more commercial trips would have access to areas with historic structures. Impacts from overnight use would be similar to impacts described for Alternative A, Maximum Group Size. As discussed in Common to all Alternatives, commercial guides would be required to adhere to specific environmental protection requirements and resource stewardship training (Appendix F). It is expected that these requirements would benefit the visitors seeking guided trips as well as enhance resource stewardship. Commercial use limitations under Alternative C would result in minor adverse, regional and long-term impacts from overall use, and minor beneficial, localize and regional, long-term effects from guide training and educational requirements.

Commercial Day Hiking

Under Alternative C, commercial hiking would be allowed to Indian Gardens and Skeleton Point in addition to those specified locations described in Alternative A. Because these additional locations occur in high use areas, it is unlikely that they would result in additional impacts. Impacts would be the same as Alternative A and would be minor, adverse, regional, short-term effects to historic structures.

Backcountry Roads, Trails, and Routes

Alternative C would manage Eremita Mesa, Cape Solitude, Francois Matthes Point, Komo, and Walhalla Glades routes as Class I Wilderness trails. Tiyo Point would be managed as a Class 4 trail suitable for stock use. The Boundary Road and Pasture Wash would be open to vehicle and bicycle access to the South Bass Trailhead. Activities necessary to develop and maintain the Class 1 and Class 4 trails and the Boundary Road would result in minor to moderate, adverse, regional, short and long-term effects as a result of maintenance activities and impacts to historic character and integrity.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A, minor to moderate, adverse, localized and regional, short and long-term.

Cumulatively, the effects of Alternative C on historic structures, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative C would contribute a small amount to this adverse effect (but to a greater degree than Alternative B). Under Section 106 there would be an adverse effect to historic structures.

Conclusion
Under Alternative C and elements common to all action alternatives, minor to moderate, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), improper human waste disposal, and development and maintenance of trails. Beneficial effects from guide requirements would have a minor, localized, and long-term impact on historic structures.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a small amount. Under Section 106, there would be an adverse effect to the historic structures.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, both large and small groups would continue to be allowed in the Corridor Zone. Group size would be reduced in the Threshold, Primitive, and Wild Zone where only small groups (1-6 people) would be allowed. Disturbances to historic structures would be similar to those described in other alternatives, but would be reduced because of the overall reduction in overnight use in the Threshold, Primitive, and Wild Zones. Effects would be minor, adverse, regional and short and long-term.

Commercial Overnight Backpacking
Similar to Alternatives B and C, commercially guided overnight backpacking trips would be authorized through concession contracts and a limited number of CUAs. Commercial use would only be permitted in the Corridor Zone. The guide training requirements (Appendix F) would improve resource stewardship in the Corridor; however it may be lacking in other use areas with historic structures. Impacts from overnight use would be similar to impacts described for Alternative D, Maximum Group Size. Commercial use limitations under Alternative D would result in minor adverse, regional and long-term impacts to historic structures.

Commercial Day Hiking
Commercial hiking would be limited to the Cross Canyon Corridor Zone; Bright Angel Trail to 3-Mile Rest House, South Kaibab Trail to Cedar Ridge, and on the North Kaibab Trail to the Supai tunnel. Disturbances would be similar to those described under previous alternatives. Limiting commercial hiking to the Corridor may reduce disturbances to historic structures in other zones. Impacts to historic structures would be negligible to minor, adverse, regional, and short-term.

Backcountry Roads, Trails, and Routes
Under Alternative D, unmaintained routes would be managed as untrailed areas to allow old roadbeds to recover naturally. Primitive roads within the Road-Natural Zone would provide access to trailheads, campsites and overlooks. Retaining trails as unmaintained routes would result in minor, beneficial, regional, long-term effects to these historic resources because there would be less visitation and potential for impacts to these resources. Impacts would be negligible to minor, beneficial, regional, and long-term.

Backcountry Roads, Trails, and Routes
Under Alternative D, unmaintained routes would be managed as untrailed areas to allow old roadbeds to recover naturally. Primitive roads within the Road-Natural Zone would provide access to trailheads, campsites and overlooks. Retaining trails as unmaintained routes would result in minor, beneficial, regional, long-term effects to these historic resources because there would be less visitation and potential for impacts to these resources. Impacts would be negligible to minor, beneficial, regional, and long-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A, minor to moderate, adverse, localized and regional, short and long-term.

Cumulatively, the effects of Alternative D on historic structures, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative D would contribute a small amount to this adverse effect (less than Alternative B and C). Under Section 106 there would be an adverse effect to historic structures.

Conclusion
Under Alternative D and elements common to all action alternatives, minor, adverse localized and regional, short and long-term impacts to historic structures would result from visitor use disturbances including vandalism (graffiti and structural damage), and improper human waste disposal. Beneficial effects from smaller group size in Threshold, Primitive and Wild zones, guide requirements, and management of unmaintained routes would have minor, localized and regional, short and long-term impacts on historic structures.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a very small amount. Under Section 106, there would be an adverse effect to the historic structures.

Traditional Cultural Properties and Ethnographic Resources

ISSUES

Issues related to traditional cultural properties and ethnographic resources identified through public and internal scoping and tribal consultation include

- Visitor access can disturb components that encompass archaeological sites, sacred places, landmarks and natural resource locations. Viewsheds and soundscapes can be adversely affected by visitation and may diminish intangible values of a resource to traditional peoples
- Ethnographic resources are co-located with many backcountry camps, attraction sites, and rest areas. Camping in or adjacent to ethnographic resources may impact site integrity and resource significance by creating trails (social trails) between locations, use of illegal campfires, depositing human waste and trash on sites, camping on features, and modifying the landscape resulting in diminishing the overall feeling evoked from the importance of place
- Large group size at camps and attraction areas has greater potential to inadvertently disturb ethnographic resources. At-large camping has potential to damage ethnographic resources when hikers establish campsites on site features. Increasing the number of campsites in certain areas, or building new campsites along certain trails, may cause direct and indirect effects to ethnographic resources
- Artifact removal and vandalism resulting from visitation can diminish NRHP eligibility of ethnographic resources and disturb cultural practices or beliefs and ties to ancestors by living communities
- Maintenance activities on dirt roads or reopening previously closed roads have potential to damage ethnographic resources in or adjacent to road alignments. Expanding parking areas or adding campsites in specific locations has potential to diminish NRHP integrity of ethnographic resources, may diminish the condition or health of these resources, and may inhibit access to them by Traditionally Associated Tribes

- Grand Canyon's Traditionally Associated Tribes acknowledge Grand Canyon as a Traditional Cultural Property rim to rim. The Arizona State Historic Preservation Office concurred July 28, 2011. The natural processes, healthy ecosystems, diverse native plant and animal populations, stable archaeological sites, the presence of features and artifacts, and natural quiet are all important aspects of TCP. Noise, congestion, crowding, and area overuse may impact some or all of these important environmental aspects and the tribal values associated with them

DESIRED CONDITIONS

Preserve tangible and intangible elements critical to integrity of culturally important places identified by Traditionally Associated Tribes. Access to traditional cultural properties (TCPs) and sacred sites for traditional tribal practices accommodated. Ethnographic resources and TCPs identified by Traditionally Associated Tribes and through research of tribal and park publications. Research data verified by consultation

METHODOLOGY

TCPs, which include cultural and natural resources, are important to the park's 11 Traditionally Associated Tribes. Natural quiet, the presence of native plants and animals, healthy ecosystems where natural processes dominate, and undisturbed archaeological sites are some of the indicators of the canyon's health (Jackson-Kelly et al. 2013, Yeatts and Huisinga 2012). Noise from aircraft, vehicles, and other forms of transportation, or visitor crowding may disturb some of the tangible and intangible qualities with which traditional cultural properties are imbued. Visitor uses can result in degradation of the physical properties of a site or area (social trails, vegetation trampling and loss), or can result in changes to soundscapes and a sense of privacy which is important to a tribe's ability to carry out traditional practices within the Grand Canyon backcountry.

In accordance with the Advisory Council on Historic Preservation's regulations for implementation of §106 (36 CFR Part 800, Protection of Historic Properties), effects of alternatives were identified and evaluated by first identifying Area of Potential Effect (APE) and then reviewing the Archaeological Site and Ethnographic Resource databases and NRHP records (Grand Canyon Cultural Resources files). These resources are listed on or eligible for listing on the NRHP. Identification and documentation of TCPs is ongoing, occurring on a project by project basis and in consultation with the Traditionally Associated Tribes.

The Grand Canyon Ethnographic and Archaeological Site databases include documentation for 467 specific ethnographic resources and 161 archaeological resources that have been identified as important to one or more of the park's Traditionally Associated Tribes. Aside from archaeological resources these ethnographic resources include, 25 documented landscape areas, 367 natural resources including plants, animal, insects, and birds, 68 places (e.g., salt mines, etc.), and seven miscellaneous resources (Grand Canyon Archaeological and Ethnographic databases, Hedquist and Ferguson 2012).

Additions to the ethnographic database are ongoing through research and consultation. The accounting of ethnographic resources presented here does not represent all ethnographic resources known to the tribes. The total number of ethnographic resources within Grand Canyon will continue to grow, but may never be completely known to NPS representatives due to the sensitive nature and cultural significance of traditional cultural properties to the tribes.

Ethnographic resources and traditional cultural properties are monitored by the tribes but their monitoring activities at present are largely restricted to those resources found along the river corridor. Visitor and cumulative effects noted for such resources may serve as a proxy for similar known resources within the

larger backcountry management planning area. However, the reader is advised to also review the sections related to natural resources for this plan as a means to better understand the effects the proposed alternatives may have on natural resources. Effects to natural resources would be relevant to understanding effects to many ethnographic resource types important to the canyon's Traditionally Associated Tribes.

Archaeological resources are sometimes identified as traditional cultural properties by the park's Traditionally Associated Tribes. Currently, 161 archaeological resources have been identified as being important to one or more of the park's Traditionally Associated Tribes. These specific resources are actively visited, monitored, assessed or evaluated for tribal importance by individual tribes and their members. All these sites include site condition and disturbances made by Grand Canyon staff during monitoring visits. Some site evaluations also contain tribal values monitoring data (Dongoske 2013, Jackson-Kelly 2013, Bulletts et al. 2012, Yeatts and Husinga 2012). Archaeological sites lacking current condition data and information on disturbance mechanisms or documented as destroyed are not included in plan/DEIS analysis. While sites lacking condition or disturbance data cannot be included in data analysis because they lack information, the NPS will work toward monitoring them in the future and determining any necessary mitigations related to backcountry use as part of the adaptive management process. Site condition monitoring and inventory and monitoring activities within the backcountry management plan APE are ongoing and are expected to result in increased numbers of archaeological sites identified in the park and as TCPs in the future.

Procedures to follow when monitoring archaeological resources within Grand Canyon (Protocols) are used (Dierker 2011) to standardize field and data entry procedures as they relate to NRHP-eligible properties. Protocols were also developed by tribes participating in the adaptive management program for operations of Glen Canyon Dam to monitor river corridor ethnographic resources. Although these protocols were developed for Colorado River resources, their methods are applicable for monitoring resources across the entire BCMP area. All sites included in analysis are eligible for listing on the NRHP under Grand Canyon's Multiple Properties Nomination for Prehistoric and Historic Resources (NPS 1984a) or were determined eligible through individual determinations by Grand Canyon and the Arizona SHPO or the NRHP Keeper (Grand Canyon site records).

To analyze effects of each alternative, all available information was reviewed. These data included information from the Grand Canyon Archaeological Site database, Ethnographic database, Tribal monitoring reports, and research documents (e.g., Hedquist and Ferguson 2012 among others). These resources include tribal information related to the resource, the condition, and its importance. Impact analysis was based on intensity, context, and duration. Traditionally Associated Tribes monitor ethnographic resources to ensure continued preservation. Tribal concerns and information are reported to the park via annual monitoring reports, on-site site visits with park staff, and though informal verbal communication to cultural resource staff.

When the character-defining features of an ethnographic resource are directly or indirectly altered, it is considered an adverse effect under Section 106. Adverse effect analysis also includes cumulative effects, including those farther removed in distance or later in time (36 CFR Part 800.5, Assessment of Adverse Effects). In the case of an adverse effect determination, a Memorandum of Agreement would be executed among the NPS, applicable state or tribal historic preservation offices, other affected parties, and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR Part 800. A no adverse effect determination means that while an effect has been identified, it would not diminish any Ethnographic Resource characteristic that qualify it for inclusion on the NRHP.

INTENSITY DEFINITIONS

Effects specific to TCPs and ethnographic resources are characterized for each alternative based on the intensity definitions presented below and NHPA Section 106 determination of effect for TCPs and ethnographic resources.

Intensity

Negligible: There would be no measurable change. Depletion or displacement of elements of integrity would be barely perceptible. Under Section 106 there would be no adverse effect.

Minor: Adverse: Effects would be detectable but resource condition would be undiminished, such as altered access or site preservation. Relationship between resource and Traditionally Associated Tribe's body of practices and beliefs would be undiminished. Under Section 106 there would be no adverse effect.

Beneficial: Effects would be measurable, resulting in increased stability to traditionally important site elements. Under Section 106 there would be no adverse effect.

Moderate: Adverse: Effects would be apparent and would alter ethnographic resource condition or interfere with traditional access, site preservation, or relationship between resource and Traditionally Associated Tribe's body of practices and beliefs; Traditionally Associated Tribe's body of practices and beliefs would survive. Under Section 106 there would be an adverse effect.

Beneficial: Effects would measurable and contribute to increased stability to traditionally important site elements. Under Section 106 there would be no adverse effect.

Major: Adverse: Effects would alter resource condition, block access, or largely affect relationship between resource and Traditionally Associated Tribe's body of practices and beliefs. Under Section 106 there would be an adverse effect.

Beneficial: Effects would be measurable and contribute to increased stability to traditionally important site elements. Under Section 106 there would be no adverse effect.

Context

Localized: Effects identified at a specific ethnographic resource.

Regional: Effects occur to several specific ethnographic resources within a management setting, management zone, or geographic location.

Duration

Short-term: Impact that within five years would no longer be detectable at an ethnographic resource mitigated to its pre-disturbance condition or appearance. An example is to brush out trails so foot traffic is no longer evident across an ethnographic resource.

Long-term: Impact that would result in change to an ethnographic resource condition where mitigation would not result in pre-disturbance condition or appearance. Example: destruction of a cairn marking a route to an important shrine.

ASSUMPTIONS

Assumptions specifically related to the alternatives and their effects on ethnographic resources are a result of long-term site condition monitoring throughout the park conducted by NPS Staff, Tribal monitors, and researchers.

- Proximity of roads, trails, rest areas, campsites, and facilities (e.g., toilets) to ethnographic resources increases likelihood of adverse effects from direct effects from road and trail maintenance activities when resources are adjacent to or located within road and trail alignments, from camping in or on cultural features, and from social trailing between camps, water sources, toilet locations, or attraction sites
- The greater the number of user days (total number of people/year), the greater the likelihood of degradation to ethnographic resources when resources are located in or adjacent to camp areas, attraction sites, or in locations that receive hiker use (day and/or overnight users)
- Corridor and Threshold Zone cultural resources are expected to show higher levels of impact due to easier access and higher levels of day and overnight use
- Large groups have potential to cause more effects to cultural sites (NPS 2005a)
- Concessioner/NPS partnerships may lead to increased resource stewardship as NPS resource staff work to educate guides on best practices
- Detailed and esoteric information about places may not be fully described to NPS resource managers and known only to specific tribal members and not available to the public
- Many places within the park are significant to multiple tribes, though some may only be important to a single tribe

IMPACT ANALYSIS

The most noticeable effects to ethnographic resources from recreational use in backcountry would be from continued visitation to sensitive locations including places, archaeological sites, plants, water sources, and landscape features. Visitation, while often well intentioned, has led to effects to a number of sensitive sites in the backcountry. Visitor disturbances have been recorded at ethnographic resources in all management zones. Camping and foot traffic create compacted surfaces that can impede vegetation growth and divert water flow into channels that further erode sediments. Vegetation loss alters the landscape and may reduce the availability of suitable habitat or food sources for important bird and animal species or plants used for important cultural purposes. These disturbances also have the potential to destabilize or remove sediments containing cultural materials. Visitors may disturb archaeological deposits by removing, moving or piling artifacts.

The most frequently disturbed aspects of integrity that may affect NRHP eligibility for ethnographic resources are association, setting, feeling, materials, workmanship and design. Camping in or adjacent to ethnographic resources may impact site integrity and resource significance by developing trails between locations, illegal campfires, depositing human waste and trash on sites, and camping on important features. Visitor effects have been noted in areas where overnight use is prohibited; therefore, visitor effects occur to sensitive resources even in day use areas. Attraction sites show adverse effects from visitation such as vegetation trampling and vegetation loss, disturbances to spring areas, noise impacts, artifact displacement, graffiti of rock writing panels, vandalism of cave features, artifact theft, crowding, and social trailing leading to erosion of site deposits. These effects are often cumulative from river and backcountry users, and are more evident in visitor areas where the two user groups overlap leading to overall greater visitor use numbers.

Locations where people lived or visited in prehistory, including the remaining site features and artifacts are considered to embody the ancestral inhabitants of those particular locations. Sites are not considered abandoned. The presence of wildlife as observed by tribal members is a sign that the ancestors are there to greet their descendants and welcome them back to the canyon. Archaeological features and artifacts, rocks, plants, mineral sources and all other aspects of the environment are considered to be living sentient (conscious) beings and their disturbance is offensive to associated tribes. When ethnographic resources are defaced, altered, or portions are moved or removed, this adversely affects cultural traditions, beliefs and history.

ALTERNATIVE A

Backcountry Management Zones

Establishment of management zones is a tool for managers to use to structure planning and resource priorities based on use levels. Variables such as group size, the number of user nights, and campsite location all contribute to determining the overall accessibility and vulnerability of ethnographic resources. Under this alternative there would be no change to management zones and it is expected that disturbances would continue at current levels. Recreational use within the management zones results in disturbances to ethnographic resources. Effects occur from trailing, artifact and structure alteration, graffiti, vandalism, loss of habitat from vegetation and soil changes, crowding, inappropriate behavior at sensitive locations, and camping at ethnographic resources. Effects would be moderate to major, adverse, localized and regional and short and long-term. Mitigation measures identified in Chapter 2 including preservation maintenance, stabilization or repair of damaged features, data recovery (planned research, documentation, or excavation), and removal of graffiti, and increased education would be implemented to decrease these adverse impacts.

Climbing Management

Unintentional disturbance from trailing across resource areas and archaeological sites leading to climbing locations, disruption to wildlife, vegetation disturbances and intentional removal or piling of artifacts may occur. Inappropriate activities such as vegetation trampling or artifact collection would result in effects that are minor to moderate adverse, regional and short-term.

Canyoneering Management

As currently allowed, canyoneering has adverse effects to ethnographic resources. Canyoneering in locations identified as TCPs could alter ethnographic resource condition, and interfere with traditional access or the relationship between the resource and the Traditionally Associated Tribe's body of practices and beliefs. Based on a long-term history of requests for use restrictions at Deer Creek, the 2012 Superintendent's Compendium has closed access to climbing and repelling in the Deer Creek Narrows. Other canyoneering routes occur in side canyons, sometimes in areas with water, and there are often ethnographic resources associated with these water sources. Under Alternative A there would continue to be no use limits or group size restrictions thus allowing for unlimited use and access. Effects on ethnographic resources under this alternative would be moderate, adverse, regional, and long-term.

Tuweep Day Use Management

Tuweep day use as currently conducted has resulted in disturbances to ethnographic resources from visitation and vehicular traffic. Documented disturbances to tribally significant archaeological sites in this area include localized effects from camping, social trailing and road and toilet construction in or adjacent to site boundaries. The current road location bisects an important site and adjacent camping results in trailing through sites, illegal campfires within sites and barren cores and trampling in archaeological sites. Impact under Alternative A would be minor to moderate, adverse and long-term, sometimes interfering with traditional access or the relationship between the resource and the Traditionally Associated Tribe's body of practices and beliefs.

Human Waste Management
Management of human waste in the backcountry impacts ethnographic resources in a number of ways. Placement of toilets within or adjacent to ethnographic resources can adversely affect the integrity of a property by damaging archaeological deposits, altering viewsheds, interfering with access to important resources, or directly through construction and trail activities through resource areas. Subsequent trail development also detracts from the viewshed, and has the potential to damage important resources. Cat holes and toilet paper piles (Foti et al. 2006) adversely impact the overall landscape where that activity has occurred. Under Alternative A, impacts would continue to be minor to moderate, adverse, regional, and long-term.

Arizona Trail
Disturbances at archaeological sites along the Arizona Trail, which may also affect ethnographic resources, include barren areas created from camping, artifact displacement, improper waste disposal, and social trailing. Impacts under Alternative A would continue to be minor to moderate, adverse, regional and long-term.

River-assisted Backcountry Travel (RABT)
Under current use, RABT has resulted in at-large camping within some ethnographic resource boundaries. Impacts would be similar to those described for archaeological resources, such as setting up camp in sensitive and fragile cultural resource locations, and would be minor to moderate, adverse, regional and both short and long-term.

Administrative Use
Administrative use can result in disturbances to ethnographic resources. Documented disturbances include road and trail work where alignments pass through ethnographic resource boundaries or when resources are adjacent to such infrastructure. Maintenance activities can result in a loss of site matrix, disturbance to plant communities, and soils, and displacement or destruction of artifacts and features. Inappropriate research practices can result in trailing, barren core areas and vegetation disturbance within ethnographic resource boundaries. Effects range from minor to major, would be adverse, regional and both short and long-term. Beneficial impacts would occur through stabilization of ethnographic resources or trail construction to avoid disturbances to ethnographic resources and deposits. These impacts would be minor to moderate, beneficial, short and long-term, and regional.

Maximum Group Size for Overnight Backpacking by Zone
Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring at campsite locations. Highly impacted campsites tend to have large barren core areas and show vegetation damage, social trailing, and litter and human waste within the camp areas. Ethnographic resources located within, or in close proximity to designated and at-large campsites show instances of alteration, graffiti, and artifact displacement. Campsite placement, whether the camps are large or small, often causes disturbances to ethnographic resources. Under Alternative A, impacts would continue to be moderate to major, adverse, regional and short-term. Mitigation measures similar to those listed under Backcountry Management Zones above would decrease these major, adverse impacts.

Commercial Overnight Backpacking
Commercial overnight backpacking is currently allowed in all management zones. Disturbances to ethnographic resources are similar to those noted for the section Maximum Group Size for Overnight Backpacking by Zone although they may not be directly linked to commercial groups. Under Alternative A would continue to be moderate to major, adverse, regional and short term. Mitigation measures similar to those listed under Backcountry Management Zones above would decrease these major, adverse impacts.

Commercial Day Hiking
Commercial day hiking is currently allowed on trail segments along the Bright Angel, South Kaibab, North Kaibab, Hermit, Grandview and Tanner trails. Disturbances include displacement of artifacts, alteration of structures, trailing, crowding, limiting access for traditional uses, and waste on site and would continue to be minor to moderate, adverse, regional and short-term.

Commercial Backcountry Vehicle Tours (Tuweep)
Alternative A would allow a maximum of two commercial backcountry vehicle tours to Tuweep per day per operator, which would result in potentially 10 trips per day. Documented disturbances to area ethnographic resources include damage from road use in or adjacent to site boundaries, crowding, and trailing. Ethnographic resources within or adjacent to the road bed are subjected to long-term disturbance from vehicular traffic. Impacts would be minor to moderate, adverse, regional and both short and long-term.

Backcountry Roads, Trails, and Routes
A number of former roadbeds are located adjacent to, or are considered to be ethnographic resources. Under Alternative A, these former roadbeds would remain unmaintained. Current monitoring data shows a range of visitor-related disturbances along these travel corridors including camping, structural modification and artifact displacement, social trailing, and soil compaction and vegetation disturbances. Impacts to ethnographic resources would continue to be minor to major, adverse, regional and both short and long-term.

Tuweep Facilities
Under current management, ethnographic resources in the Tuweep area are showing adverse effects from visitor use and vehicular traffic. There are numerous sites located in the area leading to the overlook and campground. Disturbances from camping and day use include social trailing, artifact displacement, and road and toilet construction in or adjacent to site boundaries. Effects would be minor to moderate, adverse, regional and long-term.

Corridor Zone Camping
Disturbances to ethnographic resources have been recorded as a direct result of camping in the Corridor Zone where camp locations are co-located with ethnographic resources. Camps are intended to direct visitor use away from archaeological deposits in the corridor but do not always result in ethnographic resource protection. Permits provide backcountry users information that helps reduce disturbances to resources near campgrounds. Under Alternative A, impacts would continue to be minor, adverse, regional and long-term.

Deer Creek/Tapeats Complex
There are documented disturbances in these use areas as a result of visitation and camping in ethnographic resource boundaries and by disturbing local plant and animal populations that are important to Traditionally Associated Tribes. Disturbances include artifact displacement and structure modification, barren cores (vegetation loss) within sites from camping, trailing through sites, improper waste disposal and artifact collecting. Under Alternative A, impacts would continue to be minor to moderate, adverse, regional and both short and long-term.

Deer Creek Narrows
Ethnographic resources located in the narrows are disturbed by trailing and vandalism, crowding, inappropriate behaviors on-site and altered access to traditional use locations. The temporary closure remains under annual review as described in the Superintendent's Compendium (NPS 2013g). The

restriction results in effects that would continue to be minor to moderate, beneficial, localized and long-term.

Hance Creek/Cottonwood Creek/ Cremation Use Areas
Continuation of current management includes trails and at-large camps within boundaries of ethnographic resources. Disturbances include social trails, unauthorized artifact collecting, structural modification, human waste disposal, vegetation disturbance, and soil compaction. Under Alternative A, impacts would continue to be minor to moderate, adverse, regional and both long and short-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have the potential to contribute to cumulative impacts on ethnographic resources. Past actions including fire management, maintenance/construction activities, Glen Canyon dam operations, river management and archeological site mitigations have resulted in adverse effects including direct and indirect damage to ethnographic resources from trailing, digging, removal or burial of artifacts and features, fire damage on combustible or fire-sensitive objects. These impacts are major, adverse, and long-term.

Present and foreseeable future actions overlap with some past actions and include fire management, dam operations, North Rim road improvements, and archeological site mitigations. Ground disturbance in several of these projects has prompted mitigation of archaeological sites through excavation, which has an adverse effect on the associated ethnographic resources. Fire management would have adverse impacts from damage on combustible or fire-sensitive objects. Beneficial effects from fire management include eventual return to natural fire processes into the environment. Trail construction activities would also provide beneficial effects through construction that avoids sensitive areas. Beneficial effects to ethnographic resources would be minor to moderate, regional, short and long-term.

Cumulative effects to ethnographic resources from past, present, and reasonable foreseeable future actions discussed above are major, adverse, regional, short and long-term. Alternative A would contribute a medium amount to the adverse effect. Under Section 106, there is an adverse effect to ethnographic resources.

Conclusion
Under Alternative A, minor to major, adverse, regional and both long and short-term impacts would occur from continued use of the backcountry and visitor use disturbances including crowding from large groups, reduced access to resources by the Traditionally Associated Tribes from overuse, trailing, camping on sites and within resource areas, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, vegetation disturbances, disturbances to animals, campfires, inappropriate campsite creation and management, and improper waste management. Beneficial effects result from restrictions at Deer Creek Narrows and ongoing visitor education on trail etiquette and leave no trace camping practices. These impacts are minor to moderate, localized and regional, short and long-term.

Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative A would contribute a medium amount to the adverse impact. Under Section 106, there would be an adverse effect to ethnographic resources.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Climbing Management
As described under Alternative A, climbing has the potential to impact ethnographic resources from unintentional disturbances to wildlife and plants from trailing across sites leading to climbing locations and intentional removal or piling of artifacts can occur. Some climbing locations are located adjacent to

areas where ethnographic resources are located. Under all action alternatives, climbers must identify route on backcountry permit, and motorized drills and anchoring would be prohibited. A permit system would have beneficial effects and enable resource managers to prioritize monitoring and mitigation measures in areas of higher use. These effects would be negligible.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites

Similar beneficial impacts would occur to ethnographic resources from implementation of a day use permit system. Changes in the group size have the potential to reduce disturbances from camping including the creation of barren cores and site disturbances. Any opportunities to reduce the number of visitors and group size in sensitive areas may have a beneficial effect on archaeological resources. These effects would be negligible. Restrictions to protect sensitive resources would reduce the potential for visitor effects at ethnographic resources that are too sensitive or vulnerable to withstand visitation. Any opportunities to reduce the number of visitors and group size in sensitive areas may have a beneficial effect on archaeological resources. These effects would be minor, beneficial, regional and long-term.

Canyoneering Management

Under all action alternatives, group size for this activity would be limited to 6 people per group and overnight permits would indicate which groups are participating in canyoneering. These actions would lessen adverse impacts when compared to Alternative A. Impacts to ethnographic resources would be moderate, adverse, regional, and long-term.

Management Actions Potentially Implemented through Adaptive Management

- Monitoring via day use permit that identifies canyoneering route and access/exit routes
- Use limits for specific locations
- Restrict number of groups by day or season (overnight and day use)
- Change in maximum overnight group size (decrease or increase)
- Seasonal or permanent restrictions for Natural and/or Cultural Resource protection implemented at specific locations to protect sensitive resources including, but not limited, to sensitive wildlife and plant species or archaeological sites

Permit system to track Use Areas would enable resource managers to prioritize monitoring and mitigation measures in areas of higher use. Implementation of a permit system to track use may have a beneficial effect on ethnographic resources. These effects would be negligible, beneficial, long-term, and regional. Limits on the group size and overnight use as well as seasonal restrictions, have the potential to reduce disturbances from camping including the creation of barren cores and archaeological site disturbances at ethnographic resources. Any opportunities to reduce the number of visitors and group size in sensitive areas may have a beneficial effect on archaeological resources. These effects would be minor, beneficial, regional and long-term.

Tuweep Day Use Management

As discussed under Alternative A, impacts to ethnographic resources occur from camping, social trailing, and road or trail construction in or adjacent to site boundaries, and crowding from vehicles and visitors.

These effects would be minor to moderate, adverse, regional, and long-term. Using adaptive management to guide mitigations necessary to address these adverse effects include resource monitoring, data recovery, visitor education related to resource stewardship, tribal values, Leave No Trace practices, and moving the existing toilets outside of archaeological site boundaries. Use restrictions are expected to result in decreasing effects to minor, adverse, regional and short-term.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

A day use permit or reservation system would reduce the potential for overcrowding and therefore the potential for visitors to inadvertently move into ethnographic resource boundaries creating barren cores, ash piles, and camping within sites. Restrictions on the number of vehicles per party to reduce crowding from vehicles at each camp location would reduce inadvertent damage to ethnographic resources from improper parking and driving. Group event designations would reduce crowding at the overlook and camp locations which would protect fragile resources from inadvertent vehicular damage. Any opportunities to reduce the number of visitors and group size in sensitive areas are expected to have a beneficial effect on ethnographic resources. Education and promotion of tribal values and Leave No Trace principles would increase the potential for proper etiquette. Overall, adaptive management actions, would result in minor, beneficial, regional and long-term effects to ethnographic resources.

Use Area Management

Specific actions within Use Areas could impact TCPs and ethnographic resources as described below.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

Decreasing the number of groups at one time in a Use Area would reduce the potential for overcrowding and therefore the potential for visitors to inadvertently move into ethnographic resources boundaries creating barren cores, ash piles, and camping within sites or disturbing important plants and wildlife. Any opportunities to reduce the number of groups in sensitive areas are expected to have a beneficial effect on ethnographic resource. Changing camping designations from at-large to designated sites would reduce the potential for inadvertent damage to ethnographic resources from camping, campfire use, improper waste management and barren core development by containing use to specified areas. Redefining Use Area boundaries would help track use in popular locations such as Deer Creek/Tapeats. This would have the effect of enabling resource managers to prioritize monitoring and mitigation activities in higher Use Areas. Seasonal or permanent closures at specific locations to protect sensitive resources would reduce the potential for visitor effects in ethnographic resources that are too sensitive or vulnerable to withstand visitation. Beneficial impacts from these adaptive management actions would be minor to moderate, regional, and long-term.

Having more dispersed at-large camping would have the potential to cause adverse disturbance to ethnographic resources if improper practices by users occur. Dispersed and increased at-large camping is expected to result in minor to moderate, adverse, regional and long-term impacts.

Human Waste Management
Human waste has been documented as a disturbance in some ethnographic resource locations and is a long-standing problem impacting backcountry resources and visitors. Placement of toilets within or adjacent to ethnographic resource locations is a major impact to the property's integrity by damaging deposits and can disturb native vegetation and wildlife. Cat holes (Foti et al. 2006) adversely affect ethnographic resources through ground disturbance.

Management Actions Potentially Implemented through Adaptive Management

- Replacement of existing toilets at existing sites
- Removal of primitive toilets
- Installation of primitive toilets at other sites
- Seasonal or year-round human waste carry-out requirement for specific areas or zones
- Seasonal or year-round human waste carry-out requirement for all areas or zones

Replacement of existing toilets and the opportunity to move them outside of ethnographic resource boundaries would have the beneficial effect of reducing the impact to site integrity. Removal of toilets would have the beneficial effect of reducing the impact to ethnographic resource locations where toilets occur within site boundaries. Implementation of a solid human waste carry-out system would reduce ground disturbance that occurs from the creation of cat holes. Any opportunity to reduce waste disposal in the backcountry is expected to have a beneficial effect on ethnographic resources. Overall impacts from adaptive management actions would be minor, beneficial, long-term, and regional.

Arizona Trail
As discussed under Alternative A, use of the Arizona Trail has the potential to impact archaeological and ethnographic resources from camping, artifact displacement, improper waste disposal and social trailing. In addition to the impacts from hiking, stock use, and bicycling on the South Rim section of trail, some additional impacts could occur from bicycling and associated camping along the North Rim section of trail. Impacts under all action alternatives would be slightly increased when compared to Alternative A and would be minor to moderate, adverse, regional and long-term.

River-assisted Backcountry Travel (RABT)
Unpermitted use at popular camping locations has resulted in users setting up camp in sensitive and fragile ethnographic resource locations. RABT has had minor to moderate, adverse, regional effects to ethnographic resources along the Colorado River as described under Alternative A. Implementation of mitigations including education and permitting of this activity would improve the ability to manage sites by tracking use by location and focusing condition assessment monitoring in higher use areas as well as teaching visitors proper site etiquette. Future group size limits may reduce the amount of disturbance to ethnographic resources from social trailing through areas enroute to other destinations. Any opportunities to reduce the number of groups in sensitive areas are expected to have a beneficial effect on ethnographic resource. These actions could reduce adverse effects to negligible.

Administrative Use
Administrative use would have the same impacts described in Alternative A. Adverse impacts from maintenance activities and associated loss of site matrix, disturbance to plant communities and soils, and displacement or destruction of artifacts and features would be minor to major, regional and both short and long-term. Mitigation measures to avoid major, adverse impacts would be implemented to reduce these

impacts. Beneficial impacts would from stabilization of ethnographic resources or trail construction to avoid disturbances to ethnographic resources and deposits would be minor to moderate, beneficial, short and long-term, and regional.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
The maximum group size limit for Corridor and Threshold Zone would be 11 people (both large and small groups allowed). Primitive and Wild Zone use limits would be capped at six people (small groups only). Site documentation and assessments discussed in Alternative A show a variety of disturbances occur in and around campsites. Impacts include vegetation damage, litter and trailing. Because there is documentation to suggest that larger groups have larger impact (NPS 2005a), limiting group size in two of the management zones would have decreased impacts when compared to Alternative A. However, because the actual number of permits would remain the same as current (Alternative A) impacts would be minor to moderate, adverse, regional and short-term. Mitigation measures similar to those listed under Backcountry Management Zones in Alternative A above would decrease these major, adverse impacts.

River-assisted Backcountry Travel
Alternative B RABT would be managed through the establishment of 31 sections of the river delineated by river mile. Change in management of this activity by river section would not change the impacts of the activity. Therefore, impacts would be minor, adverse, and regional from camping in and near ethnographic resources, and minor, beneficial, long-term and regional from permit requirements and increased education.

Commercial Overnight Backpacking
Commercially guided overnight backpacking trips would be authorized through concession contracts and a limited number of CUAs. As discussed in Common to all Alternatives, commercial guides would be required to adhere to specific environmental protection requirements and resource stewardship training (Appendix F). It is expected that these requirements would benefit the visitors seeking guided trips as well as enhance resource stewardship. Commercial use, when compared to overall use, would be similar to Alternative A; however it would not be allowed in Wild Zone use areas and limited to specific Primitive Zone use areas, including some with historic structures. Impacts from overnight use would be similar to impacts described for Alternative B, Maximum Group Size. Commercial use limitations under Alternative B would result in minor to moderate adverse, regional and long-term impacts from overall use, and minor beneficial, localize and regional, long-term effects from guide training and educational requirements.

Commercial Day Hiking
Under Alternative B, commercial companies would be allowed to guide clients to specified locations on Bright Angel, South and North Kaibab, and Hermit, Grandview and Tanner Trails (similar to the recommended destinations described in Alternative A), however the turn-around points would be and reduce the adverse effects to ethnographic resources as discussed under Alternative A. Impacts from disturbances to ethnographic resources would be minor to moderate, adverse, regional, and long-term.

Education and promotion of tribal values documentation would increase the potential for proper etiquette and behavior at ethnographic resources. These effects would be negligible to minor, beneficial, long-term, and regional and would reduce the adverse impacts to minor.

Commercial Backcountry Vehicle Tours (Tuweep)
Commercial tours would be limited to a total of two per day. Effects to ethnographic resources include damage from road use, crowding, trailing across the landscape and vegetation disturbances. Archaeological features in the area have also been disturbed. Under Alternative B, impacts would be slightly less than A due to the reduction in commercial tours and would result in minor, adverse, regional, and both short and long-term impacts to ethnographic resources.

Backcountry Roads, Trails, and Routes
Under Alternative B, approximately 30 miles of former roads would be converted to Class 1 Wilderness trails (route often indistinct, requiring route finding and minimal improvements), and the Eremita Mesa Trail would continue to be an unmaintained route as in Alternative A . Each of these roads/trails are located along or pass through ethnographic resources of importance. Minor, long-term, localized, beneficial effects to archaeological resources would result from retaining Eremita Mesa Trail as an unmaintained route which may passively limit use along the alignment and would result in minor, beneficial, regional, and long-term effects on ethnographic resources.

Activities necessary to maintain Cape Solitude, Tiyo Point, Francois Matthes Point, and Walhalla Glades routes may result in minor to moderate, adverse, regional, short and long-term effects to ethnographic resources as a result of trail maintenance and visitor use where these routes pass through culturally sensitive areas.

Tuweep Facilities
Alternative B would move the Toroweap Overlook parking close to the campground as recommended in the 1995 GMP and convert Vulcan's Throne Road to trail using the existing area at the junction with main road as a parking and turn-around area. Moving the overlook parking area to the campground would require careful planning to avoid disturbing ethnographic resources. Other actions under this element would result in no adverse effects to ethnographic resources. Impacts of moving the parking area and converting road to trail would be minor to moderate, beneficial, regional, and short to long-term.

Corridor Zone Camping
Alternative B would add up to four small group sites at Cottonwood (increase from 11 to 15). As described in Alternative A, disturbances to ethnographic resources have been recorded as a direct result of camping in the Corridor Zone where camp locations are co-located with ethnographic resources. Impacts would be the same as Alternative A and would be minor, adverse, regional and long-term.

Deer Creek/Tapeats Creek Complex
Alternative B would reduce the total number of groups for these Use Areas compared to Alternative A, and convert large groups to all small groups. These Use Areas are highly desirable and could frequently result in visitors off itinerary. Impacts to ethnographic resources include backcountry toilets, trails, and campsites located in culturally sensitive areas. Reduction in the number of people per night would result in reduced adverse impacts when compared to Alternative A. Impacts would be minor, adverse, regional and both short and long-term.

Deer Creek Narrows
Under Alternative B, a permanent restriction would be implemented for the Deer Creek Narrows as described in the Superintendent's Compendium (NPS 2013g) and increased visitor education would occur regarding the importance of this location to the park's Traditionally Associated Tribes, appropriate site

behavior. Impacts to ethnographic resources from this permanent restriction would be major, beneficial, localized, and long-term.

Hance Creek/Cottonwood Creek/Cremation Use Areas
Alternative B would continue Primitive Zone management, however, only small groups would be allowed in each use area. Impacts such as crowding, inappropriate behavior, trails and campsites, unauthorized artifact collection, structural modification, and soil compaction at ethnographic resources in these areas would be reduced from the decrease in users and would result in minor, adverse, regional and long-term impacts to ethnographic resources

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional, short and long-term.

Cumulatively, the effects of Alternative B on ethnographic resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional, short and long-term. Alternative B would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to ethnographic resources.

Conclusion
Under Alternative B and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management.

Beneficial effects would result from reductions in group size in the Primitive and Wild Zone, closures of culturally sensitive areas, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources.

Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative B would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Similar to Alternative A, the maximum group size limit for all management zones would be 11; therefore impacts would be the same as Alternative A, moderate to major, adverse, regional and short term.

River-assisted Backcountry Travel
Alternative C, RABT would be managed through the establishment of 11 sections of the river delineated by river mile. Change in management of this activity by river section would not change the impacts of the activity. Therefore, impact would be minor, adverse, and regional from camping in and near ethnographic resources, and minor, beneficial, long-term and regional from permit requirements and increased education.

Commercial Overnight Backpacking
Commercially guided overnight backpacking trips would be authorized through contracts and limited number of CUAs. Commercial use levels are highest under Alternative C (10%) and increase in Threshold and Primitive Zone use areas compared to Alternative A, and more commercial trips would have access to areas with ethnographic resources. Impacts from overnight use would be similar to impacts described for Alternative A, Maximum Group Size. As discussed in Common to all Alternatives, commercial guides would be required to adhere to specific environmental protection requirements and resource stewardship training (Appendix F). It is expected that these requirements would benefit the visitors seeking guided trips as well as enhance resource stewardship. Commercial use limitations under Alternative C would result in moderate, adverse, regional and long-term impacts from overall use and minor beneficial, localized and regional, long-term effects from guide training and educational requirements.

Commercial Day Hiking
Under Alternative C, commercial hiking would be allowed to Indian Gardens and Skeleton Point in addition to those specified locations described in Alternative A. Because these additional locations occur in high use areas, it is unlikely that they would result in additional impacts. Impacts would be the same as Alternative A and B and would be minor to moderate, adverse, regional, long-term effects to ethnographic resources.

Commercial Backcountry Vehicle Tours (Tuweep)
Up to three tours per day Monday-Friday and two tours per day on Saturday and Sunday would occur under Alternative C. Effects to ethnographic resources include damage from road use, crowding, trailing across the landscape and vegetation disturbances. Archaeological features in the area have also been disturbed. It is expected that impacts would be similar to Alternative A and would be minor to moderate, adverse, regional, and short and long-term.

Backcountry Roads, Trails, and Routes
Alternative C would manage Eremita Mesa, Cape Solitude, Francois Matthes Point, Komo, and Walhalla Glades routes as Class I Wilderness trails. Tiyo Point would be managed as a Class 4 trail suitable for stock use. The Boundary Road and Pasture Wash would be open to vehicle and bicycle access to the South Bass Trailhead. All of these old and current roadbeds are located adjacent to, or pass through ethnographic resources. Ground disturbing activities necessary to develop and maintain the Class 1 and Class 4 trails would result in minor to moderate, adverse impacts; and the Boundary Road development and maintenance would result in moderate to major impacts adverse impacts; all are regional, short and long-term effects.

Tuweep Facilities
Similar to Alternative A, the parking at Toroweap Overlook would remain in its current location, and therefore the impacts to ethnographic resources would be the same as Alternative A; minor to moderate, adverse, localized and long-term.

Corridor Zone Camping
Alternative C would add one large group site (increase from one to two) and four small group sites (increase from 11 to 15) to Cottonwood Campground and two small group sites at Roaring Springs day use area. As described in Alternative A, disturbances to ethnographic resources have been recorded as a direct result of camping in the Corridor Zone where camp locations are co-located with ethnographic resources, therefore, impacts would be minor, adverse, regional and long-term.

Deer Creek/Tapeats Creek Complex
Alternative C would reduce the total number of groups in the complex from 12 to 11. Overnight backpacking in these areas is highly desirable but visitors are often off itinerary. Impacts to ethnographic resources include backcountry toilets, trails, and campsites located in culturally sensitive areas. Reduction in the number of people per night would result in reduced adverse impacts when compared to Alternative A. Impacts would be minor, adverse, regional and both short and long-term.

Deer Creek Narrows
Under Alternative C, access to the Narrows would be allowed. Ethnographic resources located in the narrows are disturbed by trailing and vandalism, crowding, inappropriate behaviors on-site and altered access to traditional use locations. Continuing use of the narrows for rappelling and climbing would result in effects that are moderate to major, adverse, localized, and long-term.

Hance Creek/Cottonwood Creek/Cremation Use Areas
Alternative C would convert Hance Creek and Cottonwood Creek Use Areas from Primitive to Threshold Zone, and a designated site would be established in Cremation Use Area adjacent to the Corridor Zone. This would allow for consideration of toilets and designated camping areas. Impacts from social trails, unauthorized artifact collecting, structural modification, human waste disposal, illegal fires, vegetation disturbance and soil compaction could increase compared to current use. Toilet placement would have to be carefully considered to avoid effects to archaeological sites from ground disturbance associated with toilet installation and from trails accessing toilet locations. However, established campsites and toilet facilities could result in minor to moderate, beneficial, regional, short and long-term effects to ethnographic resources because there would be less cat holes created for human waste and fewer at-large barren core areas. Overall impacts would be minor to moderate, adverse, regional, and short and long-term.

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional, short and long-term.

Cumulatively, the effects of Alternative C on ethnographic resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional, short and long-term. Alternative C would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to ethnographic resources.

Conclusion
Under Alternative C and elements common to all action alternatives, minor to major, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, road maintenance, inappropriate campsite creation and management, and improper waste management.

Beneficial effects would result from reductions in group size for canyoneering groups, establishment of campsites outside of boundaries of ethnographic resources and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to moderate, localized and regional, long-term beneficial effects to ethnographic resources.

Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative C would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative D, both large and small groups would continue to be allowed in the Corridor Zone. Group size would be reduced in the Threshold, Primitive, and Wild Zone where only small groups (1-6 people) would be allowed. Disturbances to ethnographic resources would be similar to those described in other alternatives, but would be reduced because of the overall reduction in overnight use due to the elimination of large groups in the Threshold, Primitive, and Wild Zones. Effects would be minor, adverse, regional and short and long-term.

River-assisted Backcountry Travel

For this alternative, RABT would be managed through an 11-mile limit on river travel. Change in management of this activity by river section would not change the impacts of the activity. Therefore, impact would be minor, adverse, and regional from camping in and near ethnographic resources, and minor, beneficial, long-term and regional from permit requirements and increased education.

Commercial Overnight Backpacking

Commercial use would be limited to the Corridor Zone, and is expected to be 10.2% of the total overnight use. With commercial backpacking limited to designated campsites, it is expected that there would be reduced adverse impacts compared to at-large camping use areas. The guide training requirements (Appendix F) would improve resource stewardship in the Corridor; however it may be lacking in other use areas with ethnographic resources. These impacts would be minor, adverse, regional and long-term.

Commercial Day Hiking

Commercial day hiking would also be limited to the Corridor Zone. Limiting commercial hiking to the Corridor Zone would protect archaeological sites and ethnographic resources in other zones from unintended impacts from this activity. Some adverse impacts could occur in the Corridor Zone, but these would be minor, adverse, localized, and short and long-term. Education and promotion of tribal values would increase the potential for proper etiquette and behavior at ethnographic resources and would result in minor, beneficial, long-term, and regional impacts.

Commercial Backcountry Vehicle Tours (Tuweep)

One trip per day would be allowed if a commercial stock trip was not being conducted. Effects to ethnographic resources include damage from road use, crowding, trailing across the landscape and vegetation disturbances. The reduction in commercial groups per day would result in minor, adverse, regional and short-term impacts to ethnographic resources.

Backcountry Roads, Trails, and Routes

Under Alternative D, former roadbeds would be managed as untrailed areas and these areas would continue to recover naturally. Retaining unmaintained routes in low use areas are expected to have minor to moderate, beneficial regional, long-term effects to ethnographic resources because areas would be allowed to recover naturally.

Tuweep Facilities

Similar to Alternative B, the Toroweap Overlook parking would be moved close to the campground as recommended in the 1995 GMP and converting the Vulcan's Throne road to trail; therefore, impacts would be the same as Alternative B, minor to moderate, beneficial, regional, and short to long-term.

Corridor Zone Camping
Alternative D would add up to two small group sites at Cottonwood Campground (increase from 11 to 13). Disturbances to ethnographic resources have been recorded as a direct result of camping in the Corridor Zone where camp locations are co-located with ethnographic resources. Impacts would be the same as Alternative A and would be minor, adverse, regional and long-term.

Deer Creek/Tapeats Complex
Alternative D would reduce the total number of groups for these Use Areas from 12 to eight, convert large groups to small groups in the area. Impacts to ethnographic resources include backcountry toilets, trails, and campsites located in culturally sensitive areas. Reduction in the number of people per night would result in reduced adverse impacts when compared to all other alternatives. Impacts would be minor, adverse, regional and both short and long-term.

Deer Creek Narrows
Under Alternative D, a permanent restriction would be implemented for the Deer Creek Narrows and further restriction allow only one river trip at a time to visit The Patio. The site restrictions would further protect the culturally sensitive areas. Combined with visitor education regarding the importance of this location to the park's Traditionally Associated Tribes and appropriate site behavior would result in major, beneficial, localized, and long-term effects to ethnographic resources.

Hance Creek/Cottonwood Creek/Cremation Use Areas
Similar to Alternative B, only small groups would be allowed in these use areas, therefore, impacts would be the same as Alternative B, minor, adverse, regional and long-term impacts to ethnographic resources.

Cumulative Impacts
Past, present and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A; major, adverse, regional, short and long-term.

Cumulatively, the effects of Alternative D on ethnographic resources, when combined with the other past, present and reasonably foreseeable actions would be major, adverse, regional, short and long-term. Alternative D would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to ethnographic resources.

Conclusion
Under Alternative D and elements common to all action alternatives, minor to moderate, adverse, regional, long and short-term impacts would result from use of the backcountry and visitor use disturbances from small and large groups including crowding, reduced access to resources by the Traditionally Associated tribes from overuse, social trailing, camping on culturally sensitive sites, modification of artifacts and structures, unauthorized collecting of artifacts, vandalism, graffiti, campfires, inappropriate campsite creation and management, and improper waste management.

Beneficial effects would result from reductions in group size in the Threshold, Primitive and Wild Zone, closures of culturally sensitive areas, retaining unmaintained routes and allowing old roadbeds to naturally recover, and implementation of other mitigation measures that promote preservation of ethnographic resource and tribal values. These effects would be minor to major, localized and regional, long-term beneficial effects to ethnographic resources.

Cumulative impacts would be major, adverse, regional, short and long-term of which Alternative D would contribute a small amount. Under Section 106 there would be an adverse effect to ethnographic resources.

Cultural Landscapes

ISSUES

Issues related to cultural landscapes identified through public and internal scoping include

- Visitor access can disturb landscape features, and natural processes. Viewsheds and soundscapes can be adversely affected by visitation and may diminish intangible values of a cultural landscape area. Many features of the Cross-canyon Corridor Cultural Landscape are used by visitors to the park and maintaining the character of these features is important
- Camping in the Cross-canyon Corridor Cultural Landscape may affect the character of the corridor by degrading vegetated areas by trailing (social trails) between locations, using illegal campfires, depositing human waste and trash inappropriately
- Large group size at camps and attraction areas has greater potential to inadvertently disturb the character and feeling of the Cross-canyon Corridor Cultural Landscape. Facility addition (new campsites and/or facilities) in the Cross-canyon Corridor has the potential to cause adverse effects to the Cross-canyon Corridor cultural landscape by introducing potentially incompatible features into the corridor, and increasing the number of campsites in certain areas my cause impacts to the landscape.
- Maintenance activities on historic trails including improvement, new construction, and maintenance of existing infrastructure may lead to removal of historic features. Maintenance activities may disturb Cross-canyon Corridor feature elements located in or adjacent to trails and may add incompatible features into the corridor which could result in diminishing the NRHP eligibility of such properties

DESIRED CONDITIONS

Cultural landscapes are managed to preserve significant physical attributes, biotic systems, and historic use patterns in the design and adaptive reuse of historic districts and landscape areas. Treatment decisions are based on a cultural landscape's historical significance over time, existing conditions, and use. Treatment decisions consider both natural and built characteristics and features of a landscape, dynamics inherent in natural processes and continued use, and concerns of traditionally associated peoples. Cultural landscapes maintained in current conditions or improved (NPS 2006).

