National Park Service
U.S. Department of the Interior
Great Basin National Park

Wild Caves and Karst Management Plan

ON THE COVER
Rapelling in Systems Key Cave, Great Basin National Park
NPS Photo by Gretchen Baker

THIS PAGE
View of Wheeler Peak from Wild Goose Cave, Great Basin National Park
NPS Photo by Gretchen Baker

Wild Caves and Karst Management Plan
Great Basin National Park

Please cite this publication as:
NPS Staff. 2019. Wild Caves and Karst Management Plan, Great Basin National Park. Baker, NV.

Signature Page

This Wild Caves and Karst Management Plan for Great Basin National Park is Approved by:

James Woolsey, Superintendent | Date

Executive Summary

The Wild Caves and Karst Management Plan (WCKMP) guides management for the thirty-nine known wild (undeveloped) caves and 41,000 acres of karst landscape that are contained within Great Basin National Park (GRBA). Caves and karst are significant natural resources and many contain significant cultural resources. The primary goal of the WCKMP is to manage the caves in a manner that will preserve and protect cave resources and processes while allowing for respectful scientific use and recreation in selected caves. More specifically, the intent of this plan is to manage wild caves in GRBA to maintain their geological, scenic, educational, cultural, biological, hydrological, paleontological, and recreational resources in accordance with applicable laws, regulations, and current guidelines such as the Federal Cave Resource Protection Act and NPS Management Policies.

Section 1.0 provides an introduction and background to the park and pertinent laws and regulations.

Section 2.0 gives a definition of what is considered a cave in the park, as well as covering basic cave climate, biology, geology, cultural resources, paleontological resources, and other aspects of cave management currently in place.

Section 3.0 states the management direction and objectives for these wild caves and karst.

Section 4.0 covers how the Management Plan will meet each of the objectives in Section 3.0. This includes information on cave gates, digging and blasting, what is done when a new cave is found, how biota is protected, how cultural landscapes and resources are documented and preserved, how safety is emphasized, what scientific study is permitted, how volunteers may be utilized, how education and outreach play a role in resource protection, and what recreational access is allowed. This section contains a list of caves that are permitted and the dates they will be open. The chapter finishes with a table of data gaps, showing which caves need maps and surveys for geological, biological, cultural, and paleontological resources.

Section 5.0 covers surface management such as development and herbicide use above caves. It includes a map of no-retardant areas along Baker Creek near Grey Cliffs. Fire retardant dropped in this area could have negative impacts on various cave biota, especially the Model Cave amphipod, which is currently only known to exist in one cave in the world.

Section 6.0 lays out how the plan can be changed and updated. Section 7.0 lists the plan preparers, and Section 8.0 contains literature cited.

Appendices follow these sections.

Acronyms

ARPA	Archaeological Resources Protection Act
BCM	Best Cave Management
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
DRI	Desert Research Institute
FCRPA	Federal Cave Resource Protection Act
FMSS	Facilities Management Software System
FY	Fiscal Year
GAR	Green-Amber-Red
GRBA	Great Basin National Park
GBVC	Great Basin Visitor Center
GPS	Geographical Position System
JHA	Job Hazard Analysis
LAC	Limits of Acceptable Change
LCMP	Lehman Caves Management Plan
LCNM	Lehman Caves National Monument
LCVC	Lehman Caves Visitor Center
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Protection and Repatriation Act
NDOW	Nevada Department of Wildlife
NFBW	North Fork Big Wash
NHPA	National Historic Preservation Act
NPS	National Park Service
NSS	National Speleological Society
PIT	Passive Integrated Transponder
PPE	Personal protective equipment
SOP	Standard Operating Protocol
SPE	Severity-Probability-Exposure
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VIP	Volunteer in Park
V&RP	Visitor and Resource Protection
WACC	Western Archeological and Conservation Center
WCKMP	Wild Caves and Karst Management Plan
WNPA	Western National Parks Association
WNS	White-Nose Syndrome

Contents

1.0 Introduction & Background

Introduction

Great Basin National Park (GRBA) encompasses over 77,000 acres of the South Snake Range (Figure 1), located in east-central Nevada. The nearest large cities are Salt Lake City, Utah, 234 miles to the northeast, and Las Vegas, Nevada, 291 miles to the southwest. The park is surrounded by land managed by the Bureau of Land Management (BLM) and private land.

Over 41,000 acres of the park consist of karst, a landscape that is capable of supporting caves. Forty caves are currently known, including 39 that are undeveloped. We call these wild caves. Cave resources include cave passages, walls, ceilings, floors, and speleothems as well as cultural, hydrologic, geologic, biologic features, and climate.

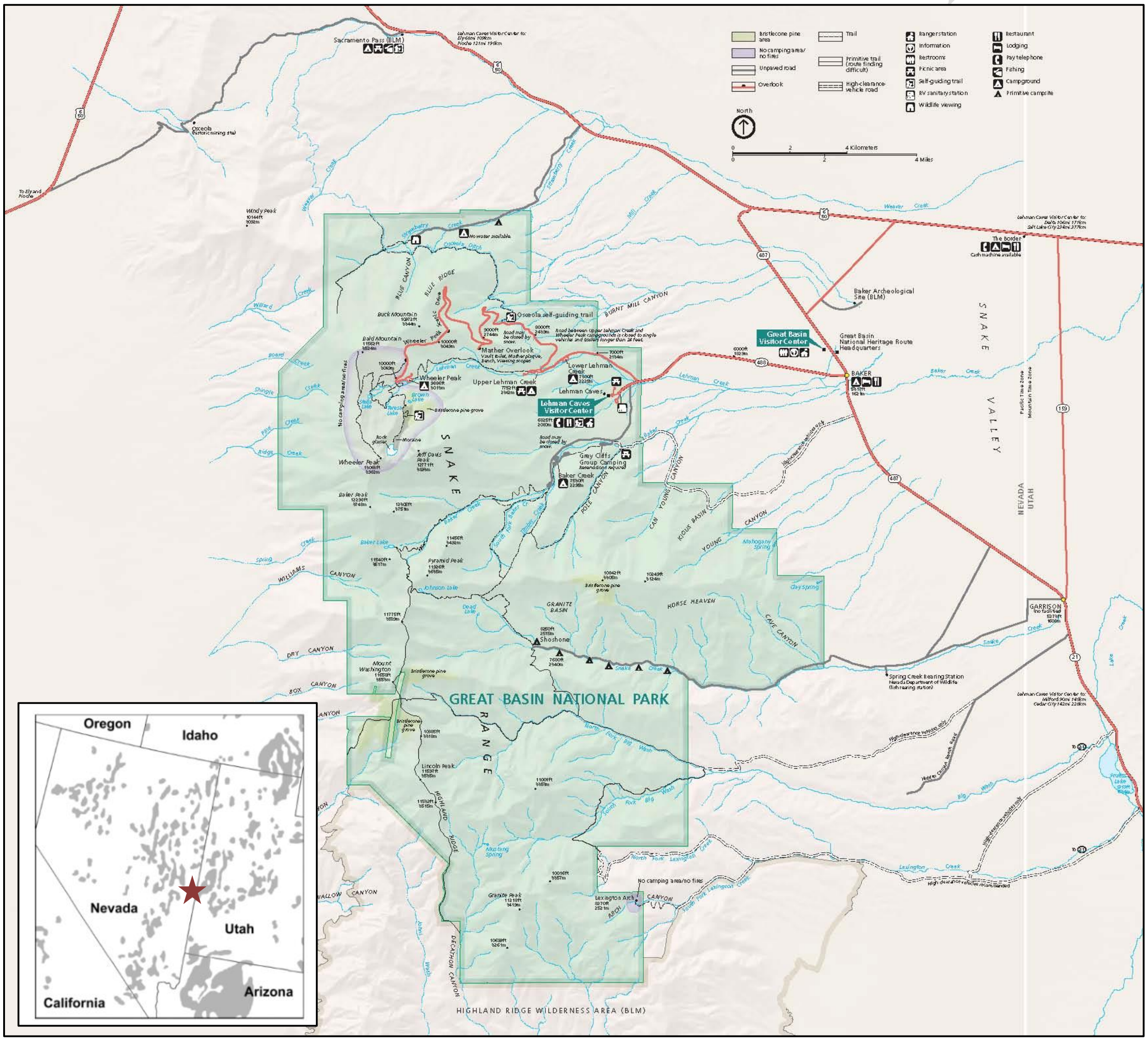


Figure 1. Great Basin National Park includes over 77,000 acres in the South Snake Range, as well as 80 acres near the town of Baker used as an administrative site. Inset map shows location of Great Basin National Park, with exposed carbonate rocks in the western US in grey. Modified after Veni (2002).

Purpose and Need

The purpose of developing a Wild Caves and Karst Management Plan (WCKMP) is to create an integrated approach to managing the wild caves and karst features in Great Basin National Park. This includes all known caves in the park, except Lehman Caves, which is mentioned but has its own management plan.

Background

Lehman Caves National Monument was designated on January 24, 1922 by President Warren G. Harding to protect "certain natural caves, known as Lehman Caves…which are…of unusual scientific interest and importance…" (Appendix A). On October 27, 1986, under Public Law 99-565, the Lehman Caves National Monument was "abolished and the lands incorporated within the Great Basin National Park" (Appendix B).