METHODOLOGY

As defined in the National Park Service Management Policies (NPS 2006), cultural landscapes are settings that humans create in the natural world. They are intertwined patterns of things both natural and constructed, expressions of human manipulation and adaptation to the land. The Grand Canyon backcountry currently contains only one defined cultural landscape area, the Cross-canyon Corridor Cultural Landscape (Logan Simpson Design 2013). Cultural landscapes are a property type of the NRHP.

Characteristics of the Cross-canyon Corridor Cultural Landscape includes land uses and activities, patterns of spatial organization, response to the natural environment, cultural traditions, circulation networks, vegetation, buildings, structures, and features. Understanding effects of the BCMP Alternatives on the cultural landscape is crucial to the resource's long-term preservation.

In accordance with the Advisory Council on Historic Preservation's regulations for implementation of §106 (36 CFR Part 800, Protection of Historic Properties), effects of Alternatives were identified and evaluated by first identifying the Area of Potential Effect (APE) and by reviewing the Cultural Landscape inventory (National Park Service Cultural Landscapes Database).

Formal documentation of the cultural landscape occurred between 2009 and 2011 (Logan Simpson Design 2013). The individual area components of this cultural landscape are extensive and include ten landscape areas. These landscape areas include the district (entire Cross-canyon corridor), sites, buildings, objects, circulation patterns, vistas, vegetation, small landscape features and other character-defining elements that were present during the landscape's period of significance (1890-1942).

- Bright Angel Trail Landscape Area
- Indian Garden Landscape Area
- Colorado River Trail Landscape Area
- Phantom Ranch Landscape Area
- South Kaibab Trail Landscape Area
- Yaki Point (South Kaibab Trailhead) Landscape Area
- North Kaibab Trail Landscape Area
- Bright Angel Campground Landscape Area
- Cottonwood Campground Landscape Area
- Roaring Springs Landscape Area

Subsequent monitoring data includes site condition and recorded disturbance mechanisms of human and non-human origin by Grand Canyon staff. While non-human effects (i.e., water erosion) can be exacerbated by human disturbance agents, non-human effects were not considered in analysis because they are not predictable.

INTENSITY DEFINITIONS

Effects specific to cultural landscapes are characterized for each alternative based on the intensity definitions presented below. The intensity definitions incorporate a NHPA Section 106 determination of effect for cultural landscapes.

Intensity

Negligible There would be no measureable change. Depletion or displacement of elements of integrity would be barely perceptible. Under Section 106 there would be no adverse effect.

Minor Adverse: Effects would be detectable but overall character defining patterns or features of cultural landscapes listed on or eligible for NRHP would not be diminished. Under Section 106 there would be no adverse effect.

Beneficial: Effects would be measurable and localized, resulting in increased stability to character defining features. Under Section 106 there would be no adverse effect.

Moderate Adverse: Effects would alter character defining patterns or features of the landscape without diminishing overall integrity or jeopardizing NRHP eligibility. Under Section 106 there would be an adverse effect.

Beneficial: Effects would be measurable resulting in increased stability to character-defining features. Under Section 106 there would be no adverse effect.

Major Adverse: Effects would alter character defining patterns or features to an extent no longer eligible for NRHP listing. Under Section 106 there would be an adverse effect[54].

Beneficial: Effects would be measurable resulting in increased stability to character-defining features. Under Section 106 there would be no adverse effect.

Context

Localized Effects occur in the boundaries of a specific cultural landscape area.

Regional Effects occur across multiple cultural landscape areas.

Duration

Short-term Impact that within five years are no longer detectable mitigated to pre-disturbance condition or appearance. Example: restore vegetation according a to a cultural landscape's treatment standards.

Long-term Impact results in a change to condition where mitigation would not result in returning location to pre-disturbance condition or appearance. Example: landscape alteration not in keeping with the treatment plan developed for the landscape area. For beneficial, impacts last longer than five years.

ASSUMPTIONS

Assumptions specifically related to the Alternatives and their effects on the Cross-canyon Corridor Cultural Landscape are a result of condition monitoring (Grand Canyon site files and records). Documentation of disturbances and treatment recommendations are found in the National Park Service Cultural Landscape Program Guidance (NPS 2013j), the Cross-canyon Corridor Cultural Landscape Inventory and National Register nomination (Logan Simpson Design 2013), the LCS Database (http://www.hscl.cr.nps.gov/insidenps/summary.asp), and Grand Canyon Archaeology lab photographic records. Photographic documentation and long-term replication of photographs show change through time, disturbances, and the effects of visitation. Assumptions specifically related to Alternatives and their effects on the Cross-canyon Corridor Cultural Landscape are:

- The most frequently disturbed aspects of integrity that may affect NRHP eligibility are materials, workmanship, design setting, feeling, and association
- Continued use of the Cross-canyon Corridor Cultural Landscape elements including trails, rest areas, campsites, and facilities (e.g., toilets) increases the likelihood of adverse effects from direct effects from trail maintenance activities, from maintaining facilities and infrastructure located within the corridor, and from social trailing between camps, water sources, toilet locations, or attraction sites
- Recreational use such as extended day hiking and running within the Cross-canyon Corridor Cultural Landscape may affect site integrity by developing trails between locations, using illegal campfires, depositing human waste and trash. Large group size both at camp and attraction area has greater potential to inadvertently disturb contributing landscape features
- The greater the number of user days (total number of people/year), the greater the likelihood of degrading Cross-canyon Corridor Cultural Landscape elements when such features are located in or adjacent to camp areas or attraction sites in locations that receive hiker use (day and/or overnight users)

[54] If adverse effect determination, a Programmatic Agreement or Memorandum of Agreement would be executed among the NPS, applicable state or tribal historic preservation offices and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFS 800.6(b) before the ROD for this EIS is signed.

- The Cross-canyon Corridor Cultural Landscape Corridor shows higher levels of disturbance because of easier access via roads and trails and higher use levels in this zone than other backcountry locations. These factors result in higher visitor numbers
- Large groups have potential to cause more effects to the Cross-canyon Corridor Cultural Landscape Corridor (NPS 2005a)
- Concessioner/NPS partnerships may lead to increased resource stewardship as NPS resource staff work to educate guides on best practices

IMPACT ANALYSIS

The most noticeable effect to the Cross-canyon Corridor Cultural Landscape would be from continued visitation to the corridor and visitor use effects such as social trail development, vegetation disturbance, and improper human waste disposal. Human waste is a significant problem that is exacerbated during spring, summer, and fall heavy use periods. Other impacts include disturbances to the Cross-canyon Corridor Cultural Landscape through the addition of non-compatible materials and removal of some character-defining elements of the district.

ALTERNATIVE A

Extended Day Hiking and Running Management

This activity takes place on established trails in the Cross-canyon Corridor, and is currently unregulated under Alternative A. The Cross-canyon Corridor's cultural landscape incorporates the setting and feeling of this rustic and unique environment. While there is the expectation of seeing other users and commercial activities in the Corridor, the current level of use and group size are inconsistent with cultural landscape designation. Large group size may adversely impact setting and feeling. Backlund and others (2006) report certain conditions, such as the number of group encounters or behavior of other users detracts from hiker satisfaction. Continuation of current management would result in minor to moderate adverse, localized, and short-term impacts to cultural landscapes.

The NPS has initiated outreach to better educate Cross-canyon Corridor users regarding appropriate trail etiquette procedures, human waste disposal practices, and Leave No Trace ethics. These activities could result in minor, beneficial, localized, and short-term effects to cultural landscapes.

Human Waste Management

High levels of day and overnight use often results in improper human waste disposal within the Cross-canyon Corridor Cultural Landscape area. Restroom facilities within the Corridor are not able to handle the amount of waste disposal that occurs during some days in the spring and fall when extending day hiking and running activities are at their peak. Impacts include human waste and toilet paper deposited along trails, adjacent to rest areas, on the grounds around Phantom Ranch and around other developed sites. Continuation of current management would result in minor to moderate adverse, localized short-term effects to cultural landscapes. Recent activities by the NPS to educate users about proper human waste disposal practices, along with Leave No trace principals has resulted in minor beneficial, localized, and short-term effects to cultural landscapes.

Arizona Trail

The Arizona Trail traverses the inner canyon using the North and South Kaibab Trails within the Cross-canyon Corridor Cultural Landscape. Effects would be similar to other forms of overnight use within the corridor such as social trailing and vegetation disturbance. Continuation of current management of AZ Trail use would result in negligible to minor adverse, localized and short and long-term impacts to cultural landscapes.

NPS and Cooperative Association Programs (Non-Commercial Services)
Under Alternative A, non-commercially guided services include NPS participation and encourage resource stewardship learning among participants. These training sessions are backpacking trips where Leave No Trace ethics can be emphasized. GCFI and NPS-led environmental education classes must obtain a backcountry permit for overnight use and must camp in established campgrounds. Continuation of current management would result in negligible to minor adverse, localized, short and long-term effects to the Cross-canyon Corridor Cultural Landscape as a result of vegetation disturbance from social trails. Resource stewardship messaging that occurs with these classes can be minor beneficial, localized, and short-term.

Maximum Group Size for Overnight Backpacking by Zone
Under current management, the maximum group size is 11 persons. Rapid site inventories (Foti et al. 2006) have shown a variety of disturbances occurring at campsite locations. Extremely impacted campsites tend to have large barren core areas and show vegetation damage, social trailing, and litter and human waste within the camp areas. However, many of these disturbances have not been documented within the Cross-canyon Corridor Cultural Landscape as a result of overnight camping. Vegetation in the designated camp areas is maintained through park programs and volunteer efforts. Restroom facilities are present and address human waste issues. Littering has occurred from parties who fail to carryout trash and camping gear. Social trails have been documented in some areas that result from travel between locations and cause soil compaction and vegetation loss. Continuation of current management would result in minor, adverse, regional and short-term effects to cultural landscape areas.

Commercial Overnight Backpacking
Commercial backpacking is permitted in the same manner as non-commercial backpacking, and currently approximately 9% of Corridor Zone use is commercial. Impacts to the Cross-canyon Corridor Cultural Landscape are similar to those noted for the section Maximum Group Size for Overnight Backpacking by Zone. Continuation of current management would result in minor, adverse, regional short-term effects to cultural landscapes.

Commercial Day Hiking
Under current management, commercial day hiking is authorized by CUA and maximum group size is 11 including guides. Commercial hiking within the Cross-canyon Corridor Cultural Landscape area includes segments of the trail and landscape areas such as the Three-mile Bright Angel Trail Resthouse and Cedar Ridge. While impacts are the same as unregulated day hiking use; authorized commercial use includes requirements for waste management. Continuation of current management would result in negligible minor to adverse, localized and regional short-term effects to cultural landscapes.

Corridor Zone Camping
Under current management, Corridor Zone campgrounds allow for a total of 57 small groups and 4 large groups. Bright Angel campground allows 31 small and 2 large groups, Cottonwood Campground allows 11 small and one large group, and Indian Garden allows 15 small and 1 large groups. Impacts from overnight use at designated campgrounds are described elsewhere in this section and include social trailing, vegetation damage, soil compaction, litter and improper human waste disposal (Foti et al. 2006). Continuation of current management would result in minor, adverse, localized and short-term effects to cultural landscapes.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (Table 4.1) have the potential to contribute to cumulative impacts on cultural landscapes. Past actions including fire management, construction and maintenance activities and non-native plant grow have resulted in adverse effects including direct and indirect damage to these resources through trailing, ground disturbance, dismantling of constructed

features of the Cross-canyon Corridor Cultural Landscape, and non-native plant growth. These impacts are minor to moderate, adverse and long-term.

Present and foreseeable future actions overlap with some past actions and include unauthorized maintenance activities (trails and buildings), the addition of non-compatible features and objects, and the replacement of the transcanyon pipeline. Unauthorized maintenance activities can diminish the integrity of character-defining features of structures, buildings and trails, and the addition of non-compatible features and objects into the landscape such as plastic signs and benches made from plastics would continue to result in minor to moderate, adverse, localized, short and long-term impacts to cultural landscapes.

Cumulative effects to cultural landscapes from past, present, and reasonably foreseeable future actions discussed above are moderate, adverse, localized, short and long-term. Alternative A would contribute a medium amount to the adverse impacts. Under Section 106 there would be an adverse effect to cultural landscapes.

Conclusion
Under Alternative A, minor to moderate, adverse, localized and regional, short and long-terms impacts to the Cross-canyon Corridor Cultural Landscape would result from visitor use disturbances including crowding, reduced access to park resources from overuse, trailing, and improper waste management.

Cumulative impacts would be moderate, adverse, localized and regional, short and long-term, of which Alternative A would contribute a medium amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Many of the Common to All Action Alternative elements would not have an effect on the Cross-canyon Corridor Cultural Landscape. In some instances minor to moderate, localized effects to features of the landscape have been noted as a result of some recreational activities which could continue under the actions proposed for the BCMP.

Extended Day Hiking and Running Management
This activity would continue to take place on established trails in the Cross-canyon Corridor Cultural Landscape. Hikers and runners would be required to obtain a day use permit for the trails segments shown in Map 2.6. Day use permits would include data collection and educational messaging to address trail etiquette, and human waste disposal, resulting in minor, beneficial, localized, and long-term effects to the cultural landscape in keeping with the area's rustic character, setting and feeling.

Actions potentially implemented in the future through adaptive management would include group size limits, daily use limits, and/or designated days for group events. Limits on overall day use would result in beneficial effects to the cultural landscape by reducing crowding at Phantom Ranch and other areas, and reduce the improper disposal of human waste and littering. Overall effects of daily use limits including group size would result in minor to moderate, beneficial, localized, short and long-term impacts to cultural landscapes.

Human Waste Management
Under adaptive management, toilets could be added or replaced. Addition of facilities would generally have an adverse effect on the landscape; however proper citing and design would mitigate the adverse effects. The removal of non-compatible toilet facilities and replacement of compatible facilities would have negligible to minor adverse, localized long-term impacts to cultural landscapes.

Arizona Trail
Overall impacts from Arizona Trail use would be the same as Alternative A. General effects from overnight use include social trailing and vegetation disturbance, resulting in negligible to minor adverse, localized and short and long-term impacts to cultural landscapes.

NPS and Cooperative Association Programs and Commercial Services
Under actions common to all alternatives, permitted operators including GCFI guides would be required to adhere to regulations and requirements including safety training and environmental education (Appendix F). Guide training and resource stewardship messaging would help reduce social trailing and vegetation disturbance of cultural landscapes, and would result in minor beneficial, localized, short term impacts to the management of cultural landscapes.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B
Maximum Group Size for Overnight Backpacking by Zone
Similar to Alternative A, the maximum group size limit for Corridor Zone would be 11; therefore impacts would be the same as Alternative A, minor, adverse, regional and short term.

Commercial Overnight Backpacking
Commercially guided overnight backpacking trips would be authorized through concession contracts and a limited number of CUAs. As discussed in Common to all Alternatives, commercial guides would be required to adhere to specific environmental protection requirements and resource stewardship training (Appendix F). It is expected that these requirements would benefit the visitors seeking guided trips as well as enhance resource stewardship. Compared to Alternative A, commercial use would increase from 9% to approximately 12% of the overall use in the corridor campgrounds. Impacts from overnight use would be similar to impacts described for Alternative A, Maximum Group Size. A slight increase in commercially guided trips would result in minor, beneficial, localized and regional, short-term effects to cultural landscapes.

Commercial Day Hiking
Management of commercial day hiking within the Cross-canyon Corridor Cultural Landscape would be the same as Alternative A, therefore impacts would be the same as Alternative A; negligible to minor, adverse, localized and regional, and short term. Beneficial effects would result from applicable guide requirements (Appendix F) that promote resource stewardship.

Corridor Zone Camping
Under Alternative B, there would be up to four small group sites at Cottonwood (increase from 11 to 15). Campsites at Bright Angel and Indian Gardens would remain the same as Alternative A. The addition of four small campsites has potential to impact visitor use circulation and vegetation, and would result in minor, adverse, localized, and long-term, effects to the Cross-canyon Corridor Cultural Landscape. Mitigations such as adding native vegetation to obscure the view of any new campsites so they are not visible from the North Kaibab Trail would result in minor beneficial, localized, long-term effects.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A, moderate, adverse, localized, short and long-term.

Cumulatively, the effects of Alternative B on cultural landscapes, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative B would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to cultural landscapes but at a lower intensity than Alternative A.

Conclusion
Under Alternative B and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative B would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape at a lower intensity than Alternative A.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Similar to Alternative A, the maximum group size limit for Corridor Zone would be 11; therefore impacts would be the same as Alternative A, minor, adverse, regional and short term.

Commercial Overnight Backpacking
Similar to Alternative B, commercially guided overnight backpacking trips would be authorized through contracts and limited number of CUAs. Commercial use levels under Alternative C (10%) would be most similar to Alternative A. Impacts from overnight use would be similar to impacts described for Alternative A, Maximum Group Size. Because of the guide training requirements and regulations, (Appendix F); effects to cultural landscapes would result in negligible to minor, beneficial, localized and regional, short-term effects to cultural landscapes.

Commercial Day Hiking
In addition to trail segments and destinations described in Alternative A, commercial hiking would be allowed on the Bright Angel Trail to Indian Gardens and South Kaibab Trail to Skeleton Point. This would increase the potential adverse effect to cultural landscapes in two landscape areas resulting in minor, adverse, localized and regional, short-term effects to cultural landscapes. Beneficial effects would result from applicable guide requirements (Appendix F) that promote resource stewardship.

Corridor Zone Camping
Under Alternative C, there would be an addition of one large and four small group sites at Cottonwood (increase from 11 to 15), on small group site at Indian Garden, and two additional sites at Roaring Springs day use area. The number of campsites at Bright Angel would remain the same as Alternative A. The number of new campsites at Cottonwood and Indian Garden, along with new disturbances at the day use area would result in minor to moderate adverse, localized, long-term, effects to the Cross-canyon Corridor Cultural Landscape. Mitigations such as adding native vegetation to obscure the view of any new campsites so they are not visible from the North Kaibab Trail would result in minor beneficial, localized, long-term effects.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A, moderate, adverse, localized and regional, short and long-term.

Cumulatively, the effects of Alternative C on cultural landscapes, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative C would contribute a medium amount to this adverse effect. Under Section 106 there would be an adverse effect to cultural landscapes equivalent to Alternative A.

Conclusion
Under Alternative C and elements common to all action alternatives, minor to moderate, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative C would contribute a medium amount. Under Section 106 there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Similar to Alternative A, the maximum group size limit for Corridor Zone would be 11; therefore impacts would be the same as Alternative A, minor, adverse, regional and short term.

Commercial Overnight Backpacking
Similar to Alternatives B and C, commercially guided overnight backpacking trips would be authorized through concession contracts and a limited number of CUAs. Commercial use would only be permitted in the Cross-canyon Corridor Cultural Landscape, and would be approximately 17% of overall Corridor use compared to 9% to 12% in other action alternatives. Impacts from overnight use would be similar to impacts described for Alternative A, Maximum Group Size. Because of the guide training requirements and regulations, (Appendix F); effects to cultural landscapes would result in minor, beneficial, localized and regional, short-term effects to cultural landscapes.

Commercial Day Hiking
Management of commercial day hiking within the Cross-canyon Corridor Cultural Landscape would be the same as Alternative B, therefore impacts would be the same as Alternative B; negligible to minor, adverse, localized and regional, and short term. Beneficial effects would result from applicable guide requirements (Appendix F) that promote resource stewardship.

Corridor Zone Camping
Under Alternative D, there would be an addition of two small group sites at Cottonwood (increase from 11 to 13). Campsites at Bright Angel and Indian Gardens would remain as they are under Alternative A. This action has potential for minor adverse, localized, long-term, effects to the Cross-canyon Corridor Cultural Landscape. Mitigations such as adding native vegetation to obscure the view of any new campsites so they are not visible from the North Kaibab Trail would result in minor beneficial, localized, long-term effects.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A, moderate, adverse, localized and regional, short and long-term.

Cumulatively, the effects of Alternative D on cultural landscapes, when combined with the other past, present, and reasonably foreseeable future actions, would be moderate, adverse, localized and regional, short and long-term. Alternative D would contribute a small amount to this adverse effect. Under Section 106 there would be an adverse effect to cultural landscapes at a lower intensity than Alternative A.

Conclusion
Under Alternative D and elements common to all action alternatives, minor, adverse and beneficial, localized and regional, short and long-term impacts would result from the addition of campsites and high day use levels and associated visitor use disturbances including social trailing, vegetation damage and manipulation, soil compaction, and human waste issues within the boundaries of the cultural landscape areas.

Cumulative impacts would be moderate, adverse, localized and regional, long-term of which Alternative D would contribute a small amount. Under Section 106, there would be an adverse effect to the Cross-canyon Corridor Cultural Landscape.

Visitor Use and Experience

ISSUES

Issues regarding visitor use and experience identified through public and internal scoping include

- Visitor access and resource protection are not well balanced in some areas
- Appropriate amounts and types of use are not well defined for all recreation activities
- Conflict between some user groups exist
- Increasing and conflicting use is degrading the quality of some visitor experiences

DESIRED CONDITIONS FOR VISITOR USE AND EXPERIENCE

In keeping with the recreation opportunity spectrum (ROS) framework described in Chapter 3, the desired conditions for visitor use and experience may be described in terms of resource, managerial, and social settings and span a continuum of conditions ranging from pristine to developed (resource), minimal to strict regimentation (managerial), and low to high visitor densities (social). By arraying varying combinations of these variables through a systems-oriented approach (e.g., zoning), Grand Canyon may

- Provide a diverse range of quality recreation opportunities
- Establish levels of use that enhance visitor experience by minimizing crowding, conflicts, and resource impacts
- Determine appropriate types of use that will not unacceptably impact visitor experience or biophysical resources
- Preserve opportunities that are appropriate and consistent with the preservation of wilderness character

METHODOLOGY

Numerous recreation planning and management frameworks help guide analysis of impacts to visitor experience (e.g., Limits of Acceptable Change [Stankey et al. 1985], Carrying Capacity Assessment Process [Shelby and Heberlein 1986], Visitor Impact Management [Graefe et al. 1990], and Visitor Experience and Resource Protection [NPS 1997]). Central to each of these frameworks is the concept of indicators and standards of quality.

Indicators are measurable, manageable variables that help define the quality of parks and outdoor recreation areas and opportunities, and standards define "the minimum acceptable condition of indicator variables" (Manning 2011, pg. 86). This analysis focuses on social indicators, standards, and management actions that may be taken to reduce impacts when standards are violated. In many cases, past research helps inform what salient indicators and standards for recreation activities are. However, where less is known, adaptive management strategies may be adopted and applied.

ROS, as discussed in Chapter 3 of this document, is another recreation planning framework that supports definition and management of diverse outdoor recreation opportunities. ROS is based on the assumption that a range of indicators and associated standards help define recreation opportunities. Alternative combinations of indicators and standards are used to help define a continuum of public land settings for recreation. ROS ensures diverse opportunities for visitors and is widely used and implemented by a number of federal land managing agencies including the U.S. Forest Service, Bureau of Land Management, and the U.S. Bureau of Reclamation (Buist and Hoots 1982, Driver et al. 1987, BOR 2004).

This visitor use and experience impact analysis assesses a range of alternatives in terms of various indicators and their potential standards. The proposed standards are specific to recreation activities and their settings, but may vary across alternatives. By clearly demonstrating differences among alternatives in terms of indicators and standards, this analysis provides an opportunity to evaluate tradeoffs across alternatives. For instance, tradeoffs exist between the quantity and quality of recreation opportunities. Higher use levels produce higher social impacts which may adversely affect the quality of an experience, but lower use levels, while assuring high quality experiences, means fewer individuals are able to have that experience.

Finally, it should be noted that perfect information may not be available for all of the issues addressed in this plan. For instance, while visitor use statistics exist for overnight backcountry use, less is known about recreation activities such as extended day hiking, trail running, canyoneering, and climbing. In cases such as these, baseline information used to assess impacts to visitor use and experience includes relevant literature from research at other recreation sites, site-specific expertise including park staff knowledge of use patterns and trends, visitor use studies conducted by park staff, and professional judgment.

INTENSITY DEFINITIONS

Effects to visitor experience are characterized for each alternative. The analysis of impacts is based on the interaction of context, duration, timing, and intensity of visitor impacts. Furthermore, impacts may have adverse, beneficial, or negligible effects to visitor experience. *Beneficial* effects may be measured through increases in visitor satisfaction or other evaluative dimensions (e.g., acceptability, preference). *Adverse* effects may be measured through decreases in visitor satisfaction or other evaluative dimensions (e.g., acceptability, displacement).

Negligible A majority of all backcountry visitors would not notice any effects of changes in visitor use patterns and levels and the effects would not change their experience of backcountry resources.

Minor — Backcountry visitors might be able to detect the effects of changes in visitor use patterns and levels, and the changes might have a slight but detectable effect on their experience of backcountry resources. Other areas within the backcountry would remain available for similar visitor experiences, and visitor satisfaction would be measurably adverse or beneficial. If mitigation was needed to offset adverse effects to visitor experience, it would be relatively simple to implement and would likely be successful.

Moderate — Backcountry visitors would be aware of the effects of changes in visitor use patterns and levels, as well as the effects on their experience of backcountry resources. Other areas within the backcountry would remain available for similar visitor experiences without effects on backcountry resources, but indicators used to measure visitor experience would clearly indicate that visitors were adversely or beneficially affected. For adverse impacts, some visitors might feel displaced and need to pursue their desired visitor experience in backcountry areas outside the park. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major — A majority of backcountry visitors would be highly aware of the effects associated with changes in visitor use patterns and levels, as well as the effects on their experience of backcountry resources. Indicators used to measure visitor experience would clearly indicate that a majority of visitors were adversely or beneficially affected. For adverse impacts, many visitors would feel displaced and need to pursue their desired visitor experience in backcountry areas outside the park. Mitigation measures to offset adverse effects would be needed, they would have to be extensive, and their success would not be guaranteed.

Context

Localized — Impacts would be realized at specific sites or locations (e.g., campsites, attractions sites, individual Use Areas).

Regional — Impacts would be realized at several sites and/or locations and are applicable to one or more of the management zones.

Duration

Short-term — Impacts would be realized a few moments to one day.

Long-term — Impacts would be realized more than one day and possibly for the duration of a trip.

Timing

Impacts have a varying degree of effect based on when they occur, both seasonally and at what time of day. For example, the high use seasons in the backcountry tend to be during spring and fall months.

ASSUMPTIONS

A number of assumptions were employed to conduct this impact analysis. They are listed below.

- With increased use comes increased impact to the social environment because increasing use levels contribute to crowding, loss of solitude, and more potential for user conflict

- Large groups tend to cause more impacts to the social environment than small groups because higher use levels contribute to crowding, loss of solitude, and more potential for user conflict
- Projected overall use under each alternative is based on use in 2012 adjusted to accommodate the limits under each alternative. These numbers do not consider which use in the past was commercial and which was noncommercial
- The commercial use projections assume companies will optimize their permit itineraries to utilize their full daily group allocations. Average commercial group sizes are assumed to remain the same as they were in 2012
- During high use seasons, many Use Areas are booked to capacity. When and where overnight backcountry camping has met its defined capacity, commercial and private uses are in direct competition. For every permit issued to a commercial group in this scenario, a private group is displaced, and vice versa

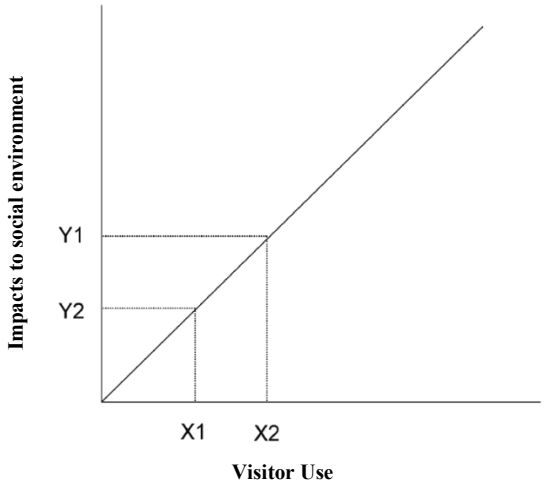
IMPACT ANALYSIS

Potential Day and Overnight Use Impacts to Visitor Experience

Because many of the Backcountry Management Plan impact topics involve some aspect of day and/or overnight use, this section helps explain potential impacts to visitor experience from these uses. It serves as a general reference to the more detailed analysis for each impact topic and Alternative that follows.

The 1988 Backcountry Management Plan clearly noted that the number of daytime contacts with other people along trails and at campsites is important to the quality of visitor experience. This is in keeping with decades of recreation research (Manning 2011). The number of contacts with other people along trails and at campsites are salient indicators of quality for visitor experience because they serve as quantifiable proxies for solitude; a longstanding motivation for visitors to Grand Canyon's Backcountry (Backlund et al. 2008, Backlund et al. 2006, Stewart 1997a, Stewart 1997b, Towler 1977). The common understanding of visitor use levels as they relate to impacts to visitor experience is illustrated in Figure 4.2. Put simply, as use increases so do impacts to visitor experience. Using encounters with other people along a trail as an example, visitor opportunities to experience solitude in the backcountry decline with each group or individual encountered. Therefore, backcountry visitors are adversely affected as use increases. This relationship also holds true for the number of groups camped within sight and sound of overnight user groups. Visitor perceptions of solitude may vary however, and other motivations for recreation in Grand Canyon's backcountry exist.

Figure 4.2 Hypothetical Relationship between Visitor Use and Impact to Social Environment (adapted from Manning 2011, pg. 85)



ROS is a framework that acknowledges differences among visitor motivations, perceptions, and preferences and provides a systematic approach (i.e., zoning) to developing a diverse range of opportunities for a diverse populace (for more regarding ROS see Chapter 3, Affected Environment, Visitor Use and Experience). This impact analysis considers proposed actions in light of diverse motivations for outdoor recreation and addresses potential tradeoffs across user groups in the context of multiple management zones. For example, establishing group size limits of 6 for overnight camping in the Primitive and Wild Zones would likely have beneficial effects on visitors seeking solitude, but may also have adverse effects on visitors that prefer to camp as part of a larger group and are less sensitive to issues of crowding and congestion. These adverse effects would be lessened by the fact that opportunities for larger groups to camp would still exist in the Corridor and Threshold Zones.

ALTERNATIVE A

Backcountry Management Zones

Under Alternative A, Grand Canyon's backcountry would continue to be organized into four management zones; Corridor, Threshold, Primitive, and Wild. For visitor use and experience, the primary purpose of backcountry management zones would continue to be to establish desired social settings. Social settings would continue to be composed of indicators such as number of encounters with other visitors per day along trails and camping within sight and sound of other visitors. Having a range of standards across management zones would continue to ensure a diverse spectrum of recreation opportunities.

While some comments were received during public scoping regarding specific Use Areas in the park, few addressed management zones as a whole. Also, longitudinal studies of overnight users at Grand Canyon illustrate that visitors are generally in agreement with permitted levels of use in the park's backcountry across all management zones. For instance, 65% of overnight backcountry users agreed or strongly agreed that "the NPS allows about the right number of people in the backcountry of Grand Canyon" (Backlund et al. 2008). Sixty-two percent of respondents from a similar survey in 1986 agreed or strongly agreed with the same statement (Underhill et al. 1986). Another study of backcountry users conducted in 1997 also found strong agreement with the 1988 Backcountry Management Plan's standards for encounters across all management zones (Stewart 1997a, Stewart 1997b). Therefore, under Alternative A, backcountry management zones would continue to have moderate, localized to regional, short to long-term beneficial effects on visitor experience for most visitors. However, for those visitors who do not agree that "the NPS

allows about the right number of people in the backcountry of Grand Canyon," minor to moderate, localized to regional, and short to long-term adverse effects would continue to occur under Alternative A.

Climbing Management
Little is known about the attitudes, motivations, and preferences of climbers at Grand Canyon, but many of the public comments received related to climbing focused on a lack of education and policy regarding anchoring and its impacts. Concerns over these impacts were primarily related to natural and physical resources, but those impacts may translate to a degraded visitor experience as well since visitors would likely prefer to experience a pristine natural setting as opposed to an impacted one. Therefore, it is assumed that adverse impacts to visitor experience given existing conditions would continue and be minor, short to long-term, and localized to regional under this alternative. Minor, short to long-term, and localized to regional beneficial impacts to visitor experience would also continue under these conditions because no restrictions specific to climbing exist and a permit is not required where day use opportunities for climbing occur; providing visitors the freedom to climb throughout the canyon with few administrative requirements.

Canyoneering Management
Because canyoneering at Grand Canyon would continue to be managed in a similar way as climbing and public scoping revealed similar comments related to the activity, the same impact analysis would apply. See above section for further detail regarding impact analysis for canyoneering/climbing under Alternative A.

Extended Day Hiking and Running Management
Under Alternative A, current use would continue with no limits and no permits required. Use levels and patterns of day hikers are summarized in Chapter 3 of this document based on the most recent studies conducted.

*Number of daytime contacts with other people***.** The 1988 Backcountry Management Plan clearly notes that the number of daytime contacts with other people is important to the quality of visitor experience. And while specific standards were defined for contacts with overnight parties in Threshold, Primitive, and Wild Zones, more general language was used to describe standards for contacts with day hikers. For instance, 'potential contacts with few day hikers…in some areas,' was used to describe the minimum acceptable social conditions in the Primitive Management Zone. Furthermore, in the case of the Corridor, even more general language, 'large numbers,' was defined as the standard for daytime contacts with other people. Under current management, it is difficult to say if these standards are being violated. However, a study conducted in 1999 suggests that over half of summer visitors to Corridor trails considered 'too many other hikers' to be a problem (Manning et al. 1999). Moreover, public scoping revealed concerns over large groups and crowding in areas such as the Corridor trails and Phantom Ranch. These concerns are bolstered by observed conditions in the Corridor by park staff. For instance, over 400 individuals have been encountered on the North Kaibab trail between Phantom Ranch and Manzanita Resthouse in a single morning, and nearly 150 individuals have been encountered between Black Bridge and Tipoff on the South Kaibab trail in a single hour. This issue is exacerbated by affiliated groups of over 250 people at one time attempting to cross the canyon in a single day on Corridor trails (NPS reports and documentation). Under Alternative A, these issues would continue and potentially grow if use levels do as well. These issues imply moderate, localized to regional, and short to long-term adverse impacts to visitor experience under Alternative A, particularly for those visitors seeking solitude. However, visitors may receive benefits from the freedom to roam the Corridor over the course of a day. Many visitors may be motivated by the challenge of endurance hiking and running and achieve benefits from participating in these activities. Therefore, beneficial impacts to visitor experience would be moderate, localized to regional, and short-term.

Group size. As noted above, crowding may be an issue in the park's Corridor Zone and large groups could be a contributing factor to this issue. A lack of a group size limit for day hiking would result in moderate, localized to regional, and short to long-term adverse impacts to visitor experience under Alternative A, especially for those seeking solitude. For those participating in large group trips, minor, localized to regional, and short to long-term benefits would occur.

Distance. There are currently no limits to the distance visitors may hike on trails in a 24-hour period at Grand Canyon without a permit, and that would continue under Alternative A. Figure 3.7-3.9 in Chapter 3 are based on a 2006 study (Backlund et al. 2006) and summarize the approximate distances traveled by day hikers along Corridor trails. Under Alternative A, it is assumed that visitor use patterns would remain similar to those documented in 2006 and that there would be negligible impacts to visitor experience. However, perceived increases in extended day use and trail-running have been documented by park managers and an update to the 2006 study may be warranted.

Numbers and types of recreational activities in backcountry management zones. Conflict between trail-runners and other user groups has been documented through the public scoping process; primarily in the Corridor Zone. Conflict may occur among trail runners, day hikers, stock users, overnight backpackers, river exchange trips, and Phantom Ranch guests. With little formal guidance to help reduce this conflict, moderate, localized to regional and short to long-term adverse impacts to visitor experience would occur under Alternative A. An increase in trail-running and extended day use at Grand Canyon may further exacerbate these issues in the future.

Tuweep Day Use Management

Use limits established for visiting Tuweep would continue to include a maximum of 30 vehicles or 85 visitors at one time (NPS 1995). However, these limits are yet to be implemented. Currently the NPS lacks data to determine how often these limits are exceeded, but it is thought to happen. When these limits are exceeded, visitors seeking solitude and sensitive to crowding may be experiencing adverse effects. Given these effects and the fact that the number of visitors traveling to Tuweep is relatively low in the context of overall backcountry use, minor, localized, short-term, adverse impact to visitor experience would continue to occur under Alternative A.

Use Area Management

Under Alternative A, Use Areas and their visitor capacities would continue to remain the same (see Table 2.14d). However, a moderate amount of interest has been expressed in adjusting management in a number of Use Areas because of crowding and the inability of Use Areas to support current use levels. This includes adding campsites to, changing the number of groups permitted in, and reconfiguring of some Use Areas. Due to the current lack of a framework to address these issues, minor, localized to regional, short to long-term adverse impacts to visitor experience would continue to occur under Alternative A.

Human Waste Management

Overnight backpackers in Grand Canyon are, and would continue to be, disturbed by a number of issues related to human waste and its management (Backlund et al. 2008, see Table 4.6). Furthermore, although only 4.9% of overnight backpackers reported being unsatisfied with sanitary facilities, 35.3% agreed that 'primitive sanitary facilities (e.g., pit toilets) should be available at more camping areas within the backcountry. Finally, it should be noted that 13.6% of respondents in the study agreed with the statement that 'backcountry users should be required to carry out their fecal wastes.' A study of backcountry day hikers also explored the issue of human waste and its disposal and management (Backlund et al. 2006). In this case 2.3% of respondents were disturbed by human waste along the trail and 8.5% were disturbed by toilet paper along the trail. It also noted that 58.2% of respondents did not know how to properly dispose of their toilet paper in the backcountry.

Table 4.6 Proportion of overnight backpackers citing disturbance from issues related to human waste

Issue	% of overnight backpackers disturbed
Toilet paper along trails	21.3
Human waste along trails	20.0
Toilet paper at camp areas	18.4
Human waste at camp areas	17.1

Studies of both overnight and day hikers in Grand Canyon's backcountry illustrate that visitor experience is impacted by human waste and its disposal and management. While numerous studies of visitors to parks and public lands demonstrate zero tolerance for the inappropriate disposal of human waste (Manning 2011, Whittaker and Shelby 1988), it does persist at some areas within the canyon and would continue to under this alternative. Furthermore, the establishment and continued maintenance of toilet facilities in the backcountry may not be in keeping with the wilderness character of the park and during public scoping Wilderness enthusiasts suggested that the presence of toilets has a negative impact on their backcountry experience. This negative impact would continue under this alternative.

Given the information above, under Alternative A, minor, localized to regional and short to long-term adverse impacts would continue to occur; although, day hikers may be less sensitive to impacts of human waste and associated issues. In addition, backcountry toilet facilities would continue to periodically require the use of helicopters for maintenance. As discussed in the Administrative Use section below, administrative overflights may have and would continue to have minor, localized to regional adverse impacts on visitor experience. In the case of backcountry toilet maintenance, these adverse effects would continue to occur on a short-term basis, and would likely be outweighed by the long-term benefits to visitor experience (e.g., facility maintenance).

Arizona Trail

Travel by foot, stock, and bicycle would continue to be allowed on the South Rim segment of the Arizona Trail. Bicycles would continue not to be allowed on the Inner Canyon or North Rim segments.

Levels of overnight use along the Arizona trail are well-described, but less is known about how many visitors may be day hiking along the trail. However, day use on the South and North rim segments is thought to be low, and what is known about day use levels for the inner canyon is described in the Extended Day Hiking and Running section of this analysis. The number of Arizona Trail through-hikers traversing Grand Canyon is not known. However, because the number of through hikers is thought to be low, and public scoping did not reveal any substantive comments regarding the management of the Arizona Trail for through-hikers or bicyclists, impacts to visitor experience under Alternative A would continue to be negligible.

Bicycling

Bicycling in the backcountry would continue to be allowed on park roads open to private vehicles. Bicycles would continue to be prohibited in Wilderness and on Inner Canyon trails. Only one segment of the Arizona Trail in the park would continue to be open to bicycle use: from the park's southern boundary to the South Kaibab Trailhead. Permits would continue to be required for overnight use and overnight group size limits would continue to apply. Bicycling opportunities are also available on adjacent Forest Service lands, including the Rainbow Rim Trail on the North Kaibab District.

Public comments received during scoping suggest that public opinion regarding biking is fairly divisive. For instance, some comments suggest that biking opportunities should be allowed on former roads closed to motorized vehicles and others suggest biking should be banned from all proposed Wilderness areas.

Most comments inferred that biking should not be allowed below the rim. This suggests that some visitors would continue to experience minor, localized to regional and short to long-term benefits based upon bicycling opportunities and restrictions, while others would continue to experience minor, localized to regional and short to long-term adverse impacts.

River-assisted Backcountry Travel
Per Grand Canyon's Compendium of Closures and Use Restrictions (NPS 2013g), the primary packrafting restriction is a five-mile limit on same-side river travel as part of any overnight backcountry trip. Day trips including packraft segments are not permitted. River crossings may be approved if the itinerary requires them, but only the minimal amount of river travel necessary to gain access to hiking terrain on the opposite shore is permitted. These restrictions would continue under this alternative.

Little is known about the attitudes, motivations, and preferences of packrafters at Grand Canyon, but public scoping revealed that impacts to their experience given existing conditions are, and would continue to be, adverse. The majority of comments received related to packrafting noted that the 5 mile travel limit was too restrictive and limited opportunities. Therefore, visitors participating in RABT would continue to experience moderate, localized to regional, and short to long-term adverse effects. However, because the number of visitors participating in RABT is thought to be low in the context of overall backcountry use, it is believed that adverse impacts to overall visitor experience would continue to be minor, localized to regional, and short to long-term under Alternative A.

Tribal Land and Interests
A number of comments received during public scoping addressed access to parts of the park that included crossing tribal lands. Many of these comments which addressed access to specific locations, such as Great Thumb Mesa, also reflected visitor frustration with a lack of or unclear permitting process administered on tribal lands. Under current conditions, visitors seeking access across tribal lands are experiencing moderate, localized to regional, and short to long-term adverse effects. It should be noted that some success with tribal permitting and access was also documented during public scoping and illustrates minor, localized to regional, and short to long-term beneficial effects to visitor experience. Given both beneficial and adverse effects and the thought that visitors pursuing access across tribal lands is relatively low in the context of overall backcountry use, minor, localized to regional, and short to long-term adverse effects to visitor experience would occur under Alternative A.

Administrative Use
Infrequent monitoring and mitigation efforts conducted by the parks' Science and Resource Management and Trail Crew staff, along with scientific research in the park's backcountry would continue to have negligible impacts on visitor experience. A number of public comments were received regarding flights over the canyon, but most specifically addressed commercial air tours. Given this strong level of concern expressed regarding impacts to visitor experience and natural soundscapes, and a possibility that visitors may not be able to discern between commercial and administrative use, administrative overflights would likely continue to have minor, localized to regional, and short to long-term adverse impacts on visitor experience. Other anthropogenic sounds caused by administrative use include operations of some facilities and the use of motorized equipment by field crews. These sounds may contribute to adverse effects on a short-term basis, but would likely be outweighed by the long-term benefits to visitor experience (e.g., trail and facility improvements). Direct impacts to soundscapes are also analyzed in Chapter 4, Soundscapes.

National Park Service and Cooperating Association Programs (Non-commercial Services)
Trips led by the NPS help achieve the agency's educational goals and provide visitors with opportunities to learn about Grand Canyon and its resources. For this reason, these trips would continue to provide moderate, localized to regional, and short to long-term beneficial effects on visitor experience.

The first-hand knowledge and insight that GCFI guides provide their clients would continue to allow visitors to experience moderate, localized to regional, and short to long-term benefits. However, during the public scoping process some aversion to the current permitting system for GCFI was expressed. This illustrates that some visitors may be experiencing minor, localized to regional, and short to long-term adverse effects based on GCFI's prioritization in the permitting process. These adverse effects would continue under this alternative.

Commercial Overnight Backpacking
Commercially guided backpacking and overnight camping would continue to be allowed with no limit on the number of CUAs under this alternative. Currently, 20 companies guide backpacking and overnight camping trips. Because commercially guided backpacking requires a CUA and overnight backcountry permit, information regarding commercial use patterns and trends is available. This information is presented in further detail on a zone-by-zone basis in Chapter 3 of this document and is also summarized in the Executive Summary.

Under Alternative A, visitors would continue to experience both adverse and beneficial effects from commercial use. For instance, the first-hand knowledge and insight of Grand Canyon that guides may provide contribute to enjoyable visitor experiences. However, not all visitors may wish to pay for or participate in commercially guided trips. With only a finite number of backcountry permits available, this displaces, and would continue to displace, non-commercial backcountry users from being able to participate in their desired experience. For example, when and where overnight backcountry camping has met its defined capacity, commercial and private uses are in direct competition. For every permit issued to a commercial group in this scenario, a private group is displaced, and vice versa. Therefore, because there would continue to be no limits to the number of CUAs or permits available to commercial guides under Alternative A, visitors preferring to participate in commercially guided trips would continue to experience, minor, localized to regional, and short to long-term beneficial effects. At the same time, visitors preferring to explore the backcountry on their own would experience, minor, localized to regional, and short to long-term adverse effects.

Commercial Day Hiking
Commercially guided day hiking trips would continue to be granted through a CUA. Group size would continue to be limited to 11 with a minimum of one guide to seven clients or two guides to nine clients. CUAs would continue to specify recommended locations and hike destinations on Bright Angel, South Kaibab, North Kaibab, Hermit, Grandview, and Tanner Trails. Under Alternative A, there would continue to be no limits on number of hikes allowed per day per trail, and no limit on number of day-hiking CUAs. Under Alternative A, no changes in regulation would occur, but it is difficult to say how many individuals may apply for CUAs in the future.

Under Alternative A, visitors would continue to experience beneficial effects from commercial use. For instance, the first-hand knowledge and insight of Grand Canyon that guides may provide through interpretation contribute to enjoyable visitor experiences. Traveling with a WFR certified guide may also contribute to visitor safety. Furthermore, since there would continue to be no permits required for day hiking, there would continue to be no competition between private and commercial use. Therefore, visitors preferring to participate in commercially guided trips would continue to experience minor, localized to regional, and short to long-term beneficial effects, and visitors preferring to travel on their own would continue to experience negligible effects under this alternative.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative A, commercial backcountry vehicle tours to Tuweep, including jeeps and vans, would continue to be granted through a CUA. Five CUAs would continue to exist, and each holder would

continue to be allowed to conduct two trips per day, Monday through Friday, and one trip per day Saturday and Sunday. Each trip would continue to be limited to one vehicle with no overlap trips from the same company. The vehicle used would continue to be limited to 15 passengers or less, and 22-feet in length or less.

Under Alternative A, visitors would continue to experience both adverse and beneficial effects from commercial use. For instance, the first-hand knowledge and insight of Grand Canyon that guides may provide through interpretation contribute to enjoyable visitor experiences. Visitors may also not have access to a vehicle appropriate for traveling in the Tuweep area, and traveling with a Wilderness First Responder certified guide may also contribute to visitor safety. However, not all visitors may wish to pay for or participate in commercially guided trips. Since capacities at Tuweep have been established (maximum 30 vehicles or 85 visitors at one time), commercial use potentially displaces the public from being able to participate in their desired experience if these use limits are implemented. For example, if Tuweep is at its capacity and being occupied by predominately commercial groups, private users may be displaced from the area. Therefore under Alternative A, visitors preferring to participate in commercially guided trips would continue to experience minor, localized and short to long-term beneficial effects. At the same time, visitors preferring to travel on their own would experience minor, localized, and short to long-term adverse effects if use limits were implemented.

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative A, small (1-6 people) and large (7-11 people) groups would continue to have access to all four management zones. Past research illustrates ongoing support for group size limits in Grand Canyon's backcountry. For example, a study of backcountry visitors conducted in 1986 found that 80% of respondents surveyed agreed with the statement that 'there should be a limit to the size of group using the backcountry' (Underhill et al. 1986). Over 20 years later, a similar study found continued support for the same statement (81% of respondents in agreement, Backlund et al. 2008).

Table 4.7 Number of Small and Large Group User Nights by Management Zone in 2012

Management Zone	Small Group User Nights	Large Group User Nights	Total User Nights
Corridor	46179	7642	53,821
Threshold	13490	3588	17,078
Primitive	15518	5180	20,698
Wild	1918	545	2,463
		Total	**94,277**[55]

Table 4.7 demonstrates the overall nights spent in the backcountry by individuals in both small and large groups in 2012. Based on campground use trends over the past decade, it is expected that use levels would remain similar to these in the future. The total overall user nights for Alternative A are also illustrated in Table 4.7.

A study of overnight backpackers (Backlund et al. 2008) at Grand Canyon measured satisfaction levels with their experience. The study found "among overnight backcountry users, the overall satisfaction is moderately high" (Backlund et al. 2008). The study included overnight users across management zones and noted varying sensitivities to resource, managerial, and social settings. However, it is important to note that "uniformly high levels of satisfaction are of only limited usefulness to recreation managers" (Manning 2011, pg. 15), and public comments reflect an interest in further limiting group size in some

[55] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.

Use Areas. Therefore, under current conditions most overnight users would continue to experience moderate, localized to regional and short to long-term benefits while some overnight users would continue to experience minor, localized, and short to long-term adverse impacts.

Backcountry Roads, Trails, Routes
Since 1993, former fire and ranch roads have been closed in Wilderness to comply with the Final Wilderness Recommendation. Visitors use many of these former roads as unmaintained hiking routes, and while some have become overgrown and are no longer detectable, all are managed in accordance with the Superintendent's Compendium. Under Alternative A, no changes would occur and unmaintained routes for hiker access would continue to be managed as untrailed areas to allow former roadbeds to recover.

Where former fire and ranch roads have been closed and managed as unmaintained hiking routes, visitors would continue to experience beneficial effects because they retain access to hiking. However, where many of these routes have become overgrown and are no longer detectable, some visitors may prefer some level of trail maintenance and might continue to experience minor adverse effects. Use of these unmaintained trails is thought to be low in the context of overall backcountry use.

Given the diverse range of backcountry roads, trails, and routes, and the relatively low use levels on few former fire and ranch roads, moderate, localized to regional and short to long-term beneficial impacts would continue to occur under this alternative.

Tuweep Facilities
Under Alternative A, the parking at the Toroweap Overlook would not be re-located closer to the campground as recommended in the park General Management Plan (NPS 1995, pg. 55). The Vulcan's Throne Road would be open for administrative use only. These actions would continue to have both beneficial and adverse impacts on visitor experience.

Toroweap Overlook would continue to remain accessible by motorized vehicles, and would continue to result in minor, short and long-term, localized beneficial impacts. However, conflict between motorized and non-motorized users is well-documented (Manning 2011) and non-motorized users in these areas may continue to experience minor, localized, and short to long-term adverse effects from this action.

Corridor Zone Camping
Under Alternative A, there would continue to be a total of 60 campsites available to visitors in the Corridor (see Table 2.14d). And while visitors have expressed high levels of satisfaction with their overnight trips to these sites for a number of years (Backlund et al. 2008, Underhill et al. 1986) public scoping revealed an interest in both preserving current numbers of campsites available, as well as increasing them. This illustrates that many visitors to the Corridor would continue to experience moderate, localized to regional, and short to long-term beneficial effects based on the current number of campsites available. However, not everyone who applies for a backcountry permit in the Corridor may receive one. For those applicants denied a permit based upon campsite capacities, minor, localized to regional, and short to long-term adverse effects would continue to be experienced. Adverse impacts to those denied permits would be considered minor, given opportunities to apply for a similar permit in the future.

Deer Creek/Tapeats Complex
Under Alternative A, the Deer Creek/Tapeats Complex would continue to be managed through five Use Areas, three of which would continue to be designated. Both small and large groups would be accommodated in each Use Area and total of 12 groups would continue to be permitted in the Complex on any given night.

Park staff has noted that many visitors to the Deer Creek/Tapeats Complex have been unable to stay on itinerary which contributes to crowding in designated campsites or out of bounds camping within the same or abutting Use Area. These observations are corroborated by a rapid site inventory of backcountry campsites conducted from 2004-2006 (Foti et al. 2006) which recommended disallowing new site development and designating all campsites to Thunder River and Deer Creek.

Few public comments were received related to visitor use and experience at the Deer Creek/Tapeats Complex during the scoping period, however as noted above, visitors may be experiencing crowding at designated campsites due to an inability to stay on itinerary. Therefore, under Alternative A, minor, localized, short to long-term adverse impacts would continue to occur.

Deer Creek Narrows
Under Alternative A, access to the creek narrows would continue to remain restricted per the park compendium. The compendium is reviewed every year and would continue to allow some flexibility in managing access to the Deer Creek narrows. However, given public response, it is clear that some visitors are dissatisfied with the closure to Deer Creek Narrows. Therefore, impacts to visitors would continue to be minor, localized, and short to long-term adverse from this decision. Yet, it should also be noted that this area is inherently valuable to the Hopi, Zuni, Hualapai, and the Southern Paiute tribes as a traditional cultural property. The significance of protecting this traditional cultural property is discussed more thoroughly in the cultural resources sections of this chapter. Beneficial effects to visitor experience may also result from the inherent value of protecting the area. While quantifying this inherent value is difficult, it is thought that beneficial impacts to some visitors, based upon the decision to restrict access to the narrows, would continue to be minor, localized, and short to long-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have potential to contribute to cumulative impacts to visitor use and experience. Past actions including fire management, aircraft overflights, the Colorado River Management Plan, construction projects, Glen Canyon Dam operations, and stock use have resulted in adverse and beneficial impacts to visitor experience. Adverse impacts include increased noise, decreased visibility from smoke, travel delays from construction, and degradation to overall aesthetics. Beneficial impacts include improved access and quality in a range of experiences throughout the park.

Present and foreseeable future actions overlap with some past actions and include changes to outdoor lighting, the Colorado River Management Plan, fire management, aircraft overflights, motor boats on the river, construction projects, Glen Canyon dam operations, Mule Operations and Stock Use EA, and the transcanyon pipeline. Transcanyon pipeline improvements may include short-term adverse impacts from increased noise, travel delays from construction, and degradation of overall aesthetics. However, long-term benefits to visitor experience by maintaining the operability of a reliable water source would exceed short-term adverse impacts. Adverse impacts from the operation of Glen Canyon Dam are included in the Colorado River Management Plan (CRMP): “continued sediment depletion from the operation of Glen Canyon Dam…would continue to diminish campsite capacities and availability. Visitors would continue to experience the erosion of beaches and campsites, and campsite frequency would continue to decline further creating competition and crowding problems” (NPS 2005a, pg. 622). This statement is not only applicable to river runners, but also to backcountry hikers seeking campsites in the river corridor. Stock trips would continue as permitted by the 2010 Mule Operations and Stock Use Environmental Assessment and may also have adverse impacts to visitor experience. “Adverse impacts to visitor experience result primarily from mule waste on trails, dust generated from stock use, trail conditions, congestion and crowding where mules and hikers congregate, and lack of trail etiquette” (NPS 2010f, pg. 92). Changes to outdoor lighting may include a short-term adverse impact from noise due to new light fixture installation. However, minor adverse impacts from changes to outdoor lighting would be

outweighed by long-term benefits to visitor experience. Finally, adverse impacts may result from white water rafting on the Colorado River. The Colorado River corridor and the park's backcountry are inextricably linked, and where encounters between whitewater rafters and backcountry users exist, opportunities for solitude may be impacted and competition for campsites may lead to user conflict. These impacts may be exacerbated at attraction sites. Cumulatively, effects of Alternative A, when combined with other past, present, and reasonably foreseeable future actions, would result in minor, localized to regional, and short to long-term adverse impacts to visitor experience.

Cumulative effects to visitor use and experience from past, present, and reasonably foreseeable future actions discussed above would be minor, adverse localized to regional, and short to long-term and Alternative A would contribute a very small amount.

Conclusion
Under Alternative A, minor, adverse, localized, short to long-term impacts to visitor use and experience would result from increasing levels of day use and associated crowding, dissatisfaction with management of RABT, and restrictions in access to the Deer Creek Narrows.

Major, beneficial, long-term, regional, impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict (with the exception of day use in some areas), general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character (with the exception of human waste management and roads and trails management in some areas).

Cumulative impacts would be minor, adverse localized to regional, and short to long-term and Alternative A would contribute a very small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones
Backcountry management zones are defined in Chapter 2 of this document. The four current backcountry management zones (Corridor, Threshold, Primitive, and Wild) would remain in use across all action alternatives. However, two new zones would be added in all action alternatives

Road-Natural Zone
Under all action alternatives, a new Road-Natural Zone would exist. The primary purpose of the proposed zone would be to establish management standards for the approximately 70 miles of primitive roads, in 300-foot-wide non-wilderness corridors that provide access to remote trailheads, rim campsites, and scenic overlooks.

Table 4.8 Use Areas associated with Road Natural Zone, their Use Limits and Current (A) and Projected (B,C, and D) Annual User Nights

Use Areas	Current Use Limit	Proposed Use Limit	Current User Nights	Projected User Nights
Signal Hill (SE1)	1 small group 6 people	1 small group 6 people	37	37
Ruby Point (SE2)	1 small group 6 people	1 small group 6 people	77	77
Havasupai Point (Day Use Only)	n/a	n/a	n/a	n/a

Use Areas	Current Use Limit	Proposed Use Limit	Current User Nights	Projected User Nights
South Bass Trailhead (SE3)	2 small or 1 large 12 people	2 small 12 people	283	251
Point Sublime (NH1)	1 small and 1 large 17 people	2 small 12 people	451	422
Fire Point (NJ1)	1 small or 1 large 11 people	2 small 12 people	126	101
Swamp Point (NJ2)	2 small or 2 large 22 people	2 small 12 people	176	169
Kanab Point[56] (NK1)	n/a	2 small 12 people	n/a	38
SB Point[57] (NK2)	n/a	1 small group 6 people	n/a	38
150 Mile Trailhead[58] (NK3)	n/a	1 small group 6 people	n/a	38
Kanab Point (NK9)	3 small and 1 large 29 people	n/a	133	n/a
Schmutz Spring TH[59] (NL1)	n/a	1 small group 6 people	n/a	30
Tuweep Campground	9 small and 1 large 85 people	9 small and 1 large 85 people	NOT AVAILABLE	NOT AVAILABLE
Total	**23**	**25**	**1283**	**1230**

While changes to overall visitor use levels would be negligible with the establishment of a Road-Natural Zone (see Table 4.8), visitor use patterns and experience would be impacted. The current Kanab Point (NK9) Use Area would be converted into three different Use Areas (NK1, NK2, and NK3) and would become designated camping rather than at-large. Therefore, visitors would experience a loss of freedom in terms of being able to camp where they want. However, it is thought that visitors are currently camping primarily at the three proposed designated sites. Therefore negligible to minor, localized, short to long-term adverse effects would be experienced by visitors traveling to these areas.

The proposed Road-Natural Zone would also restrict group size to small groups only, with the exception of Tuweep Campground. This would impact visitors camping in large groups at areas such as South Bass Trailhead (SE3), Point Sublime (NH1), Fire Point (NJ1), Swamp Point (NJ2), and Kanab Point (NK9). Therefore, for those visitors who prefer to travel in large groups, minor, localized to regional, and short to long-term adverse effects would be experienced. However, it should be noted that of the 391 total groups that visited South Bass Trailhead (SE3), Point Sublime (NH1), Fire Point (NJ1), Swamp Point (NJ2), and Kanab Point (NK9) in 2012, only 37 were large (approximately 9.5%). Therefore, negligible to minor, adverse, short to long-term localized and regional impacts to visitor experience would occur.

[56] Kanab Point (NK9) Use Area would be divided into three new Use Areas including Kanab Point (NK1) that would consist of a designated camping area at Kanab Point. Projected user nights for NK1, NK2, and NK3 assumes that use from NK9 would be distributed evenly among the 3 new sites and that-large groups would still camp as a maximum size of six.
[57] Kanab Point (NK9) Use Area would be divided into three new Use Areas including SB Point (NK2) that would consist of a designated camping area at SB Point. Projected user nights for NK1, NK2, and NK3 assumes that use from NK9 would be distributed evenly among the 3 new sites and that-large groups would still camp as a maximum size of six.
[58] Kanab Point (NK9) Use Area would be divided into three new Use Areas including 150 Mile Trailhead (NK3) that would consist of a designated camping area at 150 Mile Trailhead. Projected user nights for NK1, NK2, and NK3 assumes that use from NK9 would be distributed evenly among the 3 new sites and that-large groups would still camp as a maximum size of six.
[59] Tuckup Point (NL9) Use Area would remain available for at-large camping and Schmutz Spring Trailhead (NL1) would become a new Use Area with a designated campsite located at Shmutz Spring Trailhead. User nights projected for both Use Areas is based upon 2012 data and assumes that use levels would remain the same and would be distributed evenly among NL9 & NL1.

While Tuweep Campground is included in the Road-Natural Zone, less data is available regarding use at this area because permits for overnight use were not required until 2014. Further data should be collected regarding overnight and day use in the future. The Tuweep area and its management are discussed further in the sections of this document entitled Tuweep Day Use and Tuweep Facilities.

River Zone

Under all action alternatives, a new River Zone would be designated. Chapter 2 of this document discusses the desired resource, social, and managerial settings for the proposed River Zone. While the majority of these settings are in keeping with existing conditions for the Corridor, Threshold, Primitive, and Wild Zones that the River Zone would intersect, one new factor may impact visitor use and experience in the proposed zone.

Establishment of a River Zone would include human waste carry-out requirements for the proposed area. Human waste carry-out is already required for river users in this area through the CRMP, but historically they have not applied to backpackers who may be occupying the same locales. Therefore, establishment of a River Zone and its associated human waste carry-out requirement would have negligible impacts on river runners but would have moderate, localized to regional, and short to long-term adverse effects to backcountry users in the proposed River Zone. It should also be noted that public comments addressed toilets located in some areas (particularly proposed Wilderness) as having a negative impact on visitor experience. Therefore, a human waste carry-out program may also have minor, localized to regional, and short to long-term beneficial effects to visitor experience since it could lead to removal of toilets in the proposed River Zone. For more information regarding impacts to visitor use and experience regarding human waste management, see section of this chapter entitled Human Waste Management.

Climbing Management

Under all action alternatives a Minimum Impact Climbing Education program and monitoring and decision making framework would be implemented. Also, motorized equipment related to canyoneering activities (e.g., power drills) would be prohibited in proposed Wilderness areas. These actions would have both beneficial and adverse effects on visitor experience.

For instance, the administrative process of acquiring a backcountry permit also provides an opportunity to educate visitors in minimum impact climbing practices. This education program would include information on clean climbing techniques involving use of removable equipment and anchors, such as slings, that can be placed and removed without altering the environment. Many of the public comments received regarding climbing were related to a lack of education and policy regarding anchoring and its impacts. Concerns over these impacts were primarily related to biophysical resources, but those impacts may translate to a degraded visitor experience as well. Therefore, because many of these issues may be resolved through a basic understanding of minimum impact practices, moderate, localized to regional, and short to long-term benefits to visitor experience may be achieved. And, because most climbing trips are thought to include overnight use, climbers already have to obtain a permit for their trip. By asking permit applicants to identify if and where they plan to participate in climbing on a trip, a minor additional administrative requirement would be created. However, because this requirement may be perceived as a burden to park visitors, the extra time and effort it requires may have negligible to minor short-term adverse impacts to visitor experience.

The decision-making framework for removal, replacement, and authorization for placement of new anchors in the backcountry may also have beneficial and adverse impacts to visitor experience. For instance, a number of comments were received regarding anchoring, bolt maintenance, and safety during the public scoping period. A decision-making framework regarding anchors and bolts may not only

improve the quality of anchors in terms of convenience and safety, but it could also be used to provide visitors with more information regarding the placement, condition, and location of anchors. This process may therefore provide moderate and short to long-term benefits to the visitor experience of climbers. However, the same framework may result in the removal of anchors and elimination of bolts in some locations. Visitors in disagreement with their removal may experience moderate and short to long-term adverse effects.

Management Actions Potentially Implemented through Adaptive Management

- Monitor via day use permit that identifies climbing route and access/exit routes
- Use limits for specific locations
    - Restrict number of groups by day or season (overnight and day use)
    - Change in maximum overnight group size (decrease or increase)
    - Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations to protect sensitive resources including, but not limited to, sensitive wildlife and plant species or archaeological sites
- Climbing Management Plan development (separate NEPA would be completed)

These actions would have both adverse and beneficial effects on visitor experience. For instance, visitors do not currently have to obtain a permit to participate in single day climbing trips in the backcountry. Administrative requirements of acquiring a permit may be perceived as a burden to park visitors, and while the online permit process would be streamlined, the extra time and effort it requires may still have negligible to minor short-term adverse impacts to visitor experience.

However, beneficial effects from a day use permitting system also exist. The administrative process of acquiring a permit would provide an opportunity to educate visitors in minimum impact practices. Because impacts to resources, a perceived issue related to climbing (see previous section), may be resolved through a basic understanding of minimum impact practices, moderate, localized to regional, and short to long-term benefits to visitor experience may be achieved.

Daily use limits would also have beneficial and adverse effects on visitor experience. Where issues of crowding and congestion persist, establishing daily use limits may have moderate to major, localized to regional, and short to long-term beneficial effects to those climbers sensitive to crowding. However, depending on use levels and the limit set on permits, a number of climbers may be displaced from experiencing specific routes. This may result in moderate, localized to regional, and short to long-term adverse effects for those users. Little is known regarding climbing activities at Grand Canyon, but use levels are thought to be low and issues of crowding and congestion limited.

Seasonal or permanent restrictions for natural and/or cultural resource protection implemented at specific locations would have moderate, localized, short to long-term adverse effects on visitor experience. For instance, when and where restrictions would be established, visitors would no longer be able to experience those areas. However, it should be noted that substitute locations may be available to visitors displaced from restricted locations and some visitors may also experience minor benefits based on intrinsic values related to protecting areas of critical significance.

Given both beneficial and adverse effects, and the fact that the number of visitors participating in climbing is relatively small in the context of overall backcountry use, this equates to negligible to minor, localized to regional, and short to long-term beneficial effects to visitor experience under these proposed management actions common to all action alternatives.

Canyoneering Management
Because canyoneering and climbing are similar activities, and the proposed and potential management actions for climbing mirror those for canyoneering, the same analysis applies. Refer to the above section on canyoneering for analysis of proposed and potential management actions for climbing.

One action that applies to all action alternatives for canyoneering, but not climbing is a maximum group size of six. For groups larger than six currently participating in canyoneering, minor, localized to regional and short to long-term adverse effects would be experienced. However for canyoneers sensitive to crowding and seeking solitude, a maximum group size of six may contribute to moderate, localized to regional, and short to long-term benefits for those users. Little is known regarding canyoneering activities at Grand Canyon, but use levels are thought to be low, group sizes small, and issues of crowding and congestion limited.

Extended Day Hiking and Running Management

Under all action alternatives a permit for extended day use in the Corridor would be implemented. Permits would be made available online with no set capacities. This action would have both beneficial and adverse effects on visitor experience. For instance, visitors do not currently have to obtain a permit to participate in extended day hikes or runs in the Corridor. Administrative requirements of acquiring a permit may be perceived as a burden to park visitors, and while the online permit process would be streamlined, the extra time and effort it would require may still have minor short-term adverse impacts to visitor experience. However, beneficial effects from a permitting system would also exist.

The administrative process of acquiring a permit would provide an opportunity to educate visitors in minimum impact practices and basic trail etiquette. Many of the public comments received regarding extended day hiking and running were related to conflict between user groups and resource impacts. Most of these issues are a function of human behavior and may be resolved through common courtesy and a basic understanding of minimum impact practices. Therefore, because education provides an opportunity to alleviate these issues, moderate, localized to regional, and short to long-term benefits to overall visitor experience may be achieved.

Management Actions Potentially Implemented through Adaptive Management

- Establish group size limits
- Daily use limits by trail
- Designated days for group or individual events
- Adopt policy for other trails

Additional management actions would be considered in the future through an Adaptive Management Process. These actions include establishing group size limits, daily use limits, designated days for group or individual events, and the adoption of similar policies for other trails. These actions have both beneficial and adverse effects on visitor experience. Establishing group size limits would help reduce issues related to crowding and congestion along Corridor trails and at attraction sites such as Phantom Ranch. For visitors sensitive to crowding and congestion, limiting group size may have moderate, localized to regional, and short to long-term beneficial effects. However, for visitors who prefer to travel as part of a large affiliated group and are not sensitive to issues of crowding and congestion, there would be minor to moderate, localized to regional, and short to long-term adverse effects. It is thought that most large affiliated group extended day hikes and runs occur during the spring and fall months and primarily on weekends. Therefore, the effects from establishing group size limits would likely be limited to those times.

Daily use limits would also have beneficial and adverse effects on visitor experience. For visitors sensitive to crowding and congestion, establishing daily use limits would have moderate, localized to regional, and short to long-term beneficial effects. However, depending on use levels and the limit set on permits, a number of day users may be displaced from experiencing the inner canyon. This would result in moderate, localized to regional, and short to long-term adverse effects for those users. It is thought that most extended day hikes and runs occur during the spring and fall months and primarily on weekends. Therefore, displacement of extended day hikers and runners as a result of a permit with daily limits would likely be limited to those times and future opportunities would still exist.

Designated days for group or individual extended day hiking and running events would have beneficial and adverse effects on visitor experience. For those groups or individuals interested in participating in those events, days specifically designated for them would provide moderate, localized to regional, and short to long-term beneficial effects. This assumes that these events would not include limits on use and would accommodate the demand for extended day hiking and running. However, this use would be concentrated over designated days and may lead to adverse impacts to other visitors' experience during that time period. For instance, visitors sensitive to crowding and congestion would be adversely affected on a moderate, localized to regional, and short-term basis. However, while their experience would be degraded on designated days, it may reduce congestion over the course of the rest of the year and provide more opportunities for solitude in the long-term.

Each of the above management actions may be applied to other trails as part of an adaptive management process as well. For each trail, the adverse and beneficial effects summarize above would also apply.

Tuweep Day Use Management

Under all action alternatives visitor information and education on day use at Tuweep would be increased. Information and education sources may include roadside signs and local and regional visitor centers. Increased education would have beneficial effects on visitor experience. Not only would this information provide a greater sense of place and appreciation for the Tuweep region, but it may also inform the expectations of visitors to the area. Creating a sense of appreciation, informing visitors of the primitive nature of Tuweep and notifying them of its limits on day use would result in minor, localized, short to long-term benefits to visitors under this proposed management action common to all action alternatives.

Management Actions Potentially Implemented through Adaptive Management

- Day use permit or reservation system for Tuweep
- Establish limits for number of vehicles per party
- Designated days for group events

Additional management actions at Tuweep would be considered in the future through an Adaptive Management Process. These actions include developing a day use permit or reservation system, establishing limits for numbers of vehicles allowed per group, and designating days for group events. These actions would have both beneficial and adverse effects on visitor experience. Developing a day use permit or reservation system for the Tuweep area would help reduce issues related to crowding and congestion. For example, while standards for people and vehicles at one time already exist at Tuweep, there is currently no way for visitors to know if the location is at its capacity until they arrive on site. An established reservation system would help visitors avoid this dilemma and eliminate the need for park staff to continually monitor conditions on site prior to enforcing those standards. In this sense, developing a day use permit or reservation system may have moderate, localized, and short to long-term beneficial effects to visitor experience. However, an administrative requirement for acquiring a permit may be perceived as a burden to park visitors, and while an online permit process would be streamlined, the extra time and effort it requires may still have minor short-term adverse impacts to visitor experience.

Establishing limits for the number of vehicles allowed per group would also have beneficial and adverse effects to visitor experience. For instance, if three groups of ten people arrived at Tuweep, and each individual arrived in their own vehicle, Tuweep would have reached its vehicle capacity and only 30 people and three groups would be able to visit the site that day. But, if each of these groups were only allowed two vehicles, opportunities for more groups and people to visit the site would exist. Therefore, establishing limits for the number of vehicles per group may have moderate, localized, and short to long-term beneficial effects to visitor experience. However, some visitors may consider the opportunity to drive to Tuweep a large component of the experience or they may wish to carry more equipment with them on their trip. If these visitors were denied the opportunity to use their private vehicle at Tuweep they may experience minor, localized, and short to long-term adverse effects.

Designated days for group events at Tuweep would have beneficial and adverse effects on visitor experience. For those groups or individuals interested in participating in those events, days specifically designated for them would provide moderate, localized to regional, and short to long-term beneficial effects. This assumes that these events would include increased limits on use and would accommodate the demand for group events. However, this use would be concentrated over designated days and may lead to adverse impacts to other visitors' experience during that time period. Visitors sensitive to crowding and congestion would be adversely affected on a moderate, localized to regional, and short to long-term basis. However, while their experience would be degraded on designated days, it may reduce congestion over the course of the rest of the year and provide more opportunities for solitude in the long-term.

Use Area Management

Under all action alternatives a designated campsite would be established along the Hermit Trail. Overall, use limits would not increase but the new designated campsite would provide another option for hikers permitted for Hermit and Monument Creek Use Areas. Park staff, in addition to public comments, and a rapid site inventory of campsites (Foti et al. 2006) have noted an inability of backcountry hikers on many itineraries to arrive at designated campsites at Hermit and Monument. Therefore, demand for another designated site between the two areas does exist. Establishing a site along the Hermit Trail would provide more flexibility and convenience for backcountry users traveling in that area. Furthermore, because overall use limits would not be increased, experiential impacts related to group encounters would not be exacerbated. Moreover, opportunities to camp out of sight and sound of other groups would be increased. For these reasons, establishing a designated campsite would provide moderate, localized, and short to long-term benefits to visitor experience. However, given the fact that visitors camping in this Use Area would be relatively few in the context of overall backcountry use, this equates to minor, localized, and short to long-term beneficial effects to visitor experience under this proposed management action common to all action alternatives.

Under all action alternatives, use limits would be reduced from three to two groups at Granite Rapids (BL8). Table 4.9 illustrates the change in overall user nights projected based on this proposed action and in conjunction with other actions proposed in this plan/DEIS. Reducing use limits at Granite Rapids would reduce overall use at the site. This action would have minor, localized, short to long-term beneficial effects for visitors who are sensitive to crowding and prefer to experience solitude. However, less visitors would be able to experience Granite Rapids overall and those displaced from the site would experience moderate, localized, short to long-term adverse effects. Given the fact that visitors camping in this Use Area are a relatively few in the context of overall backcountry use, and that opportunities to camp at Granite in the future would exist, this equates to minor, localized, and short to long-term adverse effects to visitor experience under this proposed management action common to all action alternatives.

Table 4.9 Number of User Nights Spent at Granite Rapids in 2012 (A) and Projected by Alternative (B, C, and D)

Granite Rapids Use Area (BL8)	Alternatives			
	A	B	C	D
User nights	1243	1141	1141	1033
Percent Change		-8%	-8%	-17%

Proposed changes to other Use Areas are described and illustrated in Chapter 2 of this document and impacts to visitor use and experience are analyzed by alternative. This includes proposed changes to the Deer Creek/Tapeats Creek Complex as well as the Hance Creek/Cottonwood Creek/ and Cremation Use Areas.

Management Actions Potentially Implemented through Adaptive Management

- Decrease or increase number of groups in Use Area and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

Additional management actions across Use Areas would be considered in the future through an Adaptive Management Process. These actions may include decreasing or increasing the number of groups permitted in a Use Area and/or designated site, developing variable seasonal use limits (e.g., higher in winter, lower in spring), changing camping designations: from at-large camping to designated sites or from designated sites to at-large camping, redefining Use Area boundaries (e.g., split large Use Areas, identify complexes as Deer Creek/Tapeats, Hermit/Monument), and seasonal or permanent closures at specific locations.

These actions would have both beneficial and adverse effects on visitor experience. For instance, increasing the number of groups in a Use Area or designated site would have beneficial effects to visitors due to increased access to the backcountry. However, for visitors sensitive to crowding or seeking solitude, this action may have adverse effects. Decreasing the number of groups in a Use Area or designated site would have adverse effects to visitors due to decreased access to the backcountry. For visitors sensitive to crowding or seeking solitude, this action may also have beneficial effects. Depending on the degree to which use levels were increased or decreased, effects to visitor experience may be both adverse and beneficial and range from minor to moderate, localized to regional, and short to long-term.

Establishing seasonal use limits would also have adverse and beneficial effects on visitor experience. For example, if permitted visitor use levels were reduced in the winter and increased in the spring, visitors may be able to schedule and design their trip to coincide with the social settings they desire. Someone seeking solitude would know that, given the lower permitted use levels in the winter, they should plan their trip for the winter season. Visitors less concerned with solitude and more interested in increasing their odds of receiving a permit could apply for the spring season. In this way visitors would have the choice to align their desired experience with the seasonally managed settings provided. Adverse effects from this action may include decreased access to the backcountry during certain times of year. Depending on the degree that seasonal use levels were increased or decreased, effects to visitor experience may be both adverse and beneficial and range from minor to moderate, localized to regional, and short to long-term.

Changing camping designations would also have adverse and beneficial impacts to visitor use. Changing an at-large Use Area to a designated campsite would decrease visitors' freedom of choice in deciding when and where to camp. This loss of choice may result in adverse effects to visitor experience. However, changing a designated campsite to an at-large Use Area may have beneficial effects to visitor experience. Giving visitors the freedom to camp where they want in a Use Area would benefit visitor experience. Therefore, depending on the shift from at-large to designated or designated to at-large, effects to visitor experience may be both adverse and beneficial and range from minor to moderate, localized to regional, and short to long-term.

Redefining Use Area boundaries would have adverse and beneficial impacts to visitor use. For example, if a large Use Area were split, assuming use levels are divided equally in the overall geographic area, visitors would be less likely to camp within sight and sound of each other. Therefore, visitors sensitive to crowding and seeking solitude would experience beneficial effects. However, multiple groups may be seeking the same attraction site or campsite within a large Use Area. By splitting the Use Area, assuming use levels are divided equally, half of the groups would be displaced from the area they may have initially been seeking. This demonstrates an adverse effect to visitor experience in this scenario. For these reasons, and depending on a split or enlargement of a Use Area, effects to visitor experience may be both adverse and beneficial and range from minor to moderate, localized to regional, and short to long-term.

Seasonal or permanent closures at specific locations would have primarily adverse effects on visitor experience, although some benefits may exist. For instance, a permanent closure would adversely impact visitor experience by limiting access to that site in perpetuity. However, the permanent protection a closure may provide a cultural or natural site may provide benefits to some visitors based upon intrinsic value. Seasonal closures would have similar impacts, but they would be less intense since opportunities to visit the locations would still exist. Therefore, depending on whether the closure was permanent or seasonal, effects to visitor experience would be primarily adverse, but could also be beneficial, and range from minor to moderate, localized to regional, and short to long-term.

Given both beneficial and adverse effects, the high degree of variability in each of these actions, and the potential geographic extent of these actions, minor to moderate, localized to regional, and short to long-term beneficial and adverse effects to visitor experience would occur under these proposed management actions common to all action alternatives.

Human Waste Management

Under all action alternatives a human waste carry-out program would be implemented. Human waste carry-out would be required at backcountry sites in the River Zone (e.g., Granite Rapids, Hermit Rapids, Hance Rapids, South Canyon, etc.), and on all commercially guided backpacking trips in Use Areas without toilets. These actions would have both beneficial and adverse effects on visitor experience.

Backcountry users have commented upon negative impacts to their experience when observing improperly disposed of waste in the backcountry. Developing a human waste carry-out program for the River Zone would eliminate these impacts in that area. Furthermore, a human waste carry-out program may reduce the need for toilets currently located within the River Zone. Public comment illustrates that toilets located in some areas (particularly proposed Wilderness) have a negative impact on visitor experience. For these reasons, a human waste carry-out program may have minor to moderate, localized to regional, and short to long-term beneficial effects to visitor experience.

Implementing a human waste carry-out program for the River Zone would also have adverse effects on visitor experience. For example, the added weight of packing out solid waste may be considered a burden by visitors. Furthermore, the process of using human waste carry-out products and integrating them into a

backpacking system may be perceived as unsanitary and unsafe by some visitors. Moreover, 86.4% of overnight backpackers surveyed did not support a human waste carry-out program (Backlund et al. 2008). However, federal land recreation areas including NPS units, BLM and Forest Service have begun to incorporate human waste carry out programs, and visitor attitudes towards them may be changing with time. For these reasons, a human waste carry-out program may have moderate, localized to regional, and short to long-term adverse effects to visitor experience.

Commercially guided backpacking trips would experience the same adverse and beneficial effects from a required human waste carry-out program. However, the adverse effects may be more far-reaching as their requirements would extend beyond the River Zone.

Management Actions Potentially Implemented through Adaptive Management

- Replace existing toilets
- Remove toilets
- Install toilets at other sites
- Specific zones or Use Areas require year-round or seasonal human waste carryout
- All Use Areas require seasonal or year-round human waste carryout

Additional management actions related to human waste management would be considered in the future through an Adaptive Management Process. These actions include replacing toilets at sites where their function does not meet the demand, removing toilets, installing toilets at other sites, and seasonal or year-round human waste carry-out requirements for specific or all Use Areas and zones. These actions would have both beneficial and adverse effects on visitor experience.

Replacement of toilets at existing sites may improve facilities and provide minor, localized, and short to long-term beneficial effects to visitor experience. However, as noted in the prior section, public comment illustrates that toilets located in some areas (particularly proposed Wilderness) have a negative impact on visitor experience. Therefore, re-establishing toilets in these areas may have minor, localized to regional, and short to long-term adverse effects to visitor experience.

Removing or installing primitive toilets would also have both beneficial and adverse effects on visitor experience. Public comments illustrate a demand for both the installation and removal of them. Furthermore 35.3% of backpackers surveyed agreed that ‘primitive sanitary facilities (e.g., pit toilets) should be available at more camping areas within the backcountry (Backlund et al. 2008). Therefore, some visitors would experience minor, localized to regional, and short to long-term beneficial effects while others would experience minor, localized to regional, and short to long-term adverse effects. The same may be true for implementation of a seasonal or year-round human waste carry out system implemented in specific or all areas and zones; although, as noted above, 86.4% of overnight backpackers surveyed did not support a human waste carry-out program (Backlund et al. 2008).

Arizona Trail

A flexible permit system would allow through-hikers to obtain backcountry permits in the Corridor Zone with more ease than under current conditions. However, Arizona Trail through-hikers would have to verify their Arizona Trail itinerary with the permits office in advance. While the number of through hikers is thought to be low along the Arizona Trail (approximately 130 per year), and public scoping did not reveal any substantive comments regarding the management of the Arizona Trail for through hikers, it is believed that establishing a flexible permit system for this group would provide them with minor, localized to regional, and short to long-term benefits.

Under all action alternatives, the Arizona Trail in the park would be opened to bicycles from the northern boundary to the North Kaibab Trailhead. Permits would be required for overnight use in the park and overnight group size limits would apply. Public comments received during scoping suggest that public opinion regarding biking is fairly divisive. For instance, some comments suggest that biking opportunities should be allowed in more areas within the park and others suggest biking should be banned from all proposed Wilderness areas. This suggests that some visitors would experience minor, localized to regional and short to long-term benefits based upon opening the northern segment of the Arizona Trail to bicycle use, while others would experience minor, localized to regional and short to long-term adverse impacts.

Bicycling
Under all action alternatives, bicycling would be permitted in the proposed Road-Natural Zone and on the Arizona Trail above the rim. However, this does not change the status quo related to bicycling with the exception of proposed designated campsites and use limits in the Road-Natural Zone. These campsites and their associated proposed use levels are analyzed in the section of this chapter entitled Road-Natural Zone. As stated within that analysis, negligible to minor, adverse, short to long-term localized and regional impacts to visitor experience would occur.

River-assisted Backcountry Travel
Under all action alternatives backcountry permits would be required for RABT trips that include overnight stays. A RABT designation would be required as part of any backcountry permit with an itinerary including RABT. Day use permits would be required for day RABT trips (e.g., day hikes involving river travel). Visitors participating in RABT would also be required to carry their personal watercraft both in and out of the backcountry. The maximum group size for RABT would be six people.

Each of these actions has beneficial and adverse effects on visitor experience. Because most RABT trips are thought to include overnight use, visitors participating in RABT activities already have to obtain a permit for their trip. By asking permit applicants to identify their proposed RABT route, a minor additional administrative requirement would be created. Because this requirement may be perceived as a burden to park visitors, the extra time and effort it requires would have minor short-term adverse impacts to visitor experience.

Implementing a day use permit for RABT would have both adverse and beneficial effects on visitor experience. For instance, administrative requirements of acquiring a permit may be perceived as a burden to park visitors, resulting in minor adverse, short and long-term regional impacts to visitor experience. Little is known about visitors participating in RABT in Grand Canyon, but group sizes are thought to be small. Therefore, establishing group size limits would not likely affect many visitors. For those participants in RABT who prefer to travel in large groups there would be minor, localized to regional, and short to long-term adverse effects. However, group size limits may also reduce issues related to crowding and congestion along backcountry trails and in the River Zone. For visitors sensitive to crowding and congestion, limiting group size may have minor to moderate, localized to regional, and short to long-term beneficial effects. Furthermore minimizing crowding in the River Zone is in keeping with encounter rate standards implemented through the Colorado River Management Plan.

Tribal Lands and Interests
Under all action alternatives, the NPS would continue to work closely with Traditionally Associated Tribes to educate visitors about the strong historical and cultural ties that tribes maintain to Grand Canyon, and to increase knowledge about current tribal interests related to the Grand Canyon region. Furthermore, NPS would work with all Grand Canyon backcountry users to insure awareness that access to Grand Canyon backcountry across Navajo, Havasupai, and Hualapai tribal lands requires permits from

the appropriate tribal offices. In doing so, NPS would also work with tribes to determine appropriate levels of access to backcountry areas including culturally significant sites.

These actions would have beneficial and adverse effects on visitor experience. Public comments demonstrate that access across tribal lands is currently an issue. By working with Traditionally Associated Tribes to communicate their permit systems to the public and establish appropriate levels of access, these issues may be resolved. Therefore, visitors experiencing adverse effects under current conditions may experience minor, localized to regional, and short to long-term beneficial effects from these actions. However, in defining appropriate protection of culturally significant sites, some access to visitation may be limited or closed. In this case, visitors may experience minor, localized to regional, and short to long-term adverse effects.

Administrative Use
Under all action alternatives, there are no proposed changes to administrative use. Therefore impacts to visitor use and experience would remain the same as in Alternative A; minor, localized to regional, and short to long-term adverse although most long-term benefits may outweigh short-term adverse effects.

NPS and Cooperating Association Programs (Non-commercial Services)
Under all action alternatives, National Park Service programs would continue to challenge students and visitors in exciting and motivating settings. Since no changes are proposed, the benefits of these programs to visitor use and experience are described within the analysis of Alternative A, and moderate, localized to regional, and short to long-term beneficial effects on visitor experience.

Under all action alternatives, the park's cooperating association, GCFI would continue to offer programs to challenge visitors in exciting and motivating settings. Similar to commercial guides, GCFI guides would be subject to the *Requirements for Permitted Backcountry Operators* (Appendix F) to ensure high quality service while protecting park resources. Minor, beneficial, short and long-term, localized and regional impacts to visitor experience would occur.

Commercial Services
Commercially guided services offered in the park's backcountry include backpacking, day hiking, bicycling, stock, and vehicle tours. Impacts to visitor use and experience from commercial services are discussed on an activity by activity basis later in this section. However, guide qualifications and visitor use reporting requirements would be mandatory under all action alternatives and across all commercially guided activities (Appendix F).

While reporting requirements may primarily benefit future management decisions, guide qualifications would have a direct effect on visitor use and experience. For instance, guide qualifications may include a working knowledge of emergency equipment and procedures. This knowledge may potentially save clients lives and at a minimum provide a sense of safety and well-being to park visitors on guided trips. Guide qualifications may also include knowledge of Leave No Trace principles and education. By educating clients in LNT, impacts to park resources are minimized and left unimpaired for the enjoyment of future generations. Therefore, requiring guide qualifications under all action alternatives would provide minor, localized to regional, and short to long-term benefits to visitor experience.

Commercial Overnight Backpacking
Under all action alternatives, no commercial overnight backpacking would be permitted in the Wild management zone. This action would have both adverse and beneficial effects on visitor experience. For instance, in 2012 there were a total of 94 commercial user nights spent in the Wild Management Zone. Visitors relying on commercial services to access these remote regions of the backcountry would no longer be able to do so, and this would result in an adverse effect for a very small number of visitors.

However, assuming demand for overnight trips in the Wild Zone is competitive among commercial and private users, some private trips may be displaced by commercial use. Therefore, by eliminating commercial use from the Wild Zone and its associated competitive effects, visitors participating in private trips in the Wild Zone would experience minor, localized to regional, and short to long-term benefits. Regardless, it should be noted that less than 4% of user nights in the Wild Zone were commercial in 2012. Action alternatives (B, C, and D) analyze permitted commercial use levels in other management zones (Corridor, Threshold, and Primitive).

Commercial Day Hiking
Under all action alternatives, no commercial day hiking would be permitted in the Wild Management Zone. While little is known regarding commercial day use in the Wild Zone, it is thought to be low if not non-existent. Therefore, impacts from this management action are negligible. Action alternatives (B, C, and D) analyze permitted commercial use levels in other management zones (Corridor, Threshold, and Primitive).

Commercial Backcountry Vehicle Tours (Tuweep)
Under all action alternatives, commercial vehicle tours would only be permitted at Tuweep. Commercial backcountry vehicle tours were analyzed through park management's Commercial Services Analysis (see Appendix G) and were determined to be necessary and appropriate within the Tuweep area only. The proposed common to all actions related to group size and vehicle length for commercial vehicle tours are thought to have impacts primarily on commercial tour operators and not their clientele. Therefore, negligible impacts to visitor experience would occur.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, small groups would continue to be allowed in all management zones. However, large groups would be limited to the Corridor and Threshold Zones and some Use Areas would be re-zoned from Threshold to Primitive. These actions would reduce overall use levels in the Threshold, Primitive, and Wild Zones and result in both adverse and beneficial effects to visitor experience.

Table 4.10 Comparison of current and projected use levels given proposed actions under Alternative B

Management Zones	Alternatives		
	A	B	% Change
Corridor	53,821	55,531	+3%
Threshold	17,078	14,332	-16%
Primitive	20,698	20,770	-1%
Wild	2,463	2,266	-8%
Total	**94,277**[60]	**93,116**[61]	**-1%**

Visitors who prefer to travel in large groups would no longer be permitted to do so in the Primitive and Wild Zones. The overall user nights in the Threshold, Primitive, and Wild Zones would be reduced to 14,332; 20,062; and 2,262 respectively (see Table 4.10). In conjunction with other management actions proposed in Alternative B, this would equate to a 16% decrease in user nights in the Threshold Zone, a 1% decrease in user nights in the Primitive Zone, and an 8% reduction in the Wild Zone as compared to current conditions. For those who prefer to travel in larger groups, and for visitors who may be temporarily displaced from experiencing the former Threshold, newly Primitive, and Wild Zones, minor, localized to regional, and short to long-term adverse effects would be experienced.

However, public comments suggest that some visitors may prefer stricter limits on group size. Furthermore, past research illustrates ongoing support for group size limits in Grand Canyon's backcountry. For example, a study of backcountry visitors conducted in 1986 found that 80% of respondents surveyed agreed with the statement that 'there should be a limit to the size of group using the backcountry' (Underhill et al. 1986). Over 20 years later, a similar study found continued support for the same statement (81% of respondents in agreement, Backlund et al. 2008). This may be related to increased impacts from larger groups in terms of resource, social, or managerial settings. Regardless, these comments and studies illustrate that a reduction in overall use through group size limits in the Primitive and Wild Zones would result in moderate, localized to regional, and short to long-term benefits for some visitors.

It should also be noted that projected use levels under Alternative B, given all other proposed actions (including management zone changes from Threshold to Primitive for some Use Areas), result in an estimated decrease of 1,161 user nights in the backcountry annually. This equates to an approximately 1% overall decrease compared to current conditions and demonstrates minor, localized regional, and short to long-term benefits to visitor experience based on a minor decrease in overall access and increased opportunities for solitude in some Use Areas.

River-assisted Backcountry Travel

Under Alternative B, RABT would be managed through zoning. Alternative B proposes 31 river sections delineated by river mile (see Table 2.11). Each of these sections would be established based upon reasonable entry and exit points for RABT and the average river section would be 9.4 miles long.

This new management system would have both beneficial and adverse effects on visitor experience. River sections developed under this alternative provide visitors with more RABT opportunities. Many of the proposed RABT zones extend beyond the current 5 mile maximum distance, and this increase in RABT opportunities would provide moderate, localized to regional, and short to long-term benefits for visitors

[60] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.

[61] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.

participating in RABT. However, four zones would also be closed to RABT under this alternative. River section 1 is closed as its access does not require backcountry travel. River sections 13, 15, and 18 are closed since travelers have the ability to walk a trail or route with relative ease to avoid river use. Furthermore, increased use along these river sections may trigger violations of encounter rate standards implemented through the Colorado River Management Plan. Moreover, there is adequate land access along each of these river sections. Visitors currently participating in RABT in these zones would no longer have the opportunity to do so and would therefore experience minor, localized, and short to long-term adverse effects.

It should be noted that little is known about the attitudes, motivations, and preferences of visitors participating in RABT and future research should incorporate this user-group.

Commercial Overnight Backpacking
Under Alternative B, commercial overnight backpacking would be permitted in the Corridor and Threshold Zones and limited Use Areas within the Primitive Zone. There would be a limited number of contracts and CUAs would be allowed to participate in one to two trips per year. Caps on commercial use would be set across management zones.

These actions would result in both adverse and beneficial effects to visitor experience. Table 4.11 illustrates the projected percent change in commercial overnight use based on the proposed caps under this alternative (see Table 2.14d in Chapter 2 for more detail). Based on these projections, visitors who prefer commercially guided services would have more opportunities in the Corridor Zone. However their opportunities to explore the Primitive Zone would be decreased. Visitors seeking a commercially guided trip in the Wild Zone would no longer have that opportunity. Therefore, visitors who prefer to travel with a commercial guide would receive moderate, localized to regional, and short to long-term benefits for any trips traversing the Corridor and Threshold Zones. However, the same visitors seeking a Primitive or Wild trip may experience minor, localized to regional, and short to long-term adverse effects.

Table 4.11 Comparison of Commercial User Nights based upon Proposed Caps in Alternative B

	Comparison of Commercial Group Nights		
Management Zone	**Current**	**Projected**	**% Change**
Corridor	5,011	6,593	+32%
Threshold	1,572	1,572	0%
Primitive	1,861	786	-58%
Wild	94	0	-100%
Total	**8,538**	**9,009**	**+5%**

Visitors that prefer to travel independent of commercial services would also experience both adverse and beneficial effects based upon the proposed caps under this alternative. Assuming demand for overnight trips is competitive among commercial and private users, more private trips may be displaced by commercial use in the Corridor Zone. This may result in minor, localized to regional and short to long-term adverse effects for visitors preferring to participate in private trips in this zone. However, by decreasing commercial use in the Primitive Zone and eliminating it from the Wild Zone, non-commercial visitors may experience moderate, localized to regional, and short to long-term benefits from the lack of competition and increased opportunities in those zones.

Commercial Day Hiking
Under Alternative B, commercial day hiking would be permitted in the Corridor and Threshold Zones only. This would result in one commercially guided day hiking opportunity being eliminated from the current list of recommended locations.

This action would result in both adverse and beneficial effects to visitor experience. Visitors currently participating in commercially guided day hikes to Escalante Saddle (75-Mile Canyon Overlook) would no longer be able to do so. Visitors seeking a commercially guided day hike in the Primitive Zone would no longer have that opportunity. Therefore, day hiking visitors who prefer to travel with a commercial guide in the Primitive Zone may experience minor, localized to regional, and short to long-term adverse effects. However, this group of visitors is thought to be small and other opportunities for commercially led day hikes would remain in the Corridor and Threshold Zones.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative B, commercial transportation tours would continue to be authorized at Tuweep. Two trips per day would be permitted all week long under Alternative B compared to the maximum of 10 per day currently. Alternative B would allow for up to 14 commercial trips per week and therefore the overall potential of commercial transportation tours at Tuweep would be decreased. Consequently, visitors preferring to participate in commercially guided trips would experience minor, localized, and short to long-term adverse effects based upon this decrease in commercial opportunities. At the same time, visitors preferring to travel on their own would be less likely to be displaced by commercial use and would experience minor, localized, and short to long-term beneficial effects.

Backcountry Roads, Trails, and Routes
Under Alternative B, a number of unmaintained routes would be converted to Class 1 Wilderness Trails. This conversion would alter approximately 18 miles of routes. Many of these routes have become overgrown and are no longer detectable, so conversion to Class 1 Wilderness Trails would provide beneficial effects to visitor experience through a more clear delineation of paths. However, use levels are thought to be low in these areas. Therefore, overall, visitors would experience negligible to minor, localized, short to long-term benefits under this alternative. Given the diverse range of backcountry roads, trails, and routes, throughout the park, and the negligible impacts from the actions described here, visitors would experience short to long-term benefits under this alternative.

Tuweep Facilities
Under Alternative B, overlook parking would be re-located closer to the campground as recommended in the park General Management Plan (NPS 1995, pg. 55). The Vulcan's Throne Road would be converted to trail. These actions would have both beneficial and adverse impacts on visitor experience.

Toroweap overlook would no longer be accessible by motorized vehicles. For visitors who prefer accessing the overlook by motorized vehicle, moderate, localized, and short to long-term adverse effects may be experienced. However, asymmetric conflict between motorized and non-motorized users is well-documented (Manning 2011) and non-motorized users in these areas may experience minor, localized, and short to long-term benefits from this action.

Corridor Zone Camping
Under Alternative B, three campgrounds would continue to accommodate both small and large groups. The number of small and large campsites at each campground is summarized in Chapter 2. Four small campsites would be added to Cottonwood Campground under Alternative B.

This action would result in both adverse and beneficial effects to visitor experience. Visitors have expressed high levels of satisfaction with their overnight trips to these sites for a number of years (Backlund et al. 2008, Underhill 1986) and public scoping revealed an interest in both preserving current numbers of campsites available, as well as increasing them. For those visitors who would prefer to see current conditions remain, this action may have minor, localized, and short to long-term adverse impacts on their experience. However, for those visitors willing to accept an increase in campsites to achieve more

benefits through commensurate opportunities provided, minor, localized, and short to long-term benefits may be achieved. For either group the impacts would be minor due to the relatively small (6% increase in overall campsites in the Corridor) and localized (Cottonwood campground only) nature of this action.

Deer Creek/Tapeats Creek Complex
Under Alternative B, the primary impact to visitor use would be from a reduction in the overall number of groups permitted to camp in the complex. As noted in Table 2.14d, ten groups would be permitted to camp in the complex as compared to the current standard of twelve. This equates to a 24% projected decrease (1,073 user nights) in overall use in the area over the course of a year. Given this projected decrease in use, visitors sensitive to crowding and seeking solitude would experience moderate, localized to regional, and short to long-term benefits. For displaced visitors, moderate, localized to regional, and short to long-term adverse effects would be experienced.

Large groups would no longer be able to camp within the complex under this alternative. Impacts from this action are analyzed under the element Maximum Group Size for Overnight Backpacking.

Deer Creek Narrows
Under Alternative B, access to the Deer Creek narrows would be permanently restricted. Given public response to the current closure per the park compendium, a small portion of visitors would experience moderate, localized, and short-term adverse impacts from this management action. Yet, it should also be noted that this area is inherently valuable to the Hopi, Zuni, Hualapai, and the Southern Paiute tribes as a traditional cultural property. The significance of protecting this traditional cultural property is discussed more thoroughly in the cultural resources sections of this document. While more difficult to quantify, the permanent protection of a closure of this cultural and natural site may provide benefits to some visitors based upon intrinsic value.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative B, the primary impact to visitor use would be from the restriction of large groups in these areas. Impacts from this action are analyzed under the element in this section entitled Maximum Group Size for Overnight Backpacking, although it is also described below in terms of projected user nights

Under Alternative B, visitor use would be impacted by reduction in the overall number of user nights in these areas. As noted in Table 2.14d of this document, nine groups would be permitted to camp in these areas. This is the same number of groups permitted in these areas currently, but under this alternative group size would be limited to small groups. This action equates to an approximately 9% projected decrease (412 user nights) in overall use in the area over the course of a year. Given this projected decrease in use, visitors sensitive to crowding and seeking solitude would experience moderate, localized to regional, and short to long-term benefits. However, for displaced visitors, minor to moderate, localized to regional, and short to long-term adverse effects may be experienced.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative B on visitor use and experience, when combined with the other past, present, and reasonably foreseeable actions, would be minor, adverse, short to long-term, and regional. Alternative B would contribute a small amount to this adverse effect.

Cumulative effects to visitor use and experience from past, present, and reasonably foreseeable future actions discussed above would be minor, adverse, localized to regional, and short to long-term and Alternative B would contribute a very small amount.

Conclusion
Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives , minor, adverse, localized, short to long-term impacts to visitor use and experience would result from a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access to the Deer Creek Narrows. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions.

Major, beneficial, long-term, regional impacts would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative B would contribute a very small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative C, small and large groups would continue to be permitted across all management zones.

Table 4.12 Comparison of current and projected use levels given proposed actions under Alternative C

	Alternatives		
Management Zone	**A**	**C**	**% Change**
Corridor	53,821	59,421	+10%
Threshold	17,078	19,328	+13%
Primitive	20,698	17,844	-14%
Wild	2,463	2,463	0%
Total	**94,277**[62]	**99,273**[63]	**+5%**

This continued practice, in conjunction with other actions proposed in this alternative, would increase overall use levels and result in both adverse and beneficial effects to visitor experience. For instance, visitors who prefer to travel in large groups would continue to be able to do so in all zones. In conjunction with other management actions proposed in Alternative C, there would be an overall increase in user nights from 94,277 under current conditions to 99,273 (see Table 4.12). This equates to a 5% overall increase in user nights in the backcountry. For those who prefer to travel in larger groups, and for the

[62] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.
[63] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.

visitors benefitting from the extra user nights available, moderate, localized to regional, and short to long-term beneficial effects would be experienced.

However, public comments suggest that some visitors may prefer stricter limits on group size. Past research illustrates ongoing support for group size limits in Grand Canyon's backcountry. For example, a study of backcountry visitors conducted in 1986 found that 80% of respondents surveyed agreed with the statement that 'there should be a limit to the size of group using the backcountry' (Underhill et al. 1986). Over 20 years later, a similar study found continued support for the same statement (81% of respondents in agreement, Backlund et al. 2008). This may be related to increased impacts from larger groups in terms of resource, social, or managerial settings. These public comments and studies illustrate that no further reductions in overall use through group size limits would result in minor, localized to regional, and short to long-term adverse effects for some visitors.

River-assisted Backcountry Travel

Under Alternative C, RABT would be managed through zoning. Alternative C proposes 11 river sections delineated by river mile (see Table 2.12). Each of these river sections would be established based upon reasonable entry and exit points for RABT and the average river section would be 29.5 miles long. All river sections open to RABT extend beyond the current 5 mile limit and encompass more river miles per zone than Alternative B.

This new management system would have both beneficial and adverse effects on visitor experience. For instance, the river sections developed under this alternative provide visitors with more RABT opportunities. All but the closed sections of the proposed RABT zones extend beyond the current 5 mile maximum distance, and this increase in RABT opportunities would provide moderate to major, localized to regional, and short to long-term benefits for visitors participating in RABT. However, three zones would also be closed to RABT under this alternative. River section 1 would be closed as its access does not require backcountry travel. River sections 4 and 7 would be closed due to their proximity to highly used attraction sites, and travelers have the ability to walk a trail or route to avoid river use. Furthermore, increased use along this river section may trigger violations of encounter rate standards implemented through the Colorado River Management Plan. Moreover, there is adequate land access along these river sections. Visitors currently participating in RABT in these zones would no longer have the opportunity to do so and would experience moderate to major, localized, and short to long-term adverse effects. It should be noted that little is known about the attitudes, motivations, and preferences of visitors participating in RABT and future research should incorporate this user-group.

Commercial Overnight Backpacking

Under Alternative C, commercial overnight backpacking would be permitted in the Corridor, Threshold, and Primitive Zones. The number of CUAs or contracts would be limited and caps set across management zones.

These actions would result in both adverse and beneficial effects to visitor experience. For instance, Table 4.13 illustrates the projected percent change based on the proposed caps under this alternative (see Table 2.14d in Chapter 2). Based on these projections, visitors who prefer commercially guided services would have more opportunities in the Corridor and Threshold Zones. However their opportunities to explore the Primitive Zone would be decreased. Furthermore, visitors seeking a commercially guided trip in the Wild Zone would no longer have that opportunity. Therefore, visitors who prefer to travel with a commercial guide would receive minor to moderate, localized to regional, and short to long-term benefits for any trips traversing the Corridor and Threshold Zones. However, the same visitors seeking a Primitive or Wild trip may experience moderate, localized to regional, and short to long-term adverse effects.

Table 4.13 Comparison of Commercial User Nights based upon Proposed Caps in Alternative C

	Comparison of Commercial User Nights		
Management Zone	**Current**	**Projected**	**% Change**
Corridor	5011	5938	+18%
Threshold	1572	2359	+50%
Primitive	1861	1572	-16%
Wild	94	0	-100%
Total	**8538**	**9869**	**+16%**

Visitors that prefer to explore the backcountry independent of commercial services would also experience both adverse and beneficial effects based upon the proposed caps under this alternative. For example, assuming demand for overnight trips is competitive among commercial and private users, more private trips may be displaced by commercial use in the Corridor and Threshold Zones. This may result in minor to moderate, localized to regional, and short to long-term adverse effects for visitors preferring to participate in private trips in those zones. However, by decreasing commercial use in the Primitive Zone and eliminating it from the Wild Zone, non-commercial visitors may experience moderate, localized to regional, and short to long-term benefits from the lack of competition and increased opportunities in those zones.