Relationship to Other Park Laws, Regulations, Policies, and Plans

The National Park Service was established within the Department of the Interior through the Organic Act of 1916. Its key management-related provision is:

> " [The National Park Service] shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified . . . by such means and measures as 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 manner and by such means as will leave them unimpaired for the enjoyment of future generations." (16 USC 1)

Congress supplemented and clarified the provisions of the Organic Act through the General Authorities Act. That act, as amended, provides, in part:

> "Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant."

Lehman Caves National Monument was established by Presidential Proclamation 1618, issued by Warren G. Harding on January 24, 1922. This proclamation provides specific legal authority and direction for the monument. The key management provision of the proclamation states in part:

> "whereas, certain natural caves, known as Lehman Caves, which are situated upon partly surveyed lands within the Nevada National Forest in the state of Nevada, are of unusual scientific interest and importance, and it appears that the public interest will be promoted by reserving this cave with as much land as may be necessary for the proper protection thereof, as a National Monument."

GRBA was established by Congress on October 27, 1986 (Public Law 99-565). Lehman Caves National Monument was incorporated into the much larger NPS-managed area. Specific statutory guidance for the management of federal cave resources came from Congress in the Federal Cave Resource Protection Act of 1988 (FCRPA). A key provision is found in Section 2c, which states: "It is the policy of the United States that Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves."

NPS Management Policies (NPS, 2006 § 4.8.2.2), articulate service wide policy consistent with FCRPA (***emphasis added***):

> "As used here, the term "caves" includes karst (such as limestone and gypsum caves) and nonkarst caves (such as lava tubes, littoral caves, and talus caves). ***The Service will manage caves in accordance with approved cave management plans to perpetuate the natural systems associated with the caves***, such as karst and other drainage patterns, air flows, mineral deposition, and plant and animal communities. Wilderness and cultural resources and values will also be protected.
>
> Many caves or portions of caves contain fragile nonrenewable resources and have no natural restorative processes. In these cases, most impacts are cumulative and essentially permanent. As a result, no developments or uses, including those that allow for general public entry (such as pathways, lighting, and elevator shafts), will be allowed in, above, or adjacent to caves until it can be demonstrated that they will not unacceptably impact natural cave resources and conditions, including subsurface water movements, and that access will not result in unacceptable risks to public safety. Developments already in place above caves will be removed if they are impairing or threatening to impair natural conditions or resources.
>
> Parks will manage the use of caves when such actions are required for the protection of cave resources or for human safety. Some caves or portions of caves may be managed exclusively for research, with access limited to permitted research personnel. In accordance with the Federal Cave Resources Protection Act of 1988, recreational use of undeveloped caves will be governed by a permit system, and cave use will be regulated or restricted if necessary to protect and preserve cave resources. ***Under 43 CFR Part 37 regulations for the act, all caves in the national park system are deemed to be significant.*** As further established by this act, specific locations of significant cave entrances may be kept confidential and exempted from FOIA requests."

The Great Basin National Park Foundation Document (NPS 2015) was written to provide basic guidance for planning and management decisions. One of the fundamental resources identified in the document was caves, karst, and cave-forming processes. Geology, hydrology, biology, paleontology, and archeology are called out. The Foundation Document notes that the park has limited cave management guidance and calls for the development of a cave and karst management plan.

A number of specific NPS regulations apply to cave management at GRBA and have been considered in the preparation of this Cave Management Plan. Key regulations include:

Closures and Public Use Limits (36 CFR 1.5) This regulation authorizes a park superintendent to establish visiting hours, establish public use limits, and close all or part of a park area to all use or to a specific use or activity, consistent with applicable legislation and administrative policies and based upon a determination that such an action is necessary for one or more of the following reasons:

- Maintenance of public health and safety
- Protection of environmental or scenic values
- Protection of natural or cultural resources
- Aid to scientific research
- Implementation of management responsibilities
- Equitable allocation and use of facilities
- Avoidance of conflict among visitor use activities

Permits (36 CFR 1.6) This regulation authorizes park superintendents to issue permits for activities that are otherwise restricted or denied to the general public and requires superintendents to "include in a permit the terms and conditions that the superintendent deems necessary to protect park resources." Issuance of a permit is based on a determination by the park superintendent that the following factors "will not be adversely impacted":

- Public health and safety
- Environment or scenic values
- Natural or cultural values
- Scientific research
- Implementation of management responsibilities
- Proper allocation and use of facilities
- Avoidance of conflict among visitor use activities

Preservation of natural, cultural, and archeological resources (36 CFR 2.1) This regulation prohibits the possession, destruction, defacement, digging, removal, disturbance, sale, or commercial distribution of or injury to a mineral resource or cave formation, or part thereof. It further authorizes a superintendent to restrict hiking or pedestrian use to a designated trail or walkway system.

Research Specimens (36 CFR 2.5) This regulation authorizes park superintendents to issue research specimen collection permits if the collection is necessary to scientific or resource management goals and only if such collections would not damage park resources.

Cave Management (43 CFR 37) These regulations implement the Federal Cave Resources Protection Act (FCPRA) of 1988. They designate all NPS caves as 'significant' for the purposes of the act and prohibit the disclosure of the locations of significant caves.

National Historic Preservation Act of 1966 as amended (NHPA; 36 CFR 800) These regulations establish a process for evaluation and preservation of important historic, prehistoric, and ethnographic resources.

The Archaeological Resources Protection Act 1979 (ARPA) This act clarifies and defines "archaeological resources, and was enacted "to secure, for the present and future benefit of the American people, the protection of archeological resources and sites which are on public lands." ARPA establishes permitting guidelines and professional qualifications for study of archaeological resources and public lands and outlines substantial penalties for removal, sale, receipt, and interstate transport of archaeological resources obtained illegally.

Native American Graves Protection and Repatriation Act (NAGPRA) 1990 This act establishes legal authority for protection of Native American burial sites and establishes guidelines for consultation and control of Native American human remains, funerary objects, sacred objects, and items of cultural patrimony found on Federal or tribal lands.

National Parks Omnibus Management Act of 1998 Section 207 of this act authorizes the NPS to withhold information from the public in response to a FOIA request concerning the nature and specific location of threatened, endangered, rare, or commercially valuable objects, or objects of cultural patrimony located in units of the National Park System.

2.0 Wild Caves

Forty park caves are described in detail in Appendix C. This section gives an overview of the wild caves in the park, touching on their commonalities.

2.1 Definition of a Cave

For the purposes of this document, a cave is defined as a natural opening in rock, accessible by a human, which is at least 30 feet long and has a dark zone. This definition allows more emphasis to be put on caves that contain habitat commonly associated with caves, rather than rock shelters (which can be deeper than 30 feet but have no dark zone) and karst features (which may have a dark zone but are generally less than 30 feet long and/or inaccessible to humans).

2.2 Distribution of Caves

Caves are found throughout Great Basin National Park, primarily in the eastern and southern portions where sedimentary layers are located (Figure 2). Lengths of the caves vary from 30 ft. (High Hole) to about 10,800 ft. (Lehman Caves), the longest cave in the state of Nevada. The depth of park caves varies from 6 ft. (Lone Bat Cave) to 436 ft. (Long Cold), the deepest cave in the state of Nevada. Elevation of the caves varies from 6,736 ft. (Little Muddy) to High Pit (11,552 ft.), the highest cave in the state of Nevada. These caves are varied, with some intricately decorated (e.g., Lehman Caves, Lehman Annex, Snake Creek), while some have practically no speleothems (e.g., Model, T Cave). About one-third of the caves are vertical and require ropes for access. Several caves have water in them, while some are extremely dry, and some caves have both dry areas and wet areas (e.g., Snake Creek). See Table 1 for a summary of these caves.

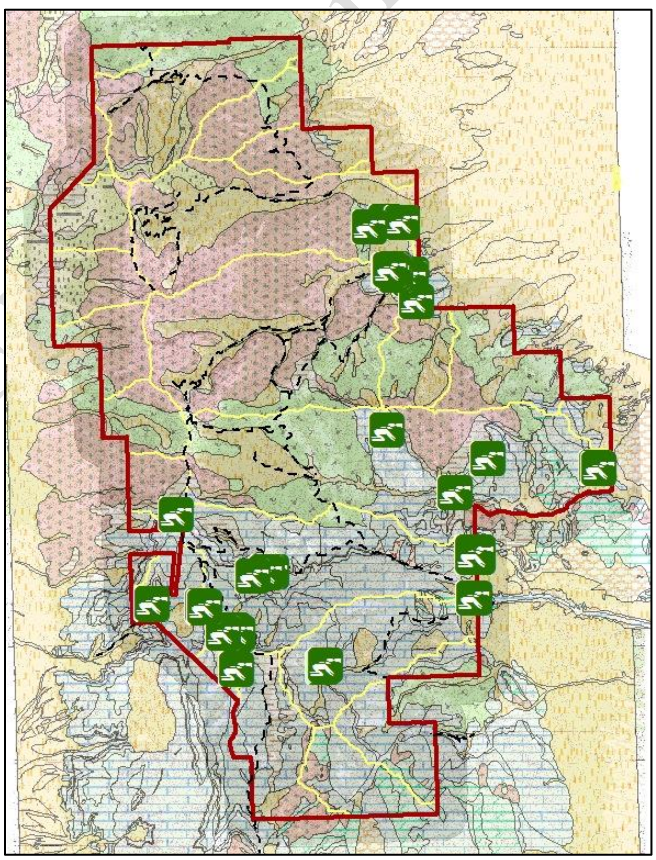


Figure 2. Distribution of caves across Great Basin National Park.