Commercial Day Hiking

Under Alternative C, commercial day hiking would be permitted in the Corridor and Threshold Zones and limited trails in the Primitive Zone. Furthermore, the approved travel distance for two hikes in the Corridor would be increased. These actions would result in both adverse and beneficial effects to visitor experience.

For instance, visitors currently participating in commercially guided day hikes on the Bright Angel and South Kaibab trails have had their hikes curtailed at 3-mile Rest House and Cedar Ridge. Under this alternative, they would have the opportunity to continue their commercially guided day hike to Indian Garden or Skeleton Point. Therefore, day hiking visitors who prefer to travel with a commercial guide may experience minor to moderate, localized, and short to long-term beneficial effects.

Commercial Backcountry Vehicle Tours (Tuweep)

Under Alternative C, commercial backcountry vehicle tours would continue to be authorized at Tuweep. Three trips per day would be permitted Monday through Friday and two trips per day would be permitted on weekends under Alternative C compared to the maximum of 10 per day currently. Alternative C would allow for up to 23 commercial trips per week and therefore the overall potential of commercial transportation tours at Tuweep would be decreased. Consequently, visitors preferring to participate in commercially guided trips would experience moderate, localized, and short to long-term adverse effects based upon this decrease in commercial opportunities. At the same time, visitors preferring to explore the backcountry on their own would be less likely to be displaced by commercial use and would experience moderate, localized, and short to long-term beneficial effects.

Backcountry Roads, Trails, Routes

Under Alternative C, a number of unmaintained routes would be converted to Wilderness Trails. This conversion would alter approximately 35 miles of routes. Many of these routes have become overgrown and are no longer detectable, so conversion to Wilderness Trails would provide beneficial effects to visitor experience through a more clear delineation of paths. Under this alternative, approximately 29 miles of unmaintained routes would be converted to Class 1 Wilderness Trails and approximately 6 miles would be converted to a Class 4 Wilderness Trail open to stock use (day use only). While stock use has been known to have adverse impacts on visitor experience (see NPS 2010f, pg. 92), use levels are thought

to be low in these areas and opening another trail to stock use would be in keeping with providing a diverse range of recreation opportunities to visitors. Therefore, overall, visitors would experience minor, localized, short to long-term benefits under this alternative.

Under Alternative C, the Boundary Road would also be open to vehicles, stock, bicycles, and hikers as part of proposed Road Natural Zone. The increased access this action would provide to visitors traveling to the Pasture Wash area would provide benefits to those who would prefer to travel by a conveyance other than foot. However, multiple uses along the road may contribute to user conflict, particularly if some visitors perceive human-caused sound such as motors undesirable. Therefore, overall, visitors would experience minor, localized, short to long-term benefits under this alternative.

Tuweep Facilities
Alternative C would maintain current conditions. For an analysis of current management conditions at Tuweep see the section entitled Tuweep Management under Alternative A within this chapter. Continuing current conditions would result in minor, short and long-term, localized beneficial impacts. However, non-motorized users may continue to experience minor, localized, and short to long-term adverse effects.

Corridor Zone Camping
The cross canyon Corridor and its associated camping opportunities are discussed in Chapter 2 of this document. Chapter 2 also summarizes proposed management actions related to Corridor camping. The following considers these actions and analyzes their impact on visitor use and experience.

Under Alternative C, a fourth campground would be established at the Roaring Springs day use area to accommodate two small groups. This alternative also proposes an additional large group campsite at both Indian Garden and Cottonwood, and four new small group campsites at Cottonwood. These actions would allow a 12% increase in campsites in the Corridor.

These actions would have both beneficial and adverse impacts on visitor use. For instance, visitors have expressed high levels of satisfaction with their overnight trips to these sites for a number of years (Backlund et al. 2008, Underhill et al. 1986) and public scoping revealed an interest in both preserving current numbers of campsites available, as well as increasing them. For those visitors who would prefer to see current conditions remain, this action may have moderate, localized to regional, and short to long-term adverse impacts on their experience. However, for those visitors willing to accept an increase in campsites to achieve more benefits through commensurate opportunities provided, moderate, localized to regional, and short to long-term benefits may be achieved. The additional sites at Roaring Springs may also contribute to new trip itineraries and greater variations in trips; another potential benefit to this group. For either group, impacts would be minor due to the relatively small (12% increase in overall campsites in the Corridor) and localized (Cottonwood and Roaring Springs campgrounds) nature of this action.

Deer Creek/Tapeats Creek Complex
Under Alternative C, the primary impact to visitor use would be from a reduction in the overall number of groups permitted to camp in the complex. As noted in Table 2.14d of this document, eleven groups would be permitted to camp in the complex as compared to the current standard of twelve. This equates to a 14% projected decrease (635 user nights) in overall use in the area over the course of a year. Given this projected decrease in use, visitors sensitive to crowding and seeking solitude would experience moderate, localized to regional, and short to long-term benefits. However, for the 14% of visitors who may be displaced from experiencing the complex, moderate, localized to regional, and short to long-term adverse effects would be experienced.

It should also be noted, that-large groups would continue to be able to camp within the complex under this alternative. Impacts from this action are analyzed under the element Maximum Group Size for Overnight Backpacking.

Deer Creek Narrows
Under Alternative C, access to the Deer Creek narrows would be unrestricted. Given public response to the current closure per the park compendium, it is clear that some visitors would experience moderate, localized, and short to long-term benefits from this management action. Yet, it should also be noted that this area is inherently valuable to the Hopi, Zuni, Hualapai, and the Southern Paiute tribes as a traditional cultural property. The significance of protecting this traditional cultural property is discussed more thoroughly in the cultural resource sections of this document.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, the primary impact to visitor use would be from an increase in the overall number of groups permitted to camp in the complex. As noted in Table 2.14d of this document, ten groups would be permitted to camp in these Use Areas as compared to the current standard of nine. This equates to a 36% projected increase (2,501 user nights) in overall use in the area over the course of a year. The increase would occur based on the establishment of a new Use Area with a designated campsite named Cremation West (BJ1). Given this projected increase in use, visitors sensitive to crowding and seeking solitude may experience negligible to minor, localized to regional, and short to long-term adverse effects. However, for the visitors who may now be able to experience the area, moderate to major, localized to regional, and short to long-term beneficial effects may be experienced. Furthermore, all visitors traveling to the area would experience minor to moderate, localized to regional, and short to long-term benefits from the flexibility and convenience associated with having another Use Area to incorporate in trip planning.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A, minor, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative B on visitor use and experience, when combined with the other past, present, and reasonably foreseeable actions, would be minor, adverse, short to long-term, and regional. Alternative C would contribute a small amount to this adverse effect.

Cumulative effects to visitor use and experience from past, present, and reasonably foreseeable future actions discussed above would be minor, adverse, localized to regional, and short to long-term and Alternative C would contribute a very small amount.

Conclusion
Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor and climbing, canyoneering and packrafting activity designations on overnight permits on overnight permits. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions.

Major, beneficial, long-term, regional, beneficial impacts under Alternative C would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of

wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative impacts would be minor, adverse, localized to regional, and short to long-term and Alternative C would contribute a very small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone

Under Alternative D, small groups would continue to be permitted across all management zones. However, larger groups would be limited to the Corridor. This action, in conjunction with others proposed under this alternative, would reduce overall use levels in the Threshold, Primitive, and Wild Zones.

Table 4.14 Comparison of current and projected use levels given proposed actions under Alternative D

	Alternatives		
Management Zone	**A**	**D**	**% Change**
Corridor	53,821	54,846	+2%
Threshold	17,078	13,426	-21%
Primitive	20,698	20,650	-1%
Wild	2,463	2,266	-8%
Total	**94,277**[64]	**91,405**[65]	**-3%**

These actions would have both adverse and beneficial impacts on visitor experience. For instance, visitors who prefer to travel in large groups would no longer be permitted to do so in the Threshold, Primitive, and Wild Zones. Furthermore, overall user nights in the Threshold, Primitive, and Wild Zones would be reduced to 13,426; 20,650; and 2,266 respectively. In conjunction with other management actions proposed in Alternative D, this equates to a 21% decrease in user nights in the Threshold Zone, a 1% decrease in the Primitive Zone, and an 8% reduction in the Wild Zone as compared to current conditions. For those who prefer to travel in larger groups and for the visitors who may be displaced from experiencing the Threshold, Primitive, and Wild Zones, moderate, localized to regional, and short to long-term adverse effects may be experienced. It should be noted that these visitors would only be temporarily displaced because other opportunities to camp in the Threshold, Primitive, and Wild Zones in small groups would exist in the future.

Public comments suggest that some visitors may also prefer stricter limits on group size. Furthermore, past research illustrates ongoing support for group size limits in Grand Canyon's backcountry. For example, a study of backcountry visitors conducted in 1986 found that 80% of respondents surveyed agreed with the statement that 'there should be a limit to the size of groups using the backcountry' (Underhill et al. 1986). Over 20 years later, a similar study found continued support for the same statement (81% of respondents in agreement, Backlund et al. 2008). This may be related to increased impacts from larger groups in terms of resource, social, or managerial settings. Regardless, public comments and studies illustrate that no further reductions in overall use through group size limits may result in minor, localized to regional, and short to long-term adverse effects for some visitors.

[64] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.
[65] Total number includes user nights from Use Areas not included within the current Management Zone Framework. See Use Area Table 2.14d for more information regarding those areas.

River-assisted Backcountry Travel
Under Alternative D, RABT would be managed through an 11 mile limit on travel. The 11 mile limit would double the distance of the current restriction. Three river sections would also be closed to RABT under this alternative (see Table 2.13).

These actions would have both adverse and beneficial impacts on visitor experience. For instance, the extension of RABT trips of up to 11 miles would allow for more freedom of travel in the River Zone. Since the current 5 mile limit was a source of negative public comment, it is inferred that increasing the limit would have minor to moderate, localized to regional, and short to long-term beneficial effects on visitor experience.

Furthermore, three zones would also be closed to RABT under this alternative (see Table 2.13). The first river section would be closed as its access does not require backcountry travel. River sections 2 and 3 would be closed due to their proximity to highly used attraction sites, and travelers have the ability to walk a trail or route to avoid river use. Furthermore, increased use along these river sections may trigger violations of encounter rate standards implemented through the Colorado River Management Plan. Moreover, there is adequate land access along each of these river sections. Visitors currently participating in RABT in these zones would no longer have the opportunity to do so and would experience moderate to major, localized, and short to long-term adverse effects. It should be noted that little is known about the attitudes, motivations, and preferences of visitors participating in RABT and future research should incorporate this user group.

Commercial Overnight Backpacking
Under Alternative D, commercial overnight backpacking would be limited to the Corridor zone. The number of CUAs or contracts would be limited and caps set for the Corridor.

These actions would result in both adverse and beneficial effects to visitor experience. For instance, Table 4.15 illustrates the projected percent change based on the proposed caps under this alternative (see Table 2.14d). Based on these projections, visitors who prefer commercially guided services would have more opportunities in the Corridor Zone. However their opportunities to explore all other zones would be eliminated. Therefore, visitors who prefer to travel with a commercial guide would receive moderate, localized to regional, and short to long-term benefits for any trips traversing the Corridor. However, the same visitors seeking a Threshold, Primitive, or Wild trip may experience moderate, localized to regional, and short to long-term adverse effects.

Table 4.15 Comparison of Commercial User Nights based upon Proposed Caps in Alternative D

	Comparison of Commercial User Nights		
Management Zone	**Current**	**Projected**	**% Change**
Corridor	5,011	9,371	+87%
Threshold	1,572	0	-100%
Primitive	1,861	0	-100%
Wild	94	0	-100%
Total	**8,538**	**9,371**	**+10%**

Visitors that prefer to explore the backcountry independent of commercial services would also experience both adverse and beneficial effects based upon the proposed caps under this alternative. For example, assuming demand for overnight trips is competitive among commercial and private users, more private trips may be displaced by commercial use in the Corridor zone. This may result in moderate, localized to regional, and short to long-term adverse effects for visitors preferring to participate in private trips in the Corridor. However, by eliminating commercial use in all other zones, non-commercial visitors may

experience moderate, localized to regional, and short to long-term benefits from the lack of competition and increased opportunities in those zones.

Commercial Day Hiking
Under Alternative D, commercial day hiking would be permitted in the Corridor zone only. This would result in three commercially guided day hiking opportunities being eliminated from the current list of approved locations.

This action would result in both adverse and beneficial effects to visitor experience. Visitors would no longer be able to participate in commercially guided day hikes outside the Corridor Zone. Additional, visitors seeking commercially guided day hikes in the Primitive and Threshold Zones would no longer have that opportunity. Therefore, day hiking visitors who prefer to travel with a commercial guide in the Threshold and Primitive Zones would experience moderate, localized to regional, and short to long-term adverse effects. However, this group of visitors is thought to be relatively small and other opportunities for commercially led day hikes would remain in the Corridor Zone.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative D, commercial backcountry vehicle tours would continue to be authorized at Tuweep. However, one trip per day would be permitted under Alternative D compared to the maximum of 10 per day currently. Alternative D would allow for up to seven commercial trips per week and therefore the overall potential of commercial transportation tours at Tuweep would be decreased. Consequently, visitors preferring to participate in commercially guided trips would experience moderate, localized, and short to long-term adverse effects based upon this decrease in commercial opportunities. At the same time, visitors preferring to explore the backcountry on their own would be less likely to be displaced by commercial use and would experience moderate, localized, and short to long-term beneficial effects.

Backcountry Roads, Trails, and Routes
Under Alternative D, a number of unmaintained routes would remain unmaintained. Many of these routes have become overgrown and are no longer detectable, and visitors may prefer some level of trail maintenance and would therefore continue to experience minor adverse effects. Use levels are thought to be low on these unmaintained trails though. Therefore, overall, visitors would experience minor, localized, short to long-term adverse effects under this alternative. However, given the diverse range of backcountry roads, trails, and routes, throughout the park, and the minor impacts from the actions described here, visitors would continue to experience major, localized to regional and short to long-term benefits under this alternative.

Tuweep Facilities
Alternative D proposes the same management actions as Alternative B. For an analysis of management actions refer to the section entitled Tuweep Management under Alternative B of this chapter. For visitors who prefer accessing the overlook by motorized vehicle, moderate, localized, and short to long-term adverse effects may be experienced. However, non-motorized users in these areas may experience minor, localized, and short to long-term benefits from this action.

Corridor Zone Camping
Under Alternative D, three campgrounds would continue to accommodate both small and large groups. The number of small and large campsites at each campground is summarized in Table 2.14d. Two small campsites would be added to Cottonwood Campground under this alternative.

This action would result in both adverse and beneficial effects to visitor experience. For instance, visitors have expressed high levels of satisfaction with their overnight trips to these sites for a number of years (Backlund et al. 2008, Underhill et al. 1986) and public scoping revealed an interest in both preserving

current numbers of campsites available, as well as increasing them. For those visitors that would prefer to see current conditions remain, this action would have negligible to minor, localized, and short to long-term adverse impacts on their experience. However, for those visitors willing to accept an increase in campsites to achieve more benefits through commensurate opportunities provided, negligible to minor, localized, and short to long-term benefits would be achieved. For either group the impacts would be minor due to the relatively small (3% increase in overall campsites in the corridor) and localized (Cottonwood campground only) nature of this action. Therefore, given both beneficial and adverse effects, and the fact that use in Cottonwood Campground is relatively low in comparison to overall backcountry use, overall benefits to visitor experience would be negligible to minor, localized, and short to long-term given these actions.

Deer Creek/Tapeats Creek Complex
Under Alternative D, the primary impact to visitor use would be from a reduction in the overall number of groups permitted to camp in the complex. As noted in Table 2.14d of this document, eight groups would be permitted to camp in the complex as compared to the current standard of twelve. This equates to a 24% projected decrease (1,091 user nights) in overall use in the area over the course of a year. Given this projected decrease in use, visitors sensitive to crowding and seeking solitude would experience moderate, localized to regional, and short to long-term benefits. However, for the visitors who may be displaced from experiencing the complex, moderate, localized to regional, and short to long-term adverse effects may be experienced.

It should also be noted, that large groups would no longer be able to camp within the complex under this alternative. Impacts from this action are analyzed under the element Maximum Group Size for Overnight Backpacking.

Deer Creek Narrows
Under Alternative D, access to Deer Creek narrows would be permanently restricted. Furthermore, access to the area known as the ‘patio’ would be restricted to one river trip at a time. Given public response to the current closure per the park compendium, it is clear that some visitors would experience moderate, localized, and short to long-term adverse impacts from this management action. Moreover, the limitation on access to the patio would exacerbate these impacts. Yet, it should also be noted that this area is inherently valuable to the Hopi, Zuni, Hualapai, and the Southern Paiute tribes as a traditional cultural property. The significance of protecting this traditional cultural property is discussed more thoroughly in the Cultural Resources section of this document. Furthermore, while more difficult to quantify, the permanent protection of a closure of this cultural or natural site would provide benefits to some visitors based upon intrinsic value.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
The proposed management actions for Hance Creek, Cottonwood Creek, and Cremation Use Areas under Alternative D are the same as Alternative B. For analysis of those actions see Hance Creek, Cottonwood Creek, and Cremation under Alternative B of this chapter. Visitors sensitive to crowding and seeking solitude would experience moderate, localized to regional, and short to long-term benefits. However, for displaced visitors, minor to moderate, localized to regional, and short to long-term adverse effects may be experienced.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A, minor, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative D on visitor use and experience, when combined with the other past, present, and reasonably foreseeable actions, would be minor, adverse, short to long-term, and regional. Alternative D

would contribute a small amount to this adverse effect.

Cumulative effects to visitor use and experience from past, present, and reasonably foreseeable future actions discussed above would be minor, adverse, localized to regional, and short to long-term and Alternative D would contribute a very small amount.

Conclusion
Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, localized, short to long-term impacts to visitor experience would include a nominal administrative burden to visitors from a day use permit system in the Corridor, climbing, canyoneering and packrafting activity designations on overnight permits, and restrictions in access at a site specific location. These nominal impacts would potentially be exacerbated by day use permits with limits and seasonal or permanent restrictions to activities in some locations based upon potential future adaptive management actions.

Major, beneficial, long-term, regional, impacts under Alternative D would include providing a diverse range of quality recreation opportunities, establishment of use levels that minimize crowding and conflict, general determination of appropriate types of use not unacceptably impacting visitor experience, and general preservation of opportunities that are appropriate and consistent with the preservation of wilderness character. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative effects would be minor, adverse, localized to regional, and short to long-term and Alternative D would contribute a very small amount.

Socioeconomic Environment

ISSUES

Issues regarding the socioeconomic environment identified through public and internal scoping include

- Placing limits on backcountry activities and use could decrease visitor spending in local communities and have a negative effect on the economy
- Opening up additional access to the backcountry could increase visitor spending for travel, supplies and outfitting
- Concerns with backcountry as a driver of business; some thought there was too much commercial use and that it should be reduced. Others thought commercial use should be increased, as they would either like to obtain the services of a guide (and were willing to pay for it), or else they would like to offer the service
- Disagreement with the access fee charged by the Havasupai Tribe to cross reservation lands to get to the South Bass Trailhead. This fee is in addition to the fees hikers pay for the NPS overnight permit
- Requests to open the Boundary Road in the park to access South Bass Trailhead and avoid crossing the Havasupai reservation and paying tribal fees
- Numerous communities spanning multiple states have a niche in the backcountry service industry. Businesses in Northern Arizona, Central Arizona, Southern Utah, and Southern Nevada could be impacted

METHODOLOGY

Data used in the analysis include gross receipts submitted by commercial companies and trip prices compiled by Science and Resource Management and Concessions Division staff.

Analysis of the economic impacts has been performed to evaluate potential effects of the alternatives on commercial companies, American Indian communities, and the regional economy.

The economic impacts to commercial companies have been determined by representing the average impact to the companies for each activity (backpacking, day hiking, transportation tours, and bicycling). The actual specific future impacts to individual companies would depend on each company's specific circumstance.

The spending impacts of park visitors and backcountry campers on the regional economy and employment were estimated using the NPS's Money Generation Model (version 2) (MGM2). The model provides estimates of the cumulative economic effects that result directly and indirectly to different types of park visitors (Stynes and Sun, 2005).

In 2013, Arizona's travel industry generated $19.8 billion in direct spending by 39.1 million overnight visitors, employing 163,500 people in tourism related jobs. In Coconino County, the travel industry generated $1.1 billion in direct spending and 11,210 jobs (Arizona Office of Tourism, 2013). Within Grand Canyon National Park, 2013 gross revenues for concessioners were almost $150 million, with an estimated more than 2,000 employees (numbers estimated using data collected by the park Concessions Management Division). These numbers frame the analysis regarding backcountry travel and management and its effect on the socioeconomic environment.

INTENSITY DEFINITIONS

The general process for assessing impacts to the environment is discussed in the "Introduction" to Chapter 4. Effects to the socioeconomic environment are characterized for each alternative based on the intensity definitions presented below. Additionally, each alternative is evaluated to determine whether effects are direct or indirect.

Negligible	Impacts would be at the lowest levels of detection and would have no noticeable adverse or beneficial effect
Minor	Impacts, adverse or beneficial, would be slight, but detectable, generally localized in geographic extent or size of population affected
Moderate	Impacts, adverse or beneficial, would be readily apparent and have the potential to become major, generally regional in geographic extent or size of population affected
Major	Impacts, adverse or beneficial, would be severe, or if beneficial would have exceptional benefits that would affect a large segment of the population, and extend across the entire community or region

Context

Localized	Impacts would affect few businesses or localities
Regional	Impacts would be widespread across the region

Duration

Short-term Impacts would last less than five years

Long-term Impacts would last longer than five years

ASSUMPTIONS

Assumptions that specifically relate to the Backcountry Management Plan alternatives and their socioeconomic effect are presented below.

- Amount of bicycling, climbing, and canyoneering in the park's backcountry is very low, compared to overnight and backpacking and day hiking
- Very little, if any, day hiking occurs in Wild Zone Use Areas
- Very little, if any, commercial use occurred on former fire and ranch roads located in Wilderness and now closed to vehicles

IMPACT ANALYSIS

ALTERNATIVE A

Alternative A describes existing operations and current conditions. Visitor spending in gateway communities would continue, likely at similar levels to current.

Direct impacts to the socioeconomic environment from backcountry use in Grand Canyon include visitor spending of participants in backcountry trips and income generated by commercial backcountry use. Impacts could also include a change in backcountry gear sales. However, these impacts are expected to be negligible under all alternatives.

Under the no-action alternative, impacts to the socioeconomic environment would remain in current condition without any measurable changes. Commercial operator income from backcountry guided services could be impacted by the global economy and changes in visitor demand for backcountry trips, but is not expected to increase or decrease significantly when compared to current condition.
A 2005 study collected information on visitor spending, including backcountry visitors defined as those visitors who stay overnight in the backcountry (Stynes and Sun 2005). Adjusted for inflation, that spending is estimated at $54 per person (Bureau of Labor Statistics Consumer Price Index (BLSCPI) Calculator), not including lodging before or after the backcountry trip or money paid to guides. In 2012, park permit data and park visitor statistics indicate that the percentage of visitors that participated in overnight backpacking trips was approximately 0.8% (35,810 overnight backcountry visitors out of 4,421,352 million total visitors). At $54 per overnight backcountry visitor, the impact on the economy is estimated at approximately $2 million. This figure does not include spending at hotel lodging, restaurants, or gift shops on either end of the backcountry trip. Other backcountry uses include day hiking, canyoneering, climbing, river-assisted backcountry travel, and bicycling. Visitors participating in these activities often stay in gateway communities, and purchase food, gas and supplies in these communities. However, the numbers of people participating is not well-documented.

Extended Day Hiking and Running Management

Extended day hiking and running, including rim-to-rim, have the potential to contribute to the local economy in ways similar to what has already been discussed. The number of people participating in this activity on an annual basis is currently not known. However, data collected in 2013 estimates that during high use times (weekends in spring and fall) up to 800 people per day are hiking or running on the corridor trails; this includes day hikers, backpackers, runners, river trip exchange groups, and Phantom Ranch clients. These visitors contribute to the economy, primarily by purchasing lodging and food.

Visitors rent hotel rooms on both North and South Rim, and possibly in Tusayan, Williams, and Flagstaff. The concessioner that operates Phantom Ranch reports that during the spring and fall season, there is a bump in sales at its Cantina from rim-to-rim hikers, but runners generally do not spend time or money at the Cantina (personal communication, 2013). Overall impacts from this recreational activity are small within the context of overall visitor spending, but could result in minor, beneficial, short-term, regional impacts to the socioeconomic environment during high use times.

Commercial Services

Commercially guided trips including backpacking, day hiking, bicycling, and vehicle tours have some impacts on the socioeconomic environment. The greatest impact to the socioeconomic environment is the fees paid to commercial operators for these guided services. Between $2.1 and 3.5 million annually is reported by commercial operators as gross revenue for these services. These operators are located throughout the United States, with 11 in Arizona (5 of those in Flagstaff), four in California and one in each New Mexico, New York, Montana, Maryland, and Wyoming.

Compared to overall visitor spending in the local region[66] of approximately $385 million (2003 dollars converted to 2014 dollars using BLSCPI Calculator) the amount reported as gross revenue for backcountry commercial use is less than one percent. Commercial operators create a small number of jobs in local economies, although the actual number of people employed from the commercial activity in in the park is not known. As noted above, the commercial operators are located in a number of communities outside of the local region. In addition to fees paid to commercial operators, visitors participating in commercial backcountry trips likely spend money at local hotels, restaurants, and shops; however this number is expected to be low compared to overall visitor spending. Under Alternative A, minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

Commercial Overnight Backpacking

Approximately 9% of overnight backpacking in the park is comprised of commercial trips. In 2013, commercial operators charged approximately $250 per day per person for overnight backpacking. In 2012, there were 8,538 user nights utilized by commercial groups, including guides. It is estimated using these numbers that over $2.1 million was generated by visitors to pay commercial outfitters for overnight backpacking trips. As mentioned previously, this is less than 1% of overall visitor spending (estimated at $385 million). In addition to fees paid to commercial operators, visitors participating in commercial backcountry trips likely spend money at local hotels, restaurants, and shops; however this number is expected to be low compared to overall visitor spending. Under Alternative A, minor, beneficial, long-term, localized and regional impacts to the socioeconomic environment would occur.

Commercial Day Hiking

The level of commercial day hiking is not well reported and therefore calculations on the amount of money generated and spent on this activity cannot be accurately calculated. Commercial operators submit gross receipts for commercial day hiking, but this information is often combined with overnight backpacking and/or trips outside of Grand Canyon. Websites of operators that offer day hiking in Grand Canyon list prices ranging from $100 to $500 per person per day. Under Alternative A, it is estimated that negligible to minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

[66] The local region is defined to encompass Coconino County, Arizona including gateway communities of Tusayan, Williams, Flagstaff, and Cameron on the South Rim and Jacob Lake, Kanab, and Fredonia on the North Rim.

Cumulative Impacts
Cumulative impacts on the socioeconomic environment were determined by combining Alternative A impacts with other past, present, and reasonably foreseeable future actions having impacts on the socioeconomic environment.

Past and ongoing activities considered in this analysis include mining, recreational use, education and interpretation, aircraft overflights, and construction projects. These actions have caused moderate, beneficial, short and long-term, regional impacts including increased visitor spending and creation of jobs.

Future projects include potential developments in Tusayan and other adjacent communities. Development has the potential to beneficially impact the socioeconomic environment; however not enough information is available to accurately determine these impacts.

Cumulatively, effects of Alternative A which would maintain the backcountry use levels and continue commercial services in the backcountry, when combined with other past, present, and reasonably foreseeable actions, would result in long-term regional beneficial moderate effects on the socioeconomic environment. Alternative A would have a small contribution to this cumulative effect.

Conclusion
Under Alternative A, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry, at approximately 9% for commercial backpacking, and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative A would have a small contribution to this overall adverse effect.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Extended Day Hiking and Running Management
As described in Alternative A, rim-to-rim and extended day hiking and running can result in beneficial impacts to the socioeconomic environment. However, even on peak days when up to 800 people are recreating in the Corridor there is a small impact to the socioeconomic environment. Beneficial impacts would be minor, short-term, and regional. Implementation of a day permit, either seasonal or year-round, could limit the number of people participating in rim-to-rim activities if people do not want to obtain a permit. However, numbers are not expected to drop dramatically. Through adaptive management, restrictions could be placed on the number of people and/or size of groups allowed to participate in extended day hiking and running. These restrictions would result in an adverse impact to the socioeconomic environment from decreased visitation and sales related to this activity. Because the numbers of people participating in this activity is low compared to overall visitation, it is expected that any restrictions would have negligible impacts on the socioeconomic environment.

Commercial Services
Commercially guided trips including backpacking, day hiking, bicycling, and vehicle tours have some impacts on the socioeconomic environment. The greatest impact to the socioeconomic environment is the fees paid to commercial operators for these guided services as described in Alternative A. Levels of commercially guided services vary by alternative and are analyzed by alternative.

Commercial Overnight Backpacking
Under all action alternatives, the vast majority of commercial overnight backpacking would be managed under concession contracts as opposed to the commercial use authorization (CUA) permits currently utilized. It is expected that 2-4 contracts would be awarded for commercial overnight backpacking;

however, the exact number of contracts would be determined after the final use levels are determined. A specific analysis, outside of the plan/DEIS process, would be conducted to project the financial feasibility of such use and to determine the appropriate number of contracts. CUAs would continue to be issued to operators conducting less than three overnight backpacking trips per year. CUA use would be further limited to Corridor Zone only and could not exceed 100 group nights per year.

This change in authorization has the potential to impact specific commercial operators that currently operate with a CUA. Between 12 and 26 operators obtain a CUA each year for commercial backpacking. In 2012, two operators conducted more than 100 trips, two conducted 50-100 trips, four conducted 10-50 trips, and four conducted less than 10. If 12 operators continue to conduct overnight backpacking trips, 2-4 would obtain contracts and the remaining operators would acquire a CUA and would be limited to three trips of less per year in the Corridor Zone. Impacts to individual operators would be beneficial if they were to obtain a contract. These impacts would be minor, beneficial, long-term, and localized. For operators failing to obtain a contract, impacts would be adverse, minor, long-term, and localized. The amount of commercial use would be similar to current under all alternatives (see additional discussion by alternative), therefore the impact to the overall socioeconomic environment would be negligible.

Level and distribution of commercial overnight backpacking varies by alternative and is analyzed under each alternative.

Commercial Day Hiking
The level of commercial day hiking has not been well reported and therefore calculations on the amount of money generated and spent on this activity cannot be accurately calculated. Commercial operators submit gross receipts for commercial day hiking, but it is often combined with overnight backpacking and/or trips outside of the park. Websites of operators that offer day hiking in Grand Canyon list prices ranging from $100 to $500 per person per day. Under Alternative A, it is estimated that negligible to minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

The most noticeable impact to the socioeconomic environment under all action alternatives is from overall recreational use and related visitor spending, and impacts to commercial services. Backcountry management under Alternative B includes

Commercial Overnight Backpacking
Under Alternative B, it is projected that approximately 9.6% (8,952 out of 93,116 user nights) of overnight backcountry use would be commercial. By zone, this would be 11.9% commercial use in the Corridor Zone, 11% commercial use in the Threshold Zone, 3.8% commercial use in the Primitive Zone, and no commercial use would be allowed in the Wild Zone. These projected numbers were calculated with the following assumptions: commercial use at Bright Angel and Indian Garden would be at maximum number of groups March through October and at 2012 levels the remainder of the year; commercial use at Cottonwood would be at maximum number of groups May 15 through October 31 and at 2012 use levels the remainder of the year; commercial use in the Threshold and Primitive Zone would

be at maximum number of groups March through May and September through October with no use the remainder of the year (commercial use is allowed year-round in these zones, but very low); and each group was calculated using an average commercial group size of 5.24 people based on 2012 data.

Using 2013 information that commercial operators charged approximately $250 per day per person for overnight backpacking, it is estimated over $2.2 million would be generated by visitors to pay commercial outfitters for overnight backpacking trips. This would be a slight increase from Alternative A. As mentioned previously, this is less than 1% of overall visitor spending (estimated at $385 million). In addition to fees paid to commercial operators, visitors participating in commercial backcountry trips likely spend money at local hotels, restaurants, and shops; however this number is expected to be low compared to overall visitor spending. Under Alternative B, minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

Commercial Day Hiking
Under Alternative B, day hiking in the Wild Zone would not be allowed, however it is assumed that very little day hiking occurs in that zone due to the difficulty involved in reaching trailheads and the challenges of the routes. Under Alternative B, it is estimated that negligible to minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur similar to Alternative A.

Cumulative Impacts
Cumulative impacts on the socioeconomic environment were determined by combining Alternative B impacts with other past, present, and reasonably foreseeable future actions having impacts on the socioeconomic environment similar to the Cumulative Impacts section in Alternative A.

Cumulatively, effects of Alternative B including a small decrease in overnight backpacking use and continued commercial services in the backcountry, when combined with other past, present, and reasonably foreseeable actions, would result in long-term regional beneficial moderate effects on the socioeconomic environment. Alternative B would have a small contribution to this cumulative effect.

Conclusion
Under Alternative B and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.6% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience minor, adverse, short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative B would have a small contribution to this overall adverse effect.

ALTERNATIVE C

The most noticeable impact to the socioeconomic environment under all action alternatives is from overall recreational use and related visitor spending, and impacts to commercial services. Backcountry management under Alternative C includes

Commercial Overnight Backpacking
Under Alternative C, it is projected that approximately 9.9% (9,869 out of 99,446 user nights) of overnight backcountry use would be commercial. By zone, this would be 10% commercial use in the Corridor Zone, 12.2% commercial use in the Threshold Zone, 8.8% commercial use in the Primitive Zone, and no commercial use would be allowed in the Wild Zone. These projected numbers were calculated using the assumptions discussed under Commercial Overnight Backpacking for Alternative B above.

Using 2013 information that commercial operators charged approximately $250 per day per person for overnight backpacking, it is estimated over $2.5 million would be generated by visitors to pay commercial outfitters for overnight backpacking trips. This would be a small increase from Alternative A. As mentioned previously, this is less than 1% of overall visitor spending (estimated at $385 million). In addition to fees paid to commercial operators, visitors participating in commercial backcountry trips likely spend money at local hotels, restaurants, and shops; however this number is expected to be low compared to overall visitor spending. Under Alternative C, minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

Commercial Day Hiking
Under Alternative C, day hiking would be allowed in all zones, similar to Alternative A. Under Alternative C, it is estimated that negligible to minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur similar to Alternative A.

Cumulative Impacts
Cumulative impacts on the socioeconomic environment were determined by combining Alternative C impacts with other past, present, and reasonably foreseeable future actions having impacts on the socioeconomic environment similar to the Cumulative Impacts section in Alternative A.

Cumulatively, effects of Alternative C including an increase in overnight backpacking use and continued commercial services in the backcountry, when combined with other past, present, and reasonably foreseeable actions, would result in long-term regional beneficial moderate effects on the socioeconomic environment. Alternative C would have a small contribution to this cumulative effect.

Conclusion
Under Alternative C and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 9.9% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse, short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative C would have a small contribution to this overall adverse effect.

ALTERNATIVE D

The most noticeable impact to the socioeconomic environment under all alternatives is from overall recreational use and related visitor spending, and impacts to commercial services. Backcountry management under Alternative D includes

Commercial Overnight Backpacking
Under Alternative D, it is projected that approximately 10.2% (9,371 out of 92,311 user nights) of overnight backcountry use would be commercial. By zone, commercial use would be 17.1% of all use in the Corridor Zone; no commercial use would be allowed in the Primitive, Threshold, or Wild Zone. These projected numbers were calculated using the assumptions discussed under Commercial Overnight Backpacking for Alternative B above.

Using 2013 information that commercial operators charged approximately $250 per day per person for overnight backpacking, it is estimated over $2.3 million would be generated by visitors to pay commercial outfitters for overnight backpacking trips. This would be a slight increase from Alternative A. As mentioned previously, this is less than 1% of overall visitor spending (estimated at $385 million). In

addition to fees paid to commercial operators, visitors participating in commercial backcountry trips likely spend money at local hotels, restaurants, and shops; however this number is expected to be low compared to overall visitor spending. Under Alternative D, minor, beneficial, long-term, regional impacts to the socioeconomic environment would occur.

Commercial Day Hiking
Under Alternative D, day hiking would be allowed only in the Corridor Zone, not in the Threshold, Primitive or Wild Zone. Limiting day hiking under Alternative D would result in negligible to minor, adverse, long-term, regional impacts to the socioeconomic environment similar to Alternative A.

Cumulative Impacts
Cumulative impacts on the socioeconomic environment were determined by combining Alternative B impacts with other past, present, and reasonably foreseeable future actions having impacts on the socioeconomic environment similar to the Cumulative Impacts section in Alternative A.

Cumulatively, effects of Alternative D including a small decrease in overnight backpacking use and continued commercial services in the Corridor Zone, when combined with other past, present, and reasonably foreseeable actions, would result in long-term regional beneficial moderate effects on the socioeconomic environment. Alternative D would have a small contribution to this cumulative effect.

Conclusion
Under Alternative D and elements common to all action alternatives, beneficial impacts to the socioeconomic environment would result from continued commercial services in the backcountry at 10.3% and backcountry visitor spending in local communities. Beneficial impacts would be regional short to long-term and minor. Specific commercial operators would experience moderate, adverse, short and long-term, localized impacts if interested in offering more than three trips per year and not awarded a contract. Cumulative impacts would be beneficial, regional, short to long-term and moderate. Alternative D would have a small contribution to this overall adverse effect.

Park Management and Operations

ISSUES

Issues regarding park management and operations identified through public and internal scoping include

- NPS presence needs to be increased to protect Wilderness and backcountry resources for park users
- Education of backcountry users on ideals of Leave No Trace, trail and campsite etiquette is needed
- Management of facilities (i.e., composting toilets campgrounds, trails) in the backcountry is difficult due to lack of resources and current funding levels
- Large numbers of rim-to-rim hikers and runners during high use periods in spring and fall are difficult to manage
- Day use permitting may be difficult to manage

DESIRED CONDITIONS

Objectives for park operations are derived from the 1995 General Management Plan and are as follows: (1) manage and monitor visitor use and park resources to preserve and protect natural and cultural resources and ecosystem processes, and to preserve and maintain a Wilderness experience or primitive

experience; (2) establish indicators and standards for desired visitor experiences and resource conditions, monitor their condition, and take action to meet the standards if they are not being met; and (3) provide a variety of primitive recreational opportunities consistent with Wilderness and NPS policies on accessibility.

Implementing the Backcountry Management Plan requires park management to verify that sufficient fiscal and human resources are available to implement the revised backcountry management plan. This analysis provides information to determine the feasibility of the alternatives.

METHODOLOGY

The general process for assessing impacts is discussed in the Introduction to Chapter 4 The discussion of impacts to park management and operations focuses on rangers and other staff that ensure visitor and employee safety and opportunities for quality experiences, as well as the ability of the resource management staff and trail crew to protect and preserve resources at current staffing and funding levels. Park staff evaluated the impacts of each alternative and based the analysis on current park management and operations presented in Chapter 3.

INTENSITY DEFINITIONS

Effects on park management and operations are characterized for each alternative based on intensity definitions below. Each alternative was evaluated to determine if effects are direct or indirect.

Intensity

Negligible — Backcountry management and operations would not be affected or the effect (adverse or beneficial) would not be apparent to park staff or the public.

Minor — Impacts would be apparent but would not have an appreciable effect (adverse or beneficial) on park management and operations.

Moderate — Impacts would be readily apparent and would result in a measurable change (adverse or beneficial) in park management or operations in a manner noticeable to staff and the public.

Major — Impacts would be readily apparent and would result in a substantial change (adverse or beneficial) in backcountry management or operations in a manner noticeable to staff and the public

Context

Localized — Effects would be realized at specific sites or locations.

Regional — Effects would be realized at several sites and/or locations and would be applicable to one or more backcountry management zones.

Duration

Short-term — Effects would occur for hours or days

Long-term — Effects would occur for months or more than one year

Timing

Effects would be realized year-round, especially in spring and fall when backcountry use is highest.

ASSUMPTIONS

The general assumptions used for analysis of effects for each alternative are discussed in the Introduction to Chapter 4. Assumptions that specifically relate to the alternatives in this document and their effect on park management and operations are presented below.

- In order to mitigate site-specific resource concerns from changes in visitor use, it is expected that additional funding and staff could be needed. Site-specific concerns would be addressed under each resource impact topic
- Currently, year-round recreational use occurs in the backcountry. NPS operations such as toilet and trails maintenance and ranger patrols occur year round but more frequently from March through October. Resource management activities occur year-round, but fieldwork (research, restoration projects, and some wildlife and threatened and endangered species surveys) occurs primarily during fall through spring. Therefore, if there is a shift in seasonal use patterns such as increased winter use or an increase in the different types of backcountry activities such as climbing, canyoneering or RABT, additional ranger patrols, visitor education and resource management may be necessary
- This plan/DEIS does not consider changes to management of Inner Canyon trails, however, the impacts of trails maintenance of the Inner Canyon trails are included as cumulative impacts

IMPACTS ANALYSIS

The impacts to park management and operations are directly proportional to the level of overnight and day use in the backcountry. High levels of backcountry use require high levels of NPS presence including ranger patrols, trail and facility maintenance, visitor education and resource management. In general, most impacts to park management and operations are related to having adequate funding and staffing to provide backcountry visitor services such as interpretation, education, resource protection and medical assistance. Other impacts include inadequate facilities such as backcountry toilets that have exceeded their lifespan, and high use trails that are in disrepair.

ALTERNATIVE A

Alternative A continues existing management practices and operations, resulting in current trends in resource conditions, visitor opportunities. The most noticeable impact to park management and operations under Alternative A is from overall backcountry use, facility management, and visitor safety. Current backcountry management includes

Backcountry Management Zones

Management zoning is a tool for managers to structure planning and set resource priorities. Each management zone prescribes overnight use levels, and zoning provides opportunities for a wide variety of backcountry experiences. Current management zoning includes. The 1988 Backcountry Management Plan included Threshold, Primitive, and Wild Zones in Wilderness, and the Corridor Zone in non-wilderness and described management objectives that focus on campsite resource conditions, recreational facility type and number including toilets and signs, and number of backcountry encounters. Impacts of recreational and administrative road use are not addressed in the 1988 Backcountry Management Plan. Overall, the impacts of management zone prescriptions result in minor, beneficial, localized and regional long-term effects because they provide goals, objectives and direction for managing the backcountry.

Climbing Management

Under Alternative A, climbing would continue in conjunction with overnight backpacking and day trips. General impacts to resources include social trailing to climbing routes, soil compaction, and vegetation trampling at the base of routes, and defacement of rock from fixed anchors such as bolts. Currently, the

NPS does not have staff dedicated to this activity and does not collect data on climbing use. The NPS does not monitor direct impacts to resources or park operations including rescue or law enforcement actions. Under Alternative A, impacts from climbing on park management and operations are negligible. This topic is retained in analysis because impacts to park operations are more than negligible under common to all action alternatives.

Canyoneering Management
Similar to climbing, general impacts to park resources include social trailing and soil compaction near route access, and damage to vegetation, geological, or archeological resources from anchoring. However, park staff time for managing canyoneering is limited to conducting an inventory of published and unpublished canyoneering routes to provide information on resource conditions. Individuals or groups of up to 11 people participating in canyoneering currently obtain overnight backpacking permits, however the specific number of people participating in this activity is unknown. Under Alternative A, impacts from inventory and monitoring of canyoneering and on park management and operations are minor, adverse, localized and long-term.

Extended Day Hiking and Running Management
Extended day hiking and running from rim to river or rim to rim occurs primarily on Corridor Zone trails. In 2013, NPS staff installed trail counters to document trail use. Preliminary data indicates that during peak use weekends, over 800 people are using the trails each day; this volume of use requires additional ranger presence to deal with trailhead traffic, injured, ill, or lost hikers or runners and conflicts amongst users. During the peak use weekends, park facilities including the composting and flush toilets and the Phantom Ranch wastewater treatment plant exceed capacity. Trailhead parking lots and facilities are crowded with buses, hikers and spectators during the North Rim opening and closing weekends. Other impacts include abandonment of gear, litter, and human waste on and adjacent to trails, and conflicts between campers, hikers, runners, and mule riders. Park staff clean up after visitors and receive comments and complaints regarding conflicts. In addition to the impacts to NPS operations, crowding occurs at the Phantom Ranch facilities. Day use permits are not required. Under Alternative A, impacts from rim to rim and extended day hiking and running on park management and operations would be major, adverse, short and long-term, localized.

Tuweep Day Use Management
As stated in the GMP, the Tuweep area should remain an uncrowded, semi-primitive area that is dominated by nature and solitude. The Tuweep area is a day use area only, except for the campground that accommodates 10 groups or 65 people maximum. The day use limits prescribed by the GMP are a maximum of 30 vehicles or 85 visitors. Total limits include visitors to Toroweap Overlook, the campground, the Vulcans Throne area and local trails. Anecdotally, the capacity is believed to be exceeded during spring and fall weekends, especially around holidays. However, the park lacks consistent data collection of day and overnight use; and it is unknown how often the capacity is exceeded.

One full time park ranger is responsible for managing this area, in addition to other remote backcountry areas in western Grand Canyon. The ranger is responsible for medical assistance, law enforcement, backcountry patrols, resource protection, maintenance, education and interpretation, and any other staffing needs. Adverse impacts are greatest during peak use periods in spring and fall when the campground is full and day use is at its peak; this is often managed with only one ranger. Based on the limited staffing, impacts of day use management at Tuweep would be minor adverse and long-term, localized with moderate to major adverse short-term impacts during peak use periods.

Use Area Management
The park's backcountry is divided into 96 Use Areas that allocate use by geographic area. There are currently some problem Use Areas where the numbers of groups exceed capacity, or visitors camp in

inappropriate areas because they cannot reach their destination. Generally, these issues occur in high use areas and therefore impact park operations from the need for more frequent patrols for permit compliance, visitor safety and resource protection. These high use areas include Hermit, Monument and Granite Rapids, Deer Creek, Tapeats Creek, and Horseshoe Mesa. Trail maintenance and campsite restoration occur infrequently in Threshold Zone Use Areas and rarely in most Primitive and Wild Zone Use Area which would result in minimal impacts to park operations. Under Alternate A, Use Areas would continue to have problems and impacts to park operations would be minor adverse, regional, and long-term.

Human Waste Management

Human waste management in the backcountry includes different types of toilet facilities and regulations on waste disposal. Backcountry visitors are required to bury human waste at least 200 feet from tributary streams and carry out the toilet paper. This often causes social trailing and vegetation trampling resulting from users seeking privacy. In 2010, park staff conducted a pilot study to determine the feasibility of using personal-size human waste carryout bags. The pilot was deemed inconclusive based on limited data and fiscal resources to support continuation of the pilot.

The park adopted a human waste carryout system for river users over 30 years ago utilizing reusable, watertight containers to address the accumulation of waste along the river corridor. River rangers and resource staff monitor and clean up human waste at river corridor campsites that are used by backpackers. Backpackers camping at river corridor sites are not required to carry out their human waste.

NPS staff services all backcountry toilets by foot, mule, or helicopter. The staffing and cost to maintain backcountry toilets is high. In 2013, the trail crew manager estimated that 58,000 lbs. of waste were removed from compost toilets below the rim which cost approximately $300,000. Even in areas with toilets, safety for park staff is a concern because of the proximity to waste and the potential for contact. Many of these toilets are not maintained adequately or have exceeded their lifespan due to lack of funding and staffing. The impacts from human waste management to park operations would be moderate adverse, short-term, and localized under Alternative A.

River-assisted Backcountry Travel

Recently, there has been increased interest in RABT, popularizing the use of lightweight watercraft such as packrafts for backcountry travel. There is currently a five-mile for RABT (see Chapter 2). The overnight backcountry permits document the RABT use. Park staff has also observed some RABT day use although it is not currently allowed. A primary impact on park operations is monitoring and checking permits for this activity. Safety concerns also exist because individuals who are packrafting may not have the necessary skills and/or required safety equipment. The impacts from RABT to park operations are moderate adverse, short and long-term and regional.

Tribal Lands and Interests

The NPS works to educate visitors and park staff about tribal values and about access to the park's backcountry across tribal lands. The NPS Tribal Liaison works closely with park managers to ensure that access across tribal lands and other issues of mutual concern with the respective tribes are addressed. The NPS permits office provides information on the Navajo Nation, Havasupai, and Hualapai tribal permit contacts; however visitors often neglect to obtain tribal permits. As noted in Chapter 4 Adjacent Lands, during tribal consultations, tribal leaders shared concerns about visitor access and impacts to natural and cultural resources in specific areas. To that end, Grand Canyon managers have worked directly with the Havasupai Tribal leaders and resource offices to address visitor access on the Great Thumb Mesa and other parts of the reservation. Under Alternative A impacts to park management and operations would be minor, adverse, short-term and regional.

Administrative Use
Administrative functions in the backcountry include ranger patrols, maintenance, resource management, interpretation and educational trips, fire management operations and research activities. Permits are generally required for overnight administrative use and efforts are made to manage this use so as not to impact visitors. All administrative use must comply with minimum requirement policies and a MRA would be completed for all activities in Wilderness.

Administrative users often need flexibility in scheduling work, and some projects such as vegetation surveys, patrols and toilet maintenance may coincide with high visitor use periods, and result in minor adverse, short and long-term, localized and regional impacts to permit operations due to the lack of a Standard Operating Procedure or policy. While current policy for administrative backcountry use may have an effect on visitor experience, it provides more flexibility resulting in a beneficial, short-and long-term, localized and regional effect for field operations.

Commercial Overnight Backpacking
Commercial backpacking fits within the overall use limits, and therefore does not put additional pressure on ranger staff. CUA operators obtain permits in the same manner as the general public through the backcountry permits office. As of January 2014, 22 operators offer guided backpacking trips. CUAs are good for one year with a one-year renewal option. CUA operators are required to pay an annual fee to help to mitigate the effects to park staffing. However, CUA processing and compliance would have a minor, adverse, short-term regional impact to park staff mainly due to the time requirement and limited number of staff.

Because of the required skills, NPS rely on guides to provide the basic safety, first aid and resource education to their clients, and recognize the overall benefit to park visitors participating in guided trips. These impacts would be minor beneficial, long-term, and regional.

Commercial Day Hiking
Beneficial impacts from commercial day hiking include visitor education and enhanced visitor safety; thereby improving conditions for park rangers. Because the number of CUAs is unlimited, Concessions Management staff would be adversely impacted from the time required to process permits (as of 2014 there were 34 companies with CUAs for this activity). Therefore the impacts to park operations from managing commercial day hiking would be minor adverse, short-term and localized.

Commercial Backcountry Vehicle Tours (Tuweep)
Currently, five commercial operators are authorized to conduct tours at Tuweep, and each operator is allowed up to two trips per day Monday through Friday, and up to one trip per day on Saturday and Sunday. Although current use is lower than what is allowed, the impacts to park operations include CUA processing, and Tuweep ranger time to ensure compliance with permit conditions. The impacts of commercial vehicle tours on park operations and management would be minor, adverse, long-term, localized. Guided tours are expected to decrease the number of private vehicles at Tuweep and staff time to manage traffic and parking; however these beneficial impacts would not be measurable.

Commercial Filming
Filming requests are processed through Concessions Management and involve additional staff (resource and compliance specialists and rangers) to review proposals and set conditions to ensure resource protection and to prevent significant disruption of normal visitor uses. Some film permits require extensive review, including those that propose filming in Wilderness.

Commercial film permits are required to recover costs of permit processing and monitoring to help minimize disruption to other park operations. The impacts of commercial filming on park operations and

management would be minor, adverse, short-term, localized due to additional staff time needed for processing and monitoring commercial filming.

Maximum Group size for Overnight Backpacking by Zone
Current group size for all zones is 1-6 for small groups and 7-11 for large groups. Park rangers stationed at the Corridor Zone campgrounds year round report that managing larger groups requires more time and effort than smaller groups. As documented in other sections, the natural and cultural resources impacts associated with group size include damage resulting from campsite proliferation and social trailing. Park staff would be required for campsite and trail maintenance and site restoration. Impacts from group size for overnight backpacking would have minor to moderate adverse, short-term and regional impacts to park operations.

Backcountry Roads, Trails, and Routes
Impacts to park operations include maintenance of trails and open roads and monitoring of old roadbeds in Wilderness and closed roads (e.g., the Boundary Road) to ensure compliance and resource protection. Currently backcountry roads on the North Rim, South Rim, and at Tuweep are maintained for high-clearance vehicle access and roads on the Kanab Plateau are unmaintained. Unmaintained routes on old roadbeds are infrequently patrolled and used to access areas for vegetation, wildlife and archaeological field surveys. Where sections of old roadbeds are obliterated due to fallen burnt trees and overgrowth from wildland fires, routes are difficult to follow. Park maintenance and/or resource staff also provide resource condition assessments and remediation for roads and trails, monitoring for invasive species (brought in by vehicles), and other resource issues. Overall impacts to park operations from managing backcountry roads and trails would be moderate, adverse, long-term, and regional.

Tuweep Facilities
Although the 1995 GMP called for the removal and relocation of parking and a composting toilet from Toroweap Overlook to the campground, the actions were never implemented. One park ranger provides day-to-day management of the Tuweep area in addition to oversight of remote areas within Grand Canyon including the Kanab Plateau. Impacts to park operations include toilet and grounds maintenance and managing overlook parking, especially during high use periods. Under Alternative A, impacts to park management and operations would be minor, adverse, short and long-term and localized.

Corridor Zone Camping
The Corridor Zone includes three campgrounds that accommodate high levels of use year round. Camping is prohibited elsewhere in the Corridor Zone including Roaring Springs (Manzanita) on the North Kaibab. Impacts to park operations include managing overnight and day use, maintenance of campsites and toilets, permitting, and maintenance and operational costs associated with NPS support facilities (ranger stations, wastewater treatment, etc.). Because the Corridor Zone requires a high level of NPS presence and management, NPS staff are not able to accomplish work in other backcountry zones, therefore impacts to park operations would be minor to moderate, adverse, short and long-term, and both localized and regional.

Deer Creek/Tapeats Creek Complex
The Deer Creek/Tapeats Complex (see Chapter 2) is a very popular backcountry destination and relatively remote. The access trails, located on the North Rim, are difficult and infrequently maintained. Many visitors to the area have been unable to stay on itinerary which contributes to crowding in designated campsites or out of bounds camping within the same or abutting Use Area. These observations are corroborated by a rapid site inventory of backcountry campsites conducted from 2004-2006 (Foti et al. 2006). In addition to crowding, impacts include increase in number of barren core areas at designated camps, human waste accumulation, and damage to vegetation and cryptobiotic soils. Park rangers infrequently patrol these areas, and toilets are maintained infrequently. Resource management activities

including trail and campsite maintenance occur infrequently as well. Impacts to park operations under Alternative A would be minor, adverse, localized and regional, short and long-term.

Deer Creek Narrows
Access to the Deer Creek narrows is currently closed as described in the Superintendent's Compendium and is reviewed on an annual basis. Park staff would need to review the closure annually and would need to patrol the area to ensure that visitors comply with the closure. For these reasons, impacts to park operations would be minor, adverse, localized, and long-term.

Hance Creek Cottonwood Creek and Cremation Use Areas
Hance Creek, Cottonwood Creek and Cremation Use Areas all offer at-large camping opportunities and include capacity for two small and one large group. The western boundary of Cremation Use Area is heavily used, serving as a Corridor Zone overflow campsite. Impacts to park operations include the need for increased ranger patrols and campsite rehabilitation and monitoring, although this occurs at lower levels than in Threshold and Corridor Zone areas. Additional staff time is required to cover these areas and address impacts. Impacts to park operations under Alternative A would be minor, adverse, short-term, and localized.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) with potential to impact park management and operations include activities within the park that require additional time and resources from NPS staff. Past actions including fire management, overflights management, maintenance and construction projects, vegetation/habitat restoration, and river management have resulted in adverse impacts to park management and operations that include lack of staffing and funding to support operations

Present and foreseeable future actions overlap with some past actions and include fire management, river management, parkwide trails and facilities maintenance, search and rescue operations, Corridor Zone facilities and pipeline maintenance, and management of commercial services parkwide. These actions cause moderate, adverse, long-term, localized and regional impacts that include lack of staff and funding to support ongoing backcountry and parkwide priorities. Beneficial impacts from safety and Leave No Trace education and interpretation of resources are minor, long-term, and regional.

Cumulative effects to park management and operations from past, present, and reasonably foreseeable future actions discussed above are moderate, adverse, long-term, localized and regional. Alternative A would contribute a small amount to this adverse impact.

Conclusion
Under Alternative A, moderate, adverse, long-term and major, adverse, short-term, localized to regional impacts would result from larger group size management in all zones, the lack of policy for managing extended day hiking and running, management of Tuweep day use, maintenance of backcountry toilets and roads and trails, and illegal use of old road beds, and the need to address direct impacts to natural and cultural resources.

Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education.

Cumulative impacts would be moderate adverse, regional, short to long-term of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones

In addition to the four backcountry management zones described under Alternative A, this plan/DEIS proposes the addition of two zones to better describe the characteristics of the road-accessible areas and river corridor by setting objectives and standards. The Road Natural Zone would recognize that management of the road-accessible backcountry differs from the trail-accessible (Inner Canyon) backcountry. The River Zone designation would provide staff with more flexibility to manage overlapping backcountry and river use. Impacts to park operations as a result of adopting the additional management zones would be minor, beneficial, localized and long-term.

Climbing Management

Similar to Alternative A, climbing would continue in conjunction with overnight backpacking trips and some day use. General impacts to resources include social trailing to climbing routes, and vegetation trampling at the base of routes, and defacement of rock from fixed anchors such as bolts. For all action alternatives anchor placement guidance, activity identification on backcountry permits, and monitoring through field surveys would be implemented. Additional actions that could be implemented through adaptive management include a day use permit, set use limits for specific locations, restriction on number of groups by day or season, change in maximum overnight group size (decrease or increase), or seasonal or permanent restrictions for natural and/or cultural resource protection at specific locations. These actions would require more staffing and funding, and impacts to park operations would be minor, adverse, localized and regional and long-term.

Canyoneering Management

Similar to climbing, general impacts to park operations would include additional staff to implement monitoring, minimum impact programs and potentially site-specific restoration, therefore impacts to park operations would be minor, adverse, regional and long term.

Additional actions that could be implemented through adaptive management include a day use permit, restricting number of groups by day or season, changing maximum overnight group size (decrease or increase), or seasonal or permanent restrictions for natural and/or cultural resource protection at specific locations. These actions would be implemented to increase resource protection and would have beneficial impacts on park resources; however more staffing would be required to implement additional actions in the future. Overall, impacts on park operations would be moderate, adverse, regional and long-term.

Extended Day Hiking and Running Management

Extended day hiking and commonly referred to as rim-to-river, rim-to-rim, and rim-to-rim-to rim would continue to be allowed under all action alternatives. Day use permits with a cost of at least $5.00 would be required seasonally. Initially, the number of available permits would be unlimited. Additional management actions implemented through adaptive management could include group size limits, daily use limits, and designated days for group or individual events. Impacts to park operations from managing high levels of day use and a new permit system would be major, adverse for the short-term. If permit strategies work, long-term beneficial effects would occur. Implementation of additional restrictions and actions through adaptive management would also have short-and long-term adverse impacts. Additional staff including park rangers, permits staff, trails and facilities staff, and resource managers would be required to implement and monitor programs. The fees associated with the day use permit would mitigate some of the operational impacts. As an adaptive management component, continuous monitoring and data collection would be required to inform future actions; a higher level of visitor education would also be required. Overall, impacts to park operations from managing extended day hiking and running would be major, adverse, short and long-term, localized. Implementation of additional management actions through adaptive management, if successful, would lessen the adverse impacts.

Tuweep Day Use Management
The NPS would implement actions to ensure that the Tuweep area would be managed to stay within the limits set in the 1995 GMP. Actions include data collection, limits on the number of commercial stock use trips and vehicle tours at one time, increased information and improved signage to inform visitors about campsite availability, road conditions and other factors that impact access to the Tuweep area. Through data collection NPS would determine whether capacity is exceeded and how resources and visitor access is impacted. Future management action through adaptive management could include a requirement for day use permits or reservations, limits on the number of vehicles per party, and/or designated days for group events.

Impacts to park operations would be compounded by the remote location and travel logistics and additional staffing would be required to assist the Tuweep ranger. Future actions through adaptive management such as implementing day use permits and/or vehicle limits would also require additional staffing for enforcement purposes. Overall, impacts to park operations from implementing day use options would be major, adverse, short-term and minor to moderate, adverse, long-term, and localized

Use Area Management
Under all action alternatives, NPS managers would institute changes to Use Area boundaries, use limits, camping designations and permanent or seasonal closures to prevent resource degradation. Several specific actions are included in this plan/DEIS and additional future adaptive management actions would require additional NEPA documentation.

Implementation of Hermit, Granite Rapids and Deer Creek/Tapeats Creek Complex changes (see Chapter 2) would have overall beneficial effects on resources and park operations. Current staffing levels would be able to better manage specific issues in these Use Areas. Designating an additional campsite in Hermit Use Area would address visitor safety concerns. The decrease in number of groups allowed in the Granite Rapids Use Area would address crowding, user conflicts, and human waste management concerns. The changes to the boundaries in the Deer Creek/Tapeats Creek Complex would address off-itinerary hiking and overuse at popular destinations. Impacts to Use Area management on park management and operations would be moderate, beneficial, long-term, and regional.

Human Waste Management
Under all action alternatives, solid human waste carry out would be required in the River Zone, and commercially guided backpacking trips would be required to carry out solid human waste in Use Areas without backcountry toilets. Impacts to park operations would include increased education, enforcement, monitoring and compliance, resulting in short-term adverse effects; long-term beneficial effects of implementing a solid human waste carry out requirement would result from minimizing the presence of human waste, associated litter, and social trailing impacts.

Additional management actions implemented through adaptive management include the replacement and/or removal of toilets at existing sites, or the installation of toilets at other sites. If the human waste carry-out system is successful for the commercial backpacking trips and for trips camping in the River Zone, the NPS would consider expanding the carry-out system to other locations and/or on a seasonal basis.

The replacement, removal and/or maintenance of existing or new toilets which require use of the park helicopter and/or mules would continue to impact park operations. Fewer toilets would have a beneficial effect while additional toilets would have an adverse effect requiring additional staffing and funding. Implementation of carry-out requirements for additional areas within the backcountry would require a rigorous effort and long-term commitment. Overall, impacts to park operations from management of

human waste carry-out system and potential addition of toilets would be moderate, adverse, short-term, and regional.

River Assisted Backcountry Travel
Under all action alternatives, RABT group size would be a maximum of 6; and a permit would be required for day use and overnight trips. Impacts to park operations include implementation of a new day use permit, overnight permitting, and ranger patrols to ensure compliance with equipment and group size limits. Although the day use permit system would have a moderate adverse impact upon initial implementation, overall impacts would be minor, adverse, long-term, and both localized and regional.

Tribal Lands and Interests
Under all action alternatives, the NPS would work with the Havasupai Tribal Council to determine appropriate levels of access across Great Thumb on the Havasupai Reservation through the implementation of a pilot program. The proposed pilot program would permit ten small groups access across Great Thumb Mesa during the months of March through May. Impacts to park operations include frequent consultations and discussion with the Tribal Council and staff, and coordination with the Grand Canyon permits office, and would be minor, adverse, long-term and localized.

Administrative Use
Administrative users would generally obtain overnight backcountry permits with the exception of law enforcement patrols, and resource management activities that need immediate attention such as trail repair. Impacts to backcountry permits office would be minor and adverse due to potential overbooking during high use periods, however, field operations would benefit from a flexible administrative permit system. Overall, impacts to park operations would be minor adverse, short-term, localized for permit and MRA processing, and minor, beneficial, long-term, and regional due to flexibility of scheduling for field operations.

Commercial Overnight Backpacking
Under all action alternatives, the majority of commercially guided backpacking trips would be granted through concession contracts that allow a greater level of NPS oversight and insure higher quality visitor services. CUAs would continue to be authorized for companies doing a small number of trips per year.

Short-term impacts to Concessions Management include the development, advertisement, and awarding of contracts. Park rangers would also be involved to ensure compliance with contract or CUA conditions. The NPS would impose higher standards for guide qualifications and use reporting requirements (Appendix F), resulting in beneficial impacts to park rangers and concessions staff. Overall, impacts to park operations from the management of commercial backpacking would be moderate, adverse, short-term and minor, beneficial, long-term, and regional.

Commercial Day Hiking
Under all action alternatives day hiking would be authorized under a CUA and would not be allowed in the Wild Zone. Impacts would occur to Concessions Management including processing and review of CUAs annually, and to park rangers who monitor day hiking groups in the backcountry. Impacts to park operations from the management of commercial day hiking would be minor, adverse, long-term, and regional.

Commercial Bicycling
Under all action alternatives, commercial bicycling would be allowed to Tuweep, Point Sublime, and on the Arizona Trail's North Rim segment. Impacts to park operations including CUA permitting and data collection would be minor, adverse, short-term, and localized.

Commercial Filming
Commercial filming would not be permitted in the Wild Zone under any action alternative. Similar to Alternative A, the impacts of commercial filming on park operations and management would be minor adverse, short-term, localized due to additional staff needed for processing and monitoring commercial filming.

Cumulative Impacts
Please refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Please refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, the maximum group size in the Corridor and Threshold Zones would be 11 persons (both large and small groups would continue to be allowed) and Primitive and Wild Zone maximum group size would be six persons (only small groups would be allowed). While the number of permits available would be the same as Alternative A, the number of visitors in the Primitive and Wild Zones would decrease. The small group size in Primitive and Wild Zones with at-large camping would decrease campsite expansion and the need for site restoration or mitigation actions by park staff. Impacts to permit operations would be negligible. Overall impacts to park operations would be minor, beneficial, long-term, and regional.

River-assisted Backcountry Travel
Under Alternative B, RABT would be managed by 31 route-based river sections, and the number of sections would be limited daily. The detailed permit information would enable park rangers to track use and ensure compliance. Impacts to resource management would not differ from other alternatives, since the number of overnight users would not necessarily change. Beneficial impacts would result from small groups and an improved system for monitoring use. Impacts to park operations from implementation of a river section concept, with 31 distinct sections would be minor, beneficial, long-term, and regional.

Commercial Overnight Backpacking
Under Alternative B, commercial use caps would be placed for Corridor, Threshold, and Primitive Zones. Impacts to park operations would include concessions contract management, CUA annual review, and backcountry permitting. Issuing permits one year in advance as compared to four-months in advance would have negligible impacts on the permits operations. Beneficial effects would result from commercial guide requirements (Appendix F) to possess Wilderness First Responder and Leave No Trace training. Overall, the impacts to park operations would be minor, adverse, short-term, and localized, and minor beneficial, long-term, and regional.

Commercial Day Hiking
Under Alternative B, commercially guided hiking would be allowed only on six trail segments. Similar to Alternative A, impacts to park operations include CUA processing and data collection, and would be minor, adverse, long-term and regional.

Commercial Backcountry Vehicle Tours (Tuweep)
Under Alternative B, a maximum of two trips per day, compared to up to 10 per day currently, would be allowed. If a stock use trip were scheduled for the same day, only one vehicle tour would be allowed.

Impacts to park operations include CUA processing, scheduling and onsite monitoring to ensure compliance with CUA conditions. Beneficial effects would result from limiting the number of trips per day, and thereby the overall number of CUAs to process annually. Overall impacts to park operations would be minor, beneficial, long-term, and localized.

Backcountry Roads, Trails, and Routes
Under Alternative B, approximately 30 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails. North Rim trails were affected by moderate to high severity fires, and approximately three miles of the Francois Matthes and Walhalla Glades routes have been obliterated as a result of fallen burnt trees and new growth of native and non-native vegetation. The initial clearing of the trail segments would require a significant amount of time and would have moderate adverse impacts to the NPS trail crew. Overall impacts to park operations include trail development, trail maintenance and increased patrols resulting from improved access of trails. Class 1 trails are minimally developed and expected to have long-term beneficial effects due to maintenance requirements. Overall, impacts to park operations from development of Class 1 trails would be moderate, adverse, short term, localized and maintenance and patrols would be minor, adverse, long-term, and regional.

Tuweep Facilities
Under Alternative B, the Toroweap Overlook parking area would be relocated adjacent to the campground as described in the 1995 GMP. The road would be used as a trail and remain handicap accessible. Short-term adverse impacts to park operations include funding and staffing for the development of a new parking area, and installation of gates to manage access to the overlook. In addition, changes to use patterns would require more onsite management in early stages to ensure compliance with changes. Overall, impacts to park management and operations would be major, adverse, short-term, and minor adverse, long-term and localized.

Corridor Zone Camping
Under Alternative B, the number of campsites at Cottonwood Campground would increase by up to four small group campsites. Impacts to park operations include ranger patrols, maintenance of campsites and toilets, permitting, and maintenance and operational costs associated with NPS support facilities (ranger stations, wastewater treatment, etc.). Up to four more campsites at Cottonwood would result in minor adverse, short and long-term, and localized impacts to park operations.

Deer Creek/Tapeats Creek Complex
Under Alternative B, the overall number of groups in the complex would be reduced from 12 to 10 groups, and all would be small groups. Direct impacts to natural and cultural resources from less use per night and small groups would be decreased; and result in beneficial impacts to park operations due to decrease need for resource protection actions. Impacts to park operations from Deer Creek/Tapeats Creek Complex management and reduced number of groups would be minor, beneficial, localized and regional, and short-term. Minor, adverse, long-term impacts would result from continued use of the area and associated resource impacts.

Deer Creek Narrows
Under Alternative B, the Deer Creek Narrows closure described in Alternative A would become permanent. Annual review would not be required therefore; impacts to park operations would be minor, beneficial, localized and long-term.

Hance Creek Cottonwood Creek and Cremation Use Area Changes
Under Alternative B, Hance Creek, Cottonwood Creek, and Cremation Use Areas would offer at-large camping and the maximum group size of six. Beneficial, minor, long-term regional impacts would result from managing smaller groups and reduced efforts to address resource impacts such as campsite

rehabilitation. Ranger patrols would continue at levels similar to Alternative A, therefore impacts to park operations would be minor, adverse, short-term, localized.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. These impacts are moderate, adverse, short- to long-term, localized and regional. Beneficial impacts from safety and leave no trace education and interpretation of resources are minor, long-term, and regional. Cumulatively, the effects of Alternative B on park management and operations, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, and regional. Alternative B would contribute a small amount to this adverse effect.

Conclusion
Under Alternative B, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails, and maintenance of these trails, day use permits for RABT and Extended Day hiking, day and overnight use at Tuweep, and the need to address direct impacts to natural and cultural resources.

Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in Primitive and Wild Zones, authorizing commercial backpacking trips through concessions contracts and establishing caps for these trips in Corridor, Threshold and Primitive Zones.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a small amount.

ALTERNATIVE C

Maximum Group size for Overnight Backpacking by Zone
Same as Alternative A, group size for all zones would be 1-6 for small groups and 7-11 for large groups. Park rangers report that managing larger groups requires more time and effort than smaller groups. Resources impacts associated with group size include damage resulting from campsite proliferation and social trailing. Park staff would be required for campsite and trail maintenance and site restoration. Impacts from group size for overnight backpacking would have minor to moderate adverse, short-term and regional impact to park operations.

River-assisted Backcountry Travel
Under Alternative C, RABT would be managed by 11 river sections, and the number of sections allowed per permit would be limited daily. The detailed permit information would enable park rangers to track use and ensure compliance. Impacts to resource management would not differ from other alternatives, since the number of overnight users would not necessarily change. Beneficial impacts would result from small groups and an improved system for monitoring use. The implementation of a river section concept with 11 distinct river sections would require additional monitoring as compared to Alternative B due to the longer river sections and would result in minor, adverse, long-term, regional impacts to park operations.

Commercial Overnight Backpacking
Under Alternative C, commercial use caps for Corridor campgrounds would be lower than Alternatives B and D and higher than Alternative B for Threshold and Primitive Zone Use Areas. Impacts to park operations include concessions contract management, CUA annual review, and backcountry permitting. Issuing permits one year in advance as compared to four months in advance would have negligible

impacts on the permits operations. Beneficial effects result from commercial guide requirements (Appendix F). Overall, the impacts to park operations would be minor, adverse, short-term, and localized, and minor beneficial, long-term, and regional.

Commercial Day Hiking
Under Alternative C, day hiking would be allowed on trail segments described in Alternatives A and B and would add additional hikes with longer distances. Longer hikes on Corridor Zone trails would have negligible impacts on park operations, and overall impacts to park operations that include CUA processing and data collection, and would be minor, adverse, long-term and regional.

Commercial Backcountry Vehicle Tours (Tuweep)
Alternative C would allow a maximum number of three trips per day Monday through Friday and two trips per day on Saturday and Sunday. If a stock use trip were scheduled for the same day, one less vehicle tour would be allowed. Impacts to park operations include CUA processing, scheduling and onsite monitoring to ensure compliance with CUA conditions. While the number of CUAs processed each year is limited, the impacts would be slightly higher than under Alternatives B and D. Overall impacts to park operations would be minor, adverse, long-term, localized.

Backcountry Roads, Trails, and Routes
Under Alternative C, approximately 50 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 or Class 4 trails. The Boundary Road on the South Rim would be open to public vehicle use for access to the Pasture Wash area. This would require upgrades to provide primitive road access to high-clearance vehicles.

North Rim trails were affected by moderate to high severity fires, and approximately 4.5 miles of the Francois Matthes, Walhalla Glades, and Komo Point routes have been obliterated as a result of fallen burnt trees and new growth of native and non-native vegetation. The Tiyo Point route would be developed as a Class 4 trail to accommodate private stock use and would require extensive work to remove large fallen trees and vegetation clearing. The initial clearing of the trail segments would require a significant amount of time and would have moderate to major, adverse, short-term impacts.

The Vulcan's Throne Road would provide vehicle access to the rim, and Kanab Plateau trails would provide access to Boysag Point and Toroweap Point. Impacts to park operations include trail development, trail maintenance, new road maintenance and increased patrols resulting from improved access of trails and the Boundary Road. Class 1 trails are minimally developed and expected to have long-term minor impacts. Class 4 trails require additional maintenance to ensure that trails are maintained for stock and hiker use. Overall, impacts to park operations from development and maintenance of Class 1 and Class 4 trails and the development and maintenance of the Boundary Road would be major, adverse, short-term localized, and minor to moderate adverse long-term regional.

Tuweep Facilities
Same as Alternative A, the Toroweap Overlook parking would remain in the same location and not implemented as described in the 1995 GMP. There would be no changes to the campground. Impacts to park operations include maintenance of existing facilities, patrols to the overlook, campground and roads. Impacts to park operations from Tuweep Facilities would be minor adverse, short and long-term and localized.

Corridor Zone Camping
Under Alternative C, Corridor Zone camping would increase by adding one large campsite at Indian Garden, up to four small and one large campsite at Cottonwood, and two small campsites at Roaring Springs. There would be no changes to the Bright Angel Campground or other day use areas. The

addition of up to seven campsites would have adverse impacts to park operations including development of campsites, managing increased overnight use, maintenance of campsites and toilets, permitting, and maintenance and operational costs associated with NPS support facilities (ranger stations, wastewater treatment, etc.). Impacts from additional campsites would result in moderate long-term and major short-term adverse, localized and regional impacts to park operations.

Deer Creek/Tapeats Creek Complex
Under Alternative C, the overall number of groups in the complex would be reduced from 12 to 11 groups, and all would include small and large groups. Impacts to park operations includes toilet and trails maintenance and patrols for visitor use and resource monitoring. Impacts from redefining Use Area boundaries and one less group in the complex would also be similar to Alternative A, and overall the impacts to park operations from Deer Creek/Tapeats Creek Complex management and one less group would be minor, adverse, short and long-term, localized and regional.

Deer Creek Narrows
Under Alternative C, the Deer Creek Narrows would be open to climbing or rappelling and impacts to cultural values and natural resources would occur. Impacts to park operations would include ongoing resource monitoring of river and backcountry use in the Deer Creek Use Area, and would be minor, adverse, localized and long-term.

Hance Creek Cottonwood Creek and Cremation Use Areas
Under Alternative C, Hance Creek, and Cottonwood Creek Use Areas would be managed as Threshold, whereby designated campsites may be established and toilets may be installed. Cremation Use Area would continue to be managed as Primitive with at-large camping and no toilets. Alternative C would establish Cremation West, a designated site for one group on the use area boundary adjacent to the Corridor Zone. Impacts to park operations include increased ranger patrols, designated campsite development and maintenance, trails maintenance, and toilet installation and maintenance. Impacts to park operations would be moderate to major adverse short-term, localized, and minor to moderate adverse long-term regional.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. These impacts are moderate, adverse, short- to long-term, localized and regional. Beneficial impacts from safety and leave no trace education and interpretation of resources are minor, long-term, and regional.

Cumulatively, the effects of Alternative C on park management and operations, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, and regional. Alternative C would contribute a medium amount to this adverse effect.

Conclusion
Under Alternative C, and moderate to major, adverse, localized and regional, short to long-term impacts would result from larger group size management in all zones, management of extended day hiking and running, backcountry toilets installation and maintenance, conversion of old roadbeds to trails, development or upgrade and maintenance of Class 4 Tiyo Point trail and Boundary Road, day use permits for RABT and extended day hiking and running, Tuweep area management, and the need to address direct impacts to natural and cultural resources.

Minor beneficial, regional, long-term impacts would result from unmaintained routes in Wilderness and visitor education.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a medium amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, the maximum group size for the Corridor Zone would be 11 persons (both small and large groups would continue to be allowed), and Threshold, Primitive and Wild Zone maximum group size would be six persons (small groups only). While the number of permits would be the same as Alternative A, the number of visitors in the Threshold, Primitive, and Wild Zones would decrease, and maintenance of trails and toilets would be conducted less frequently. The small group size in Threshold, Primitive, and Wild Zones would decrease campsite expansion resulting in minor beneficial effects for park operations. Impacts to permit operations would be negligible. Overall impacts to park operations would be minor, beneficial, long-term, and regional.

River-assisted Backcountry Travel
Under Alternative D, RABT management would be most similar to Alternative A, but with an 11 mile travel limit that would not specify the RABT entry and exits points, and thereby would make it difficult for park rangers to track use and ensure compliance with permit conditions. Impacts to resource management would not differ from other alternatives, since the number of overnight users would not necessarily change. Beneficial impacts would result from small groups. Impacts to park operations from implementation of the 11 mile travel limit would be minor to moderate adverse, localized and regional.

Commercial Overnight Backpacking
Under Alternative D, commercial use would be allowed only in the Corridor Zone and use caps would be higher than Alternatives B and C. Limiting commercial use to the Corridor Zone would have beneficial impacts by concentrating management efforts to this zone. Impacts to park operations include concessions contract management, CUA annual review, and backcountry permitting. Issuing permits one year in advance as compared to four months in advance would have negligible impacts on the permits operations. Minor, beneficial, long-term, regional impacts would result from commercial guide requirements (Appendix F). Adverse impacts to park operations would be minor, adverse, short-term, and localized.

Commercial Day Hiking
Commercial day hiking would be authorized through a CUA and allowed in the Corridor Zone only on the Bright Angel, South Kaibab, and North Kaibab trails. Beneficial impacts would result from concentrating management efforts to one zone. Impacts to park operations include CUA processing and data collection, and would be minor, beneficial, long-term and regional.

Commercial Backcountry Vehicle Tours (Tuweep)
Alternative D would allow one trip per day if a stock use trip were not scheduled for the same day. Impacts to park operations include CUA processing, scheduling and onsite monitoring to ensure compliance with CUA conditions. Beneficial effects result from limiting the number of trips per day. Overall impacts to park operations would be minor, beneficial, long-term, localized.

Backcountry Roads, Trails, and Routes
Under Alternative D, approximately 14 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails. The Cape Solitude Trail on the South Rim would need minimal work at the beginning of the trail to better define the route, otherwise the impacts would be negligible. North Rim trails on the Walhalla Plateau and Tiyo Point would remain unmaintained routes, and the Vulcan's Throne trail would be designated. Impacts to park operations include trail development, trail maintenance and increased patrols resulting from improved access of trails. Class 1 trails are

minimally developed and expected to have long-term minor impacts. Overall, impacts to park operations from minimal development and maintenance of a limited number of Class 1 trails would be minor, beneficial, short and long-term, localized and regional.

Tuweep Facilities
Same as Alternative B, the Overlook parking area would be relocated adjacent to the campground as described in the 1995 GMP. The road would be used as a trail and remain handicap accessible. Short-term adverse impacts to park operations include funding and staffing for the development of a new parking area, and installation of gates to manage access to the overlook. In addition, changes to use patterns would require more onsite management in early stages to ensure compliance with changes. Overall, impacts to park management and operations would be major, adverse, short-term, and minor adverse, long-term and localized.

Corridor Zone Camping
Under Alternative D, no changes to the Indian Garden and Bright Angel Campgrounds or day use areas would occur. At Cottonwood Campground, the number of small campsites would increase by up to two small campsites. Impacts to park operations include development of new sites, ranger patrols, maintenance of campsites and toilets, permitting, and maintenance and operational costs associated with NPS support facilities (ranger stations, wastewater treatment, etc.). Up to two more campsites at Cottonwood would result in moderate adverse, short-term, localized, and minor adverse long-term, localized and regional impacts to park operations.

Deer Creek/Tapeats Creek Complex
Under Alternative D, the overall number of groups in the complex would be reduced from 12 to 8 groups, and all would be small groups. Direct impacts to natural and cultural resources would be decreased from less use per night and small groups; and result in beneficial impacts to park operations. Impacts to park operations from Deer Creek/Tapeats Creek Complex management and reduced number of groups would be minor, beneficial, short and long-term, localized and regional.

Deer Creek Narrows
Alternative D would implement the closure described in Alternative B, and would limit patio visitation to one river trip at one time. Monitoring of river and backcountry use in the Deer Creek Use Area would be more frequent to ensure compliance with the closure. Impacts to park operations would be minor, adverse, localized and long-term.

Hance Creek Cottonwood Creek and Cremation Use Areas
Under Alternative D, Hance Creek, Cottonwood Creek, and Cremation Use Areas would be managed as Primitive Zones with at-large camping and the maximum group size of six. Beneficial impacts of managing smaller groups include reduced efforts to address resource impacts such as campsite rehabilitation. Ranger patrols would continue at levels similar to Alternative A, therefore impacts to park operations would be minor adverse short-term, localized and minor beneficial long-term regional due to reduced group size.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. These impacts are moderate, adverse, short- to long-term, localized and regional. Beneficial impacts from safety and leave no trace education and interpretation of resources are minor, long-term, and regional.

Cumulatively, the effects of Alternative D on park management and operations, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term,

and regional of which Alternative D would contribute a very small amount.

Conclusion
Under Alternative D, and common to all action alternatives, minor to moderate, adverse, localized to regional, short and long-term impacts would result from increased overnight use at Cottonwood Campground, management of extended day hiking and running, maintenance of backcountry toilets, conversion of old roadbeds to trails and maintenance of these trails, day use permits for RABT and extended day hiking and running, Tuweep facilities changes, and the need to address direct impacts to natural and cultural resources.

Minor to moderate, beneficial, localized and regional, long-term impacts would result from smaller groups in all zones, and limiting commercial backpacking and day hiking to the Corridor Zone, and limits on commercial vehicle and stock use trips at Tuweep.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.

Adjacent Lands

ISSUES

Issues regarding adjacent lands identified through tribal consultation and public and internal scoping include

- Better access to park backcountry across tribal lands
- Access across Great Thumb on the Havasupai Reservation to the park is not currently permitted by the tribe
- Tribes have reported that some backcountry and river users access tribal lands including Havasupai, Navajo, and Hualapai without required tribal permits
- Due to the $25 fee collected by the tribe to cross Havasupai lands on the road to South Bass Trailhead, the public requested the NPS open the Boundary Road on park land
- Grand Canyon does not have a system in place to share information with adjacent land owners and managers and better understand reasons and extent to which people access adjacent lands

DESIRED CONDITIONS

From the 1995 General Management Plan: A Vision for the Future

- The park should work cooperatively with surrounding entities to encourage planning and management actions outside the park's boundaries compatible with those inside the park. Planning should be done regionally so concepts developed in the park can be linked to adjacent surrounding areas. The defined visitor experience for particular park areas should be carried over to Adjacent Lands. Information concerning the entire region should be provided and should explain visitor use management strategies, resource sensitivity, and interpretation, as well as help respond to general visitor needs

From the 1995 General Management Plan: Management Objectives

- Understand, assess, and consider effects of park decisions outside the park as well as inside

METHODOLOGY

Assessment of impacts to Adjacent Lands focuses on issues listed in Chapter 4, Adjacent Lands, Issues. Analysis identifies types and degree of impacts to Adjacent Lands associated with visitor use management and how these impacts would change with implementation of each Alternative.

INTENSITY DEFINITIONS

The general process for assessing impacts to the environment is discussed Chapter 4, Introduction. Effects specific to Adjacent Lands are characterized for each Alternative based on Intensity definitions defined below. Additionally, each Alternative was evaluated to determine whether effects would be direct or indirect.

Intensity

Negligible	Impacts would be barely detectable and/or would affect few neighbors
Minor	Impacts, adverse or beneficial, would be slight, but detectable, and/or would affect a minority of neighbors
Moderate	Impacts, adverse or beneficial, would be readily apparent and/or would affect many neighbors
Major	Impact severely adverse or exceptionally beneficial and/or would affect the majority of neighbors

Context

Localized	Impacts restricted to specific resources, facilities, locations, or operations on Adjacent Lands
Regional	Impacts occur to multiple facilities, locations, or operations on Adjacent Lands. Could also include impacts to facilities, locations or operations of regional significance

Duration

Short-term	Effects occur for a period of less than one year
Long-term	Effects occur for more than one year

Timing

Impacts have varying degrees of effect based on when they occur.

ASSUMPTIONS

Assumptions specifically related to alternatives and their effects on adjacent lands are

- An increase in education efforts related to tribal lands and required permits are expected to result in greater compliance by visitors and a subsequent reduction in trespass concerns
- Use of BLM and USFS roads leading to the park is assumed to decrease when adjoining park roads are closed because of the limit of access in the park

IMPACT ANALYSIS

Impacts to adjacent lands from day and overnight use

The most noticeable impacts to adjacent lands under all alternatives result from overall recreational use and demand to access the park's backcountry. Backcountry activities that may require access across adjacent lands include overnight backpacking, day hiking, technical canyoneering, climbing, river-assisted backcountry travel, bicycling, and touring in vehicles. Additionally, park backcountry recreationists may explore areas on adjacent lands during their visit.

Effects of backcountry recreation on adjacent tribal lands result from authorized and unauthorized visitation. Based on consultations with tribal representatives (see Chapter 5), adverse impacts resulting from this access includes disturbance of local residents and damage to cultural and natural resources. Tribal permit fees can help mitigate these impacts, but due to backcountry and Adjacent Land remoteness, tribal permit systems are difficult to implement and enforce. Under current conditions, NPS rangers inform backcountry visitors they are required to pay fees to appropriate tribal jurisdictions when visiting tribal lands, but anecdotal information suggests many visitors do not obtain permits or pay fees. Entering tribal lands without permission constitutes trespass. Tribal reservations are sovereign nations and have sole authority to regulate access to their lands.

Backcountry users access trails and park areas from USFS lands primarily on the North Rim. Crossing USFS land affords access to some popular backcountry destinations including Nankoweap, Deer Creek and Thunder River, South Canyon, and Kanab Creek. The Arizona Trail also leads into and out of the park on USFS land. Use of the Arizona Trail in the park is primarily day use. Backcountry users also access trails and park areas from BLM lands to the north and west of Grand Canyon, more specifically on the west side of Marble Canyon and on Kanab Plateau. These fairly remote areas are becoming more popular with backcountry hikers and canyoneers. Grand Canyon-Parashant National Monument borders approximately 15 of Grand Canyon's backcountry Use Areas and provides access to numerous park trails and canyons. These fairly remote areas are increasing in popularity with local and non-local visitors. Impacts to these lands include use of roads, facilities where present, camping impacts including direct impacts to natural and cultural resources and impacts of human waste management.

Although Grand Canyon borders Glen Canyon and Lake Mead, there is little access directly from those NPS units to Grand Canyon's backcountry.

ALTERNATIVE A

Backcountry Management Zones

Backcountry management zoning prescribes overnight use levels, guides backcountry management actions, and provides opportunities for a wide variety of backcountry experiences. Adjacent lands border Threshold, Primitive, and Wild Zones. The amount of overnight use and management levels would have some impact on adjacent lands from visitors and NPS staff access. More specific impacts are discussed by activity in the following sections. In general, access across and staging on adjacent lands would continue to have an impact. Indirect impacts to adjacent lands include campsite impacts such as social trailing, soil compaction, and human waste management near trailheads or access points, and direct impacts to natural and cultural resources. In addition, on tribal lands, impacts include disturbance to residents and livestock, and general trespass concerns. Minor, adverse, regional, short and long-term impacts would occur to adjacent lands from backcountry management zones.

Canyoneering Management

Access to canyoneering routes has potential to impact adjacent lands. Although information is not currently available regarding amount of canyoneering occurring, the NPS has started a monitoring

program to obtain baseline information along many popular canyoneering routes. Permits are only required if the trip includes an overnight backcountry stay. No day use permits are required. Canyoneering has become more popular with guide book publication, and overall increased interest in adventure sports. Due to increased activity, minor adverse short to long-term regional impacts would occur to adjacent lands from canyoneering.

Use Area Management
The park's backcountry is divided into 96 Use Areas that allocate use by geographic area. These Use Areas occur within park boundaries, but access to many Use Areas is across adjacent lands. Current Use Areas management would continue current impacts to adjacent lands. Impacts include those from camping and staging at trailheads. Indirect impacts include social trailing, soil compaction, and human waste management near trailheads or access points, and direct impacts to natural and cultural resources. Minor, adverse, regional, short and long-term impacts would occur to adjacent lands from Use Area management.

River-assisted Backcountry Travel
Access to some RABT routes is from adjacent lands (i.e., BLM and Navajo Nation in Marble Canyon). This access has potential to impact adjacent lands through staging and camping at trailhead or access points. Tribal permits are required for any access on or across tribal lands; however, based on feedback during tribal consultation, permit requirements are not always satisfied. Indirect impacts on adjacent lands include campsite impacts such as social trailing, soil compaction, and human waste management near trailheads or access points, creation of trails to canyoneering routes, or direct impacts to natural and cultural resources. Impacts to adjacent lands from RABT would be minor, adverse, short to long-term, regional.

Tribal Lands and Interests
The NPS works to educate visitors about backcountry access through tribal lands including sovereignty of these lands and need to contact respective tribes for permits. Tribal lands bordering the park include the Navajo Nation, and Havasupai and Hualapai Reservations. Visitors do not always obtain proper tribal permits, but instead access tribal lands without authorization. This trespass has been identified as an issue through tribal consultation with the Navajo, Havasupai, and Hualapai tribes.

During public scoping, visitors also expressed frustration about difficulties obtaining permits to access the park across tribal lands. In some cases, visitors were dissatisfied because they could not get permits. Other visitors shared comments that fees were too high or the process was too lengthy.

During consultation, tribes shared concerns about visitor impacts on tribal lands whether use is permitted or not. Impacts include direct impacts to natural and cultural resources; disturbance to archaeological and cultural sites, sacred areas, plants, livestock, resource gathering areas, and wildlife particularly during hunting season; privacy infringement, and wildlife poaching. Under Alternative A impacts to adjacent lands, specifically tribal lands, would be moderate, adverse, short to long-term, regional from continued access across tribal lands.

Maximum Group Size for Overnight Backpacking by Zone
Current small group size is 1-6, and 7-11 for large groups. Access across adjacent lands to the park for backpacking or venturing onto adjacent lands during a backcountry trip can impact neighboring lands. Larger groups have potential to result in greater indirect impacts including trail creation, hardening of surfaces for camping, human waste issues, noise, and direct impacts to natural and cultural resources. Under Alternative A, impacts to adjacent lands would be minor, adverse, long-term, localized from group size.

Backcountry Roads, Trails, and Routes
Grand Canyon's backcountry trails and routes in the Inner Canyon and rim areas total approximately 400 miles. In addition, approximately 140 miles of former fire or ranch roads in Wilderness have been closed under the Superintendent's Compendium since 1993 and used as trails or for administrative purposes. Many former fire or ranch roads have become overgrown and impassable. Designated roads provide access to scenic overlooks and trailheads. Elimination of these old roads has limited road access into the park from adjacent lands. At the same time, traffic has decreased over time on previous access roads on adjacent lands and has resulted in minor, beneficial, long-term, regional impacts to resources on adjacent lands from backcountry roads and trails.

Deer Creek/Tapeats Creek Complex
The primary trailhead to access the Deer Creek/Tapeats Complex is on USFS land; therefore, impacts to USFS land may occur from the park's backcountry recreationists. Camping and parking at the trailhead could have ground disturbing effects from compacted soils, digging cat holes for human waste, creation of fire pits, and other impacts associated with camping. Impacts to adjacent lands would be minor, adverse, short to long-term, regional from the Deer Creek/Tapeats Complex.

Cumulative Impacts
Cumulative impacts on adjacent lands were determined by combining Alternative A impacts with other past, present, and reasonably foreseeable future actions having impacts on lands adjacent to Grand Canyon's backcountry.

Past and ongoing activities considered in this analysis include fire management actions including prescribed and wild fires, mining, recreational use, education and interpretation, aircraft overflights, exotic plant management, and construction projects. These actions have caused moderate, adverse, long-term, regional impacts including increased noise, decreased visibility from smoke, and direct impacts to natural and cultural resources. Beneficial impacts from education and interpretation of resources and adjacent lands, and exotic plant management have been minor, long-term, and regional.

Recently completed and in-progress projects that could have a cumulative effect when combined with Alternative A include South Entrance Road and Desert View Improvements, and the South Rim Visitor Transportation Plan. These projects have a nexus with adjacent lands; however, adverse impacts to those lands are negligible.

Future projects include potential developments in Tusayan and other adjacent communities. Additional infrastructure in the area has potential to adversely affect adjacent lands and natural and cultural resources; however, not enough information is available to accurately determine these impacts.

Cumulatively, effects of Alternative A when combined with other past, present, and reasonably foreseeable actions, would result in moderate long-term regional adverse effects on adjacent lands. Alternative A would have a small contribution to this cumulative effect.

Conclusion
Under Alternative A, moderate, adverse, regional, long-term impacts would result from access across adjacent lands, associated campsite and staging impacts, trespass on tribal lands, and direct impacts to natural and cultural resources.

Minor, beneficial, long-term, regional impacts would result from conversion of roads in Wilderness.

Cumulative impacts would be moderate, adverse, short to long-term, regional of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones

As discussed under Alternative A, management zoning prescribes overnight use levels, guides backcountry management actions and provides opportunities for a wide variety of backcountry experiences. Primary proposed changes that would affect adjacent lands is addition of a new management zone, the Road Natural Zone and decreased group size in some Road Natural Zone areas. Only small groups (1-6 people) would be allowed in the following Road Natural Use Areas: Point Sublime, South Bass Trailhead, Kanab, and Tuckup. In addition to overnight group limits, Road Natural Zone areas would also have vehicle limits for both day and overnight use. These changes would result in less people accessing Road Natural areas and would reduce traffic/use on adjacent lands. However, these beneficial impacts would be negligible.

Canyoneering Management

Access to canyoneering routes has potential to impact neighboring lands, and impacts are described in Alternative A. For all action alternatives minimum impact canyoneering education, a monitoring program to track this activity through field surveys and backcountry permits, and a group size limit of six people per trip would be implemented. These actions are expected to decrease impacts especially through education efforts and limited group size. Potential impacts at staging and access points to canyoneering routes would be expected to decrease from current. However, as stated in Alternative A it is not known whether measureable impacts are occurring currently on adjacent lands from this activity. It is expected the decreased group size would decrease impacts to adjacent lands, however impacts including social trailing, soil compaction, and human waste management would continue to be minor, adverse, short to long-term, and regional.

Additional actions that could be implemented through adaptive management include a day use permit, restricting number of groups by day or season, changing maximum overnight group size (decrease or increase), or seasonal or permanent restrictions for natural and/or cultural resource protection at specific locations. These actions would be implemented to increase resource protection and would have beneficial impacts on resources both in the park and on adjacent lands. These impacts to adjacent lands would be beneficial and negligible.

Use Area Management

This plan/DEIS proposes specific management actions to address resource impacts, and analyzes potential management actions to allow NPS managers flexibility to address resource and visitor experience impacts that arise in the future. Changes in Use Area boundaries, use limits, camping designations, and permanent or seasonal closures are tools managers may use to prevent resource degradation. Specific actions proposed include establishment of a designated campsite along Hermit Trail (overall use limits would not increase); decrease in use limits at Granite Rapids from three to two groups; and redefinition of Use Areas in the Deer Creek/Tapeats Creek Complex.

Hermit Trail and Granite Rapids are accessed within the park and therefore no impacts to adjacent lands would occur. The Deer Creek/Tapeats Creek Complex is accessed across USFS lands, but Use Area redefinition does not affect adjacent lands.

These additional management actions would be considered in the future through the Adaptive Management Process

- Decrease or increase number of groups in Use Area(s) and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)

- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

Use area location would determine specific impacts to adjacent lands. Decrease in the amount of use either by decreasing number of groups, implementing seasonal decreases in use, or closing Use Areas would decrease impacts from camping and staging at trailheads for overnight backpackers. At the same time, camping and staging areas could still be used and impacted by day hikers or other recreationists. Impacts would be minor, beneficial, short to long-term regional.

Tribal Lands and Interests
The NPS would increase efforts to educate visitors about access to the park's backcountry through tribal lands including the Navajo Nation and Havasupai and Hualapai Reservations. Increased efforts would have a minor, regional, long-term beneficial impact on adjacent lands.

NPS would also work with the Havasupai Tribal Council to determine appropriate level of access across Great Thumb on the Havasupai Reservation as has been requested by backcountry users to more easily access park Use Areas. Tribal concerns with access across the reservation include wildlife poaching, hunting season safety, and sensitive cultural site disturbance. Allowing Great Thumb access would result in minor, adverse, short and long-term, localized impacts to adjacent lands.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Reduced group size limits in Primitive and Wild Use Areas would result in smaller groups, and in turn fewer people accessing the park across adjacent lands or crossing onto adjacent lands from the park. Decreased numbers of people staging and camping at trailheads and visiting adjacent lands on backcountry trips would result in fewer indirect impacts like campsite and human waste issues, and direct impacts to natural and cultural resources. Minor, beneficial, long-term, regional impacts would occur to adjacent lands from reduced group size.

River-assisted Backcountry Travel
As described in Alternative A, access to some RABT routes is from adjacent lands (i.e., BLM and Navajo Nation in Marble Canyon). This access has potential to impact adjacent lands through staging and camping at trailhead or access points. Tribal permits are required for any access from or across tribal lands; however, based on feedback in tribal consultation, permit requirements are not always satisfied. Impacts on adjacent lands include indirect impacts such as social trailing, soil compaction, and human waste management near trailheads or access points, creation of trails to climbing routes, or direct impacts to natural and cultural resources.

Implementation of a river permit by section concept, with 31 distinct sections, would not have additional impacts on adjacent lands. Impacts to adjacent lands from RABT would be minor, adverse, short to long-term regional.

Backcountry Roads, Trails, and Routes
Under Alternative B, several former roadbeds as described in Alternative A would be maintained as Class 1 and Class 2 Wilderness trails including Tiyo, Francois Matthes, and Walhalla Glades. These are currently unmaintained routes and do not border adjacent lands; therefore, maintenance of these trails would not impact adjacent lands. Old roads on Kanab Plateau would be managed as in Alternative A: road access would continue to Kanab and SB Points, 150-Mile, and Schmutz Spring Trailhead. Decreased traffic on BLM and USFS access roads would continue to result in minor, beneficial, long-term, regional impacts to adjacent lands.

Deer Creek/Tapeats Creek Complex
As described in Alternative A, the primary trailhead to access this area is on USFS land. Camping and parking at the trailhead could have ground disturbing effects from compacted soils, digging cat holes for human waste, fire pit creation, and other impacts associated with camping. Alternative B proposes to decrease the number of groups in this area from 12 to 10, and all would be small groups. This change is expected to have similar and possibly slightly reduced adverse impacts to adjacent lands based on the decrease in users.

Cumulative Impacts
Cumulatively, effects of Alternative B and Common to All Action Alternative elements, when combined with other past, present, and reasonably foreseeable actions, would be similar to those described for Alternative A and would result in moderate adverse long-term regional effects on adjacent lands. Alternative B would also result in a very small contribution to this cumulative effect.

Conclusion
Under Alternative B and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources.

Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in some zones, and limits on number of people and vehicles for organized groups.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative B would contribute a very small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone
Impacts would be the same as described for Alternative A. Impacts to adjacent lands would include staging and camping at trailhead and access points and result in trail creation, hardening of surfaces for camping, human waste issues, noise, and direct impacts to natural and cultural resources. Minor, adverse, regional, short and long-term impact would occur to adjacent lands.

River-assisted Backcountry Travel
Impacts to adjacent lands would be the same as those described in Alternative A and B. No change in impacts is expected from the number of river sections defined for this activity. Impacts from access across adjacent lands would be minor, adverse, short to long-term and regional.

Backcountry Roads, Trails, and Routes
Under Alternative C, several former roadbeds as described in Alternative A would be maintained as Class 1 Wilderness trails including Eremita Mesa, Cape Solitude, Francois Matthes, Walhalla Glades, and Komo Point. These are currently unmaintained routes and do not border adjacent lands, therefore maintenance of these trails would not have an impact on adjacent lands. Old roads on the Kanab Plateau would be managed the same as Alternative A, road access would continue to Kanab Point, SB Point, 150-Mile, and Schmutz Spring Trailhead. A decrease in traffic on the previous access roads on BLM and USFS lands have resulted in minor, beneficial, long-term, regional impacts to resources on adjacent lands.

Deer Creek/Tapeats Creek Complex
As described in Alternative A, the primary trailhead to access this area is on USFS land. Camping and parking at the trailhead could have ground disturbing effects from compacted soils, digging cat holes for human waste, creation of fire pits, and other impacts associated with camping. Alternative B proposes to decrease the number of groups in this area from 12 to 11 and would allow both large and small groups. This is expected to have similar impacts to Alternative A.

Cumulative Impacts
Cumulatively, effects of Alternative C and Common to All Action Alternative elements, when combined with other past, present, and reasonably foreseeable actions, would be similar to those described for Alternative A and would result in long-term regional adverse moderate effects on adjacent lands. Alternative C would also result in a small contribution to this cumulative effect.

Conclusion
Under Alternative C and elements common to all action alternatives, minor to moderate, adverse, regional, short to long-term impacts would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources.

Minor to moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, and limits set for people and vehicles in organized groups.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative C would contribute a small amount.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Reduced group size limits in Threshold, Primitive and Wild Zone Use Areas would result in smaller groups, and in turn fewer people, accessing the park across adjacent lands or crossing onto adjacent lands from the park. This is expected to have a minor, beneficial, long-term, localized impact on adjacent lands from decreased numbers of people staging and camping at trailheads and decreased numbers of people visiting adjacent lands on backcountry trips.

River-assisted Backcountry Travel
Impacts to adjacent lands would be the same as those described in Alternative A, B, and C. No change in impacts is expected from managing RABT by an 11-mile travel limit. Impacts from access across adjacent lands would be minor, adverse, short to long-term and regional.

Backcountry Roads, Trails, and Routes
Under Alternative D, several former roadbeds as described in Alternative A would remain unmaintained as in Alternative A. In addition, old roads on the Kanab Plateau would be managed the same as Alternative A, road access would continue to Kanab Point, SB Point, 150-Mile, and Schmutz Spring Trailhead. A decrease in traffic on the previous access roads on BLM and USFS lands have resulted in minor, beneficial, long-term, regional impacts to resources on adjacent lands.

Deer Creek/Tapeats Creek Complex
As described in Alternative A, the primary trailhead to access this area is on USFS land. Camping and parking at the trailhead could have ground disturbing effects from compacted soils, digging cat holes for human waste, creation of fire pits, and other impacts associated with camping. Alternative D proposes to decrease the number of groups in this area from 12 to 8 and all would be small groups. Compared to Alternative A, Alternative D is expected to have reduced adverse impacts to adjacent lands based on the decrease in use.

Cumulative Impacts
Cumulatively, effects of Alternative D and Common to All Action Alternative elements, when combined with other past, present, and reasonably foreseeable actions, would be similar to those described for Alternative A and would result in long-term regional adverse moderate effects on adjacent lands. Alternative D would result in a very small contribution to this cumulative effect.

Conclusion
Under Alternative D and elements common to all action alternatives, minor, adverse, regional, short to long-term impacts to adjacent lands would result from access across adjacent lands and associated campsite and staging impacts, some continued trespass onto tribal lands, and direct impacts to natural and cultural resources.

Moderate, regional, long-term beneficial impacts would occur from increased education of permit requirements for tribal and other agency lands, increased education about resource stewardship on overnight and day use permits, decreased group size in all zones bordering adjacent lands, and limits on number of people and vehicles for organized groups.

Cumulative impacts would be moderate, adverse, regional, short to long-term of which Alternative D would contribute a very small amount.