Table 1. Great Basin National Park Caves. The Baker Creek Cave System contains four cave entrances: Crevasse, Halliday's Deep, Ice, and Wheelers Deep. These are treated as separate caves as usually only one part of the system is entered via each entrance due to narrow constrictions. NFBW=North Fork Big Wash. SFBW=South Fork Big Wash.

Cave Name	Water-shed	Length (ft.)	Depth (ft.)	Elevation (ft.)	Notes
Baker Creek Cave System (4 entrances)	Baker	4315	238	~7,116	Intricate cave system with vertical drops
Crevasse	Baker	252	126	7,080	Long fissure entrance
Halliday's Deep	Baker	4315	238	7,185	Crawling passages
Ice Cave	Baker	677	41	7,084	Occasionally has ice near entrance
Wheelers Deep	Baker	4315	238	7,169	Contains perennial stream
Bristlecone	Snake	309	184	9,817	Rig off a bristlecone tree
Broken Cave	NFBW	108	55	11,195	High elevation cave
Catamount Cave	Baker	~33	~31	~7,150	Short enlarged fracture cave
Cats Meow Cave	SFBW	43+		6,992	One small room
Cave 24	NFBW	272	48	9,613	Sinkhole entrance
Chamber Cave	SFBW	~40		8,849	One room with high ceiling
Deep Fall Cave	Decathon	204	130	10,936	Often plugged with snow and ice
Dip Cave	NFBW	41	17	7,660	Cave in small limestone outcropping
Dome-Ice	NFBW	120	unknown	11,182	Not visited since 1971
Drumming	Lincoln	50	20	8,600	In mine shaft at fracture
Fox Skull	Snake	102	11	6,555	Attracts a lot of wildlife
Hiding Hole	Baker	61	16	7,038	Small collapse
High Hole	SFBW	~30			found in 2003
High Pit	Dry Canyon	188	72	11,552	Highest cave in Nevada
Highland	NFBW	120	unknown	11,251	Not visited since 1971
Lehman Annex	Lehman	992	56	7,248	Well decorated crawling cave
Lehman Caves	Lehman	~11,000	~100	6,920	Longest cave in Nevada
Little Muddy	Lehman	1015	25	6,736	Belly crawling maze; low oxygen levels
Lone Bat Cave	Snake	32	6		Small one-room cave
Long Cold	NFBW	721	436	9,922	Deepest cave in NV; has ice
Lower Pictograph	Baker	162	17	7,097	Contains many pictographs
Miners Massacre	Lincoln	30+	15	8,600	In mine
Model Cave	Baker	1970	147	7,028	Biologically most diverse
Mountain View	NFBW	53	12	11,296	Scenic, high elevation cave
Pine Cone	NFBW	354	246	9,902	Narrow slot rappel
Roaring Wind	NFBW	588	129	9,928	Multi-level with rebelays
Rockfall Cave	Baker	57	41	7,097	Needs to be dug out to enter
Root Cave	Lehman	183	31	6,907	Steep, narrow entrance
Snake Creek	Snake	1682	57	6,552	Varied passages and speleothems
Snow Cone	NFBW	66	15	11,346	Contains snow year round
Squirrel Springs	Snake	51	23	7,215	Sumps during wet years
Systems Key	Baker	1039	94	7,195	Goes under Baker Creek
T Cave	Baker	33	7	7,169	Short cave with two levels
Upper Pictograph	Baker	185	21	7,149	Pictographs and bats
Water Trough Cave	Can Young	144	11	7,701	Biologically diverse; wear waders
Wild Goose Cave	NFBW	118	20	11,226	Access from steep ravine

Cave surveys and maps have been completed for most of the caves (Table 2). Basic inventories and biological inventories have been completed for more than half of the caves. A basic inventory documented an overview of all the resources in the cave, but did not go into detail (e.g., species, minerals, identification of bones, drawings of pictographs). A biological inventory was conducted by trained cave biologists who spent many hours surveying for cave biota. Paleontological, cultural, and detailed physical surveys have been completed for just a few of the caves. Many data gaps exist for wild caves.

Table 2. Status of cave surveys, maps, and inventories in Great Basin National Park. A cave survey includes line plot data and some sketching of the cave, a map includes at least plan and profile views, a basic inventory is a quick snapshot of resources present in the cave, a biological inventory involves cave biologists surveying a cave for cave biota, a paleontological survey consists of a paleontologist studying the cave for paleo resources, and a cultural survey involves archeologists documenting cultural resources.

CAVE NAME	SURVEY	MAP	BASIC	BIOLOGICAL	PALEO	CULTURAL
Baker Creek Cave System (contains 4 entrances treated as separate caves)	**partial**	**see below**				
Crevasse	yes			2003		
Halliday's Deep	partial	1994, 2003+		2003		
Ice Cave	yes	58,89, 2003		2003, 2006		
Wheelers Deep	partial	54, 67, 2002+	2015	2003		
Bristlecone	yes	1966		2007		
Broken Cave	yes	2002	2015	2007	2014	
Catamount Cave	No		2016			
Cats Meow Cave	yes	2005, 2014	2015		2015	
Cave 24	yes	03,04,05		2007	2014	
Chamber Cave	yes		2010			
Deep Fall Cave	partial	2016 sketch				
Dip	Yes	2016	2015			
Dome-Ice	no	1971 sketch				
Drumming	yes	1998, 2005	2008	2007		
Fox Skull	yes	2002	2015	2006		
Hiding Hole	yes	2003				
High Hole	no					
High Pit	yes	1967				
Highland	no	1971 sketch				
Lehman Annex	yes	1961, 2003	1997	2006	2015 partial	
Lehman Caves	yes	1951, in progress		2006-present	2015	1939, 1963
Little Muddy	yes	87, 88, 2003		2003, 2006-07		
Lone Bat Cave	yes	no				
Long Cold	partial	1991 sketch				
Lower Pictograph	yes	2002	1997, 2002, 2017	2003		1924, 1933, 1989
Miners Massacre	yes	2005	2008	2007		

CAVE NAME	SURVEY	MAP	BASIC	BIOLOGICAL	PALEO	CULTURAL
Model Cave	yes	55, 66, 2002+		2003, 2006-07		
Mountain View Cave	yes	2005	2016	2007		
Pine Cone	yes	2004		2007		
Roaring Wind	partial	1991 sketch	2015			
Rockfall Cave	yes	2003				
Root Cave	yes	1965, 1997	2003, 2015	2003, 2006	2015 partial	
Snake Creek	yes	1972, 2002	2015	2006	2015	
Snow Cone	yes	2004	2015		2014	
Squirrel Springs	yes	1997	Yes	2006-2007		
Systems Key	yes	1969, 2002	Yes	2003		
T Cave	partial	2003	2016			
Upper Pictograph	yes	2002	2017	2003	2015 partial	1924, 1933, 1989
Water Trough Cave	yes	2000	2017	2006		
Wild Goose Cave	yes	2004	2016			

2.3 Geology

2.3.1 Geology Overview

The southern Snake Range consists of a vast array of rock types and ages. Of primary interest for this document are the carbonates where caves are found. Caves formed primarily in the following Paleozoic rock layers: the Cambrian-age Pole Canyon Limestone, the Cambrian Lincoln Peak Formation, the Ordovician Notch Peak Limestone, and the Devonian Guilmette Formation.

The Cambrian-age (541 to 485 million years ago (mya)) Pole Canyon Limestone is located on the fringes of the Snake Range at about 6,500 feet elevation. This limestone layer once covered the entire area, but today is only found in the park along the eastern border, the middle section of Snake Creek, most of the North Fork Big Wash drainage, Mount Washington, and near the South Forth Big Wash trailhead (Drewes and Palmer 1957, Hose and Blake 1976, Miller et al. 2007). The limestone can be found in units up to 1840 ft. (557 m) thick. This and other Cambrian age units were deposited when the area was a shallow and nearshore marine environment (Drewes and Palmer 1957).

Approximately 140 mya (early Cretaceous), major surface compression to the east caused the Sevier Orogeny, creating many mountain ranges within the Great Basin. The section of Pole Canyon Limestone containing Lehman Caves and nearby Baker Creek caves was metamorphosed into a low-grade marble due to the pluton intrusion during the early Tertiary (now Paleogene) 35 mya, or late Cretaceous (Miller et al. 1989).

The next major geologic event with a significant impact on park caves also began about 35 mya, when a major extension period caused the younger rock layers (e.g., Pole Canyon Limestone) to slip and tilt off the older rock layers (e.g., Prospect Mountain quartzite, the dominant rock on Wheeler Peak). With the weight removed, this allowed the metamorphic core complex to rise, creating what we now know as the northern part of the park (Miller et al. 1987, Graham 2014). Continued stretching and rising produced the ranges (horsts) and basins (grabens) that we see today across the Great Basin geographic region.

For more in-depth information on this topic, please refer to Hose's *Notes on the geology of Lehman Caves from a November 2017 Reconnaissance Trip* (Hose 2018a, Hose 2018b) and Graham's (2014) *Great Basin National Park: Geologic Resources Inventory Report*, available online at: http://www.nature.nps.gov/geology/inventory/publications/reports/grba_gri_rpt_body_print.pdf

2.3.2 Wild Caves Speleology

Most caves in the park likely formed by two distinct processes: epigenic and hypogenic. The epigenic cave-forming process is when surface water, which would have been abundant during the wet Pleistocene (2.6 million years ago to 11,700 years ago), flowed through the fractured limestone and dissolved away the calcium carbonate along fractured planes, creating cavities. This is still ongoing for some park caves, particularly those located near Baker Creek and those that contain streams and fluctuating water tables. The hypogenic cave-forming process is when warmer, acidic groundwater from below, that does not have contact with the surface, rises and dissolves away the limestone or marble (Klimchouk 2007). Some wild caves show many characteristics of hypogenic cave formation, including abundant gypsum, bubble vents, and ceiling cupolas.

Some caves, especially at higher elevations, appear to be fracture caves, where movement along faults and joints created spaces in the rock. These spaces were further enlarged by epigenic processes. Many of these caves have few speleothems, possibly indicating a younger age.

Most of the speleothems in the caves are made from calcite, a different form of calcium carbonate precipitated from water dripping into the cave. Others may be made of gypsum. A summary of speleothems found in park caves is listed in Table 3.

2.3.3 Hydrology

The hydrology of wild caves in the park varies greatly. Most caves only have water moving from the surface, through the soil and overlaying rock, into the cave. Two caves are known to have fluctuating water tables (Model and Squirrel Springs), which can totally inundate the caves and make them impassable. At least two caves have perennial stream channels within them (Wheelers Deep and Water Trough). Specific details, when known, are provided in each cave description.

2.3.4 Limits of Acceptable Change (LAC) Photomonitoring

Limits of Acceptable Change (LAC) photomonitoring locations were established in the Halliday's, Crevasse, and Wheelers sections of the Baker Creek System in 2003 to assess long-term ecological impacts to the cave environment. Plans were made to re-photograph them every five years. This has not proved possible due to funding and time limitations. If funding becomes available, then this LAC photomonitoring will continue.

Table 3. Selected speleothem types in wild caves (based on Hill and Forti 1997, Palmer 2007).

Type	Speleothem	Description
Pool deposit	Rimstone	Deposit of calcite around edges of cave pools
	Shelfstone	Flat ledges of calcite that grow inward along the water surface from the shore
	Folia	Shelf-like tiers of calcite
	Cave rafts	Thin mineral deposits that crystallize on pool surfaces
Flowing & Dripping Water	Cave pearls	Calcite or aragonite coating tiny grains of sand under water drips
	Flowstone	Calcite deposited where water runs down cave walls or across sloping floors
	Stalactites	Formations hanging from ceilings or ledges; contain a hollow central tube through which water initially flows; often aligned along ceiling fractures
	Soda Straws	Thin-walled tubes with nearly uniform diameter along the length hanging from ceiling or ledges
	Stalagmites	Conical or cylindrical features that form where drops of falling water hit the cave floor
	Columns	Calcite deposits formed when a stalactite and stalagmite grow together
	Draperies	Curtain-like sheet of calcite formed by water flowing down an inclined cave ceiling; surface tension keeps the water next to the cave wall rather than dripping
Capillary Water	Helictites	Twisted speleothems formed by water that seeps in tiny amounts through internal canals
	Anthodites	Long, quill-like spikes composed mainly of aragonite
	Shields	Two parallel plates of calcite separated by a thin crack; Over 300 present in Lehman Caves
	Welts	Outward growths from fractures in speleothems; resemble rudimentary shields
	Bulbous Stalactites	Appear like turnips; The bulbous part of the stalactites may be welts covered by travertine
Evaporative	Coralloids/Cave Popcorn	Small balls that project outward from bedrock and other speleothems; most commonly found in windy areas
	Frostwork	Delicate, white, needle-shaped aragonite crystals that branch in delicate clusters. Aragonite has the same chemical composition of calcite, $CaCO_3$, but a different crystal pattern
	Gypsum crust	Deposit of gypsum on floor, walls, or ceiling that ranges in thickness from 0.1 mm to several cm in Lehman Caves
	Gypsum flower	Flower-like speleothem made of gypsum; in Lehman Caves small and weathered
Microbial	Moonmilk	White deposit of microscopic crystals; pasty when wet and powdery when dry

2.4 Discovery

Some wild caves, like Upper and Lower Pictograph Caves, have pictographs and cultural artifacts within them dated to over two thousand years. The date 1885 is found in Snake Creek Cave. Many wild caves were found by caving organizations in the 1950s and 1960s. The most recent cave discovery was in the summer of 2016. Due to the large amount of karst in the park and the difficult terrain, more caves are expected to be discovered.

2.5 Permits and Visitation

Some caves, like Upper and Lower Pictograph Caves, have been entered and used for millennia. Most others have only seen documented use in the past 100 years.

Most of the South Snake Range was designated as US Forest Land in 1909. Much of the range was transferred to the National Park Service with the establishment of Great Basin National Park in 1986. Visitation to the caves under USFS administration and early NPS administration is unknown. In 1989, a permit system was set up for recreational visits to caves. An average of 20 recreational visits per year took place between 1989 and 2007 (Table 4). Recreational caving has continued since then. In 2010, the park developed a White-Nose Syndrome (WNS) response plan, limiting recreational caving to Little Muddy Cave, a cave with no bat use, pending the acquisition of additional information about WNS.

Table 4. Table of recreation visits to Great Basin National Park permitted caves, 1989-2007. The table shows the total number of recreational visits to each cave, along with the average number of visits each year.

Cave	Grand Total	Average Recreation Visits/Year
Crevasse Cave	24	1
Halliday’s Deep	21	1
Ice Cave	64	3
Little Muddy	15	1
Model	53	3
Snake Creek Cave	111	6
Systems Key	32	2
Upper Pictograph	19	1
Wheelers Deep	40	2
Grand Total	**379**	**20**

2.6 Cave Gating

Apart from Lehman Caves, the first cave gate known in what is now GRBA is a gate in Snake Creek Cave, which was installed in 1965 about 300 feet from the entrance (Bridgemon 1966). This gate was destroyed about 1970. In 1998, seven wild caves were gated to protect cave resources: Model, Wheelers Deep, Halliday’s Deep, Ice, Root, Systems Key, and Snake Creek. Gates were constructed with angle iron to meet the then-current Best Cave Management (BCM) guidelines for bat access. Two additional caves were dug open, and those gates have a solid metal lid: Lehman Annex and Little Muddy. Cave gates will be added to the NPS Facilities Management Software System so they will be eligible for cyclic maintenance funds.

2.7 Cave climate

Cave temperature and humidity generally vary most at the cave entrance and become more stable the further from the entrance (Figure 3). Cave temperatures (within the dark zone, where they are stable) are usually the average annual surface temperature. These temperatures usually are representative of their elevation, with caves at higher elevations colder than caves at lower elevations. However, there are some exceptions. Systems Key and Ice Cave both have temperatures about 10 °F lower than other caves in the area. Deep Fall and Long Cold are two caves with perennial ice, and Snow Cone has perennial snow, despite other caves in the area with no ice or snow in the summer.

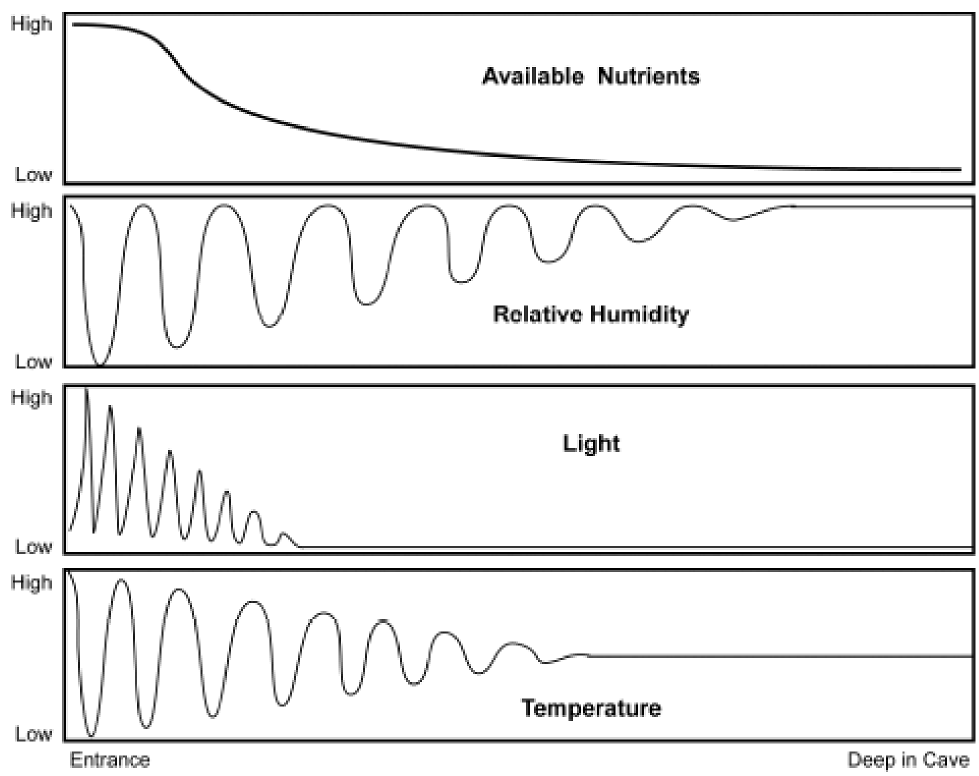


Figure 3. The effects of distance from the entrance on several cave environmental factors.

A park-wide cave climate monitoring was initiated in 2015 to provide baseline data on temperature and humidity in over 20 caves. Temperature and humidity dataloggers programmed to record every two hours were placed at numerous locations within each cave to better understand differences within the cave as well as differences between caves. The data will be used to determine how the cave climate at a particular elevation compares with the average outside temperature of an area to see if there are more exceptions like Systems Key and Ice Caves.