Wilderness Character

ISSUES

Issues regarding wilderness character identified through public and internal scoping include

- Overall protection of Grand Canyon wilderness character and compliance with NPS Wilderness management policy
- Visitor use management consistent with wilderness character including outstanding opportunities for solitude and unconfined recreation and less restriction in more remote areas

- Wilderness access
    - support for prohibitions on bicycle use and other non-conforming uses
    - and conversely, support for opening trails to bicycle use (Cape Solitude, Tiyo Point, etc.)
- Need for an improved framework and programmatic guidance for consistent decision making in managing backcountry areas
- Facilities in Wilderness
    - impacts on visitor experience include presence of structures and maintenance activities
    - impacts on other park resources including wildlife, vegetation, and cultural resources from concentrated use
- Consistent implementation of Minimum Requirement Analysis for administrative activities
    - ensure park operations, particularly those affecting Wilderness, use procedures and equipment that eliminate or at least minimize natural and cultural resource impacts, including experiential impacts and reduce carbon footprint

DESIRED CONDITIONS

- The NPS recognizes Wilderness is a composite resource with interrelated parts and wilderness character is the combination of biophysical, experiential, and symbolic ideals that distinguishes Wilderness from other lands
- Grand Canyon's Wilderness retains its wilderness characteristics and values. Visitors find ample opportunities for primitive recreation and solitude. Wilderness areas are affected primarily by the forces of nature, and signs of modern people remain substantially unnoticeable. Backcountry visitors value and support Wilderness preservation

METHODOLOGY

The analysis identifies how impacts to wilderness character would change with implementation of the alternatives proposed in this plan/DEIS. Baseline information and methods used for analysis include park staff knowledge of resources and sites, review of existing literature and park plans and studies, information provided by specialists in the NPS and other agencies, and professional judgment. Additional wilderness character information sources used are as described in Chapter 3, Affected Environment, and Wilderness Character.

INTENSITY DEFINITIONS

The general process for assessing impacts to the environment is discussed in Chapter 4's Introduction. Effects specific to wilderness character are characterized for each alternative based on intensity definitions defined below.

Negligible — Wilderness character would not be affected, or changes in character and qualities would be below or at level of detection. Visitors would not likely be aware of effects whether adverse or beneficial

Minor — Changes, adverse or beneficial, in wilderness character and qualities would be detectable, although changes would be slight and within limited areas. Some visitors would be aware of effects, but not noticeable by most visitors

Moderate — Changes, adverse or beneficial, in wilderness character and qualities would be readily apparent within limited areas. Visitors would be aware of effects and might express an opinion about changes

Major	Changes in wilderness character and qualities would be readily apparent; and may be severely adverse or exceptionally beneficial. Visitors would be aware of effects associated and express a strong opinion about changes

Context

Localized	Impacts would be restricted to specific resources, locations, or operations in Wilderness
Regional	Impacts would occur to multiple locations or operations in Wilderness. Could also include impacts to facilities, locations, or operations of regional significance

Duration

Short-term	Effects would occur for hours or days
Long-term	Effects would occur for months or more than one year

Timing

Impacts have varying degree of effect based on when they occur

ASSUMPTIONS

Assumptions specifically related to impacts on wilderness character are as follows:

- In accordance with NPS Management Policies 2006, proposed Wilderness will be managed as designated Wilderness
- Visitor use on the Colorado River through Grand Canyon is prescribed by the 2006 Colorado River Management Plan (CRMP); impacts to backcountry users from river use and management is addressed as a cumulative impact
- Wilderness character is the combination of biophysical, cultural, and experiential conditions that must be analyzed collectively. It is possible that adverse impacts to one wilderness character quality may result in a beneficial impact to another quality

IMPACT ANALYSIS

ALTERNATIVE A

Alternative A would continue existing management practices, and would result in current trends in resource conditions and visitor opportunities. The most noticeable impact to wilderness character under Alternative A would be from overall backcountry recreational use and facility management. Recreational activities that may impact wilderness character include overnight backpacking, day hiking, technical canyoneering, climbing, and river-assisted backcountry travel.

Backcountry Management Zones

Management Zoning is a tool for managers to structure planning and set resource priorities. Each management zone would prescribe overnight use levels, guide backcountry management actions, and provide opportunities for a wide variety of backcountry experiences. Current Management Zoning includes, and would continue to include, Threshold, Primitive, and Wild Zones in Wilderness, and the Corridor Zone in non-wilderness. The 1988 Backcountry Management Plan described management objectives for each Zone that focus on campsite resource conditions, recreational facility type and number

including toilets and signs, and number of backcountry encounters. Backcountry roads would continue to provide access to rim overlooks and trailheads within a 300-foot-wide non-wilderness corridor that overlays Threshold, Primitive, and Wild Zone Use Areas. Continuation of current of management zones would result in minor, adverse, localized to regional, long-term impact to wilderness character.

Climbing Management
Under Alternative A, climbing would continue on a relatively limited basis, generally in conjunction with an overnight backpacking trip. General impacts to resources would continue to include trailing, soil compaction, and vegetation trampling at the base of routes and defacement of rock from chalk and fixed anchors such as bolts. While NPS policy prohibits use of motorized drills in Wilderness, the park currently lacks policy or programs to monitor drill use or resource impacts from this activity. The amount of climbing is generally unknown and anecdotal information from NPS staff indicates climbing is fairly limited at Grand Canyon. Continuation of current climbing management would result in minor, adverse, localized, and long-term impact to wilderness character; however beneficial impacts to visitor experience are moderate, localized and short-term.

Canyoneering Management
Canyoneering would continue to be managed in a similar way as climbing, therefore the same impacts of climbing would apply. See above section for further detail impact analysis for canyoneering/climbing under Alternative A.

Use Area Management
The park's backcountry is, and would continue to be, divided into 96 distinct Use Areas that allocate use by geographic area. Wilderness Use Areas would continue to be zoned as Threshold, Primitive and Wild, and would constitute over 90% of the park's backcountry. Current management of Use Areas with no change to number of groups, group size, or facilities including toilets and trails would continue current impacts to wilderness character. Impacts include encounters with large groups, vegetation trampling and soil compaction at campsites, direct impacts to archaeological sites and facility maintenance activities. Continuation of current management would result in minor, adverse, localized and regional short and long-term impacts to wilderness character.

Human Waste Management
Human waste management in Grand Canyon's backcountry is currently addressed on a site-specific basis and would continue under Alternative A. Continuation of current management would allow toilets in Threshold Zone use areas, and would continue to be maintained using helicopters. Although a toilet may be the minimum tool for addressing resource and health issues in backcountry areas with higher use, the overall management and maintenance of these areas and facilities impact Wilderness qualities. Backcountry toilet maintenance currently requires the use of helicopters (NPS 2003b). Impacts to Wilderness include the presence of toilet structures, encounters with maintenance crews and noise and visual impacts from helicopter use. Impacts to vegetation, wildlife, soils, water and archaeological sites include improper human waste burial, trash, and trailing. These impacts would continue to result in minor to moderate, adverse localized and regional short and long-term impacts to wilderness character.

River-assisted Backcountry Travel
RABT affords visitors the opportunity to experience Wilderness utilizing various human-powered modes of travel. Under Alternative A, RABT would continue to be managed in accordance with the Superintendent's Compendium of Closures and Use Restrictions (Compendium, NPS 2013g), which is a five-mile limit on same-side river travel as part of any overnight backcountry trip. River crossings may be approved for the minimal amount of river travel necessary to gain access to hiking terrain on the opposite shore. This restriction may be perceived as a constraint and result in minor adverse impacts on Wilderness experience (see also Chapter 4, Visitor Use and Experience). Impacts to natural and cultural resources

associated with RABT, are generally minor and adverse. However, when combined with other activities such as canyoneering, overall intensity may increase based on location and presence of sensitive resources. Continuation of current management would result in minor, adverse, localized and short-term impacts to wilderness character.

Tribal Lands and Interests
The NPS works, and would continue to work, to educate visitors about access to the park's Wilderness backcountry through tribal lands including the sovereignty of these lands and the need to contact the respective tribe for permits. The remote tribal lands surrounding the park tend to increase the overall "Wilderness" of the greater Grand Canyon landscape. Due to some visitor concerns about access and permitting on tribal lands, the Wilderness experience would be adversely affected. As noted in Chapter 4 Adjacent Lands, during tribal consultations, tribal leaders shared concerns about visitor access and impacts to natural and cultural resources in specific areas. Continuation of current management would result in minor, adverse, short-term and regional impacts to wilderness character.

Administrative Use
Administrative use in Wilderness would continue to include maintenance (e.g., toilets, trails), ranger patrols, visitor education, resource management (wildlife monitoring, invasive plant management, campsite rehabilitation, archaeological monitoring and mitigations, water quality monitoring, etc.) and research. The minimum requirement analysis evaluates impacts to Wilderness qualities and values and frequently results in trade-offs amongst those qualities and values. Impacts to wilderness character would continue to include, noise disturbances from helicopter use and work crews, encounters with work crews and potential displacement of overnight visitors, and disturbance to vegetation, wildlife and cultural resources due to management activities. Impacts to wilderness character would continue to be moderate, adverse, localized and short-term.

Commercial Overnight Backpacking
Commercially guided backpacking trips would continue to occur in all Wilderness management zones. Commercially-guided trips are included in the overall Use Area limits, and impacts from these trips are not differentiated from the impacts from the overall use. The NPS does not currently have educational or skills requirements in place to ensure greater protection of Wilderness values and resources. Therefore, continuation of current management would result in minor, adverse, localized and regional, short-term impacts to wilderness character.

Commercial Day Hiking
Commercial day hiking trips would continue to be limited to the non-wilderness Corridor Zone and three trails in the Wilderness, with recommended distances of three to five miles. The impact to Wilderness experience would be beneficial due to the maximum group size when compared to the absence of group size limits for unguided day hikes. Under Alternative A, most guided hikes would remain on non-wilderness Corridor Zone trails, with short hikes on Threshold Zone trails. Continuation of current commercial day hiking management would result in minor, beneficial, localized and short-term impacts to wilderness character.

Commercial Filming
Continuation of Grand Canyon's general commercial filming policy would not provide specific guidance for filming in Wilderness. Impacts from commercial filming may include encounters with film crews and disturbance to wildlife, lighting and noise disturbances. Therefore, continuation of current management would result in minor to moderate, depending on location, adverse, localized and short-term. impacts to wilderness character

Maximum Group Size for Overnight Backpacking by Zone
Overnight backpacking use limits are described for each Use Area. The maximum group size for all management zones is 11 persons, no more than one large group (7 to 11 persons) would be allowed per night per Use Area in the Threshold, Primitive and Wild Management Zones. The current maximum group size limit would continue to be consistent with group size limits in other NPS-managed Wilderness (Hendee et.al 1990). The Threshold Zone designated camping areas include more large groups compared to Primitive and Wild Zone areas with at-large camping. Impacts associated with large groups include campsite expansion resulting from soil compaction and vegetation damage and effects on the visitor experience from campsite competition and campsite and/or trail encounters. Continuation of current management would result in minor to moderate, adverse, regional and long-term impacts to wilderness character

Backcountry Roads, Trails, and Routes
Since 1993, former fire and ranch roads have been closed in Wilderness to comply with the Final Wilderness Recommendation and NPS Management Policy. No current plan addresses the temporary or permanent closure of the roads, restoration of old roadbeds, or conversion of roads to trails. Visitors use many of these former roadbeds as unmaintained hiking routes and, while some have become overgrown and are no longer detectable, all are managed in accordance with the Superintendent's Compendium. Under Alternative A, no changes would occur and unmaintained routes for hiker access would continue to allow former roadbeds to recover naturally. Beneficial effects include absence of non-conforming vehicle use in Wilderness, regrowth of vegetation along old roadbeds. Adverse effects include illegal vehicle use of "closed roads" resulting in soil compaction and vegetation damage. Continuation of current management would result in minor to moderate, adverse, regional and long-term impacts to wilderness character

Deer Creek/Tapeats Creek Complex
The Deer Creek/Tapeats Complex consists of five Use Areas and the number of small and large groups permitted in each of these areas is shown on Map 2.2. Three of these Use Areas are within the Threshold Zone with designated campsites and two Use Areas have toilets. Park staff has noted that many visitors to the area have been unable to stay on itinerary which contributes to crowding in designated campsites or out of bounds camping within the same or abutting Use Area. These observations are corroborated by a rapid site inventory of backcountry campsites conducted from 2004-2006 (Foti et al. 2006). In addition to crowding, impacts include an increase in number of barren core areas at designated camps, human waste accumulation, and damage to vegetation and cryptobiotic soils. Under Alternative A, no changes to management of the Deer Creek/Tapeats Creek Complex would occur and these impacts would continue. Therefore, continuation of current management would result in moderate, adverse, localized and regional, and short and long-term impacts to wilderness character.

Deer Creek Narrows
The Deer Creek Narrows restriction is authorized under the Superintendent's Compendium (NPS 2013g) to protect cultural values and natural resources by prohibiting climbing or rappelling into the narrow canyon to the base of Deer Creek Falls. While the Patio area of the Deer Creek is frequently visited by river users and backpackers, limited use of the Narrows occurred prior to implementation of the closure. Ethnographic resources are adversely affected by crowding, and altering access to traditional Use Areas. Under Alternative A, the restriction would continue to be reviewed annually. Continuation of current management would result in minor, adverse, localized, and short and long-term impacts.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Hance Creek, Cottonwood Creek, and Cremation Use Areas would continue to be managed as Primitive Zones with at-large camping. In Hance Creek and Cottonwood Creek, camping would continue to be concentrated near perennial water sources. Impacts include soil compaction, trailing, improper human

waste and food disposal, and disturbances to archaeological sites. Cremation Use Area lies east of the Corridor Zone and is often used as an alternate or "overflow" for visitors and commercially guided trips seeking permits for Bright Angel Campground. Impacts include a high concentration of campsites near the western Use Area boundary (Foti et al. 2006) resulting in crowding, trailing, improper human waste and food disposal, and disturbances to archaeological sites. Continuation of current management would result in moderate, adverse, localized and long-term impacts to wilderness character.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions (see Table 4.1) have potential to contribute to cumulative impacts to wilderness character. Past actions include fire management actions (prescribed and wildfires), mining, recreational use, aircraft overflights, exotic plant management, fisheries projects, motorized and non-motorized river use, ongoing river research and administrative backcountry activities and have resulted in adverse impacts to wilderness character. Adverse impacts include increased noise, loss of solitude, and degradation to overall aesthetics.

Present and foreseeable future actions overlap with some past actions and include fire management, mining, recreation use, overflights, exotic plant management, fish management, motorized and non-motorized use, river use and research, and long-term experimental and management plan for operation of Glen Canyon Dam. Ongoing fire management activities, focused on fuel reduction and restoration of fire as an ecological process, can have both beneficial and adverse impacts to wilderness character. NPS and adjacent land managers including the U.S. Forest Service conduct fire management activities each year. Fire has been a natural part of the ecosystem, but suppression activities over a number of years have resulted in an unnatural fire regime and changes to vegetation and wildlife habitat. Bringing fire back to the system will have long-term beneficial impacts to Wilderness. Air tour overflights impact Wilderness Character through decreased opportunities for solitude. These air tours occur using both airplanes and helicopters and have an adverse effect on wilderness character. Maintenance and construction including road maintenance and repair impact wilderness character. Impacts from these activities include noise disturbance from mechanized equipment and helicopters and increased human presence in the backcountry. Vegetation management, particularly removal of exotic species such as tamarisk, has occurred in Grand Canyon for several years and will continue to occur. Removal of tamarisk is a beneficial impact to the natural quality of wilderness character.

Cumulative effects to wilderness character from past, present, and reasonably foreseeable future actions discussed above are moderate, adverse, short to long-term, localized to regional. Alternative A would contribute a small amount to this adverse impact.

Conclusion
Under Alternative A, moderate, adverse, regional, short to long-term impacts to wilderness character would result from large groups in Primitive and Wild Zones, presence of toilet facilities and the effects of toilet maintenance, the absence of an anchor policy, presence and illegal use of old road beds, and direct impacts to natural and cultural resources.

Minor beneficial, regional, long-term impacts would result from conversion of roads in proposed Wilderness.

Cumulative impacts would be moderate, adverse, short to long-term, localized to regional of which Alternative A would contribute a small amount.

IMPACTS OF ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Backcountry Management Zones

In addition to the four backcountry management zones described under Alternative A, this plan/DEIS proposes the addition of two zones. The Road Natural Zone would recognize road-accessible backcountry as an experience different from trail-accessible (Inner Canyon) backcountry and resources management standards within and adjacent to the proposed Road Natural Zone would also differ from other backcountry management zones.

The proposed River Zone would overlap with existing Wilderness and non-wilderness areas; Corridor, Threshold, Primitive, and Wild Zones; and Use Areas along the Colorado River corridor for its 270-mile length. The proposed River Zone would recognize and acknowledge resources and visitor use differ from other remote backcountry areas. Proposed River Zone resource management standards also differ from other remote backcountry management zones due to the upstream presence and influence of Glen Canyon Dam. As a management tool, zoning would allow park managers to better describe the characteristics of the road-accessible areas and river corridor, thereby setting objectives and standards. For the reasons above, impacts to wilderness character as a result of adopting the additional management zones would be moderate, beneficial, localized and long-term.

Climbing Management

Similar to Alternative A, climbing would continue, likely on a relatively limited basis based on past and present use, in conjunction with an overnight Wilderness backpacking trip. For all action alternatives anchor placement guidance, activity identification on backcountry permits, monitoring through field surveys, and minimum impact climbing education would be implemented. These actions would be expected to decrease impacts to park resources specifically through education efforts and guidance on anchor placement and would result in minor, beneficial, regional, long-term impacts to wilderness character.

Additional actions that could be implemented through adaptive management include monitoring day use via permitting, setting use limits for specific locations, restrictions on number of groups by day or season, changes in maximum overnight group size, or seasonal or permanent restrictions for natural and/or cultural resource protection at specific locations. In addition, a Climbing Management Plan could be developed if deemed necessary based on monitoring and impacts to park resources. These actions would be implemented to increase overall resource protection and would have beneficial impacts on wilderness character. These impacts to wilderness character would be moderate, beneficial, localized and long-term.

Canyoneering Management

Because canyoneering and climbing are similar activities, and the proposed and potential management actions for climbing mirror those for canyoneering, the same analysis applies. Similar to climbing, impacts would be moderate, beneficial, localized and long-term.

Use Area Management

Under all action alternatives, the following management actions would allow NPS managers flexibility to address resource and visitor experience impacts. 1) The designated campsite along the Hermit Trail would help disperse overnight use and decrease encounters at the other designated camp in Hermit Use Area. Impacts to natural and cultural resources would be negligible because the campsite would be within an area currently impacted by visitation. 2) The use limits at Granite Rapids from three to two backpacking groups would have beneficial effects on Wilderness experience by reducing crowding. This camp is also a popular camp for river runners and is often shared during spring and fall months. Fewer people and groups at one time would also decrease social trailing and human waste compared to current. 3) The redefinition of Use Areas in the Deer Creek/Tapeats Creek Complex would result in greater dispersal of

visitors, thereby reducing trail encounters and crowding at designated campsites, which would decrease impacts to natural and cultural resources in those areas. For all action alternatives, the impacts to wilderness character from these Use Area changes would be moderate, beneficial, localized, short and long-term.

Management Actions Potentially Implemented through Adaptive Management Process

- Decrease or increase number of groups in Use Area(s) and/or designated sites
- Variable seasonal use limits (e.g., higher in winter, lower in spring)
- Change camping designations: from at-large camping to designated sites, or from designated sites to at-large camping
- Redefine Use Area boundaries (e.g., split large Use Areas, identify complexes such as Deer Creek/Tapeats Creek, Hermit/Monument)
- Seasonal or permanent closures at specific locations

The location of the Use Area and the specific management action would determine the impacts to wilderness character, and would likely result in a trade-off amongst Wilderness qualities. For example, the increase in use limits and designating sites generally have adverse impacts on the untrammeled and undeveloped quality, and beneficial impacts on Wilderness experience, while the decreased use and/or seasonal or permanent closures would generally have beneficial impacts to natural and untrammeled quality. Regardless of these trade-offs, the overall intent of implementing these management actions would be to improve resource conditions; the impacts to wilderness character would be minor to moderate, beneficial, localized and regional, short to long-term.

Human Waste Management

Under all action alternatives, solid human waste carry-out would be required at backcountry sites in the River Zone and that commercially guided backpacking trips would be required to carry-out human waste in Use Areas without toilets.

Management Actions Potentially Implemented through Adaptive Management Process

- Replace existing toilets at existing sites
- Remove primitive toilets
- Install primitive toilets at other sites
- Seasonal or year-round human waste carry-out requirement for specific areas or zones
- Seasonal or year-round human waste carry-out requirement for all areas or zones

Human waste carry-out and elimination of toilet structures in Wilderness would have beneficial impacts to wilderness character. The addition and replacement of toilet structures if determined to be the minimum tool required for the management of the area as Wilderness would likely have both beneficial and adverse impacts to wilderness character. Similar to actions proposed under Use Area Management, the specific management action would determine the impacts to wilderness character, and would likely result in a trade-off amongst Wilderness qualities. Regardless of these trade-offs, the overall intent of implementing these management actions would be to improve resource conditions; the impacts to wilderness character would be minor to moderate, beneficial, localized and regional, short to long-term.

Tribal Lands and Interests

Under all action alternatives, the NPS would continue to work closely with Traditionally Associated Tribes to educate visitors about tribal connections to Grand Canyon. The NPS would work to educate backcountry users about permit requirements for access across tribal lands to the park's backcountry, including the appropriate level of access across the Great Thumb on the Havasupai Reservation. The NPS would also work closely with tribes to identify culturally important places. Visitor use on Tribal Lands

does not impact wilderness character, however, Grand Canyon Wilderness protects an important cultural history and has identified cultural resources and tribal interests as an important component of wilderness character, and impacts would be minor, beneficial, regional and long-term.

Administrative Use
Administrative use under all action alternatives would be similar to Alternative A, as administrative use would be subject to the minimum requirement analysis. It is expected that an updated Grand Canyon Minimum Requirement Policy would be applied to all non-emergency administrative actions in Wilderness. Under all action alternatives, impacts to wilderness character would be minor, adverse, localized and long-term.

Commercial Overnight Backpacking
Under all action alternatives, commercially guided backpacking trips would not be allowed in the Wild Zone, and limited in other backcountry zones. Most commercial operators would be authorized under contracts and subject to more stringent resource protection standards and Requirements for Permitted Backcountry Operators (see Appendix F) that would emphasize Wilderness training and stewardship. It is expected that trained guides would better protect park resources while providing a high quality service for Wilderness users. Under all action alternatives, impacts to wilderness character would be minor, beneficial, localized and regional, long-term. The levels of commercial overnight backpacking vary by alternative and are discussed in more detail under each alternative.

Commercial Day Hiking
Under all action alternatives, commercially guided day hiking trips would not be allowed in the Wild Zone, and would have limited distances on other backcountry trails. The impact to Wilderness experience would be beneficial due to the maximum group size when compared to the absence of group size limits for unguided day hikes. The limitation on the distances of commercial day hikes would also minimize encounters with other groups in remote Wilderness areas. Impacts to wilderness character would be minor, beneficial, localized and short-term.

Commercial Filming
Under all action alternatives commercial filming would continue to be allowed in Corridor, Threshold and Primitive Zones, and would not be allowed in the Wild Zone. Commercial filming would be subject to the minimum requirement analysis to ensure that the filming activities are appropriate for Wilderness; therefore, impacts to wilderness character would be minor, adverse, localized and short-term.

Cumulative Impacts
Refer to Alternatives B-D for discussion of cumulative impacts that includes these elements common to all action alternatives.

Conclusion
Refer to Alternatives B-D for conclusion that incorporates these elements common to all action alternatives.

ALTERNATIVE B

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative B, the maximum group size in Corridor and Threshold Zones with designated camping would be 11 persons, and Primitive and Wild Zone maximum group size would be six persons. Compared to Alternative A, the small group size in zones with at-large camping would decrease campsite expansion, and have a beneficial impact on visitor experience by decreased encounters and competition for campsites overall. Impacts to wilderness character would be minor, beneficial, regional and long-term.

River-assisted Backcountry Travel
Under Alternative B, RABT would be managed by 31 river sections to allow users more flexibility in trip planning. Impacts from RABT are associated with the access route(s) and interactions or encounters with other user groups. Whether hiking or canyoneering, off-river travel with RABT has the potential to impact vegetation, archaeological sites and other resources. River travel has potential to impact other river users as a result of campsite competition or on-river encounters. Beneficial impacts from the smaller group size, and flexibility of camping in at-large areas would allow participants the freedom and flexibility to minimize encounters with other groups. The implementation of a river section concept, with 31 distinct sections would not have additional impacts on wilderness character and would be minor, adverse, regional, and short to long-term.

Commercial Overnight Backpacking
Under Alternative B, commercial backpacking would be allowed in Corridor, Threshold and Primitive Zones only. Because commercial use fits within all overnight backpacking, these changes would not be expected to measurably impact wilderness character beyond impacts described in Maximum Group Size for Overnight Backpacking by Zone section above. However, with additional training and operating requirements (see Appendix F), it is expected that commercial trips would adhere operational standards for providing services in Wilderness. It is expected that Wilderness ethics and stewardship messages would be passed on to visitors engaging in these services in Wilderness. Impacts to wilderness character would be minor, beneficial, regional and long-term based on the decrease in group size and implementation of operational requirements in Wilderness zones.

Commercial Day Hiking
As discussed for all action alternatives, commercially guided day hikes would not be allowed in the Wild Zone, and limited distances would be prescribed on other trails in Wilderness. The impact to Wilderness experience would be beneficial due to the maximum commercial group size of 11 when compared to the absence of group size limits for unguided day hikes. The limitation on the distances of commercial day hikes would also minimize encounters with other groups in remote Wilderness areas. Impacts to wilderness character would therefore be minor, beneficial, localized and short-term.

Backcountry Roads, Trails, and Routes
Under Alternative B, approximately 30 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails. Development of trails would be consistent with the minimum requirements analysis, and would have short-term adverse impacts from trail crew presence, and disturbance of soils, vegetation, and wildlife disturbance. Overall, impacts from trails development would be minor adverse, localized and short-term. Other former roads would be restored to natural condition, resulting in long-term beneficial impacts to wilderness character.

Under Alternative B, impacts to wilderness character would be both beneficial and adverse. The development of Class 1 trails would have minor, adverse, localized, long-term impacts because maintenance would be needed on an annual basis, although environmental conditions change the required maintenance. Conversion of old roadbeds to trails would have minor beneficial, localized and regional long-term impacts on wilderness character.

Deer Creek/Tapeats Complex
Alternative B would decrease the number of groups in this area from 12 to 10 and all would be small groups. Direct impacts to natural and cultural resources from decreased use and small groups would be reduced which would result in beneficial impacts to wilderness character. Beneficial impacts would also result from fewer encounters and less competition for camping in the at-large and designated campsites in the complex. Impacts to wilderness character would be moderate, beneficial, localized and long-term.

Deer Creek Narrows
Under Alternative B, the Deer Creek Narrows closure described in Alternative A would become permanent. The closure would protect cultural values and natural resources, and prohibit climbing or rappelling into the narrows section of the canyon. Beneficial impacts to ethnographic resources would result from the closure of this area. The Patio section of the Deer Creek area would continue to be open to visitation; during peak river use season this area receives high levels of visitation. Cultural resources are recognized as a quality of wilderness character. Under Alternative B, the impacts to wilderness character from closure of this small area within the Deer Creek narrows would be minor, beneficial, localized, and long-term.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Hance Creek, Cottonwood Creek, and Cremation Use Areas would be managed as Primitive Zones with at-large camping and a maximum group size of six (small groups only). Impacts to soils, vegetation, water resources and archaeological sites may continue to a lesser degree than Alternative A. The Cremation Use Area lies east of the Corridor Zone and is often used as an alternative or "overflow" area for visitors and commercially guided trips seeking permits for Bright Angel Campground. The small group size would decrease competition for commercial groups. The recent refinement of the Use Area boundary directs visitors to campsites, thereby eliminating confusion regarding use of the western Cremation Use Area. Impacts to wilderness character would be minor, adverse, localized and long-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative B as well. The impacts of these actions would be the same as Alternative A, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative B on wilderness character, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, localized to regional. Alternative B would contribute a small amount to this adverse effect.

Cumulative effects to wilderness character from past, present, and reasonably foreseeable future actions discussed above would be moderate, adverse, regional, and short to long-term and Alternative B would contribute a very small amount.

Conclusion
Under Alternative B, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from large groups in Threshold Zone Use Areas, presence of toilet facilities and the effects of toilet maintenance, and direct impacts to natural and cultural resources.

Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative impacts would be moderate, adverse, regional, and short to long-term. Alternative B would contribute a very small amount.

ALTERNATIVE C

Maximum Group Size for Overnight Backpacking by Zone

Group size would remain the same as Alternative A and therefore impacts to wilderness character would also be the same as minor to moderate, adverse, regional and long-term.

River-assisted Backcountry Travel

Under Alternative C, RABT would be managed by11 river sections to allow users the most flexibility in trip planning. Impacts from RABT are associated with the access routes and interactions or encounters with other user groups. Whether hiking or canyoneering, off-river travel with RABT has the potential to impact vegetation, archaeological sites and other resources. River travel has the potential to impact other river users as a result of campsite competition or on-river encounters. Compared to current management, reduced impacts to wilderness character would result from smaller group size, and flexibility of camping in at-large areas would allow participants the freedom and flexibility to minimize encounters with other groups. Therefore, the implementation of a river section concept, with 11 distinct sections would result in minor, adverse, short to long-term and regional impacts to wilderness character.

Commercial Overnight Backpacking

Under Alternative C, commercial backpacking would be allowed in all zones except the Wild Zone, and the overall commercial use in the Threshold and Primitive Zones would be higher compared to Alternative B and D. Because commercial use fits within all overnight backpacking, these changes would not be expected to measurably impact wilderness character beyond impacts described in Maximum Group Size for Overnight Backpacking by Zone section above. However, with additional training and operating requirements (see Appendix F), it is expected that commercial trips would adhere to operational standards for providing services in Wilderness. It is expected that Wilderness ethics and stewardship messages would be passed on to visitors engaging in these services in Wilderness. Impacts to wilderness character would be minor, beneficial, regional and long-term based on the operational requirements applicable to the Wilderness zones.

Commercial Day Hiking

As discussed for all action alternatives, commercially guided day hikes would not be allowed in the Wild Zone, and limited distances would be prescribed for other trails in Wilderness. Under Alternative C, two additional hikes would be allowed in the Corridor Zone beyond those described in Alternative A and would not directly impact Wilderness. However, the additional commercially guided hikes in the non-wilderness areas may help direct more day use to these trails rather than Wilderness trails. The impact to Wilderness experience would be beneficial due to the maximum commercial group size when compared to the absence of group size limits for unguided day hikes. The limitation on the distances of commercial day hikes would also minimize encounters with other groups in remote Wilderness areas. Therefore, impacts to wilderness character would be minor, beneficial, localized and short-term.

Backcountry Roads, Trails, and Routes

Under Alternative C, approximately 44 miles of former fire and ranch roads, currently unmaintained routes, would be converted to Class 1 trails, and six miles converted to a Class 4 trail to accommodate stock use to Tiyo Point. In addition, the Boundary Road, currently an administrative road, would be opened to private vehicles and stock use. Development of trails would be consistent with the minimum requirements analysis and Class 1 trails would have short-term adverse impacts from trail crew presence, and the disturbance of soils, vegetation, and wildlife disturbance. Class 4 trails require a higher level of development to accommodate stock and would result in similar adverse impacts but at a greater intensity; trails would need to be wider and additional vegetation manipulation may be required. Overall, impacts from trails development would be minor to moderate, adverse, localized and short-term. Long-term

adverse impacts would result from maintenance of Class 4 trails. Other former roads would be restored to natural condition, resulting in long-term beneficial impacts to wilderness character.

Under Alternative C, the Boundary Road would be opened for public vehicle use, and included in the Road Natural Zone. The Wilderness boundary is immediately north of the road, providing greater access to the Wilderness areas west of Eremita Mesa and to the Pasture Wash area. The NPS would need to improve the road to make it accessible to the public and the impacts from road development such as noise from motorized equipment and direct impacts to natural and cultural resources would result in moderate adverse, localized, short and long-term impacts to wilderness character. Beneficial impacts of road improvements would be access to other areas that provide opportunities for solitude and primitive recreation.

Under Alternative C, impacts to wilderness character would be both beneficial and adverse. The development of a Class 4 trail as compared to Class 1 trails would have minor to moderate, adverse, localized, long-term impacts because maintenance would be required on a more frequent basis. Conversion of old roadbeds to trails would have minor beneficial, localized and regional long-term impacts on wilderness character. The improvements to the Boundary Road would have moderate, adverse localized, short and long-term impacts to wilderness character.

Deer Creek/Tapeats Creek Complex
Alternative C would decrease the number of groups in this area from 12 to 11 including small and large groups in each Use Area within the complex. Direct impacts to natural and cultural resources would be similar to Alternative A based on the total number of groups per night in the complex. Beneficial impacts would also result from fewer encounters and less competition for camping in the at-large and designated campsites in the complex. Impacts to wilderness character would be minor, beneficial, localized and long-term.

Deer Creek Narrows
Under Alternative C, the Deer Creek Narrows would not be closed to visitation. Adverse impacts to cultural values and natural resources would be a result of vegetation damage and trailing in the narrows. During peak river use season this area receives high levels of use and entry to the narrows would likely be low compared to the overall visitation. However, the potential for increased use exists. Cultural resources are recognized as quality of wilderness character. Under Alternative C, the impacts to wilderness character would be minor (natural resources) to moderate (cultural values), adverse, localized, and long-term.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Under Alternative C, Hance Creek, and Cottonwood Creek Use Areas would be converted from Primitive to Threshold Use Areas. Designated campsites would be established and primitive toilets may be installed to address human waste issues. Each Use Area would allow small and large groups, similar to Alternative A. Impacts to soils, vegetation, water resources and archaeological sites would also be similar to Alternative A. However impacts would be concentrated in designated areas and reduced in at-large camping areas. Similar to Alternative A, Cremation Use Area would be managed as a Primitive Zone Use Area. In addition, the western Use Area boundary of Cremation Use Area would be adjusted, and a designated campsite (Cremation West) would be established to provide additional camping adjacent to the Corridor Zone. The recent refinement of the Use Area boundary directs visitors to campsites; thereby eliminating confusion regarding use of the at-large Cremation Use Area and the Cremation West designated campsite Use Area.

The establishment of designated sites has both beneficial and adverse impacts to visitor experience and park resources. If determined to be the minimum tool for addressing human waste issues at designated

campsites the installation and maintenance of a toilet would have adverse impacts to wilderness character. Under Alternative C, changes to Hance Creek, Cottonwood Creek, and Cremation West Use Areas would result in minor to moderate adverse, localized short and long-term impacts to wilderness character.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative C as well. The impacts of these actions would be the same as Alternative A, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative C on wilderness character, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, localized to regional. Alternative C would contribute a small amount to this adverse effect.

Cumulative effects to wilderness character from past, present, and reasonably foreseeable future actions discussed above would be moderate, adverse, regional, and short to long-term and Alternative C would contribute a small amount to this adverse effect.

Conclusion
Under Alternative C, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts from larger groups in all use areas, additional designated campsites, presence of toilet facilities and the effects of toilet maintenance, and direct impacts to natural and cultural resources.

Minor, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and the conversion of old roadbeds to Class 1 Wilderness trails. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative C would contribute a small amount to this adverse effect.

ALTERNATIVE D

Maximum Group Size for Overnight Backpacking by Zone
Under Alternative D, the maximum group size in the Corridor Zone would be 11 persons (both small and large groups allowed), and the maximum group size in the Threshold, Primitive and Wild Zone Use Areas would be six persons (small groups only). Small group size in zones with designated and at-large camping would decrease campsite expansion, and have a beneficial impact on visitor experience from decreased encounters and competition for campsites overall. Therefore, impacts to wilderness character would be moderate, beneficial, regional and long-term.

River-assisted Backcountry Travel
Under Alternative B, RABT would be managed using an 11-mile travel limit. Impacts from RABT are associated with the hiking or canyoneering access routes and encounters with other user groups. Off-river travel along on RABT trips has potential to impact vegetation, archaeological sites and other resources, analyzed for those activities. River travel has potential to impact other river users as a result of campsite competition or on-river encounters. Beneficial impacts from the smaller group size, and the 11-mile restriction provides more flexibility than the current five-mile restriction, but not the same level of flexibility that Alternatives B and C provide. Impacts to wilderness character would be minor, beneficial localized and regional, short-and long-term.

Commercial Overnight Backpacking
Under Alternative D, commercial backpacking would be allowed in the Corridor Zone only. Because commercial use fits within all overnight backpacking, these changes are not expected to measurably impact wilderness character beyond impacts described in Maximum Group Size for Overnight Backpacking by Zone section above. Limiting commercial use to the Corridor Zone may increase the competition for permits, and potentially displace users seeking Corridor campground permits to the Wilderness. The absence of commercial overnight trips in the Wilderness zones would provide greater access for the non-commercial user, which may be perceived as beneficial. It is expected that trained guides adhering to operating requirements would include education and interpretation applicable to Wilderness areas as well as the Corridor Zone. Impacts to wilderness character from commercial overnight backpacking in the Corridor Zone only, would be minor, beneficial, localized and long-term.

Commercial Day Hiking
Under Alternative D, commercial day hiking trips would be allowed in the Corridor Zone only and limited to varying distances on the Bright Angel, South Kaibab, and North Kaibab trails. Non-commercial day hikers in Wilderness would not encounter commercial groups. Because commercial day trips would be restricted to the Corridor Zone, impacts to wilderness character would be negligible.

Backcountry Roads, Trails, and Routes
Under Alternative D, the 12.4 mile unmaintained Cape Solitude route would be converted to a Class 1 Wilderness trail, and other former fire and ranch roads on the North Rim and the Kanab Plateau would remain unmaintained hiking routes. Direct impacts to soils, vegetation and archaeological sites may occur due to the absence of identified trails in some locations. Other former roads would be restored to natural condition, resulting in long-term beneficial impacts to wilderness character. Overall the impacts to wilderness character would be moderate, beneficial, regional, and long-term.

Deer Creek/Tapeats Creek Complex
Alternative D would decrease the number of groups in this area from 12 to 8 and all would be small groups. Direct impacts to natural and cultural resources from lower use levels and small groups would be decreased. Beneficial impacts would also result from fewer encounters and less competition for camping in the at-large and designated campsites in the complex. Therefore, impacts to wilderness character would be moderate, beneficial, localized and long-term.

Deer Creek Narrows
Under Alternative D, the Deer Creek Narrows closure described in Alternative A would become permanent and would further restrict patio visitation to one river trip at one time. The closure and restriction would be for the protection of cultural values and natural resources, and would prohibit climbing or rappelling into the narrows section of the canyon. Beneficial impacts to ethnographic resources would result from the closure of this area. The Patio section of the Deer Creek area would continue to be open to visitation; however, the number of trips at one time would be limited to one group, which would have adverse impacts to visitor experience due to the access limitations. Under Alternative D, the impacts to wilderness character from closure of this small area within the Deer Creek narrows would be minor, beneficial, localized, and long-term.; however the restricted access to the patio area would be perceived as a minor to moderate adverse impact on Wilderness experience.

Hance Creek, Cottonwood Creek, and Cremation Use Areas
Management of Hance Creek, Cottonwood Creek, and Cremation Use Areas would be the same as Alternative B, therefore impacts to wilderness character would be the same as B, minor, adverse, localized and long-term.

Cumulative Impacts
Past, present, and reasonably foreseeable future actions are described under the Cumulative Impacts section for Alternative A and would apply to Alternative D as well. The impacts of these actions would be the same as Alternative A, adverse, short to long-term, and localized to regional. Cumulatively, the effects of Alternative D on wilderness character, when combined with the other past, present, and reasonably foreseeable actions, would be moderate, adverse, short to long-term, localized to regional. Alternative D would contribute a small amount to this adverse effect.

Cumulative effects to wilderness character from past, present, and reasonably foreseeable future actions discussed above would be moderate, adverse, regional, and short to long-term and Alternative D would contribute a very small amount.

Conclusion
Under Alternative D, including the impacts described under the Impacts of Elements Common to all Action Alternatives, minor, adverse, regional, short to long-term impacts would result from presence of toilet facilities and the effects of toilet maintenance, and direct impacts to natural and cultural resources.

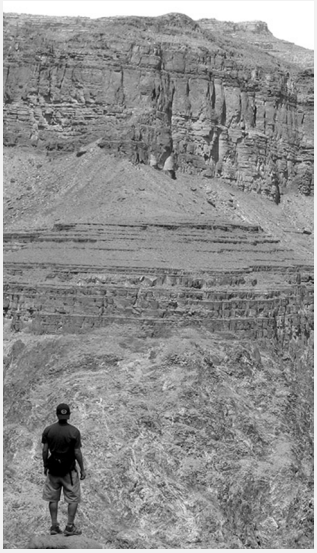
Minor to moderate, beneficial, localized and regional short to long-term impacts would result from a reduction in the maximum group size for canyoneering groups and hikers in Threshold, Primitive and Wild Zones, prohibition of commercial services and filming in the Wild Zone, a climbing policy that addresses bolting and clean climbing practices, and natural restoration of old roadbeds. These beneficial impacts would potentially be enhanced based upon potential future adaptive management actions.

Cumulative impacts would be moderate, adverse, regional, short to long-term. Alternative D would contribute a very small amount.

CHAPTER 5: CONSULTATION AND COORDINATION

INTRODUCTION

Chapter 5 describes consultation and coordination that occurred during preparation of this plan/DEIS. Consultation, coordination, and public involvement are integral in identifying relevant issues and concerns and ensuring issues are addressed. Formulation of issues was achieved through public meetings and workshops, agency meetings, tribal consultations, individual contacts, news releases, and Federal Register notices.



●●●

"**Scoping** helps determine the range of issues and opportunities considered in developing Alternatives and assessing environmental effects"

●●●

Public Scoping

Public scoping is part of NEPA requirements (40 CFR 1501.7) for preparing an EIS. The scoping process must be open to the public and include state, local, and tribal governments, and affected federal agencies. According to NPS DO 12, Conservation Planning, Environmental Impact Analysis and Decision Making, scoping objectives are

- Involve as many interested parties as possible in the environmental review process
- Provide clear, easily understood, factual information to potentially affected parties
- Provide meaningful and timely opportunities for public input
- Identify, consider, and evaluate issues raised by interested parties to prepare the EIS
- Identify, and eliminate from detailed study, insignificant issues
- Consider public comments throughout the decision-making and review process

The process used during public scoping, consultation, and coordination for this plan/DEIS is described below and summarized in Table 5.1.

Public Input to the Planning Process

A Notice of Intent to Prepare an Environmental Impact Statement for the Backcountry Management Plan, Grand Canyon National Park, was published in the Federal Register Volume 76, Issue 81 (April 27, 2011) available at: http://www.gpo.gov/fdsys/granule/FR-2011-04-27/2011-10118/content-detail.html

A public scoping letter dated April 27, 2011 was mailed to members of the public identified by the NPS as those who normally receive notification of park NEPA actions. Federal, state, and local governmental agencies also received the scoping letter. Scoping letters were posted to Traditionally Associated Tribes March 3, 2011. A news release was emailed on April 27, 2011 to a list of NPS media contacts.

Scoping comments were accepted for 60 days, April 27 through June 27, 2011, and accepted 1) through the NPS Planning Environment and Public Comment (PEPC) database (http://parkplanning.nps.gov/grcabmp) mailed to: Superintendent, Grand Canyon National Park, Attn: Backcountry Management Plan, P.O. Box 129, Grand Canyon, AZ 86023, and 3) submitted in person at one of the open-house style meetings. Park staff manually entered all comments received by mail or at a public meeting verbatim into PEPC.

Open house public scoping meetings were held at Grand Canyon Village, Arizona, on May 25, 2011; in Kanab, Utah, May 26, 2011; and in Flagstaff, Arizona, June 1, 2011. Flip charts were available at stations for each of the three meetings to document public comment.

Press releases and information provided at the open house public meetings was posted on the PEPC website: http://parkplanning.nps.gov/grcabmp

A total 581 responses were received from individuals, organizations, and other interested parties addressing the scope, issues, and concerns related to the plan/DEIS.

Public Scoping Comments Review and Evaluation

Planning team members read every submission, identified specific comments in each, and coded them according to a database coding structure developed to sort comments into general headings.

Methodology for Collecting Comments
The NPS planning team read all comments. Methodology consisted of

Develop Coding Structure
The planning team developed a coding structure to sort comments into logical groups by topic. The coding structure used was inclusive rather than restrictive. Codes were assigned to comments received through letters, public meeting comment forms, electronic mail, and PEPC entries.

Read and Code Public Comment Submissions
As each submission was read, distinct comments were identified and coded. Submissions could, and often did, contain several comments.

Create Comment Database
For each correspondence, comments were entered into a database (PEPC).

Scoping activities included the following

Public scoping is an opportunity for the public to provide ideas about the Environmental Impact Statement (EIS) and Alternatives that should be considered, in other words, the scope of the plan.

In defining the scope of the Backcountry Management Plan, park planners want to capture what you consider an ideal backcountry experience and what you would like Grand Canyon's backcountry and wilderness resources to look like 20 years from now.

We want to know what you value about Grand Canyon's proposed Wilderness and non-wilderness backcountry areas (including Tuweep and the Cross-canyon Corridor), and any issues or concerns you have regarding how these resources are used and managed.

What should Grand Canyon's backcountry and wilderness look like in the future?

Your comments are important to us.

Prepare Comment Summary
The planning team used the database to construct a summary of all comments. Opinions, feelings, preferences, and comments of personal and philosophical nature were all read and analyzed. All comments were considered, whether voiced by hundreds or a single entity, but only listed once in the summary.

The purpose of reading, coding, and analyzing comments was to assist the team in determining which topics warranted further analysis. With information provided through the public review process, the NPS developed a range of Alternatives, and identified an NPS Preferred Alternative as described in Chapter 2.

Although analysis attempted to capture the full range of public concerns, it is acknowledged comments from people who chose to respond do not necessarily represent the sentiments of the entire public. Further, scoping is not a vote-counting process; emphasis is on content rather than number of times a comment is received.

Comments and responses are categorized by topic. A topic is a subject-matter category. These categories were developed through the scoping process and selected to track topics through the plan/DEIS (and Final EIS).

After public comments were entered into the database by topic, reports were generated per topic. The team analyzed and grouped comments with similar subject matter. Some comments appear verbatim, while others are summarized, reflecting content of several similar comments.

Table 5.1 Scoping Activities Summary

Activity	Date
Article, *Grand Canyon Backcountry Management Plan*, in *Boatman's Quarterly Review,* by NPS staff Linda Jalbert http://www.gcrg.org	• Spring 2011 issue
Scoping letter sent to Traditionally Associated Tribes	• March 3, 2011
Notice of Intent (NOI) to prepare plan/DEIS published in Federal Register Volume 76, Issue 81 (April 27, 2011) available at: http://www.gpo.gov/fdsys/granule/FR-2011-04-27/2011-10118/content-detail.html	• April 27, 2011; began 60-day scoping period
Grand Canyon's Maureen Oltrogge, Superintendent's Office; and Rachel Bennett, Office of Planning and Compliance met with Heather Ainardi, Flagstaff Convention and Visitors Bureau	• April 25, 2011
Public scoping announcement e-mail and postcard sent to approximately 11,000 backcountry users and planning address lists	• April 27, 2011
News release emailed to NPS media list. News release available at: http://www.nps.gov/grca/learn/news/national-park-service-begins-process-to-revise-backcountry-management-plan-for-grand-canyon-national-park.htm	• April 27, 2011
Planning link to added to Grand Canyon's webpage and Twitter http://www.nps.gov/grca/learn/management/bmp.htm	• April 27, 2011
Flyers and postcards placed in park Backcountry Information Center, park Visitor Contact Stations, and Flagstaff and Kanab businesses	• May 2011
• Public meetings news release and media advisory • Media site visits and interviews	• May 2, 2011 *Arizona Daily Sun* interview[67] • May 5, 2011 public meeting reminder sent • May 27, 2011 KNAU interview[68]

[67] http://azdailysun.com/news/local/backpacking-below-the-rim-under-scrutiny/article_e0ffba12-371e-5814-aa97-e1a8d9131e66.html.
[68] http://knau.org/post/grand-canyon-officials-revisit-backcountry-plan

• Letter to State Historic Preservation Officer initiating consultation • Letter to Advisory Council on Historic Preservation	• May 25, 2011
Public open houses • South Rim, Grand Canyon, Arizona • Kanab, Utah • Flagstaff, Arizona	• May 25, 2011 • May 26, 2011 • June 1, 2011
Federal agency meetings	• June 9, 2011 BLM and NPS Grand Canyon-Parashant National Monument • June 10, 2011 USFS, North Kaibab
Tribal Consultations	• See Table 5.2

Organizations and Agencies Consulted

In addition to public scoping, federal agencies are required to consult with American Indian tribes and federal and state agencies and entities due to jurisdictional responsibilities (40 CFR 1502.25).

Tribal Consultations

In keeping with provisions of NEPA, NHPA, NPS Management Policies 2006, the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments; Executive Orders 13007 and 13175; DOI 512 Departmental Manual, Chapter 2 (American Indians and Alaska Native Programs); and DO 71, Relationships with American Indian Tribes, the following traditionally associated tribes were consulted regarding this plan/DEIS

- Havasupai Tribe
- Hopi Tribe
- Hualapai Tribe
- Kaibab Band of Paiute Indians
- Las Vegas Paiute Tribe
- Moapa Band of Paiute Indians
- Navajo Nation
- Paiute Indian Tribe of Utah
- Pueblo of Zuni
- San Juan Southern Paiute Tribe
- Yavapai-Apache Nation

Federal agencies routinely consult with tribal and other governments during NEPA and other processes. Governmental discussions and consultations have been ongoing for many years. A tribal scoping letter was sent to the park's Traditionally Associated Tribes March 7, 2011 followed by emails and phone calls in April and May to set up an initial series of meetings. Table 5.2 summarizes steps in tribal consultation.

Table 5.2 Tribal Consultations

Date		Event
March 7	2011	Scoping letter from Superintendent to Traditionally Associated Tribes
June 21	2011	Informational/Scoping meeting in Flagstaff with representatives from Navajo Nation, Hopi Tribe, and Yavapai-Apache Nation
June 30	2011	Informational/Scoping meeting with Hualapai Tribe at Peach Springs office
August 8	2011	Informational/Scoping meeting with Southern Paiute tribes at Shivwits Reservation (participants included Shivwits and Koosharem Bands of the Paiute Indian Tribe of Utah, Las Vegas Paiute Tribe, Kaibab Band of Paiute Indians, and San Juan Southern Paiute Tribe)
October 20	2011	Brief BCMP presentation to Kaibab Paiute Tribal Council
February 17	2012	Grand Canyon Tribal Program Manager spoke with Kurt Dongoske, Tribal Historic Preservation Officer, Pueblo of Zuni. At request of tribe, agreed on a BCMP meeting after draft Alternatives developed

Date		Event
February 27	2012	General meeting with Havasupai Tribal Council at park including full BCMP informational/scoping
October 25	2012	Meeting at Zuni with representatives from Zuni Cultural Resource Advisory Team and council liaison. Park staff presented information and received input on draft Alternatives
January 11	2013	Letter from Superintendent to Traditionally Associated Tribes providing BCMP update including information on draft Alternatives and suggesting additional consultation meetings prior to plan/DEIS writing
January 23	2013	Meeting at Shivwits Reservation. Park staff presented information and received input on draft Alternatives. Participants included representatives of Moapa Band of Paiutes and Shivwits Band of the Paiute Indian Tribe of Utah
March 4	2013	BCMP team and Superintendent met with Havasupai Tribal Council in Supai Village
March 14	2013	BCMP team met with Tim Begay, Navajo Nation Historic Preservation Department representative, in Window Rock, AZ to discuss ideas on draft Alternatives
March 20	2013	BCMP team met with Hopi Cultural Preservation Office staff at Kykotsmovi, AZ
April 19	2013	BCMP team visited with Helen Webster (Navajo Nation Parks and Recreation) in Cameron, AZ to provide information on BCMP (since she couldn't attend the 3/14/13 meeting)
November	2013	Letter from Superintendent to Havasupai Tribal Chairman regarding tribe's June 24, 2013 letter (Great Thumb access, trails, and permit issues)
February 3	2014	BCMP team and Superintendent met with Havasupai Tribal Council to discuss BCMP and permits for Great Thumb area
June 14	2014	Email from park tribal program manager to tribes with detailed information on draft alternatives and EIS schedule
April 30	2015	BCMP team met with Havasupai Tribal Council to discuss the pilot permit program for Great Thumb area

Arizona State Historic Preservation Office

NHPA requires agencies consult with the State Historic Preservation Officer (SHPO) regarding undertakings that may affect historic properties. Formal consultation regarding this plan/DEIS was initiated with SHPO on May 25, 2011. Consultations are ongoing.