2.8 Biology

Caves support a variety of biota. Bats, other vertebrates, and invertebrates are mentioned in more detail below. Microbial life is also found in caves, but virtually nothing is known about them at this time.

2.8.1 Bats

Nine bat species are documented from the park and vicinity (

Table 5). Five species (*Myotis volans, M. ciliolabrum, M. evotis, Coryhorhinus townsendii,* and *Tadarida brasiliensis*) are physically documented through museum specimens. Other species documented through captures include *Lasionycterius noctivagans, Lasiurus cinereus, Antrozous pallidus,* and *Eptesicus fuscus*. Seven other species likely occur and may be documented with future survey work.

History of Bat Research
The first bat work documented in what is now Great Basin National Park was conducted in 1929 (Hall 1946) when several species of bats were collected with shotguns from Lehman Caves and Baker Creek. These specimens are still available through the Museum of Vertebrate Zoology (MVZ; http://vertnet.org/).

In 1965, surveys were conducted of significant bat caves in eastern Nevada (Soulages 1966). Surveys included caves in Baker Creek (Pictograph, Lower Pictograph, Three-hole, Deep, Halliday's Deep, Ice, Crevasse, and Model). One hundred to 200 Townsend's big eared bats were noted in Crevasse Cave. However, the methods and timing of the surveys were not documented. Photos taken during the survey of Crevasse Cave show a large cluster of bats near the entrance, suggesting that this group was likely a maternity colony, as hibernating bats typically do not cluster in large groups and are often found deeper in caves. Hibernating bats were noted in Ice Cave. Presumably the number of hibernating bats was small as no bat counts or species identifications were given. Bat use was documented from several other caves in the Baker Creek cave system (Halliday's Deep, Wheelers Deep, and Model) as well as Lehman Caves.

Baldino conducted the most thorough surveys of bats in park caves to date. These surveys were summarized in two reports which documented the use of caves by bats (Baldino 1998a; Baldino 1998b). Four caves (Crevasse, Systems Key, Halliday's Deep and Forgotten) were used as hibernacula. A 50% decline in hibernating bats was noted in Crevasse and Systems Key caves between 1994 and 1997. This estimate of decline based on two point counts is suspect and underscores uncertainty in methods associated with surveying hibernating bats in the western US. Most park caves were not considered suitable as hibernacula, a conclusion that data loggers and roost surveys have recently corroborated. Five of seven caves surveyed showed significant bat activity as active season roost sites.

In 2002 and 2003, additional bat surveys were conducted. No reports were produced but all survey and capture data is available and stored in a Microsoft Access databases. A summary is reported in

Table 5.

In FY14-17, the park received funding through the NPS white-nose syndrome (WNS) fund source to conduct bat capture, roost survey, and acoustic monitoring, with a focus on cavernicolous bats which may be susceptible to WNS. Building on this funding, a 2016 Southern Nevada Public Land Management Conservation Initiative project “Can land managers prevent the ’inevitable collapse’ of bats in the western US?” was funded for research, inventory, and management of bats in conjunction with partners in BLM, USFS, Nevada Department of Wildlife (NDOW), and academia. In 2017, the park began collecting data as part of a larger study on bats to assess abundance on the continent, the North American Bat Monitoring Project.

Table 5. Bat species found in Great Basin National Park caves, as known in November 2017.

Code	Latin Name	Common Name	Cave Name
ANPA	*Antrozous pallidus*	Pallid Bat	Snake Creek
COTO	*Corynorhinus townsendii*	Townsend's big-eared Bat	Baker Creek (Crevasse, Halliday's Deep, Ice, Wheelers Deep), Cave 24, Fox Skull, Lehman, Lincoln adit, Long cold, Lower Pictograph, Model, Root, Snake Creek, Systems Key, Upper Pictograph, Water Trough
EPFU	*Eptesicus fuscus*	Big Brown Bat	Lincoln Adit, Upper Pictograph
EUMA	*Euderma maculatum*	Spotted Bat	None
LACI	*Lasiurus cinereus*	Hoary Bat	None
LANO	*Lasionycteris noctivagans*	Silver-haired Bat	Lincoln Adit
MYCI	*Myotis ciliolabrum*	Western Small-footed Myotis	Baker Creek (Crevasse, Wheelers Deep), Lincoln Adit, Model, Snake Creek, Upper Pictograph, Water Trough
MYCA	*Myotis californicus*	California Myotis	Snake Creek
MYEV	*Myotis evotis*	Western Long-eared	Baker Creek (Wheelers Deep), Cave 24, Lincoln Adit, Snake Creek, Upper Pictograph, Water Trough
MYLU	*Myotis lucifugus*	Little Brown Myotis	None
MYVO	*Myotis volans*	Long-legged Myotis	Baker Creek (Wheelers Deep), Lehman, Lincoln Adit, Snake Creek, Upper Pictograph, Water Trough
MYTH	*Myotis thysanodes*	Fringed Myotis	None
MYYU	*Myotis yumanensis*	Yuma Myotis	None
PAHE	*Parastrellus hesperus*	Western Pipistrelle, or Canyon Bat	None
TABR	*Tadarida brasiliensis*	Mexican or Brazilian Free-tailed Bat	None
Myotis	*Myotis*, unknown species	Unknown Myotis species	Baker Creek (Crevasse, Halliday's Deep, Ice), Cave 24, Lehman, Model, Systems Key

Snake Creek Caves is known to host the most bat species, with six species. Lincoln Adit, which is a mine adit that accesses Drumming and Miners Massacre Caves, is also known to host up to six bat species. Upper Pictograph is known to have five bat species using it.

Bat Use of Caves

Two bat species in the park, Mexican free-tailed and Townsend's big eared bats, are dependent on subterranean habitat for their long term survival (Guild I species; Sherwin et al. 2009). Mexican free tailed-bats, the most abundant mammal species in the world, are migratory and do not hibernate. A large roost of Mexican free-tailed bats (1-2 million individuals) occurs in summer in Rose Guano Cave, six miles northwest of the park. Mexican free-tailed bat roosts in the park are likely limited to cliffs, crevices, and buildings. Small caves may occasionally be used for day or night roosting but they have not been documented at this time. The species has been documented at several buildings.

Townsend's big eared bats (*Corynorhinus townsendii*) are strictly caverniculous, and subterranean disturbances can result in population level impacts. Past declines in Townsend's big-eared bat populations have been attributed to disturbances in caves (Pierson and Rainey 1998). However, recent improvements in cave and mine management; particularly bat compatible closures and gates, have allowed the species to stabilize and increase in the western US since 1980 (Hammerson et al. 2017). In the park, for example, big-eared bats have returned to Lehman Caves due to installation of a bat compatible cupola on the natural entrance.

Historically, Townsend's big-eared bats likely hibernated exclusively in caves (Sherwin et al. 2009). Currently, the Nevada hibernacula with the largest numbers of bats are in mines, where multiple openings and levels facilitate air flow and cold conditions required for Townsend's big-eared bat hibernation. During hibernation most big-eared bats are solitary or clustered in small groups. Big-eared bats hibernate in the open which makes them highly detectible during winter surveys. Individuals arouse frequently and change locations during the winter. Guano is typically absent from hibernacula. Townsend's big-eared bats tagged at Lehman and Pictograph Caves have been recaptured at hibernacula in Chief Mine and Forgotten Cave, 16 and 11 miles distant from their capture site, respectively. This suggests that hibernacula in the park are limited for the species.

Male and female big-eared bats separate for much of the summer. Males are less dependent on caves than females and summer in cooler roosts in cracks and crevices to conserve energy via daily torpor. Females emerge from hibernation and move to warmer roosts for gestation and pup rearing. Gestation and maternity roosts are often located at cave entrances, in the twilight or sunlit zones, where warmer temperatures facilitate growth of pups. To save energy and conserve heat, females and pups form clusters in maternity roosts. Unlike hibernacula, maternity roosts are identifiable by fresh guano, which accumulates under clustered bats. Young bats can fly at two and a half to three weeks of age and are fully weaned by six weeks age. Maternity colonies break up in August.

Roost switching is an important and poorly understood aspect of the life history of Townsend's big-eared bats. During maternity season, roost switching occurs in response to variety of stimuli. For example, females sometimes carry their young to new caves after human disturbance. Females actively thermoregulate, choosing optimal temperatures and microclimates for gestation, parturition, and pup rearing. Variable surface and cave temperatures may play a role in roost switching. When pups become volant, the entire colony may move to cooler roosts to minimize energy expenditure. A key aspect of management for Townsend's big-eared bats is that even apparently unused caves may provide habitat in the future.

White-nose syndrome (WNS) is currently a major threat to bats in North America. The disease is caused by a fungal pathogen (*Pseudogymnoascus destructans),* can cause mortality rates of up to 100%, and has killed over 5.7 million bats in the eastern United States. Bats with WNS have been found as far west as Washington and predictive models suggest WNS could arrive in the park by

2025 (Maher et al. 2012; Ihlo 2013). The park currently does not allow any clothing, footwear, or gear that has been in a county with WNS to enter any wild caves. Clothing, footwear, and gear that has been in caves in non-WNS areas must be decontaminated before entering any wild cave, and between trips in any park caves. The park follows the latest USFWS protocols, available at: https://www.whitenosesyndrome.org/topics/decontamination

2.8.2 Other Vertebrates

Biological inventories have documented the use of other vertebrates in park caves. Woodrats are one of the most obvious inhabitants, with large middens in many caves. Some cave entrances are used as rattlesnake dens. Tracks of ringtail cats have been noted in Model Cave and bighorn sheep tracks in the snow at the entrance of Deep Fall Cave.

Vertebrates that have been captured by remote wildlife camera in caves in order of prevalence during the summer of 2013 are mouse (*Peromyscus* cf. *maniculatus*), cliff chipmunk (*Tamias dorsalis*), desert woodrat (*Neotoma lepidus*), human (*Homo sapiens*), rock squirrel (*Otospermophilus variegatus*), bat (various), rock wren (*Salpinctes obsoletus*) western spotted skunk (*Spilogale gracilis*), mountain cottontail (*Sylvilagus nuttallii*), gray fox (*Urocyon cinereoargenteus*), western fence lizard (*Sceloporus occidentalis*), dog (*Canis lupis familiaris*), ringtail (*Bassaricus astutus*), black-chinned hummingbird (*Archilochus alexandri*), and cliff swallow (*Hirundo pyrrhonota*) (Baker 2015). Additional species captured by wildlife camera since then include mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), and spotted towhee (*Pipilo maculatus*).

2.8.3 Invertebrates

Invertebrates have been studied in wild caves in the park starting in the 1950s, with interest from the Desert Research Institute and others. In 1962, Dr. Muchmore described a new pseudoscorpion (Figure 4) from Lehman Caves (Muchmore 1962), which was subsequently found in other caves. Briggs described a new subspecies of harvestman from Model Cave in 1971 (Briggs 1971); this harvestman was later reclassified as a new species (Derkarabetian and Hedin 2014). Biological inventories from 2003-2007 under the lead of Dr. Steve Taylor and Dr. Jean Krejca found numerous new species to science (Krejca and Taylor 2003; Taylor et al. 2008), including a new genus of millipede, *Nevadesmus ophimontis* (Figure 5). In addition, the range for some known species was extended to multiple caves in high elevation areas. A summary of cave invertebrates is found in Table 6.

Park staff continue to note biological specimens on cave trips. When an unfamiliar invertebrate is found, it is collected to be sent off to the appropriate taxonomist for identification.

Figure 4. *Microcreagris grandis*, the Lehman Caves pseudoscorpion, has also been found in numerous other park caves, including some at high elevation.

Figure 5. *Nevadesmus ophimontis*, or Snake Range millipede, a new genus of cave millipede found in several park caves.

Table 6. Selected invertebrates found in wild caves in Great Basin National Park

Common Name	Scientific Name	Caves Where Found	Notes
Lehman Caves Pseudoscorpion	*Microcreagris grandis*	Cave 24, Fox Skull, Lehman, Little Muddy, Model, Root, Squirrel Springs, Water Trough	Endemic to South Snake Range
Model Cave Harvestman	*Sclerobunus ungulatus*	Baker Creek (Ice, Wheelers Deep), Cave 24, Model,	
Snake Range Millipede	*Nevadesmus ophimontis*	Lehman, Model, Snake Creek	Endemic to South Snake Range; about 10 mm long, all white
Great Basin Cave Millipede	*Idagona lehmanensis*	Baker Creek (Halliday's Deep, Wheelers Deep), Bristlecone, Broken, Lincoln Adit, Model, Squirrel Springs, Water Trough	Endemic to Great Basin National Park; found in caves with water and high elevation; up to 20 mm long and yellowish
Model Cave Amphipod*	*Stygobromus albapinus*	Model	Endemic to Great Basin National Park; prefers groundwater
Globular Springtail	*Pygmarrhopalites shoshoneiensis*	Lehman, Model, Snake Creek	
Root Cave Dark-Winged Fungus-Gnat	*Camptochaeta prolixa*	Lehman, Lehman Annex, Root	Endemic to Great Basin National Park
Pinecone Cave Scuttle Fly	*Aenigmatias bakerae*	Pinecone	Endemic to Great Basin National Park
Lincoln Mine Scuttle Fly	*Megaselia excuniculus*	Lincoln Adit	Endemic to Great Basin National Park
Cave 24 Scuttle Fly	*Megaselia krejcae*	Cave 24	Endemic to Great Basin National Park
Follicle Scuttle Fly	*Megaselia folliculorum*	Cave 24, Lincoln Mine	Endemic to Great Basin National Park
Lehman Cave Scuttle Fly	*Megaselia necpleuralis*	Lehman Caves	Endemic to Great Basin National Park
Cave Cricket	*Ceuthophilus hadeus?*	Cave 24, Lehman, Snake Creek	A definitive identification is still needed
Diplurans	*Family Campodeideae*	Lehman, Model, Root, Water Trough	
Milbert's Tortoiseshell Butterfly	*Aglais milberti*	Broken, Mountain View, Snowcone*	First high elevation cave documentation in Broken

***** Found since 2008 biological surveys

2.9 Cultural

Caves in the park have not had a systematic cultural resource survey and inventory completed. Early note of the native use of caves in the Snake Range come from Julian Steward's ethnographic informants who named two Shoshone families who were living in a cave west of Baker. In the 1930's Willis Evans explored caves in the Snake Range under direction of M.R. Harrington and Nevada Governor Scruggham. In short articles and correspondence Evans noted artifacts in a cave near Baker but conditions were wet not good for preservation. He said Lehman Caves had more potential. Lehman Caves was excavated near the same time. Archaeologists targeted suspected or known cave sites for testing in the 1960's. The NPS asked Dr. Charels Rozaire from Nevada State Museum to perform a number of exploratory efforts at sites in Nevada. Rozaire concentrated on

Lehman Caves but other caves in the area were tested. A report was written for Lehman Caves and although artifacts were found a report was never completed. Only field notes give information about what was found.

In 1989 the NPS Western Archaeological Conservation Center (WACC) crews explored four caves and documented cultural deposits in three, including Lehman Cave. Others were recorded as cultural sites based on old records of artifacts observed. Some were recorded as cultural sites without any evidence other than they were caves. Two caves that have been studied extensively are Upper and Lower Pictograph, which contain numerous pictographs. Early excavations and pot hunting destroyed much of the deposit. In 2002 WACC crews excavated a portion of Pictograph Cave to stabilize damage done by illegal digging. Significant to this excavation was a corn fragment that C14 dated much earlier than is usually identified for Fremont culture. At this time only three caves in the park have had archaeological testing or excavation. Although other caves have evidence prehistoric and historic use documentation is not complete.

Historic elements in the caves include inscriptions, broken bottles, and cave registers. Trip reports from the 1960s detail the exploration of some of the caves in the Baker Creek area.

2.10 Paleontology

Limited paleontological surveys have been completed in park caves. Lehman Caves has been the primary location, with Ziegler (1964) presenting a list of bones from toads, tortoises, snakes, small birds, grouse, rodents, rabbits, bats, foxes, bobcats, mustelids, hores, bighorn sheep, deer, and pronghorns. Archeological surveys at the Pictograph Caves found some bones and a bison tooth (Harrington 1937).

Gorden Bell brought new attention to cave paleontological resources in 2013. Pleistocene bones were found in Snake Creek Cave, including remains of conifers, angiosperms, gastropods, beetles, fish, frogs, turtles, lizards, snakes, birds, shrews, rodents, pikas, rabbits, bats, mustelids, horses, deer, bighorn sheep, and pronghorns (Baker and Bell 2013; Bell 2015; internal GRBA site reports; as reported in Tweet et al. 2016). Numerous marmot and pika bones were also found, as well as the extinct small rabbit *Aztlanolagus agilis* (Baker and Bell 2013) and a second rare rabbit, *Brachylagus coloradoensis* (Bell 2015). Several other caves in the park contain remains of snakes, birds, rodents, rabbits, skunks, deer, and other animals (internal GRBA site reports). Most caves have not been surveyed for paleo resources. Middens remain an untapped resource, although middens in nearby caves have been studied (e.g., Owl Cave, Cathedral Cave, Smith Creek Cave).

2.11 Research

A variety of research has been conducted in park caves. Hydrologic research has focused on the Baker Creek Cave System. The University of Arizona Adventure Club (UAAC) mapped and conducted various hydrologic studies to see how the caves in the Baker Creek area were connected. They put water into Dynamite Cave and found that the water level in Model Cave rose within a few hours (Lange 1958).

Biological research has revealed new species and classifications. One example is the reclassification of the Model Cave Harvestman, *Cyptobunus ungulatus ungulatus*, a subspecies endemic to the park, to a different genus and elevated to the species level: *Sclerobunus ungulatus* (Derkarabetian and Hedin 2014).

Microbiologic research by Megan Porter was conducted in Halliday's Deep Cave and found a variety of bacteria types. More microbiological research is needed.

All researchers working in the park are required to have a valid NPS Scientific Research and Collecting Permit. Often, park staff are required to accompany researchers into park caves to ensure cave conservation and to assist with logistics.

2.12 Outreach and Education

Currently, park staff are invited to accompany resource management staff on selected cave trips. Interpreters later incorporate these experiences into presentations for the general public. Information about wild caves is also shared via the park employee newsletter, *The Lehman Ledger*; the resource management newsletter, *The Midden*; the NPS cave newsletter, *Inside Earth*, and in various social media channels. A video produced by park staff is available about Model Cave and available on YouTube: https://www.youtube.com/watch?v=gwwCNvJOpEM. In 2016, the TV show *Rock the Park* featured a trip into Little Muddy Cave.