Advisory Council on Historic Preservation

NHPA requires agencies consult with the Advisory Council on Historic Preservation (ACHP) regarding undertakings that may affect historic properties. Formal consultation regarding this plan/DEIS was initiated with ACHP on May 25, 2011. Consultations are ongoing.

U.S. Fish and Wildlife Service

Informal USFWS consultation was initiated January 10, 2012 on potential BCMP Alternative impacts on threatened and endangered species. Consultations are ongoing.

List of Recipients

This plan/DEIS is available online at the NPS PEPC website http://parkplanning.nps.gov/grcabmp

A notice of the availability of this plan/DEIS for review and comment may also be sent to

Federal Agencies
Advisory Council on Historic Preservation
Coconino National Forest
Kaibab National Forest
Bureau of Indian Affairs
Bureau of Land Management, Arizona Strip
Bureau of Reclamation
Fish and Wildlife Service
U.S. Geological Survey
Albright Training Center
Flagstaff Area Monuments
Glen Canyon National Recreation Area
Grand Canyon—Parashant National Monument
Intermountain Regional Office
Lake Mead National Recreation Area
Pipe Springs National Monument
Southeastern Utah Group of National Parks
Zion National Park
U.S. Environmental Protection Agency

Congressional Delegations
Arizona
Office of Representative Trent Franks
Office of Representative Paul Gosar
Office of Representative Raul Grijalva
Office of Representative Ann Kirkpatrick
Office of Representative Ed Pastor
Office of Representative Matt Salmon
Office of Representative David Schweikert
Office of Representative Kyrsten Sinema
Office of Senator Jeff Flake
Office of Senator John McCain

Utah
City Government
City of Kanab, UT

State and Local Agencies
State of Arizona
Attorney General
Office of the Governor
State Historic Preservation Office
Department of Environmental Quality
Game and Fish Department

City Government
City of Flagstaff, AZ
City of Fredonia, AZ
City of Page, AZ
City of Phoenix, AZ
City of Tusayan, AZ
City of Williams, AZ

County
Coconino County Board of Supervisors, AZ
Mohave County, AZ

Local Libraries
Flagstaff, AZ
Grand Canyon, AZ
Northern Arizona University, AZ

Tribal Governments
Havasupai Tribe
Hopi Tribe
Hualapai Tribe
Kaibab Band of Paiute Indians
Las Vegas Paiute Tribe
Moapa Band of Paiute Indians
Navajo Nation
Paiute Indian Tribe of Utah
Pueblo of Zuni
San Juan Southern Paiute Tribe
Yavapai-Apache Nation

Organizations and Businesses
360 Adventures LLC
AAA Arizona
A.V.I. Inc. dba Air Vegas
Adventure Cycling Association
Adventure Partners LLC
Adventure Travel West Inc.
Adventures in Good Company
Air Bridge, Inc.
Air Grand Canyon
Air Star Helicopters
Air Transport Association of America
All Aboard America
High Sonoran Adventures
Hillside Enterprises
Holiday Inn Express – Tusayan
Hydros Adventures LLC IMAX Theater
International Mountain Biking Association
Jacob Lake Lodge
Just Roughin' It Adventure Company LLC
King Airlines, Inc.
Kling Mountain Guides LLC
Hatch River Expeditions Inc.
Knoxville Tours Inc.
KY Wolf Info Center

All-Star Grand Canyon Tours Inc.
Alliance of Parachutists
American Canyoneering Association
American Hiking Society
American Packrafting Association
Angel's Gate Inc.
Arizona Bicycle Club
Arizona Outdoor Specialists
Arizona Public Service
Arizona Raft Adventures
Arizona River Runners
Arizona Trail Association
Arizona Wilderness Coalition
Arizona Wildlife Federation
Around the Bend Adventures LLC
Austin-Lehman Adventures
Auto Bus Tours & Charter
Aventure Monde Eco Plein Air Inc.
Aviation Ventures, Inc. dba Vision Air
Backcountry Found
Backcountry Horsemen
Badlands Off-road Adventures
Best Tours and Travel
Big Wild Adventures
Blue Sky Guides LLC
Boy Scouts of America
CA USA Inc.
California Charters Inc.
Canyon Country Out-back Tours
Canyon Expeditions
Canyoneers Inc.
Canyon Rim Adventures Inc.
Canyon Tough LLC
Canyon Trail Rides
Centerfocus Experiences LLC
Center for Biological Diversity
Certified Transportation Services
Colorado River and Trail Expeditions Inc.
Conquer the Canyon LLC
Corporate Transportation Tours
Country Walkers
Cycle America
Delaware North Parks Services
Denure Tours Limited
Detour Nature
Discovery Treks LLC
Dreamland Safari Tours
Eagle Canyon Airlines, Inc. dba Scenic Airlines
Escape Adventures Inc.
Fast Deer Bus Charters Inc.
Forever Resorts Grand Canyon
Las Vegas Helicopters, Inc.
Leave No Trace
Ma & Pa Tours Inc.
Marble Canyon Outfitters
Maverick Helicopter Tours
McDowell Sonoran Land Trust
Mike and Maggies Adventures LLC
Moki Mac River Expeditions
Mountain West Travel Inc.
Museum of Northern Arizona
National Outdoor Leadership School
National Parks Conservation Association
National Speleological Society
National Tour Association
National Parks Visitors Alliance
Natural Habitat Adventures
O.A.R.S. Inc.
Off the Beaten Path LLC
Oldwest Outfitters
Outdoors Unlimited
Overland Travel Inc.
Pacific Coast Sightseeing
Pack, Paddle, Ski Corp
Papillon Airways, Inc.
Paul Revere Transportation
Peak Performance Association Inc.
Peregrine Fund
Piggyback Tours
Pikes Peak Alpine School
Pink Jeep Tours – Las Vegas Inc.
Public Employees for Environmental Responsibility
Pygmy Guides
Quality Inn – Tusayan
Red Earth Adventures
Red Feather Inc.
Red Mountain Spa Management LLC
RLT, Inc.
Rubicon Outdoors
Seven Mile Lodge
Sierra Club
Sierra Club Outings
Silverado Stages
Sonoran Institute
Southern Utah Wilderness Alliance
Sportvac Plus Inc.
Sundance Helicopters, Inc.
Teens' Camping Tour of the West
The Grand Hotel
The Monarch Center
The Nature Conservancy

Four Season Guides LLC
Frontier Tours
Grand Canyon Trail Guides
Grand Canyon Airlines
Grand Canyon Airport
Grand Canyon Association
Grand Canyon Expeditions
Grand Canyon Field Institute
Grand Canyon Helicopters
Grand Canyon Hikers and Backpackers Association
Grand Canyon Hikes
Grand Canyon Historical Society
Grand Canyon Outback Jeep Tours
Grand Canyon Private Boaters Association
Grand Canyon Railway
Grand Canyon Resort Corporation
Grand Canyon River Guides Association
Grand Canyon River Outfitters Association
Grand Canyon Squire Inn
Grand Canyon Trust
Grand Canyon Whitewater LLC
Grand Canyon Wildlands Council
Grand Classroom
The Southern Terrain
The Wildland Trekking Company LLC
The Wilderness Society
Timberline Adventures
Touch the Earth – Earthtours
Tour West America Inc.
Tour West Inc.
Trans-Canyon Shuttle
Travel Dream West Tours Inc.
US Air Tour Association
Vacation Tours Inc.
Vista Helicopters, Inc.
We Cook Pizza
Western River Expeditions Inc.
Western Spirit Cycling
Westwind Aviation, Inc.
Wilderness River Adventures Inc.
Wild Horizons Expeditions
Wolff Treks LLC
Woman Tours Inc.
Xanterra Parks & Resorts
Zion Adventure Company LLC
Zion Canyoneering Coalition

Individuals
List on file at the Office of Planning and Compliance, Grand Canyon National Park.

Preparers and Contributors

All individuals who helped prepare this plan/DEIS or who contributed to its preparation are listed in Table 5.3.

Table 5.3 Preparers – Grand Canyon Team Members

Name	Title	Qualifications	Role
Rachel Bennett	Environmental Protection Specialist Planning and Compliance	15 years natural resource management and NEPA	Co-Leads
Linda Jalbert	Wilderness Coordinator Science and Resource Management	23 years resource and wilderness management	
Mike Kearsley	Biologist Science and Resource Management	23 years professional desert and riparian plant ecologist	Vegetation, Wildlife, Physical Resources
Peter Pettengill	Former Outdoor Recreation Planner Science and Resource Management	1 year NEPA; PhD Natural Resources; MS Environmental Law	Visitor Use and Experience
Debbie Brenchley	Canyon District Ranger Visitor and Resource Protection	19 years NPS backcountry and wilderness visitor and resource protection management	Backcountry Operations
Steve Sullivan	Permits Program Manager Visitor and Resource Protection	20 years NPS backcountry and river permitting management	Use Statistics and Projections; Permitting; Review

Name	Title	Qualifications	Role
Theresa deBoer	Former Physical Scientist/GIS Specialist Science and Resource Management	13 years GIS; 15 years physical science	Maps
Jill Beshears	Environmental Protection Specialist Planning and Compliance	14 years NEPA specialist	Park Management and Operations
Ellen Brennan	Manager, Cultural Resources Science and Resource Management	17 years cultural resources management	Cultural Resources
Janet Cohen	Tribal Consultation Coordinator Science and Resource Management	24 years anthropologist in tribal natural and cultural resources	Tribal Consultation and Review
Jen Dierker	Archaeologist, Science and Resource Management	15 years NPS cultural resources	Cultural Resources
Rick Ernenwein	Outdoor Recreation Planner (retired) Planning and Compliance	30 years federal land management, planning, and NEPA	Soundscape
Deanna Greco	Former Physical Science Program Manager Science and Resource Management	23 years federal natural resource management	Soils, Caves, Water Resources
Greg Holm	Wildlife Program Manager Science and Resource Management	20 years wildlife biologist/specialist	Wildlife
Lori Makarick	Vegetation Program Manager Science and Resource Management	20 years NPS vegetation management	Vegetation
Robin Martin	Chief Planning and Compliance	9 years NPS concessions and planning	Document review
Cynthia Valle	Hydrologist Science and Resource Management	3 years NPS Hydrology	Water Resources
Gigi Wright	Permit Office Web Developer Visitor and Resource Protection	20 years writer / editor experience	Editor

Table 5.4 Contributors and Reviewers

Name	Title	Office
Brandon Holton	Wildlife Biologist Science and Resource Management	Grand Canyon National Park
Cory Mosby	Former Integrated Pest Management Coordinator Science and Resource Management	Grand Canyon National Park
Mark Nebel	GIS Coordinator, Program Manager Science and Resource Management	Grand Canyon National Park
Rosa Palarino	Natural Resource Specialist Section 7 Coordinator Planning and Compliance	Grand Canyon National Park
Steve Rice	Former Park Hydrologist; Cave and Karst Resources Manager Science and Resource Management	Grand Canyon National Park
Kassandra Skeen	Former Vegetation Biologist Science and Resource Management	Grand Canyon National Park
Janice Stroud-Settles	Wildlife Biologist Science and Resource Management	Grand Canyon National Park
Laura Williams	Former Night Sky Inventory Coordinator Science and Resource Management	Grand Canyon National Park
Bill Allen	Trails Program Manager Facilities Management	Grand Canyon National Park

Jan Balsom	Deputy Chief Science and Resource Management	Grand Canyon National Park
Martha Hahn	Chief (retired) Science and Resource Management	Grand Canyon National Park
Matt Jenkins	Canyon Ranger Visitor and Resource Protection	Grand Canyon National Park
Catherine Lentz	Section 106 Coordinator Planning and Compliance	Grand Canyon National Park
Donna Richardson	Chief Interpretation and Resource Education	Grand Canyon National Park
Jane Rodgers	Deputy Chief Science and Resource Management	Grand Canyon National Park
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Melissa Trenchik	Chief, Environmental Quality Regional Wilderness Coordinator	NPS Intermountain Region
Suzy Stutzman	Wilderness Coordinator (retired)	NPS Intermountain Region
Connie Rudd	Superintendent (retired)	Black Canyon of the Gunnison National Park/Curecanti National Recreation Area
Kate Cannon	Superintendent	Southeast Utah Group of National Parks (Arches and Canyonlands National Parks and Hovenweep and Natural Bridges National Monuments)
Heidi Wiley	Former Chief of Concessions	
Lisa Leap	Chief of Resources	Flagstaff Area National Monuments (Wupatki, Sunset Crater Volcano, and Walnut Canyon National Monuments)
Ray O'Neil	Former Wilderness Coordinator	Zion National Park
Dale Pate	Cave & Karst Program Coordinator	Geologic Resource Division, Washington Support Office
David Jacob	NEPA Technical Specialist	Environmental Quality Division, Washington Support Office
Megan McKenna	Acoustic Biologist	Natural Sounds and Night Sky Division, Washington Support Office

ACRONYMS

ACHP	Advisory Council on Historic Preservation
ADA	American's with Disabilities Act
ADOT	Arizona Department of Transportation
ARPA	Archaeological Resources Protection Act
ATV	All-terrain vehicle
AZGFD	Arizona Game and Fish Department
BCMP	Backcountry Management Plan
BIC	Backcountry Information Office
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BRO	Backcountry Reservation Office
CEQ	Council on Environmental Quality
CCC	Civilian Conservation Corps
CFR	Code of Federal Regulations
CRMP	Colorado River Management Plan
CUA	Commercial Use Authorization
dB	decibels
dBA	A-weighted decibels
DEIS	Draft Environmental Impact Statement
DO	Director's Order
DOI	Department of the Interior
DWMP	Draft Wilderness Management Plan
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FCRPA	Federal Cave Resources Protection Act
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FR	Federal Register
FTE	Full-Time Equivalent
GCFI	Grand Canyon Field Institute
GCMRC	Grand Canyon Monitoring and Research Center
GGCLA	Greater Grand Canyon Landscape Assessment
GIS	Geographic Information Systems
GLCA	Glen Canyon National Recreation Area
GMP	General Management Plan
Hz	hertz

IDT	Interdisciplinary Team
LAKE	Lake Mead National Recreation Area
LCS	List of Classified Structures
LTEMP	Long-term Experimental and Management Plan for Operation of Glen Canyon Dam
LRU	Land Resource Unit
MOA	Memorandum of Agreement
MRA	Minimum Requirement Analysis
MSO	Mexican spotted owl
NAU	Northern Arizona University
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHLD	National Historic Landmark District
NHPA	National Historic Preservation Act
NNL	National Natural Landmark
NOI	Notice of Intent
NPS	National Park Service
NRA	National Recreation Area
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OPAC	Office of Planning and Compliance
PAC	Protected Activity Center (for Mexican spotted owl)
PARA	Grand Canyon-Parashant National Monument
PEPC	NPS Planning Environment and Public Comment Website
PPCP	Pharmaceutical and personal care product
PSAR	Preventative Search and Rescue
RABT	River-assisted backcountry travel
RM	Reference Manual
RM	River Mile
RMP	Resource Management Plan
RNA	Research Natural Area
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SAR	Search and Rescue
SCPN	Southern Colorado Plateau Network
SHPO	State Historic Preservation Office/Officer
SRM	Division of Science and Resource Management
SUP	Special Use Permit
SWFL	Southwestern willow flycatcher
TCP	Traditional Cultural Properties
TUL	Traditional Use Lands (Havasupai)
USC	United States Code
USDA	U.S. Department of Agriculture

USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRP	Division of Visitor and Resource Protection
4FRI	Four Forest Restoration Initiative

GLOSSARY

National park backcountry management and the plan/DEIS process require the use of technical terms. Some of the most important are defined in this section. Terms below in ***bold italics*** are defined separately in this glossary.

Affiliated Group — Backcountry users associated with the same club, organization, or group of friends. (http://www.nps.gov/grca/planyourvisit/backcountry-regs.htm)

At-large Camping — In ***Use Areas*** without ***designated camping***, individuals or groups can camp anywhere in accordance with normal regulations and Compendium restrictions

Backcountry — According to NPS Management Policies (NPS 2006), Chapter 8.2.2.4, the term *backcountry* generally refers to "primitive and undeveloped portions of parks. Usually these areas limit development to trails, unpaved roads, and administrative facilities." Grand Canyon's backcountry consists of over 1.1 million acres of primitive, undeveloped area, most of which is proposed for ***Wilderness*** designation. For planning purposes, the backcountry also includes the ***Cross-canyon Corridor*** and ***Tuweep***. Backcountry is not the same as Wilderness. Rather, backcountry refers to a general condition of land, whereas Wilderness is a federal designation. Management of park Wilderness portions requires different administrative practices than backcountry because the Wilderness Act and NPS Management Policies impose additional conditions and constraints. NPS policy requires Wilderness awaiting designation be treated as Wilderness until Congress acts

Bicycle — Any device propelled solely by human power on which a person or persons may ride on land, having one, two, or more wheels, except a manual wheelchair (see 36 CFR 1.4, Definitions)

Bright Angel Campground — 9.9 miles from South Rim; 14 miles from North Rim at the bottom of Grand Canyon, ½ mile north of the Colorado River along Bright Angel Creek, ½ mile from Phantom Ranch. Characterized by the Bright Angel Creek delta. Ranger station, emergency phone, pay phone, year-round potable water, toilets. Snack items and meals available for purchase at Phantom Ranch Lodge (meals reserved in advance). Each campsite has a picnic table, pack pole, and metal food storage can

Canyoneering — Canyoneering is traveling in canyons, typically narrow canyons, using a variety of techniques that may include walking, wading, scrambling, climbing, jumping, rappelling, and swimming. Non-technical canyoneering is the travel through a canyon using non-technical methods, such as walking or scrambling, without the use of ropes and harnesses. In a general sense, non-technical canyoneering is most similar to a typical overnight backpacking trip or day hike in the Grand Canyon backcountry or Wilderness.

For purposes of this plan/DEIS, canyoneering is considered technical canyoneering and is defined as descent or ascent of a canyon by rappelling, building anchors, or other rope work like technical ***climbing*** or down-climbing (placing protection or using rope for belay) while wearing a harness. Similar to

climbing, the NPS recognizes canyoneering is a legitimate and appropriate ***Wilderness*** use. However, any canyoneering or related activity must be restricted or prohibited when its occurrence, continuation, or expansion would result in unacceptable impacts to park resources or ***wilderness character***, or interfere significantly with the experience of other park visitors. Establishment of bolt-intensive routes is considered incompatible with Wilderness due to concentrated human activity and types and levels of impacts that may be associated with these routes. The NPS promotes ***Clean Climbing*** practices, and motorized drills are prohibited in Wilderness.

Cave

The Federal Cave Resources Protection Act (FCRPA) of 1988 defines the term *cave* as:

> "Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge, including any cave resource therein, and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Such term shall include any natural pit, sinkhole, or other feature that is an extension of a cave entrance or which is an integral part of the cave."

Grand Canyon has adapted this definition to include any dissolution or erosional feature 50 feet or longer where the entrance (drip line) is not wider than the cave is long. For example, by this definition, Redwall Cavern on the Colorado River is not a cave but an alcove.

Clean Climbing

NPS Reference Manual 41, Wilderness Stewardship, (2013) states, Clean Climbing involves use of temporary equipment and anchors that can be placed and removed without altering the environment (e.g., slings, cams, nut, chocks and stoppers). Practices such as gluing or chipping holds and damaging or removing vegetation on or at the base of climbing routes are prohibited by NPS regulations, as is motorized equipment (e.g., power drills). Climbers and canyoneers are encourage to adopt Leave No Trace principles and practices for all climbing and canyoneering activities

Climbing

Director's Order 41: Wilderness Stewardship, defines climbing to include rock climbing, snow and ice climbing, mountaineering, and caving where climbing equipment, such as ropes and fixed or removable anchors, is generally used to support an ascent or descent. The policy states, "Any climbing use or related activity must be restricted or prohibited when its occurrence, continuation or expansion would result in unacceptable impacts to park resources or ***wilderness character***, or interfere significantly with the experience of other park visitors," and, "Establishment of bolt-intensive face climbs, commonly known as sport climbs, is considered incompatible with ***Wilderness*** due to concentrated human activity, and the types and levels of impacts that may be associated with climbing routes." The NPS promotes ***Clean Climbing*** practices, and motorized drills are prohibited in Wilderness.

Commercial Filming

Filming that involves digital or film recording of a visual image or sound by a person, business, or other entity for a market audience (Management Policies 8.6.2.2).

Commercial Use Authorization (CUA) A permit that authorizes suitable commercial services for park visitors within Grand Canyon National Park. The term of a CUA may not exceed 2 years and no preferential right of renewal or similar provisions for renewal may be provided. (http://www.nps.gov/grca/learn/management/cua.htm).

Commercial User Night A commercial user night is one hiker, guide or client, on a commercial overnight backpacking trip in the backcountry for one night.

Concessioner A commercial venture operating under a concession contract with the National Park Service. The term of a concession contact is generally 10 years. (P.L. 105-391)

Cottonwood Campground Campground 6.8 miles below North Rim on North Kaibab Trail. Bright Angel Creek flows through. Potable drinking water available mid-May to mid-Oct. Other times of year, filter/treat water from creek. Emergency phone, toilets. Each campsite has a picnic table, pack pole, and metal food storage can.

Cross-canyon Corridor (Corridor Zone) Bright Angel, South Kaibab, and North Kaibab Trails and their associated facilities including ***Indian Garden, Bright Angel***, and ***Cottonwood Campgrounds; Phantom Ranch*** tourist lodging, ranger stations, and sewage and water treatment facilities. Overnight use by backcountry permit.

Deer Creek/Tapeats Creek Complex Current Use Area boundaries in the Deer Creek/Tapeats Creek Complex (Map 2.7) would be redefined to address crowding at designated campsites and associated impacts to cultural and natural resources. These ***Use Areas*** have become popular due in part to reliable water sources in Deer Creek and Tapeats. The Complex would include the current Esplanade (AY9) Use Area, modified Deer Creek (AX7) and Tapeats (AW7) Use Areas, and the newly created Bonita Creek (AW9) Use Area (Table 2.8a). Surprise Valley (AM9) Use Area would be eliminated, and its northern half split between Deer Creek and Tapeats Use Areas to disperse use between Deer and Tapeats Creeks. ***Designated camping*** would continue to be required along Deer (AX7) and Tapeats Creeks (AW7), and ***at-large camping*** would be allowed in the former Surprise Valley area of both Use Areas. The southern half of Surprise Valley Use Area would become Bonita Creek Use Area, an at-large Use Area which would also encompass Tapeats Creek delta and routes along the Colorado River to disperse use along routes between Tapeats and Deer Creeks.

Designated Camping Required when necessary to restrict intensive use to previously disturbed areas and limit the impact. Designated campgrounds (composed of several adjacent sites) are found in the Corridor Management Zone. Separate designated campsites are located in Use Areas outside of the Corridor Management Zone with sites located according to aesthetic, environmental, and sociological criteria. Where designated camping exists, backcountry users may not select other campsites.

Encounter Rate The number of other people or groups of people that an observer may pass or be passed by while traveling along specific trail segments. Encounter rates serve as a measurable manageable proxy for opportunities for solitude. The Wilderness Act of 1964 mandates that designated wilderness will have “outstanding

opportunities for solitude," and approximately 1.1 million acres of Grand Canyon's backcountry is managed as wilderness. Encounters with numbers of other people are used along more heavily traveled segments of trail, where distinguishing between groups may be difficult. Encounters with other groups of people are used in wilderness settings as a proxy for solitude.

Exotic Species Those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with ***native species***, the exotic species is not a natural component of the natural ecosystem at that place (NPS Management Policies 2006).

Extended Day Hiking or Running For purposes of this plan/DEIS, Extended Day Hiking and Running in the ***Corridor Zone*** is defined as day use leaving South or North Rim on a Corridor Zone Trail and extending beyond points defined in Table 2.5 and Map 2.6. Under all action alternatives (B, C, and D), management actions described in Table 2.6 would occur as described.

Group Night A group night is one group in the backcountry for one night. For overnight use in the backcountry, groups can either be small (1-6 people) or large (7-11 people).

Indian Garden Campground Campground 4.8 miles below South Rim on Bright Angel Trail. A small creek passes beneath cottonwood trees on its way to the distant Colorado River. Ranger station, emergency phone, year-round potable water, toilets. Each campsite has a picnic table, pack pole, and metal food storage can.

Lower Gorge Diamond Creek to Pearce Ferry

Upper Gorge Lees Ferry to Diamond Creek

Inventorying The process of acquiring information on park resources including the presence, distribution, and condition of plants, animals, soils, water, air, geological features, biotic communities, natural processes, cultural resources, and human-induced changes in park resources. Resource inventories are accounts of park resources including presence, class, distribution, and normal variation of plants, animals, and abiotic components such as water, soils, landforms, climate, and cultural components. Inventories contribute to a statement of park resource condition, best described in relation to a standard condition such as the unimpaired state. Inventories may involve both compilation of existing information and acquisition of new information. They may be either intensive in space (synoptic) or intensive in time (i.e., designed to detect temporal variations).

Karst Limestone terrain characterized by caves, sinkholes, and the absence of surface streams and lakes.

Large Group For overnight use in the backcountry, a large group is 7-11 people.

Leave No Trace The member-driven Leave No Trace Center for Outdoor Ethics teaches people

how to enjoy the outdoors responsibly. www.LNT.org

Management Zone Geographic area defined by resource, managerial, and social conditions/settings. For example, the ***Corridor Zone*** has ranger stations, designated campsites, toilets, running water, and a lodge with cabins at ***Phantom Ranch***. The Corridor Zone is managed for high visitation levels. The Primitive Zone is, by comparison, managed for lower use levels, does not generally have ***designated camping*** or toilets, and one can expect to see five or fewer backpacking groups per day; providing increased opportunities for solitude. A more detailed management zone discussion is included in Table 2.14d and Chapter 3, Visitor Use and Experience. Management zones help guide backcountry management actions and help provide opportunities for diverse experiences. They are comprised of smaller geographic units called ***Use Areas***.

Monitoring Long-term systematic repetition of a specific resource survey and analysis of those data to predict or detect natural and human-induced changes in resource condition to determine if natural or cultural resource condition objectives are being achieved.

Native Species All species that occurred, occur, or may occur as a result of natural processes on national park system lands. Native species in a place evolve in concert with each other (NPS Management Policies 2006).

Packrafting See ***River-assisted Backcountry Travel (RABT)***

Permit A backcountry use permit provides permission for a specified number of hikers to camp overnight in a specified ***Use Area.***

Phantom Ranch Tourist lodging designed by noted architect, Mary Elizabeth Jane Colter, located in the Corridor Management Zone. Phantom Ranch accommodates stock trips, hikers, and river runners, and provided 12,604 room-nights to visitors in 2012.

Preventative Search and Rescue (PSAR) A division under the Emergency Services Branch of Grand Canyon. Staff of PSAR's main function is to patrol upper Corridor trails and educate the public on safe hiking practices in the desert environment. PSAR staff duties also include responding to requests for rescue and practicing emergency medicine to the EMT-Paramedic level.

Recovery An operation to retrieve human remains and transport them to a safe, secure place.

Rescue An operation to retrieve persons in distress, provide for initial medical or other needs, and deliver them to a safe place.

River-assisted Backcountry Travel (RABT) RABT is transient travel on the Colorado River using a portable, personal watercraft to cross the river to access a route or trail on the other side or travel a limited distance to gain access to an exit route or trail. This activity is commonly referred to as ***packrafting***.

Route	Non-delineated access with no evident historical trail construction and minimal user-defined path development.
Search	An operation using personnel and facilities to locate persons in distress.
Search and Rescue (SAR)	Search and/or rescue operations to assist persons and property in potential or actual distress.
Search and Rescue Services	Performance of distress monitoring, communication, coordination, and SAR functions including provision of medical advice, initial medical assistance, or medical evacuation through public and private resources including aircraft, vessels, and other craft and installations.
Small Group	For overnight use in the backcountry, a small group is 1-6 people.
Special Use Permit (SUP)	A special park use is an activity that takes place in a park area, and that: provides a benefit to an individual, group, or organization rather than the public at large; requires written authorization and some degree of management control from the Service in order to protect park resources and the public interest; is not prohibited by law or regulation; is not initiated, sponsored, or conducted by the Service; and is not managed under a concession contract, a recreation activity for which the NPS charges a fee, or a lease. Special use permits may be issued by the superintendent upon finding that the proposed activity would not cause unacceptable impacts.
Stock Use	Stock only includes horses, mules, and burros. Mules and horses are most commonly used, whereas burro use is very rare. North and South Rim concessioners operate visitor mule rides, and use mules to pack supplies into and out of Phantom Ranch at the bottom of the canyon. Private stock users bring horses and mules into the park and ride below the canyon rim. NPS uses both mules and horses for park operations. Mules access Inner Canyon sites for maintenance and supply of facilities, and to haul dirt and support trail crew operations. Horses are used on North and South Rim by NPS Visitor and Resource Protection and Interpretation staff, but are not taken below the rim.
Soundscape	Soundscape is the total acoustical environment, which is the combination of all acoustic resources in a given area. Acoustic resources are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence).
Technical Canyoneering	See *Canyoneering*
Through-hikers	*Through-hikers* are those hiking the entire 800-mile Arizona Trail across the state and crossing Grand Canyon as a portion of their longer hike
Traditionally Associated American Indian Tribes	American Indian tribes that remain attached to a park area despite having relocated. Tribes are traditionally associated when (1) the entity regards park resources as essential to its development as a culturally distinct people; (2) the association has endured for at least two generations (40 years); and (3) the association began prior to establishment of the park. Grand Canyon's

Traditionally Associated Tribes include the Havasupai, Hopi, Hualapai, Kaibab Band of Paiute Indians, Las Vegas Band of Paiute Indians, Moapa Band of Paiute Indians, Navajo Nation, Paiute Indian Tribe of Utah, San Juan Southern Paiute Tribe, Yavapai-Apache Nation, and The Pueblo of the Zuni.

Trail Encounter Rate See ***Encounter Rate***

Trespass Wildlife Wildlife occurring in the park that has come from adjacent lands and is not wanted in the park. These include feral animals, domestic livestock, and other species that occur on adjacent lands.

Tuweep Tuweep is a unique, road-accessible primitive area on western Grand Canyon's north side and, with a large day use area and small campground (Map 2.2). Tuweep Campground is limited to ten groups: 9 small groups (maximum 6 people and 2 vehicles) and 1 large group (maximum 11 people and 4 vehicles). Tuweep Campground reservations will be implemented in September 2014 through the Backcountry Permit Reservation System. Tuweep day use (i.e., sunrise to 30 minutes after sunset) is limited to a maximum 30 vehicles or 85 visitors at one time to provide an "uncrowded and primitive experience." This day use limit includes visitors at Toroweap Overlook and Campground, in the Vulcans Throne area, and on local trails. Visit www.nps.gov/grca/planyourvisit/tuweep.htm

Undeveloped Retaining its primeval character and influence, and is essentially without permanent improvement or modern human occupation.

Untrammeled Essentially unhindered and free from the intentional actions of modern human control or manipulation.

Use Area Grand Canyon's ***backcountry*** is divided into 96 distinct Use Areas defined, to the extent possible, according to identifiable topographic features such as ridge tops and drainages that allocate use by geographic area, but may vary in size from several hundred to several thousand acres. Backcountry permits specify allowable Use Areas. Each area is described by a three-digit code referencing location and camping opportunities. Each Use Area is classified in one of four ***management zones***: Corridor, Threshold, Primitive, or Wild (Map 1.2). Classification of Use Areas into management zones is associated with how the park manages resources given the level of visitor use and types of activities.

Use night A user night is one hiker in the backcountry for one night

Wilderness In this plan/DEIS, Grand Canyon's ***Proposed Wilderness*** is referred to as ***Wilderness***. Wilderness is a Federal designation granted by Congress and the president. ***Wilderness character*** is defined in the 1964 Wilderness Act as "…an area of undeveloped Federal land retaining its primeval character and influence…" One difference between Wilderness and ***backcountry*** is that motorized equipment and mechanized transport is generally prohibited in Wilderness, whereas both may be present in backcountry if such uses are deemed necessary and appropriate. The Wilderness Act specifically prohibits commercial enterprise, permanent structures, and roads in Wilderness. Permanent structures such as shelters and cabins may be allowed in

backcountry for public safety and resource protection purposes. Land managers have defined Wilderness' primeval character as untrammeled, natural, and undeveloped land

Designated Wilderness Federal land designated by Congress as Wilderness and a component of the National Wilderness Preservation System where the NPS is required to manage according to the Wilderness Act of 1964 (DO RM 41 2013)

Proposed Wilderness Formal Wilderness study completed and lands identified as Proposed, Record of Decision signed, and Federal Register Notice completed, but Director has not acted on or forwarded to the Secretary of the Interior OR Lands evaluated by Director and forwarded to the Secretary as Proposed Wilderness, but Secretary has not evaluated and forwarded to the President. Grand Canyon's Wilderness falls into this category (DO RM 41 2013)

Proposed Potential Wilderness Formal Wilderness study completed and lands identified as Potential, Record of Decision signed, and Federal Register Notice completed, but Director has not acted on or forwarded to Secretary OR Lands evaluated by Director and forwarded to Secretary as Potential Wilderness, but Secretary has not evaluated and forwarded to President (DO RM 41 2013)

Recommended Wilderness Lands forwarded by the Secretary to President as suitable for Wilderness designation, but not transmitted by President to Congress. Public hearing must be completed by this stage. Lands recommended by President to Congress for designation have accompanying maps and legal descriptions (DO RM41 2013)

Recommended Potential Wilderness Recommended Potential Wilderness lands forwarded by Secretary to President, but not transmitted by President to Congress. Lands recommended by President to Congress for Potential Wilderness designation have accompanying maps and legal descriptions (DO RM 41 2013)

Designated Wilderness Lands designated by Congress and signed into law by President as Wilderness (DO RM41 2013)

Designated Potential Wilderness Lands designated by Congress as Potential Wilderness (DO RM41 2013)

Wilderness Character Defined by DO RM 41 (2013) as, "The combination of biophysical, experiential, and symbolic ideals that distinguishes Wilderness from other lands. The five qualities of wilderness character are Untrammeled, Undeveloped, Natural, Solitude or a Primitive and Unconfined Type of Recreation, and Other Features of Value."

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APPENDIX A: CURRENT BACKCOUNTRY USE AND MANAGEMENT

Grand Canyon's backcountry is comprised of over 1.1 million acres (approximately 96% of the park) and offers popular and unique backcountry opportunities. 94% of the park is managed as Wilderness. In addition to the vast backcountry rim and inner canyon, it includes Corridor Zone trails and campgrounds, Tuweep road-accessible primitive area, miles of backcountry roads, and North Rim Winter Use. Overnight backpacking and day hiking are the most popular backcountry activities; other recreational activities include trail running, climbing, canyoneering, river-assisted backcountry travel, stock use, bicycling, driving for pleasure, and vehicle tours.

Overnight Backcountry Trips
More than 37,000 visitors participate in overnight backcountry trips in the park each year. Most backpack; however, some car camp on the rims. Of the four backcountry management zones over 50% of overnight backpacking occurs in the Corridor Zone. Commercially guided backpacking trips comprise approximately 9% of overnight backcountry use.

Backcountry Management Zones
There are four backcountry management zones: Corridor, Threshold, Primitive, and Wild. Zones define management conditions or settings. For example, the non-wilderness Corridor Zone has ranger stations, designated campsites, toilets, running water, and a lodge with cabins at Phantom Ranch. The Corridor Zone is managed for high visitation levels. The Threshold, Primitive, and Wild Zones are within the Wilderness and managed for low to moderate use levels as compared to the Corridor Zone. A more detailed management zone discussion is included in Chapter 3 under Visitor Use and Experience.

Backcountry Use Areas
Grand Canyon's backcountry is divided into 96 Use Areas. Each area is described by a three-digit code referencing location and camping opportunities. To the extent possible, Use Area boundaries follow topographic features such as ridge tops and drainages, but may vary in size from several hundred to several thousand acres. Backcountry permits specify Use Areas where permit holders will stay overnight. Each Use Area is categorized into one of the four backcountry zones.

Backcountry Permit System
Requests for backcountry permits are considered no more than four months in advance of the trip's proposed start month (e.g., requests for a May permit can be submitted on or after January 1). To obtain a backcountry permit for certain dates and Use Areas/campsites, visitors must ensure their request arrives at the park's Backcountry Information Center on the first day it will be accepted (but not before). Popular Use Areas/campsites fill the first week of the first month they become available for reservation. Verbal in-person permit requests are considered for start dates one-to-three months out. For more information see http://www.nps.gov/grca/planyourvisit/backcountry-permit.htm. The NPS plans to convert to an online permitting system by winter 2015.

Group Size for Overnight Use
For overnight backcountry use, small groups are defined as 1-6 persons traveling together under one backcountry permit; large groups as 7-11 persons.

Affiliated Groups
Only one group from the same club, organization, group of friends, etc., is allowed to camp in the same campground or Use Area on the same night. Examples of groups affected by this rule might include Boy

Scouts of America, college or school groups, and clubs. Groups can obtain small group permits but must ensure itineraries never bring more than one group into the same campground or Use Area on the same night. No more than four large affiliated groups (or eight small) may camp in the backcountry on the same night.

Permit Fees
A non-refundable fee of $10 per permit plus $5 per person per night for those camped below the rim and $5 per group per night camped above the rim is charged. Frequent users may purchase a one-year Frequent Hiker Membership for $25 that waives the initial $10 fee for each permit obtained by the trip leader for twelve months from date of purchase.

Starting October 2015, a non-refundable cost recovery charge of $10 per permit plus $8 per person per night camped below the rim and $8 per group per night camped above the rim will be charged. The Frequent Hiker Membership program will be terminated.

For more information on the permitting system including permit responses, last minute permits for Corridor Zone campgrounds, and waitlist details visit
http://www.nps.gov/grca/planyourvisit/backcountry-permit.htm

Day Hiking
Up to 1,500 visitors per day hike the Corridor Trails (Backlund et al. 2006). This number may exceed this amount during busy weekends. Day hiking permits are not required for individuals. The NPS does issue permits for commercially guided day hiking.

Extended Day Hiking and Running
During busy spring and fall weekend days, an estimated 400 to 600 people hike or run rim-to-rim or rim-to-river-to-rim[69]. Some of this use is by large groups of over 30 people. Permits are not required for individuals or non-organized groups for hiking or running if it is completed in a day; overnight use requires a permit.

An interim policy is in place that requires organized groups participating in rim-to-rim or extended day hiking and running to obtain special use permits. This policy became effective September 15, 2014 (see http://www.nps.gov/grca/parknews/interim-permits-r2r.htm). Group size is limited to 30 people and only one permit per day will be issued per organization/group. However, the overall number of special use permits being issued is not limited. This activity is not authorized as a commercial service.

Climbing
Technical climbing using ropes, harnesses, fixed and removable anchors, and other gear to climb features such as walls, buttes, and temples has occurred for many years. The level of climbing activity is unknown, but anecdotal information suggests use is fairly low. There are no limits on climbing, and permits are not required for day use. Backcountry permits are required for backcountry overnight stays. Little is known about the impacts of this activity, and further research is needed to address potential impacts on visitor experience and park resources. The NPS promotes clean climbing practices (see Glossary) including use of temporary equipment and anchors (removable without altering the environment). This activity is not authorized as a commercial service.

Canyoneering
Technical canyoneering using ropes and fixed and removable anchors to descend canyons has occurred for many years and has become more popular recently. The increase in popularity may be due in part to

[69] NPS 2013h.

guide books and information sharing on the internet. There are currently no limits on canyoneering (excluding Deer Creek Narrows Compendium restrictions). No canyoneering permits are required, although backcountry permits are required for overnight use. Little is known about impacts of this activity and further research is needed to address potential impacts on visitor experience and park resources. The NPS promotes Clean Climbing practices including use of temporary equipment and anchors (removable without altering the environment). This activity is not authorized as a commercial service.

Caving
Public presence, use and access in all caves is prohibited except for research or administrative use approved by the NPS, excluding Cave of the Domes which is open for day use. Trespass into caves and abandoned mines by backcountry and river users occurs, but levels are unknown. The NPS intends to develop a Cave Management Plan.

River-assisted Backcountry Travel (RABT)
RABT (also known as packrafting) uses portable personal watercraft to allow backcountry travelers to access routes and trails along the Colorado River. RABT is currently restricted by a five-mile river-travel limit per permit as part of any overnight backcountry trip. While RABT has occurred for some years, little is known about impacts, and further research is needed to address potential impacts on visitor experience and/or park resources. In 2011, the Backcountry Information Center started to gather information about the amount of RABT occurring. Staff asked overnight backcountry users with certain itineraries (i.e., including Use Areas on both sides of the river) if they would use RABT; preliminary information showed 5-30 permits per year since 2011 included this activity. However, more of this activity is believed to occur than is reported, including day use which is not currently allowed.

Bicycling
Bicycling in the park's backcountry is currently allowed on established roads and designated rim trails outside Wilderness. Little is known about this activity, although use levels are thought to be low. This may be due to bicycling opportunities on adjacent lands such as the U.S. Forest Service Rainbow Rim Trail, and the Arizona National Scenic Trail. Commercially guided bicycle tours are currently allowed on North Rim dirt roads to Point Sublime and Tuweep. The amount of commercially guided bicycling is not well reported.

Stock Use
Private and commercial stock use is managed in accordance with the Mule Operations and Stock Use EA and Finding of No Significant Impact (FONSI) (NPS 2010f). Stock animals allowed in the park include horses, mules, and burros. Group size limits for private parties staying overnight are six head of stock with riders. Day use is limited to 12 head of stock with riders. For more information on private stock use, visit http://www.nps.gov/grca/planyourvisit/private-stock.htm. Commercial stock trips occur on South Rim on Bright Angel and South Kaibab Trails and on North Rim on North Kaibab, Uncle Jim, and Ken Patrick Trails, and at Tuweep. For specific number of trips allowed by location, visit https://parkplanning.nps.gov/projectHome.cfm?projectID=26166

Vehicle Touring and Backcountry Vehicle Tours
Approximately 75 miles of drivable backcountry roads exist. These primitive roads provide access to remote trailheads, rim campsites, and scenic overlooks. Various vehicle types may be used for travel on roads including all-terrain vehicles, single-rider dirt bikes, cars, jeeps, vans, and trucks. The only day use limits exist at Tuweep where a maximum of 30 vehicles or 85 visitors at one time has been established. Adjacent lands on the North and South Rim also provide vehicle touring opportunities.

Commercial vehicle tours to Tuweep, including jeeps and vans, are granted through a commercial use authorization. Currently six Commercial Use Authorizations exist, and each holder is allowed to conduct two trips per day, Monday through Friday, and one trip per day Saturday and Sunday.

North Rim Winter Use

The North Rim developed area is open May 15 to October 15, offering full visitor services. Visitor services including lodging and restaurants are closed after October 15 with limited services available until November 1. Backcountry use is available year-round, with a backcountry permit, but access to trailheads may be restricted off-season due to weather and road conditions.

The 2013 North Rim Operations Plan (NPS 2013d), an internal document reviewed annually, implements a day use policy November 1 to December 2, after which time the North Rim is closed for day use. Backcountry users with overnight permits will have access to all backcountry areas unless access roads become snow covered. Each fall, when the Arizona Department of Transportation (ADOT) closes Highway 67 outside the park's north entrance, North Rim Entrance Road (inside the park) will also close to motor vehicles and bicycles. Recreational use of snow machines is prohibited in the park.

A yurt, situated one-quarter mile from North Kaibab Trailhead, accommodates six people and is permitted through the Backcountry Information Center**.** The yurt can be reserved from December 1 through April 15. Normal backcountry permit fees apply. The yurt is a 50-mile ski (or hike depending on snow) from Jacob Lake Lodge, or a 6.8 mile hike from Cottonwood Campground.

Backcountry Closures

Some specific areas in the backcountry are closed to either overnight use or to all visitation. These areas are listed in Table A.1 below and include the documents where these closures are listed.

Table A.1 Backcountry Closures

Areas Closed to Overnight Use	
Clear Creek drainage below East Fork	1988 Backcountry Management Plan
Elves Chasm	1988 Backcountry Management Plan Superintendent's Compendium Non-commercial River Regulations 36 CFR 7.4 (b)
Havasu Creek within the park	1988 Backcountry Management Plan Superintendent's Compendium
Havasu Creek – mouth of the creek	Non-commercial River Regulations 36 CFR 7.4 (b)
Lee's Ferry to Navajo Bridge	1988 Backcountry Management Plan Non-commercial River Regulations 36 CFR 7.4 (b)
Little Colorado River – within ½ mile of the confluence	1988 Backcountry Management Plan Non-commercial River Regulations
Matkatimiba below the Redwall	1988 Backcountry Management Plan Non-commercial River Regulations
Pasture Wash Ranger Station – no camping within 100 yards	Superintendent's Compendium
Phantom Creek below 3600' contour	1988 Backcountry Management Plan Superintendent's Compendium
Redwall Cavern	1988 Backcountry Management Plan Non-commercial River Regulations 36 CFR 7.4 (b)
Saddle Canyon (AD9) below the Redwall	1988 Backcountry Management Plan Superintendent's Compendium

Shinumo Creek – within 100 yards of the confluence	Non-commercial River Regulations
The Basin	1988 Backcountry Management Plan Superintendent's Compendium
Uncle Jim Point	1988 Backcountry Management Plan
Areas Closed to Visitation	
Anasazi Bridge	Superintendent's Compendium
Bass Mine in Hakatai Canyon	1988 Backcountry Management Plan
Deer Creek Narrows	Superintendent's Compendium
Furnace Flats	1988 Backcountry Management Plan
Hance Mine south of Hance Rapid	1988 Backcountry Management Plan
Hopi Salt Mines	Superintendent's Compendium

Backcountry Rules and Regulations

Additional backcountry rules and regulations available at
http://www.nps.gov/grca/planyourvisit/backcountry-regs.htm

APPENDIX B: ADAPTIVE MANAGEMENT PROCESS OBJECTIVES, INDICATORS, STANDARDS AND POTENTIAL ACTIONS

Adaptive management is a decision process that promotes flexible decision making in light of uncertainties as management outcomes from actions and other events become better understood. Adaptive management includes development of desired conditions and management objectives, formulation of indicators and standards, and a strong commitment to monitoring. Desired conditions are broad narrative statements that help define park settings to be provided and maintained. Management objectives are derived from desired conditions and help refine broad narrative statements into more achievable goals. Indicators are specific, measureable variables that reflect the essence of desired conditions and serve as quantifiable proxies for management objectives. Standards provide an evaluative tool, and define the minimum acceptable condition of indicator variables. As indicator variables are monitored, management actions may be taken to maintain standards and preserve desired conditions. For an example of how adaptive management may be applied to extended day hiking and running in the Corridor Zone see pages 4-5 of this appendix.

GRAND CANYON DESIRED CONDITIONS

Beginning in April 2012, Grand Canyon worked with stakeholders to describe resource desired conditions that characterize the preferred state of a park resource and what that resource should be like after implementing management actions. Management actions analyzed in this plan/DEIS and those proposed in other park plans and projects, should be consistent with natural, cultural, and experiential resource (visitor experience) desired conditions.

Landscape

Grand Canyon's 1.2 million acres is dominated by natural processes supporting high levels of biodiversity, community resilience, and facilitating adaptation in the face of climate change.

Vegetation

Vegetation diversity reveals influences of many intersecting gradients of environmental variation. Natural processes dominate, and vegetation resources are in the condition that would occur in the absence of human intervention (NPS 2006). Species richness and vegetative productivity vary greatly among habitats, reflecting natural disturbance regimes and diversity of moisture, temperature, soil development, and other organizing influences arising from organic causes.

Vegetation resources unimpaired for present and future generations, and the natural range of genetic variability protected through perpetuation of naturally occurring evolutionary processes. Native plant species listed as endangered under the ESA are protected and monitored. Traditional plant collection recognized as an important tribal use and Grand Canyon is aware of traditional collection trends. Targeted vegetation resources monitored to ensure availability for current users and future generations.

Wildlife

Grand Canyon's large size, relatively unfragmented and diverse habitat, and range of elevations and associated climates make it a valuable wildlife preserve. Effects of natural processes dominate human influences, and wildlife resources in the condition that would occur in the absence of human intervention (NPS 2006). Species richness and productivity vary greatly among habitats, reflecting natural disturbance regimes and diverse conditions of moisture, temperature, soil development, and other organizing

influences arising from organic causes. Wildlife resources unimpaired for present and future generations, and the natural range of genetic variability protected through perpetuation of naturally occurring evolutionary processes. Wildlife species listed as endangered under the ESA protected and monitored.

Aquatic Resources
Grand Canyon maintains multiple populations of humpback chub and other native fish (including those found in the Little Colorado and Colorado Rivers). These populations have recovered, and recruitment rates are maintained or increased. Extirpated fish species reintroduced and populations self-sustaining.

Physical Resources
Physical resources preserved and protected as integral components of scenic, abiotic and physical resource values.

- Air quality meets national ambient air quality standards for criteria pollutants and protects air quality-sensitive resources
- Geologic resources preserved and protected as integral components of scenic and geologic values
- Paleontological resources, including organic and mineralized remains in body or trace form, protected, preserved, and managed for public education, interpretation, and scientific research
- Soil resources and processes function in as natural a condition as possible, except where special considerations are allowable under policy

Caves
Caves, and the integrity of cave and karst processes, maintained. Cultural, biological, paleontological, geological, and hydrological components associated with cave and karst features unimpaired. Park management encourage high-quality caves and karst scientific research; provide for cave and karst system education, outreach, and recreation; and recognize these features' cultural significance to tribes associated with Grand Canyon.

Water Resources

- Quality and chemical integrity of park waters (surface and ground waters) supports all native life, and meets or exceeds designated use standards
- Hydrologic integrity of park waters (surface and ground waters) support natural geomorphic processes of fluvial and aquifer systems and support native life

Cultural Resources
Cultural Resources preserved for future generations. Cultural Resource management is consistent with legislative and regulatory provisions and policies and procedures. Research about, and stewardship of, Cultural Resources occur after adequate planning and consultation with interested or affected individuals, groups, and other outside entities. Cultural Resources management employs the most effective concepts, techniques, and equipment for protection against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats without compromising resource integrity. Cultural Resources are managed to maintain their National Register integrity and eligibility (NPS 2006).

- **Archaeological Sites** managed in situ and to maintain National Register eligibility and integrity. Preservation treatments include proactive measures that protect resources from vandalism and looting, and maintain or improve condition by limiting damage from natural and human agents. Data recovery actions occur in the context of planning, consultation, and decision making. Preservation treatments and data recovery activities conducted within the scope of an approved research design. Archaeological research uses nondestructive methods of testing and analysis whenever possible. Information about archaeological resources incorporated into interpretive, educational, and preservation programs without inappropriate dissemination of location information. Artifacts and specimens recovered from archaeological resources, along with

associated records and reports, will be maintained together in archaeological records and museum collections whether within park-specific collection facilities or authorized facilities, such as the Western Archaeological and Conservation Center, located off park lands. Archaeological sites maintained in current conditions or improved (NPS 2006)

- **Cultural Landscapes** managed to preserve significant physical attributes, biotic systems, and historic use patterns in design and adaptive reuse of historic districts and landscape areas. Treatment decisions based on a cultural landscape's historical significance over time, existing conditions, and use. Treatment decisions consider both natural and built characteristics and features of a landscape, dynamics inherent in natural processes and continued use, and concerns of traditionally associated peoples. Cultural landscapes maintained in current conditions or improved (NPS 2006)
- **Historic and Prehistoric Structures** sound management enables long-term preservation of features, materials, and qualities; allows appropriate adaptive reuse of such resources; and ensure long-term preservation and sustainability. Structures maintained in current condition or improved (NPS 2006)
- **Indigenous Peoples and Links to the Canyon** Grand Canyon maintains relationships and conducts meaningful government-to-government consultation with Traditionally Associated Tribes. Park managers respect tribal sovereignty and recognize tribes have strong historic, cultural, and spiritual connections to the Grand Canyon region; and that tribal members have knowledge about lands now managed by NPS. Park planning documents reflect a shared interest by the park and tribes to maintain healthy ecosystems and preserve and protect cultural and natural resources which in turn maintain integrity of tribal associations
- **Traditional Cultural Properties/Ethnographic Resources** preserve tangible and intangible elements critical to integrity of culturally important places identified by Traditionally Associated Tribes. Access to Traditional Cultural Properties and sacred sites for traditional tribal practices accommodated. Ethnographic and Traditional Cultural Properties identified by traditionally associated tribes and through research of tribal and park publications. Research data verified by consultation

Visitor Experience

Visitors have opportunity for a diverse range of quality experiences compatible with Grand Canyon's resources, values, and protection of those resources and values.