2.13 Surface Activities

Caves can be greatly impacted by surface activities, especially roads, campgrounds, wildfires, and fire suppression activities.

The road near Upper and Lower Pictograph Caves kicks up dust onto the nearby pictographs. This can reduce the lifespan of these pictographs.

Roads in several watersheds can channelize water during flood events. Roads and campgrounds may also be places for oil spills, which could get into the adjacent stream. This would especially impact caves in the Baker Creek Cave System, which have been shown to be hydrologically connected with Baker Creek, as well as Systems Key Cave, Model Cave, and Squirrel Springs Cave.

Wildfires may occur anywhere in the park, and the caves that have been in place for thousands and sometimes millions of years have been able to cope with these natural events. However, fire retardant is a relatively new invention and can have large impacts on cave biota due to the increased nitrogen content. Because the Baker Creek Cave System and Model Cave have so much biological diversity and are so connected hydrologically with Baker Creek, an area of no retardant drops has been designated. See Section 5.0 for more details.

2.14 Cave Files

Each cave has an electronic file folder in the RM Drive, Cave Resources File, GRBA Caves Folder. An effort has been made to put all pertinent material relating to that cave in its cave folder so that it is easy to find. Some paper files (which have been scanned) are stored in the cave cabinet in the Resource Management office.

The Federal Cave Resources Protection Act (FCPRA) of 1988 designates all NPS caves as 'significant' for the purposes of the act and prohibits the disclosure of the locations of significant caves. Thus these cave files do not contain cave locations; cave locations are restricted access.

2.15 Nearby Caves

Several caves are located just outside park boundaries. Most of these caves are managed by the BLM. Rudolph and Forgotten Caves are very close to the park boundary and likely bats use these caves as well as park caves. Rose Guano Cave is a known migratory stop for millions of bats, and is found on the west side of the South Snake Range. Old Man's Cave is found in the North Snake Range, is managed by the USFS, and it is a known maternity colony for Townsend's big-eared bats.

Working with agency partners helps protect the bats and other cave biota and cave resources.

3.0 Management Direction and Objectives

The National Park Service preserves unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. The NPS cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

The primary goal of the Wild Caves and Karst Management Plan is to manage the caves and karst in a manner that will preserve and protect cave resources and processes while allowing for respectful scientific use and recreation in selected caves. More specifically, the intent of this plan is to manage wild caves in GRBA to maintain their geological, scenic, educational, cultural, biological, hydrological, paleontological, and recreational resources in accordance with applicable laws, regulations, and current guidelines such as the FCRPA, 43 CFR Part 37, and NPS Management Policies.

<u>Objectives</u>

1. Regulate or prohibit uses that could cause damage to cave systems. These uses may include land actions (e.g., surface disturbance above or near caves or projects that change the hydrologic systems connected to the cave), research (e.g., archaeological or paleontological), recreation, or other uses.

2. Protect and preserve biodiversity by minimizing human disturbance. Cave life would have full access to caves by maintaining connectivity between the surface and sub-surface. Staff would work to protect the cave ecosystem from White-nose syndrome and other potential diseases.

3. Manage the cultural landscape and cultural resources of wild caves through documentation and preservation to allow for longevity, preservation, interpretation, and research.

4. Prioritize safety for both staff and visitors in and out of the caves.

5. Encourage, facilitate, and conduct high-quality scientific study of cave and karst resources.

6. Use partnerships and volunteer resources where feasible to augment park staff resources for inventory, monitoring, surveys, and restoration. Develop and foster communications, cooperation, and volunteerism with interested publics, Federal agencies, Native American Tribes, local governments, and academic institutions. Utilize partners and volunteer assistance.

7. Support cave and karst systems education and outreach.

8. Provide recreational access to selected wild caves in order to provide a high quality visitor experience, while meeting all other management objectives.

4.0 Wild Cave Management

Wild caves will be managed based on the management direction and objectives laid out in Section 3.0. This section provides more details for each of the objectives. This section will be updates as more information becomes available. For a broader background on each topic, see Section 2.0. Surface management above these caves is covered in Section 5.0.

4.1 Regulate or prohibit uses that could cause damage to cave systems.

The following uses will be regulated or prohibited to avoid impacts: disturbance above or near caves (see Section 5.0); projects that change the hydrologic systems connected to the cave; research (e.g., archaeological or paleontological); recreation; and other uses.

4.1.1 Cave gates

Nine wild caves (Model, Wheelers Deep, Systems Key, Ice, Halliday's Deep, Little Muddy, Lehman Annex, Snake Creek, and Root) are already gated to protect their geologic, biologic, and cultural resources.

Additional caves may be gated for:

- Significant biota (including bat populations)
- Unusual or delicate geologic/mineralogical resources
- Cultural resources
- Liability threat for GRBA (Vertical rope work required or flooding potential)

All cave gates will be inspected regularly to ensure that they are in good working condition. All gates will be added to Facilities Management Software System (FMSS) so that future funds are available for maintenance. Repairs will be made as needed. Any new cave gates will be designed and installed to the current standards for minimal disruption to wildlife (e.g., bats), nutrient flow, and air flow (Fant et al., 2009). Any new gates will also be constructed so that they allow access for cave rescue (i.e., a litter can fit through the gate).

4.1.2 Digging Policy

Digging in caves to access passageways will only be allowed if park resource management staff are present and both NEPA and Section 106 compliance is completed. Digging will not harm cultural, biological, or geological resources.

4.1.3 Blasting Policy

Blasting will not be allowed in any park caves except for emergency situations.

4.1.4 Bolting Policy

Bolts will only be allowed with permission from the Chief of Natural Resources or designee. Bolt placement should be planned so that bolts will be long-lasting and excessive bolts will not be left behind.

4.1.5 New Cave Policy

If a new cave is reported, the following tasks will be coordinated by park RM staff:

- GPS location
- If cave meets park criteria, install a brass cap at entrance
- Survey and map cave to park standards (Appendix D)

- Conduct a basic inventory of cave (Appendix E)
- Photograph cave
- Enter information into cave database
- Create electronic folder for documents about cave

4.1.6 Cave Inventory
Every cave will be inventoried as funding and time allow. The park maintains a geodatabase of cave inventories, which includes biologic, geologic, cultural, and paleontological resources as well as safety issues at all caves. This geodatabase will be updated as new caves are found and additional inventories are completed. Currently the park uses a basic inventory system adapted from Grand Canyon National Park (Appendix E).

4.1.7 Cave Files
Cave files will be maintained. These consist of both paper and digital files, with an emphasis on digital files. These are all considered confidential under FCRPA. The files include all known caves in the park. Files contain cave maps, trip reports, inventory reports, research, register pages, and any additional information concerning the cave. Cave location information is not included with individual cave files to help maintain confidentiality. Cave locations are shared only on a need-to-know basis and the information is secured. Electronic cave files will be saved to an external hard drive in January of each year for a backup. A protocol for updating electronic files to the most current format needs to be developed.

4.1.8 Climate Change
Selected caves will be monitored for changes in climate. In-cave and above-cave temperatures will be compared.

4.1.9 Restoration
When it is necessary to perform restoration of cave passages (e.g., graffiti) or speleothems, the most current best management practices will be followed.

4.1.10 Resource Management Trips
Resource management staff may lead trips to monitor caves and conduct surveys. The trip leader will be an experienced caver. Objectives for the trip will be stated, and appropriate personnel will be recruited. All backcountry travel conditions will apply; a plan will be filed at least a day ahead of the trip. If weather conditions are not conducive for the trip, it will be postponed. The Caving JHA (Appendix F) will be reviewed before the cave trip, and a tailgate safety form filled out. If technical rope work is part of the trip, then a Green-Amber-Red (GAR) or Severity-Probability-Exposure (SPE) analysis will be completed and documented. The trip leader will ensure that all necessary PPE is available and used for the trip. A surface contact will be used to ensure that the group is out by the stated time. If not, the surface contact will notify Lake Mead Dispatch, and the emergency cave procedures will be followed (Appendix G). The trip leader will ensure that all clothing and gear is decontaminated and that a trip report is sent to the cave specialist and saved in the digital cave files.

4.2 Protect and preserve biodiversity by minimizing human disturbance.
Cave life will have full access to caves by maintaining connectivity between the surface and sub-surface. Staff will also work to protect the cave ecosystem from White-nose syndrome and other potential diseases.

4.2.1 Bats

The park is a participating agency in the Nevada Bat Working Group, Western Bat Working Group, Pacific West Region white-nose response team, and Mojave Inventory and Monitoring Network. Data gathered in the park are contributed to two national bat monitoring efforts, the North American Bat Monitoring Program and the Bat Acoustic Monitoring Portal. Participation in these efforts is important for maintaining best standards and practices for park biologists and for coordinating bat research between managing agencies.

Management, monitoring, and research of cavernicolous bats is largely focused on maintaining maternity and hibernating colonies of Townsend's big-eared bats found in several caves. This species has been historically considered sensitive to human disturbance, particularly maternity colonies which have been shown to abandon roosts in response to disturbance. Townsend's big-eared bats have been shown to host the WNS causative fungus, *Pseudogymnoascus destructans*, but have not been shown to develop WNS as of 2017.

Two agreements with academic and state partners are focused on understanding Townsend's big-eared bat roost patterns at the landscape scale, bat compatible cave and mine closures, and management focused research. A long-term mark-recapture project was started in 2015 to understand life history, demographics, and roost switching patterns in Townsend's big-eared bats. Traditional capture and visual survey methods, as well as passive integrated transponder (PIT) tags, radio telemetry, and genetic methods will be employed to gather life history information on the colonies.