- **Recreational Opportunities**
    - **Parkwide:** Developed and undeveloped area recreational opportunities diverse and appropriate for resource value preservation
    - **Backcountry and Wilderness:** A diverse range of recreational opportunities maintained and enhanced as appropriate for visitors to experience and understand resources and values in the backcountry. Activities and range of opportunities is appropriate and consistent with wilderness character preservation

Information, Interpretation, and Education

Visitors receive adequate information to orient themselves and have a safe and enjoyable visit. Interpretation and Education services facilitate intellectual and emotional connections between visitors and park resources.

Wilderness

Areas retain Wilderness characteristics and values. Visitors find ample opportunities for primitive recreation and opportunities for solitude. Wilderness is affected primarily by forces of nature, and signs of modern people remain substantially unnoticeable. Backcountry and Wilderness visitors value and support Wilderness preservation.

Soundscape
Visitor opportunities exist throughout Grand Canyon to experience natural sounds. Sounds of civilization generally confined to developed areas, and noise from air tours and commercial overflights restricted to flight corridors. Soundscapes maintained to allow tribal songscapes to persist.

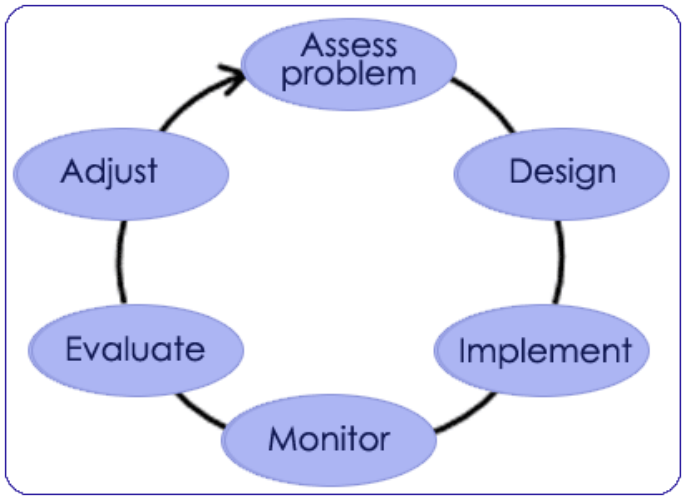
Viewscape

- **Daytime Views:** Natural visibility conditions maintained or enhanced in the park, and scenic landscape views not impaired by human activities
- **Nighttime Views:** Night sky views are not impaired by light pollution within park boundaries and from outside park boundaries

Example of Adaptive Management Process as Applied to Extended Day Hiking and Running in the Corridor Zone[70]

Step 1.Assess Problem

Desired Conditions for visitor experience in the backcountry include providing a diverse range of recreational opportunities, and management objectives for the Corridor Zone acknowledge that it provides the most accessible of those opportunities. However, public scoping, combined with staff observations, revealed a number of issues related to extended day hiking and running in the Corridor Zone. They include decreased opportunities for solitude, crowding at specific sites, conflict among user groups, increased instances of litter, and improper disposal of human waste. Each of these issues may be exacerbated by increasing use levels.



From: *Adaptive Management: The U.S. Department of the Interior Technical Guide*. 2009. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Step 2.Design

An extended Day Hiking and Running permit system would be designed to help further assess and address these problems. For instance, conflict among user groups, litter, and improper disposal of human waste may be addressed largely through minimum impact and trail etiquette education. Permits would present an opportunity to disseminate this information and educate trail users. Regarding opportunities for solitude and issues of crowding, permits would help identify high use periods and characterize the frequency and extent of them.

Visitor surveys would also be designed to assess the importance of solitude to visitors and their perceptions of crowding. The survey design would incorporate indicators such as 'number of encounters per trail segment with other people' and allow visitors to evaluate how acceptable a range of social conditions are. For example, on a scale ranging from -3 Very Unacceptable to +3 Very Acceptable, how acceptable would encountering zero other visitors while hiking between Black Bridge and Tipoff be? Or, how acceptable would encountering 120 other visitors between Tipoff and Black Bridge be? This indicator serves as a proxy for issues related to crowding and results from the survey would help establish a range of acceptable conditions, including a minimum acceptable condition, as assessed by park visitors. This range of acceptable conditions would represent potential standards for visitor use along trail segments and may vary across user types as well as times of year.

Step 3.Implement

Implementation would include initiation of a day use permit system. The system would include an educational message designed to reduce user conflict and eliminate littering and improper disposal of human waste to the greatest extent possible. Data collected from the permit system would also provide a means of monitoring visitor use levels.

Step 4.Monitor

Backcountry overnight and day use permits would provide a monitoring system for visitor use levels in the Corridor. Monitoring would also include staff observations of encounters with visitors along trail

[70] Note: This example focuses primarily on social conditions. Relevant resource and managerial conditions should also be incorporated in the interest of an interdisciplinary approach to Adaptive Management.

segments to help assess experiential conditions. These measures combined would help evaluate overall social conditions in the Corridor.

Step 5.Evaluate

Use levels (based on the number of permits issued and encounter rates), when compared with standards based on the results of visitor surveys, will help park managers evaluate the frequency of and extent to which social conditions are unacceptable in the Corridor Zone. Depending on the frequency of and extent to which social conditions are unacceptable, and how standards of quality may vary across user groups and times of year, managers have a number of management actions to consider.

Step 6.Adjust

Adjustments to maintain Desired Conditions include developing group size limits, daily use limits by trail, and designated days for group events. Managers will consider the full suite of these management actions, their efficacy in tandem with each other, and their pragmatism from an operational perspective. As adjustments are made, this iterative process may begin again through problem assessment by park managers and through public involvement.

Table B.1 Extended Day Hiking and Running (Rim-to-Rim): Adaptive Management Process

Management Objectives for Resource Conditions[71]	Indicator	Measure	Standard	Monitoring	Management Actions[72]
Water Resources Quality and chemical integrity of park waters is unimpaired, supports native life, and meets appropriate use standards	Levels of bacteria and presence of human waste	Presence of human waste (e.g., excrement, toilet paper, urine) in and near water sources near Corridor trails	No presence of human waste in water sources during peak extended day hiking and running periods	Staff will monitor water sources during peak and non-peak extended day hiking and running periods	Visitor Education on use patterns and trail etiquette Day use permit required seasonally Establish Group size limits Designate days for group or individual events Variable seasonal use limits (e.g., higher in spring, lower in winter) Establish Daily use limits by trail Day use permits required year round.
	Presence of litter / food	Presence of litter or food in water sources adjacent to Corridor trails	No accumulation of litter or food in water sources during peak extended day hiking and running periods		
Visitor Experience Visitors have the opportunity for a diverse range of quality experiences compatible with Grand Canyon's resources and values, and the protection of those resources and values. The Corridor Zone will provide highest level of access to most diverse suite of user groups.	Encounters with other people People at one time (PAOT) at attraction sites (e.g., Manzanita, Phantom Ranch, etc.)	Number of encounters with other people per trail segment Number of people at one time (PAOT) at attraction sites (e.g., Manzanita, Phantom Ranch, etc.)	Trail encounter rate standards for area in Table 2.5 and Map 2.6 and Attraction site standards to be determined through ongoing visitor use studies and data collection.	Staff periodically reports encounter rates for areas in Table 2.6 and Map 2.6 Documentation of people at one time at Phantom Ranch Cantina and Manazanita Resthouse during peak use periods	
	Human waste and litter along Corridor trails	Presence of human waste and litter along Corridor trails	No presence of human waste or litter along Corridor trails during peak extended day hiking and running periods	Staff will monitor trails during peak and non-peak extended day hiking and running periods	
	Physical injuries or heat related illnesses	Number of incidents during peak and non-peak day use on Corridor Trails	TBD based on analysis of NPS database	Documentation of visitor assists and medical treatments. Analysis on annual basis	

[71] Resource Objectives are derived from, and serve as a proxy for, Desired Conditions as outlined at the beginning of this appendix.
[72] Management Actions may be implemented singly or in combination with options as new information becomes available or resource conditions change.

Table B.2 Canyoneering and Climbing: Adaptive Management Process

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Vegetation Productivity and richness reflects diversity of environmental gradients and natural disturbance regimes Exotic species rare and have little effect on local and ecosystem processes	Vegetation damage	Social trailing Broken branches	No increase in social trails/ no new trails. No increase in broken branches near routes and staging areas	Staff periodically visits routes to measure social trails and broken branches along access routes	Minimum impact education including Clean Climbing techniques Overnight permit identifies canyoneering and/or climbing route Remove climbing hardware Day use permit or reservation system Use limits for specific locations (e.g., limit number of groups or adjust group size) Seasonal, temporary or permanent closure of specific location for resource protection (especially archeological sites and special status species)
		Mortality of and damage to shrubs and trees used as anchors	No loss of trees and shrubs used as anchors	Staff will periodically visit routes to assess trees and shrubs used as anchors	
	Exotics	Exotic species along access route	No increase in number of exotic species and no significant increase in abundance and dominance of exotic species	Staff periodically visits climbing routes and assesses number and abundance of exotic species along access routes	
Special Status Plant Species Native plant species listed as endangered under the Endangered Species Act are protected and monitored, and rare and endemic species and rare plant communities are monitored to ensure protection and availability for future generations.	Populations of endangered species, native endemic species (*Flaveria macdougalii*, *Argemone arizonica*, and others), and rare plant communities.	Presence of self-sustaining population of species, and geographic extent of rare communities	No canyoneering or climbing-related loss of populations, no impacts on recruitment / reproduction, no more than 10% loss of individuals or areal extent of populations related to activity	Staff will periodically visit areas where populations of special status species have been documented.	
Special Status Wildlife Species Wildlife species listed as endangered under the Endangered Species Act are monitored and protected	Peregrine falcon aeries, Mexican Spotted Owl (MSO) nest and roost sites, and Condor nests	Nest occupancy and success	No displacement of nesting pairs, no abandonment of nests or nest / roost sites	Annual surveys for Peregrine and MSO, and periodic surveys of Condor nests and nest success	

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Archaeological Sites Archaeological resources are managed in situ and in a manner that maintains their National Register eligibility and integrity	Archaeological site disturbances	Artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, human waste	No evidence of artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, or human waste	Staff will monitor archaeological sites and document social trails, artifact collection piles, incidents of architectural modification, graffiti, trash, campfires, or human waste near access trails and along routes	
		Installation of climbing and canyoneering hardware	No climbing hardware present		
Visitor Experience A diverse range of recreation opportunities are maintained as appropriate for visitors to experience and understand resources and values in the backcountry and wilderness	Use of climbing and canyoneering routes	Number of climbing and canyoneering trips	TBD based on future research regarding social standards for climbing and canyoneering activities	Annual number of overnight permits with these activities identified	

Table B.3 Tuweep Day Use: Adaptive Management Process

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Vegetation Richness in productivity reflect the diversity of environmental gradients and natural disturbance regimes	Vegetation damage	Trampling	No loss of vegetation	Staff will assess trampling at locations TBD at Tuweep and Toroweap overlook	Information on Day Use at Tuweep (road signs, regional visitor centers, website) Tuweep day use permit or reservation system Limits for number of vehicles per party Designated days for
Vegetation Exotic species are rare and have little effect on local and ecosystem processes	Exotics	Exotic species richness in area	Number of exotic species in area	Staff will periodically visit Tuweep area and count number of exotic species	

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Special Status Plant Species Native plant species listed as endangered under the Endangered Species Act are protected and monitored, and rare and endemic species and rare plant communities are monitored to ensure protection and availability for future generations.	Populations of special status species (*Chylismia confertifolia* and others)	Presence of self-sustaining populations	No loss of plant populations related day use, no day use impacts on recruitment / reproduction, no more than 10% loss of individuals or areas extent of rare communities	Staff will periodically visit areas where populations of special status species have been documented.	group events
Archaeological Sites Archaeological resources are managed in situ and in a manner that maintains their National Register eligibility and integrity.	Archaeological site disturbances	Artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, and human waste	No evidence of artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, or human waste	Staff will monitor archaeological sites and document social trails, artifact collection piles, incidents of architectural modification, graffiti, trash, campfires, or human waste.	
Visitor Experience Provide opportunities for road-accessible uncrowded and primitive experiences. Ensure these opportunities through low levels of people and vehicles at one time at scenic overlooks, along road corridors, trailheads and campgrounds.	Day use levels at Tuweep	Number of people at one time at Tuweep	No more than 85 people or 30 vehicles at one time consistently during seasonal weekends (i.e., spring and fall) at Tuweep	Monitoring methods and plan TBD; incorporate automated vehicle traffic counters and park staff observations	

Table B.4 Use Area Management: Adaptive Management Process

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Water Resources Quality and chemical integrity of park waters is unimpaired, supports native life, and meets appropriate use standards	Water quality: presence of litter in water sources	Presence of litter in water sources along trails and at campsites	No accumulation of litter in water sources	Staff will periodically monitor water resources to assess litter and other contaminants in water resources	Monitor Use and Resource Conditions at Campsites Conduct campsite rehabilitation and trails maintenance Decrease/increase a Use Area's group number and/or designated sites Variable seasonal use limits (e.g., higher in winter, lower in spring . Change Use Area camping designations: from at-large to designated or vice versa
Vegetation Richness and productivity reflect the diversity of environmental gradients and natural disturbance regimes	Vegetation damage	Soil compaction Social trailing Condition of biological crust	No increase in social trailing/no new social trails created No increase in soil compaction and loss of vegetation or biological crusts around campsites.	Staff will monitor social trails, vegetation damage including biological crusts and soil compaction at campsites and attraction sites.	
Wildlife Wildlife resources are in the condition that would occur in the absence of human interventions	Wildlife attracted to litter and food at campsites	Presence of nuisance wildlife at campsites due to litter and food (e.g., ravens, rodents, and ringtails)	No increase in presence of nuisance wildlife at campsites due to litter and food	Staff will monitor campsites and assess presence of nuisance wildlife	
Archaeological Sites Archaeological resources are managed in situ and in a manner that maintains their National Register eligibility and integrity.	Archaeological site disturbances	Artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, and human waste	No evidence of artifact collection piles, social trails, architectural modification, graffiti, trash, campfires, or human waste	Staff will monitor archaeological sites and document social trails, artifact collection piles, incidents of architectural modification, graffiti, trash, campfires, or human waste.	
Historic Structures Buildings and structures are managed to allow for appropriate adaptive reuse of such resources while ensuring long-term preservation and sustainability. Structures	Historic building and structures disturbances	Damage to architectural features	Historic buildings and structures are preserved in situ. Character-defining features are retained. Aspects of integrity are preserved. Structures and buildings are stable	Staff will assess National Register eligible or listed properties every five years according to the List of Classified (LCS) Structures condition criteria	

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
are maintained in current conditions or are improved					
Visitor Experience A diverse range of recreation opportunities are maintained as appropriate for visitors to experience and understand resources and values in the backcountry and wilderness Threshold Zone use areas provide opportunities to transition from a developed backcountry experience (Corridor Zone or rim) to Wilderness. Primitive Zone use areas provide opportunities for solitude on trails long distances from developed areas. Wild Zone use areas provide outstanding opportunities for solitude requiring the highest level of self-reliance.	Encounters with other groups	Number of encounters with other groups per day	Threshold Zone: 10 or fewer contacts with other overnight groups per day at least 80% of the time. Primitive Zone: 5 or fewer contacts with other overnight groups per day at least 80% of the time. Wild Zone: 3 or fewer contacts with other overnight groups per day at least 90% of the time.	Trail counter data from Threshold and Primitive Zone trails. Survey of overnight permit holders and day hikers to report encounter rates.	
	Other groups camping within sight and sound of each other	Number of groups camping within sight and sound of each other	Threshold Zone: No more than 5 other groups per night at least 80% of the time camping within sight and sound of each other Primitive Zone: No more than 2 other groups per		

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
			night at least 80% of the time camping within sight and sound of each other Wild Zone: No more than 1 other group per night at least 90% of the time camping within sight and sound of each other		

Table B.5 Human Waste Management: Adaptive Management Process

Management Objectives for Resources	Indicator	Measure	Standard	Monitoring	Management Actions
Soils Minimal soil loss and disturbance resulting from human waste disposal	Loss of soil and biological crust, and soil compaction due to social trailing and disturbance (catholing) related to waste disposal	Amount of exposure of mineral soil, compaction, presence of biological crust, and number of social trails	No increase in exposure or loss of soil or compaction along trails and at campsites and no loss of biological crust along trails and at campsites	Staff will periodically monitor social trails, soil condition and biological crust along trails and at campsites	Minimum impact education on proper methods for human waste disposal in backcountry areas. Monitor resource conditions Implement seasonal or year round carry out programs as necessary Adjust backcountry toilets to accommodate management and visitor needs Decrease/increase a use levels or adjust limits on seasonal basis (e.g., higher in winter, lower in spring
Water Resources Quality and chemical integrity of park waters is unimpaired, supports native life, and meets appropriate use standards	Water quality; levels of bacteria	E. coli counts	Water along trails and at campsites will not exceed health standards	Staff will periodically visit Use Area trails and campsites with water and sample and test for E. coli and assess presence of human waste in and near water sources	
Archaeological Sites Archaeological resources are managed in situ and in a manner that maintains their National Register eligibility and integrity.	Archaeological site disturbances	Social trails, digging, and human waste within archaeological sites	No social trails, digging, or human waste on archaeological sites	Staff will periodically monitor archaeological sites and will count social trails, evidence of digging and presence of human waste	

APPENDIX C: BACKCOUNTRY ROADS AND TRAILS

Mileages were gathered from various information sources including Grand Canyon databases, and GIS. Note: mileages may change as GIS and other mapping tools are improved or upgraded.

Table C.1 Current Backcountry Roads

Road Name	Miles
South Rim	
South Bass Trailhead	4.6
Havasupai Point	3.0
North Rim	
Fire Point	1.0
Swamp Point	7.7
Point Sublime	17.2
Kanabownits	8.7
Kanab Plateau	
150 Mile Canyon	5.9
Kanab Point	4.3
SB Point	7.8
Schmutz	8.1
Toroweap	6.3
Total Mileage (approximate)	75

Table C.2 Current Backcountry and Wilderness Trails

Trail Name	Zone	Miles
Arizona (North)	Threshold	11.9
Beamer	Primitive	9.7
Bill Hall	Primitive	2.5
Boucher	Primitive	6.8
Bright Angel	Corridor	7.8
Cape Final	Threshold	2.1
Cape Solitude	Primitive	12.4
Carbon-Lava Canyon	Primitive	3.2
Clear Creek	Threshold	8.6
Cliff Springs	Primitive	0.5
Cottonwood Creek	Primitive	1.6
Deer Creek	Threshold/Primitive	3.1
Dripping Springs	Threshold	3.5
East Tonto	Primitive	33.4
Eremita Mesa	Primitive	1.8
Escalante	Primitive	11.0
Francois Matthes	Primitive	4.70
Grandview	Threshold	4.3
Hance Creek	Primitive	1.3
Havasu Canyon	Primitive	3.4
Hermit	Threshold	9.7
Ken Patrick	Primitive	9.5
Komo Point	Primitive	5.2
Monument Creek	Threshold	1.5
Nankoweap	Primitive	14
New Hance	Primitive	6.5
North Bass	Primitive	13.5

Trail Name	Zone	Miles
North Kaibab	Corridor	14.5
Old Bright Angel	Corridor	4.4
Plateau Point	Corridor	1.5
Point Imperial	Wild	2.6
Powell Plateau	Primitive	3.7
Ribbon Falls	Corridor	0.5
River	Corridor	1.8
Saddle Canyon	Primitive	1.0
Saddle Horse Loop	Developed	1.0
South Bass	Primitive	7.8
South Canyon	Primitive	6.5
South Kaibab	Corridor	6.4
Surprise Valley	Primitive	1.6
Tanner	Primitive	9.0
Tapeats Creek	Threshold	3.2
Tapeats-Deer River	Primitive	1.9
Thunder River	Primitive	11.0
Tiyo Point	Primitive	6.3
Tuckup	Threshold	3.0
Uncle Jim	Primitive	2.5
Waldron	Threshold	2.6
Walhalla Glades	Primitive	7.3
Walhalla Spur	Primitive	2.6
West Tonto	Primitive	56.0
Whitmore	Threshold	1.3
Widforss Point	Threshold	4.6
Total Mileage (approximate)		**358.4**

APPENDIX D: BACKCOUNTRY AND WILDERNESS TRAIL CLASS STANDARDS

Grand Canyon Trail Standards guide park managers and field crews on park trail construction method and maintenance, and are consistent with Interagency Trail Data Standards (http://www.nps.gov/gis/trails/).

National Trail Class categories range from Trail Class 1 to Trail Class 5 and prescribe general trail development including intended design and management (see Table D.1 and Table D.2).

Table D.1 Trail Class Definitions

Trail Class	Trail Definition
1	Minimal/Undeveloped Trail
2	Simple/Minor Developed Trail
3	Developed/Improved Trail
4	Highly Developed Trail
5	Fully Developed Trail

Trail Class is defined in terms of applicable tread and traffic flow, materials and constructed features, and allowable recreational uses and use levels of trails. In applying Trail Class standards, the NPS chooses the level that most closely matches the Backcountry Management Zone objectives.

Table D.2 Trail Class Standards

	Trail Class				
Trail Attributes	**1 Minimally Developed**	**2 Moderately Developed**	**3 Developed**	**4 Highly Developed**	**5 Fully Developed**
Tread	May require route finding Tread Intermittent, often indistinct	Tread continuous and discernible, but narrow and rough	Tread continuous and obvious	Tread wide and relatively smooth with few irregularities	Tread wide, firm, stable, generally uniform
Traffic Flow	Narrow: no allowances constructed for passing		Narrow with allowance constructed for passing	Single or Double Lane: allowances for passing in high volume areas	
Materials	Native		Native or imported	May be hardened	Commonly Hardened
Constructed Features	Minimal to non-existent; Drainage typically done w/out structures No bridges	Limited size and quantity using native materials; Bridges as needed for resource protection	May be common using native/other materials Bridges as needed for resource protection and access	Frequent and substantial; using native or imported Bridges as needed for resource protection and access and convenience	Frequent and continuous; may include bridges, curbs, hand rails, and similar features
Typical Uses in Grand Canyon	Hiking			Hiking, Bicycling, Stock	
Backcountry Management Zones	Primitive and Wild		Threshold	Threshold and Corridor	Not applicable to Backcountry

APPENDIX E: MINIMUM REQUIREMENT ANALYSIS

GRAND CANYON MINIMUM REQUIREMENT ANALYSIS

PROPOSED ACTION TITLE

Grand Canyon Study/Project Number

PREPARED BY **DATE**

PART A IS THIS ACTION NECESSARY TO MANAGE THE AREA *AS WILDERNESS*?

DESCRIPTION OF PROPOSED ACTION

1. Describe Requirements of Legislation, Policy, and Guidance
Does action conform to and implement relevant standards and guidelines and direction contained in legistation, policy, management plans, species recovery plans, tribal government agreements, and/or other interagency agreements?

- ***Wilderness Act of 1964 (PL 88-577):***
- ***2006 NPS Management Policies:***
- ***1995 Grand Canyon General Management Plan:***
- ***2006 Colorado River Management Plan:***

2. Describe options outside Wilderness
Can this action be accomplished outside Wilderness?

☐ ***Yes*** ☐ ***No Explain***

3. Describe how the action would contribute to preservation of wilderness character
How would the action contribute to preservation of wilderness character as described by components below? (Components are from the Wilderness Act and NPS policy)

Untrammeled (Wilderness is ideally unhindered and free from modern human control or manipulation):

Undeveloped (Wilderness has minimal evidence of modern human occupation or modification):

Natural (Wilderness ecological systems are substantially free from the effects of human use, e.g., visitation and/or management activities):

Outstanding opportunities for solitude or a primitive and unconfined type of recreation (Wilderness provides opportunities for people to experience natural sights and sounds, solitude, risk, adventure and other attributes):

4. Describe effects to Wilderness' public purposes
How would this action support the public purposes of Wilderness (recreation, scenic, scientific, education, conservation and historical use)?

PART A DECISION: **Is it necessary to take this action in Wilderness?**
☐ ***Yes*** ☐ ***No*** ***Explain:***

GRAND CANYON MINIMUM REQUIREMENT ANALYSIS

PART B: DETERMINE THE MINIMUM TOOL *HOW* THE ACTION WILL BE DONE

ALTERNATIVE 1
Proposed activity description:
Location of proposed activities:
Period of proposed activities:
Frequency of proposed activities:
Duration of proposed activities:
Methods that will be used:
Personnel requirements:
Rationale for proposed methods:
Impacts to park resources:
Impacts to Wilderness qualities
- Untrammeled
- Undeveloped
- Naturalness
- Outstanding Opportunities for solitude or unconfined recreation

Mitigation of adverse impacts:

Alternative 2
Proposed activity description:
Location of proposed activities:
Period of proposed activities:
Frequency of proposed activities:
Duration of proposed activities:
Methods that will be used:
Personnel requirements:
Rationale for proposed methods:
Impacts to park resources:
Impacts to Wilderness qualities
- Untrammeled
- Undeveloped
- Naturalness
- Outstanding Opportunities for solitude or unconfined recreation

Mitigation of adverse impacts:

ALTERNATIVE 3
Proposed activity description:
Location of proposed activities:
Period of proposed activities:
Frequency of proposed activities:
Duration of proposed activities:
Methods that will be used:
Personnel requirements:
Rationale for proposed methods:
Impacts to park resources:
Impacts to Wilderness qualities
- Untrammeled
- Undeveloped
- Naturalness
- Outstanding Opportunities for solitude or unconfined recreation

Mitigation of adverse impacts:

GRAND CANYON MINIMUM REQUIREMENT ANALYSIS

PART B DECISION
Requester: *What is the Minimum Tool?*

What is the preferred alternative? 1 2 3 Other Explain:

Wilderness Coordinator: What is the Minimum Tool? State Rationale:

APPROVALS

1. Recommended Alternative ____ Comment:

_____ _____
Wilderness Coordinator Date

2. Recommended Alternative_____ Comment:

_____ _____
Chief, Science and Resource Management Date

3. Approved Yes ___ No ___ **Comment:**

_____ _____
Deputy Superintendent Date

APPENDIX F: DRAFT REQUIREMENTS FOR PERMITTED BACKCOUNTRY OPERATORS

Introduction

These Draft Backcountry Operating Requirements address guided overnight backpacking and day hiking trips in Grand Canyon engaged in by Permitted Operators including Concessions, Commercial Use Authorization (CUA) and Special Use Permit (SUP) holders, and National Park Service (NPS) cooperating associations. These Draft Requirements are being included in the plan/DEIS for review, and may differ from final Operating Requirements signed by Permitted Operators. The NPS may delay or terminate guided trips at any point if conditions, as set forth herein, are not met, or until noted deficiencies are corrected and documented.

GENERAL OPERATING PROCEDURES

Permitted Operators must

- take adequate steps to determine physical capabilities of clients and select (or adjust) routes suited to a group's abilities so as not to risk safety or diminish enjoyment of the group's backcountry experience
- conduct an orientation talk discussing safety, rescue, human waste, hiking, resource protection, etc. prior to the trip
- cooperate with the NPS when the NPS performs evaluations to ensure clients are provided high-quality services that meet NPS environmental, health, safety, and operational standards
- insure guides wear identifying nametag or logo to aid in observation/identification during emergencies or other contacts with NPS employees

EMERGENCY EQUIPMENT AND PROCEDURES

Incident Response
When incidents occur, life-safety is priority. NPS will coordinate such activities with Permitted Operators in determining response level by both NPS and operator to achieve these goals. NPS has final authority on response level. Permitted Operator may be responsible for incident cost.

First Aid
Each trip must carry a first-aid kit stocked with items highly recommended for inclusion listed in the Supplement Suggested First Aid Items.

Communications and Signaling
Emergency signaling equipment must include a signal mirror of the U.S. Air Force type, and a two-way communications device (a satellite telephone or Satellite Emergency Notification Device (SEND)). Devices must be programmed to enable guides to call NPS dispatch. Initial requests for emergency evacuations must be placed through Park Dispatch at (928) 638-7911.

Safety and Equipment

- Trip leader and guide(s) will ensure each group member has adequate food and water, appropriate footwear, sufficient clothing, and sun-block for the proposed itinerary
- Every trip must carry a repair kit appropriate for the type of equipment used

- Trips outside the Corridor Zone must carry one or more accurate topographical maps of the hiking route
- During late fall, winter, and early spring, when ice and packed snow may be present on many trails, over-the-shoe traction devices are required for guides and clients in the Corridor Zone and are strongly recommended for areas outside the Corridor Zone

Aircraft Operations

- Helicopter evacuations are available only for medical emergencies, and only the NPS may make such arrangements
- See Supplement, Helicopter Evacuations, for evacuation procedures and preparation checklist

TRIP LEADER AND GUIDE REQUIREMENTS

Maintaining Trip Leader and Guide Requirement Records

- Permitted Operator must ensure all trip leaders and guides meet NPS-established minimum requirements. Operators must maintain files including guide resumes and copies of current Wilderness First Responder (WFR) and Cardiopulmonary Resuscitation (CPR) Certifications, and driver's license. The resume must include, at a minimum, the guide's name, birth date, address, telephone number, and a list or description of the guide's backcountry guiding experience. The Permitted Operator must provide record of its guides' qualifications to NPS on request
- Permitted Operator must ensure trip leaders and guides are appropriately qualified and certified in accordance with NPS requirements <u>prior to their entering the backcountry to provide services to visitors</u>

Guides

A guide must

- Be at least 18 years old
- Have completed at least two trips on the route to be guided, and be capable of leading the route, not just participating in a trip on the route
- Possess working knowledge of all equipment and sanitation procedures for backcountry trips, including the proposed River Zone where human waste carry out is required
- Possess knowledge of NPS regulations applicable to backcountry travel and camping in the park
- Possess knowledge of federal regulations protecting natural and cultural resources from human impact
- Be certified in WFR through a program sponsored in the United States. Higher emergency medical certifications obtained in the U.S. above WFR also qualify (for example: emergency medical technician (EMT), wilderness emergency medical technician (WEMT), and Emergency Medical Doctor)
- Possess current CPR Certification obtained through an in-person class
- A guide must possess the following skills, as verified by the Permitted Operator
    - Ability to safely travel park backcountry trails and routes
    - Ability to operate emergency communications equipment carried by the Permitted Operator and perform evacuation procedures
    - Knowledge of Grand Canyon's natural, cultural and physical resources, natural and human history, points of interest encountered; knowledge of American Indian perspectives on these resources; and ability and willingness to impart this knowledge to clients
    - Working knowledge of safety aspects and equipment-repair procedures for common backpacking equipment

- Knowledge of Leave No Trace camping methods, interpretive techniques, and environmental health and safety in the backcountry

Trip Leaders

- A trip leader is a person whose social and physical capabilities qualify him/her as a responsible leader. A trip leader must be in charge of each backcountry trip, and is responsible for clients and additional guides
- In addition to meeting the guide qualifications specified above, the trip leader must
  - Have completed at least two trips on the trail to be guided as a guide, in addition to the two trips required to achieve trip guide status
  - Be knowledgeable and capable of giving orientation talks to all clients throughout the trip as verified by the permitted operator. This required orientation must cover hiking safety, drinking water, sanitation, and Grand Canyon cultural and natural history. If the trip reaches the Colorado River, the talk must also include safety cautions about bathing/swimming in the river
  - Be certified as a WFR through a program sponsored in the United States. Higher emergency medical certifications obtained in the U.S. above WFR will also qualify (for example, EMT, WEMT, and Emergency Medical Doctor)
  - Have current CPR Certification
  - Be certified in Leave No Trace

Drug-Free Workplace

- All staff and client use of alcoholic beverages during the course of a trip must be managed by the Permitted Operator at all times to ensure the safety and well-being of staff and clients
- The Permitted Operator must maintain, to the greatest extent possible, a drug-free workplace. The operator must conduct educational programs for its employees to deter substance and alcohol abuse. All guides are required to participate in periodic drug testing. The NPS will not dictate a program the Permitted Operator must use unless repeated violations are observed. The NPS will not dictate the program the Permitted Operator must use; however, repeated violations can lead to contract or permit termination

Possession of Firearms by Guides

- Permitted Operator employees may not possess firearms while on duty (i.e., while in the park). The Superintendent, in his/her sole discretion, may grant exceptions to this prohibition on consideration of a written request from the Permitted Operator with a thorough explanation of the request basis

Alcohol Use by Clients

- The Permitted Operator must not sell, serve, or furnish any alcoholic beverages to its clients. The Permitted Operator may permit clients to bring their own alcohol for personal consumption

ENVIRONMENTAL PROTECTION AND SANITATION

Solid Waste

- Solid waste, which may commonly be referred to as rubbish, refuse, trash, litter, or garbage may not be discarded anywhere in the canyon. The trip leader must ensure all trip members properly dispose of solid waste. All solid waste must be carried out
- Feeding wildlife is prohibited
- Permitted Operator must not deposit solid waste at Phantom Ranch or any other in-Canyon facility including backcountry toilets

- Soap must not be used in side streams or within 100 yards of the confluence of any side stream and the mainstem Colorado River

Human Waste Disposal

- All guides and clients must abide by all park rules regarding proper human waste disposal to prevent water pollution, disease spread, and aesthetic degradation of backcountry. Improper human waste disposal is a violation of park regulations and violators are subject to fines
- All trips must use backcountry toilets in those Use Areas with designated camping and available facilities
- All backcountry trips using campsites in Use Areas without toilets must carry out human waste. Personal-sized human waste carry out systems (such as WAG BAG® or RESTOP®) must be carried out and disposed of properly

Fires

- Wood or charcoal fires of any type are prohibited
- Gas stoves (propane and white gas) for cooking are allowed on all overnight trips

Drinking Water

- Water from natural sources must be treated by boiling, filtering, and/or disinfecting

Hand Washing

- Backcountry trips must be equipped with supplies to prevent food-borne illness and fecal-oral contact. This can include hand washing after defecation or urination, and prior to food preparation. This must be followed by hand sanitizer use if non-potable water is used. If water is in short supply, at a minimum hand sanitizer must be used

Food Operations

Permitted Operator will demonstrate commitment to visitor safety by planning safe food storage, handling, and preparation

Food Preparation

- Permitted Operator will minimize bare hand contact for ready-to-eat food products. NPS strongly encourages use of gloves or utensils to handle foods that will not be cooked
- Use of stoves on campground picnic tables is not allowed

Food Storage

- Permitted Operator must use food containers provided at Corridor campgrounds to prevent wildlife entry
- For areas outside the Corridor, where food storage containers are not provided, food must be stored in sealed containers, or wire mesh rat sack type containers must be used to prevent wildlife entry

Fuel Storage

- All liquid fuel must be carried in external backpack pockets separate from food

Trails

- Guides must stress to their clients the need to stay on established trails. Short-cutting, multiple trailing, or off-trail hiking must be avoided, as it creates damage at attraction sites and along backcountry trails and causes impacts on vegetation and soils

Campsite Impacts

- In Use Areas with at-large[73] camping, guides must select campsites suitable to group size. For permits in designate sites or campgrounds, guides must use assigned small or large group campsites. Guides must instruct clients not to create new hiking routes or sleeping areas outside the established camp area. Securing hammocks to area vegetation is not allowed

Archaeological Sites

- Backcountry archaeological sites can be damaged by people walking on fragile cultural deposits, piling and/or stealing artifacts, digging in ruins, rearranging wall fall or building up walls, and other activities such as graffiti and vandalism. These activities are prohibited and punishable under federal laws. Guides must inform their clients about federal laws prohibiting disturbance of archaeological remains on federal lands. Permitted Operator must comply with the Grand Canyon Cultural Site Information Standard Operating Procedures Supplement

Restricted Areas

- Grand Canyon backcountry areas closed to either camping or visitation by CFR (36 CFR 7.4) or Superintendent's Compendium (36 CFR 1.5 (a)) are listed in a Supplement and may change seasonally or annually. Trip leaders should verify seasonal closures, such as those required to protect endangered species, with the Backcountry Information Office. For the most up-to-date trail conditions and closures, visit the park's Backcountry Updates website at http://www.nps.gov/grca/planyourvisit/trail-closures.htm

TRIP LIMITATIONS

Trip Definition

- A trip is defined as a group of people traveling and camping together, assigned to one scheduled trip permit, and occupying one campsite per night. A trip may split for the purpose of a day loop hike; however, the trip must rejoin and camp together. At least one guide must be present on the day loop hike
    - Trip Size and Guide to Client Ratio
        - Maximum number of people (clients plus guides) per trip (traveling and/or camping together at any time) is 11
        - All groups will maintain a ratio of no less than one guide for every seven clients or two guides for every nine. If the Permitted Operator has staff members participating in a training capacity, those staff members will be counted as clients in the guide/client ratio

Training Trips

- Permitted Operator may conduct training trips to train new guides or familiarize guides with new types of equipment, interpretive methods, and operational requirements. Training trips are included in the commercial use cap. Permitted operators are encouraged to work jointly to sponsor training trips. Training trips must adhere to allowable trip size limits unless otherwise determined by the NPS

Access on Adjacent Lands

Permitted Operators accessing Grand Canyon National Park backcountry across Tribal Lands must contact the appropriate office and obtain permits

[73] Use Areas without designated campsites, individuals or groups can camp anywhere in accordance with normal regulations and compendium restrictions.

Use of **Navajo Nation** lands is by permit only, obtained through the Navajo Nation, Navajo Nation Parks and Recreation Department, Cameron Tribal Office, P.O. Box 459, Cameron, Arizona 86020; http://www.navajonationparks.org Permitted Operators are responsible for paying appropriate fees to the Navajo Nation.

Use of **Hualapai Tribal lands** must be approved in advance in writing by the Hualapai Tribe, P.O. Box 246, Peach Springs, Arizona 86434; http://hualapai-nsn.gov Permitted Operators are responsible for paying appropriate fees to the Hualapai Indian Tribe.

Use of **Havasupai Tribal lands** must be approved in advance by contacting the Havasupai Indian Tribe at (928) 448-2121. For reservations at Havasu Campground, contact the Havasupai Indian Tribe at (928) 448-2121; http://www.havasupai-nsn.gov A fee is charged for each person entering or crossing the Havasupai Indian Reservation, payable at time of entry. An additional charge is made for each night camping in the reservation. Permitted Operators are responsible for paying appropriate fees to the Havasupai Indian Tribe.

DATA COLLECTION AND REPORTING

Backcountry Use Reports

- Permitted Operator will list each trip by location and date, number of people, trip leader and guide's name. Reports are due to the NPS Concessions Office by the 15th day of each month following the month reported

Incident Reports

- Permitted Operator must report
    - All incidents resulting in evacuation from the canyon
    - Personal injury requiring more than basic first aid
    - Death or disappearance of any trip participant
    - Assistance provided to other operators or private individuals involving any of the above situations
- Permitted Operator must give a completed Trip Incident Report Form to the park ranger at time of evacuation, or mail it to the Canyon District Office within 48 hours of trip completion
    - Incident Report Form is available through the NPS Permits or Concessions Office or the operator may make and use duplicates of Supplement, Trip Incident Form
- Permitted Operator must fax or telephone notification of any evacuation for a serious injury or an injury requiring hospitalization <u>completed by another agency</u> to the Canyon District Office within 24 hours of the incident.
- Permitted Operator must also immediately report to Park Dispatch any of the following
    - fires
    - motor vehicle accidents
    - incident that affects park resources
    - known or suspected violations of the law

OTHER CONDITIONS

- Permitted Operator must submit all advertisements and brochures for Superintendent approval prior to publication, distribution, posting, or broadcasting. All such publications must include a statement that Permitted Operator is authorized by the NPS, Department of the Interior, to serve the public in Grand Canyon National Park

- Parking on South Rim is limited. Permitted Operators are limited to parking in approved parking areas. Permitted operators and clients are encouraged to use the shuttle system to access trailheads

SUPPLEMENTS

The following Supplements mentioned in the Draft Requirements above will be included in Final Operating Requirements signed by Permitted Operators

- Orientation Talks
- Suggested First Aid Items
- Helicopter Evacuations
- Restricted Areas and Use Limits (Superintendent's Compendium and CFR)
- Trip Incident Report Form
- Cultural Site Disclosure Information

APPENDIX G: COMMERCIAL BACKCOUNTRY SERVICES ANALYSIS

Introduction

Appendix G defines the process used to evaluate potential commercial backcountry services and activities within Grand Canyon, including the 1.1 million acres proposed for Wilderness designation. Commercial backcountry services are authorized under concession contracts, commercial use authorizations (CUAs), or special use permits (SUP) according to federal law, regulation, and policy. Grand Canyon's purposes including preservation of wilderness character, protecting park resources, and meeting visitor needs are primary considerations in determining if and what commercial services are appropriate and to what extent they are necessary in Wilderness.

Authorities

The National Park Service Organic Act of 1916 (16 USC 1) directs parks be managed to "conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The NPS Concessions Management Improvement Act of 1998 (PL 105-391) provides for services that "1) are necessary and appropriate for public use and enjoyment of the unit of the National Park System in which they are located; and 2) are consistent to the highest practicable degree with the preservation and conservation of the resources and values of the unit." The Act provides for CUAs or concession contracts as a mechanism to deliver commercial services to park users as long as those services have minimal impact on resources and values of the NPS unit and are consistent with the purpose for which the unit was established and with all applicable management plans, park policies, and regulations.

NPS Management Policies (2006, 6.4.4) allow wilderness-oriented commercial services that contribute to public education and visitor enjoyment of wilderness values if they meet the "necessary and appropriate" tests of the NPS Concessions Improvement Act of 1998 and section 4(d)(6) of the Wilderness Act. NPS Reference Manual 41 outlines the process to determine which commercial activities are appropriate and the extent to which the commercial services are necessary services in wilderness.

Definitions

A commercial service is defined as any service offered to the general public and undertaken for, or that results in, compensation, monetary gain, benefits or profit to an individual, organization, or corporation, whether or not such entity is organized for such purposes or recognized as non-profit. Grand Canyon issues concessions contracts, CUAs, and SUPs for these types of activities.

Group activities in which there is no paid staff, no goods or services are sold or transferred for money, all commissary is pooled, and in which the unexpended balance for commissary is reissued to members at the activity's conclusion are not considered commercial services. Educational programs offered through accredited schools, colleges, and universities (as defined in NPS Reference Manual 22, ch.10, §1.3) are not considered commercial services.

Process for Determining Necessary and Appropriate Commercial Services

Three sets of criteria were used to determine the appropriate types and levels of commercial visitor services in Grand Canyon's backcountry including Wilderness

1. **Is the commercial backcountry service appropriate?**
2. **Is it necessary? and,**
3. **Does the commercial backcountry service meet NPS Management Policies (2006) criteria for Wilderness? To what extent are services necessary in Wilderness?**

1. Is the commercial service appropriate in the park's backcountry and Wilderness?

Current uses appropriate in Grand Canyon's Wilderness and non-wilderness backcountry have been determined by laws, regulations, policies, park purposes, and plans to protect Desired Conditions[74] for resources and visitor experiences.

The first set of criteria applied evaluates whether or not a commercial backcountry service is an *appropriate* use in a national park. An appropriate commercial backcountry service must meet <u>all</u> of the following criteria.

***Appropriate* commercial backcountry services**

- *are* consistent with purposes and values for which the park was established, as well as applicable laws, regulations and policies
- *will not*
  - compromise public health, safety, or well-being
  - cause unacceptable impacts to park resources
  - unduly conflict with other authorized park uses and activities
  - conflict with other services outside the park
  - monopolize recreational opportunities at the expense of the general public

The answers to these questions assist in determining if the activity is appropriate in the backcountry and/or wilderness. The answers are not necessarily a yes or no decision but a piece to consider within the totality of the decision making process. For example, if impacts from certain activities are unknown, additional monitoring or information may be needed to make the determination before allowing the commercial service. Table G.1 outlines the determination of appropriate commercial services.

2. Is the commercial service necessary in the park's backcountry and Wilderness?

If a commercial backcountry service meets the criteria for an appropriate commercial service, the next step is to determine whether or not the commercial backcountry service is *necessary*. Necessary commercial backcountry services must meet <u>one or more</u> of the following criteria.

***Necessary* commercial backcountry services will**

- meet backcountry visitor needs
- assist the park in educating visitors on safety and appropriate skills for backcountry travel

[74] Grand Canyon Wilderness Desired Conditions (Appendix B)

- The NPS recognizes Wilderness is a composite resource with interrelated parts and wilderness character is the combination of biophysical, experiential, and symbolic ideals that distinguishes Wilderness from other lands
- Grand Canyon's Wilderness retains its wilderness characteristics and values. Visitors find ample opportunities for primitive recreation and solitude. Wilderness areas are affected primarily by the forces of nature, and signs of modern people remain substantially unnoticeable. Backcountry visitors value and support Wilderness preservation

- assist the park in educating park visitors about the park's natural and cultural resources
- enhance visitor understanding and appreciation of park mission and values

Table G.2 outlines the process for determining if the commercial service is necessary.

3. To what extent are commercial services necessary in Wilderness?
Because most of Grand Canyon's backcountry is proposed for Wilderness designation and managed accordingly, an additional filter is applied. As described in NPS Management Policies (NPS 2006), necessary and appropriate commercial services in Wilderness must meet all of the following criteria

***Wilderness* necessary and appropriate commercial services will**
- realize a recreational, scenic, scientific, educational, conservation, or historical use of the Wilderness
- protect and enhance wilderness character desired conditions
- If the first two criteria are met, apply Minimum Requirement Analysis (see Chapter 4, Wilderness Character)

Table G.3 outlines the extent necessary determination for commercial services in Wilderness.

Decision Process

During the BCMP public scoping process, the NPS received comments both in support of and opposition to allowing commercially guided backpacking, day hiking, canyoneering, and river-assisted backcountry travel (RABT).Comments in opposition suggested guided trips do not have a role in backcountry, and should not be competing for limited permits in popular camping destinations such as Corridor Zone campgrounds. Comments in support contended commercially-guided trips allow people who do not have experience or equipment to access the backcountry, and suggested such trips help manage park resources by educating clients about park resources, wilderness skills, and minimum impact techniques.

Analysis involved an interdisciplinary team (IDT) composed of park staff and managers which met on several occasions to discuss scoping comments, public concerns, and BCMP goals in light of policies and regulations. The first step in the analysis process was to develop a set of questions based on three sets of criteria (described above). The IDT then convened in small groups to evaluate each activity based on the criteria. Small group results were documented, summarized, and presented to the larger group for additional discussion and confirmation. IDT findings are summarized in Table G.1, Table G.2 and Table G.3.

IDT discussions included benefits of commercial companies in assisting the park with visitor education, including natural and cultural history, important safety practices, and minimum impact techniques. Support exists for guided overnight backpacking services because commercial guides educate visitors about heat-related illnesses, winter extremes, and other aspects of backcountry travel that may result in an overall reduction of park-provided emergency services, especially during periods of extreme heat. Park specialists also agree commercial guides may help mitigate impacts to natural and cultural resources by educating visitors about sensitive wildlife, plant species, and archaeological sites. While the term "need" means different things to different people, the IDT focused on needs of park visitors who are novices in desert backcountry and who would benefit from a skilled guide's support (knowledge and equipment) to introduce safe experiences that protect park resources.

Conclusions

The IDT found that not all activities are currently appropriate or necessary commercial backcountry services. In particular, RABT, canyoneering, climbing, and extended day hiking did not meet the necessary and appropriate criteria. Resource and visitor impacts from these activities are not well understood and data is needed to make future management decisions. The park will continue to collect data on these activities and their impacts, and future decisions on managing these activities will be addressed through an adaptive management process (see Chapter 2).

The IDT found most commercial services appropriate, but not necessary in all management zones, and determined such services should be limited to certain Use Areas to maintain a broader range of opportunities for the un-guided visitor.

The IDT determined commercially guided backpacking and day hiking trips enhance opportunities for fostering or improving understanding of Wilderness values, particularly for participants who are backcountry novices. Limited commercial backcountry service opportunities will be available in Corridor, Threshold, Road Natural, and Primitive Zones; no commercial backcountry services will be permitted in the Wild Zone.

Vehicle tours consolidate use (reducing overall vehicle numbers) in the care of an experienced driver who must follow resource-protecting practices. Bicycle tours provide a healthy and virtually silent way to experience the park and its values, in the care of an experienced leader who must follow resource-protecting practices.

Necessary and appropriate commercial backcountry visitor services will be managed by operating requirements that include guide training standards and environmental regulations (Appendix F).

Table G.1 Commercial Backcountry Visitor Services Analysis – Is the Commercial Backcountry Service *Appropriate*?

Criteria	Backcountry/Wilderness Activity							
	Overnight Backpacking	Day Use Hiking	Extended Day Use*	Canyoneering	RABT	Climbing	Bicycling	Vehicle Tours
Appropriate‡: Appropriate commercial backcountry services must meet **all** criteria (a-f)								
a. Service consistent with purposes and values for which park established, and applicable laws, regulations, and policies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
b. Service will not compromise public health, safety, or well-being	Yes	Yes	Requires monitoring	Yes	Requires Monitoring	Yes	Yes	Yes
c. Service will not cause un-acceptable impacts to park resources	Yes	Yes	Requires monitoring	Requires monitoring	Yes	Requires monitoring	Yes	Yes
d. Service will not unduly conflict with other authorized park uses and activities	Yes	Yes	Requires monitoring	Yes	Requires monitoring	Requires monitoring	Yes	Yes
e. Service will not conflict with other services outside the park	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
f. Service will not monopolize recreational opportunities at the expense of the general public	Yes	Yes	Requires monitoring	Yes	Requires monitoring	Requires monitoring	Yes	Yes
Appropriate commercial backcountry service = all criteria met	Yes Limited by Zone	Yes Limited by Zone	No	No	No	No	Yes Limited by Zone/area	Yes Limited by Zone/area

*Extended Day Use: extended day hiking or running such as rim-to-river or rim-to-rim, occurs primarily on Bright Angel, South Kaibab, and North Kaibab Trails, but also on other backcountry trails; see Table 2.5 and Map 2.6

‡In accordance with the NPS Concessions Management Act of 1998 (PL 105-391) and NPS 48, Concessions Management Policy

Table G.2 Commercial Backcountry Visitor Services Analysis – Is the Commercial Backcountry Service *Necessary*?

Criteria	Backcountry/Wilderness Activity							
	Overnight Backpacking	Day Use Hiking	Extended Day Use*	Canyoneering	RABT	Climbing	Bicycling	Vehicle Tours
Necessary‡: Necessary commercial backcountry visitor services **must meet <u>one or more</u>** criteria (a-d)								
a. Service required to meet back-country visitor needs	Some visitors	No	No	No	No	No	No	No
b. Service will assist park in educating visitors on safety and appropriate backcountry travel skills	Yes	Yes	Maybe	Yes	Maybe	Yes	Yes	No
c. Service will assist park in educating visitors about the park's natural and cultural resources	Yes	Yes	Maybe	Yes	Maybe	Maybe	Yes	Yes
d. Service will enhance visitor understanding and appreciation of park mission and values	Yes	Yes	No	Maybe	Maybe	Maybe	Maybe	Yes
Necessary commercial backcountry service = must meet one or more criteria (and all criteria for appropriate)	Yes Limited by Zone	Yes Limited by Zone	No	No	No	No	Yes Limited by Zone	Yes Limited by Zone/area

Table G.3 Commercial Visitor Services Analysis – Wilderness

<table>
<tr><th rowspan="2">Criteria</th><th colspan="8">Wilderness Activity</th></tr>
<tr><th>Overnight Backpacking</th><th>Day Use Hiking</th><th>Extended Day Use*</th><th>Canyoneering</th><th>RABT</th><th>Climbing</th><th>Bicycling</th><th>Vehicle Tours</th></tr>
<tr><td colspan="9">Wilderness Commercial Use: Per NPS Wilderness Management Policy 6.4.4, Wilderness-oriented services that contribute to achieving public enjoyment of Wilderness values or provide opportunities for primitive and unconfined recreation, may be authorized if they meet the “necessary and appropriate” tests of the Concessions and Wilderness Acts and if consistent with the park’s Wilderness management objectives, i.e., meet <u>all</u> criteria (a-c)</td></tr>
<tr><td>• To what extent is Service necessary to realize recreational or other Wilderness purpose (scenic, scientific, educational, conservation, and historical use) of the area?</td><td colspan="2">Opportunities for unconfined recreation, education, instill Wilderness ethics
Recreation, education</td><td colspan="6" rowspan="3">Did not meet necessary and appropriate concessions policy tests</td><td rowspan="2">Prohibited in Wilderness
These commercial activities are conducted on backcountry roads and limited areas as described in Table G.1 and Table G.2</td></tr>
<tr><td>• Does Service protect and enhance Desired Conditions** for wilderness character?</td><td colspan="2">Yes</td></tr>
<tr><td>• How is Minimum Requirement applied to necessary and appropriate Services? If the first two criteria are met, what is the Minimum Service necessary to achieve Wilderness management objectives?</td><td colspan="2">Limited Services in Threshold and Primitive Zones</td><td></td></tr>
</table>

*Extended Day Use: extended day hiking or running such as rim-to-river or rim-to-rim, occur primarily on Bright Angel, South Kaibab, and North Kaibab Trails, but also on other backcountry trails; see Table 2.5 and Map 2.6
**See Appendix G, Footnote1 (or Appendix B)

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