Data gaps exist for most caves within the park regarding seasonal bat use. Roost Loggers will be used to quantify general bat activity patterns throughout the year in permitted and high elevation caves. Internal cave surveys, direct capture surveys, and exit counts will also be used when time and resources allow.

If recreational or other activities are shown to disrupt the typical behaviors of bats, management practices will be reviewed to limit disturbances and prevent harm.

4.2.2 Other Vertebrates

Other vertebrates will be monitored as timing and funds allow. Wildlife cameras have been placed near various cave entrances since 2013. These cameras help document other vertebrates using caves. These vertebrates provide an important nutrient flow to cave obligate species.

4.2.3 Invertebrates

Park staff have compiled all the known biological data about invertebrates for this management plan. It is included in the section for each cave. This allows those who enter a cave to quickly know what has already been seen in that cave, so if anything not on the list is noted, it can be updated in the cave database.

Park staff will continue to document biological specimens on cave trips. When an unfamiliar invertebrate is found, it is collected to be sent off to the appropriate taxonomist for identification.

It would be helpful to learn more about the natural history of cave organisms, particularly those that are endemic to the park or mountain range. Research that can help answer this question with minimal impact to cave organisms will be encouraged.

4.2.4 Palentological Resources

Preliminary paleontological surveys have found numerous animals in caves (see Section 2.10). Additional paleontological work is needed to better understand animal assemblages that have lived in and near the caves over the past millennia.

4.2.5 Other

Virtually no microbial studies have been done in park caves. Additional microbial research is needed and will be pursued as funding and time allow.

4.3 Manage the cultural landscape and cultural resources of wild caves.

Caves are important repositories of cultural history and information about human adaptation to environmental conditions. The cultural landscape, cultural resources, and ethnographic resources of wild caves will be managed through documentation and preservation to allow for longevity, interpretation, and research.

4.3.1 Documentation

Cultural landscape

A context will be prepared to determine cultural values and National Register eligibility for wild caves. Caves will be individually evaluated for National Register values and collectively evaluated for cultural landscape eligibility.

Cultural resources

Cultural resources of caves include archaeological deposits and artifacts, historic inscriptions and artifacts, and the ethnographic resources and values identified by Tribes and associated ethnic groups.

Archaeological resources

Archaeological resources are currently identified in eight wild caves. The level of recording varies. Archaeological inventory and documentation will be conducted to update records. Archaeologists will document cultural resources for wild caves as they are identified. If archaeologists determine it is appropriate, limited “shovel” tests may be conducted to identify subsurface deposits that are not apparent in surface examination. Access may be limited to caves if archaeological resources are valuable and sensitive to disturbance. Rock art (pictographs and petroglyphs) are often associated with caves. Rock art will be documented according to Nevada Rock Art Foundation documentation standards.

Historic resources

Inscriptions in wild caves document visitation during the historic period. Archaeologists will continue to document historic inscriptions and artifacts that are evidence of early exploration or use of caves. These values will be considered in National Register evaluation.

Ethnographic resources

Caves are important cultural places for area Tribes. If Tribes identify specific areas or ethnographic resources that are important, the information about ethnographic resources will be kept by the Cultural Resource division. This information will be restricted and will not be released unless the Tribes authorize. Tribes will be consulted about use and access to caves as appropriate.

4.3.2 Preservation and Interpretation

Least invasive preservation techniques are preferred. Documentation will be considered least invasive and excavation is most invasive and will be a last resort to preserve data. Sites currently accessible to the general public are Upper Pictograph Cave and Lower Pictograph Cave. These sites are currently the only wild caves recommended for interpretation. Pictographs are exposed to increasing dust and damage from automobile traffic. These sites are recommended for active preservation through the following actions.

- Interpretive signs with Tribes perspective
- Viewing platform restricting access
- Cameras with beam break trigger
- Resource protection and/or site steward regular visits
- Hard surface the road to prevent dust
- Professional rock art conservation cleaning

Cave sites with cultural resources will be evaluated and recommended for passive protection when necessary. Appropriate actions will be considered in consultation with Tribes. Those actions may include:

- Interpretive signs
- Cameras with beam break trigger
- Motion sensors
- Resource protection and/or site steward visits
- Restricted entrance
- Gates

4.3.3 Cultural Resource Research

All cultural resource related research requires NPS scientific permit, Antiquities permit, and ARPA permit. Cultural permits are authorized by the PWR Regional Director. Research permit requests require a research design for review and authorization by GRBA Cultural Resource Program Manager. In addition requests that include excavation and/or collection require Section 106 compliance and a signed repository and loan agreement for artifacts recovered. Artifacts and all field notes remain property of NPS.

4.3.4 Native Tribes Access

Executive Order (EO)13007 (1998), provides Tribes access to areas they identify as a sacred site or important for ceremonial practice. If Tribes identify caves as a sacred site NPS will "accommodate access to and ceremonial use of Indian sacred sites by Indian religious practicioners" (EO13007).

4.3.5 Human Remains

If human remains are inadvertently discovered, the park Superintendent and Cultural Resource Program Manager or cultural staff will be notified immediately. The cave will be closed to public access and Tribes will be notified as per Native American Graves Protection Repatriation Act (NAGPRA) guidelines. The cave will remain closed pending the outcome of Tribal consultation.

4.4 Prioritize safety for both staff and visitors in and out of the caves.

4.4.1 Standardized Safety Procedures

Park staff will review the appropriate section in Appendix C of the WCKMP about the cave before entering it. Information will include length of ropes needed, any special passage sizes, flooding potential, and any other data that relate to safety.

Before entering the cave, all park staff, volunteers, and researchers that enter wild caves will periodically review the Caving JHA (Appendix F) and conduct a tailgate safety session. Park staff will be encouraged to attend the annual Lehman Caves Emergency Training to learn how to respond to an incident in a cave. Park staff also will be encouraged to have current CPR and first aid training and take additional cave rescue training as feasible. Upcoming trainings are listed at http://ncrc.info//

Everyone entering the cave needs to inform a surface contact of where they are going and when they expect to return.

4.4.2 Cave Emergency Procedures

Despite best efforts to remain safe, it is possible for an injury to occur in a cave. If this happens, park staff will refer to the Cave Emergency Procedures (Appendix G). They will contact Lake Mead Dispatch and begin the Cave Rescue Callout. A list is maintained by the park and updated periodically.

4.5 Encourage, facilitate, and conduct high-quality scientific study of cave and karst resources.

Many data gaps still exist for wild caves in GRBA. High-quality scientific study of cave and karst resources in all disciplines is desired. Any studies will be completed with minimal impact to caves. Any research and collection requests will be handled through the NPS Scientific Research and Permitting System, available online (https://irma.nps.gov/rprs/). Park staff will review applications, and if they meet park criteria, will be forwarded to the Park Superintendent or designee for approval. Cave specific criteria include that intact speleothems will not be broken; for biological studies, a limited number of biota may be taken; and for all in-cave research, minimum impact techniques will be used. All researchers will be accompanied in the cave by park personnel for their research.

4.6 Use partnerships and volunteer resources where feasible

The park will use partnerships and volunteer resources where feasible to augment park staff resources for inventory, monitoring, surveys, and restoration.

In addition, the park will develop and foster communications, cooperation, and volunteerism with interested publics, Federal agencies, Native American Tribes, local governments, and academic institutions.

The NPS and NSS have a Memorandum of Understanding (MOU) for cooperation. Grottos, local groups that are part of the NSS, may have skills that will assist with park cave resources.

To help provide more meaningful management strategies, the park will cooperate with other agencies to determine seasonal closures across boundaries, especially for bats. Interpretive opportunities may be leveraged by multi-agency or multi-organizational input. Park staff will work with other agency staff from the BLM, USFS, and NDOW to achieve shared resource protection goals.

4.7 Support cave and karst systems education and outreach.

The park will support cave and karst systems education and outreach with a multi-pronged approach. This may include:

- NSS grotto presentations/trips
- Photos on park social media
- Webcams of cave entrances
- Virtual cave tours posted on Park YouTube channel
- Park signage
- Park staff trips
- Recreational trip permitting system
- Professional symposia or meetings

All education and outreach will ensure that cave locations remain confidential. In addition, education and outreach will promote respect of cave and karst systems.

4.8 Provide recreational access to select wild caves in order to provide a high quality visitor experience, while meeting all other management objectives.

4.8.1 Cave permits

Park staff will determine which wild caves may be accessible to recreation based on location, biological use, cultural resources, air concerns, climate issues, and other factors. Caves available for recreational use may be closed at any time with no advance notice.

4.8.2 Permitted Caves

A maximum of one permit will be issued each week. The group size will be a minimum of three and a maximum of six people. The trip leader must be at least 18 years old and fill out a caving resume before the permit will be approved. Cave permit applications (Appendix H) can be obtained by contacting the Cave Specialist at least two weeks in advance of the intended trip date. Trip leaders will certify that all cave gear and clothing has been decontaminated following the latest WNS decontamination protocols before entry. All those issued a permit will be required to submit a trip report within one week after the cave trip that includes cave areas visited, biota or wildlife observed, any disturbances or unusual feathers, and anything else of note.

Upon approval of this plan, the following caves will be open for limited recreational use:

Cave	Dates Open	Notes
Little Muddy	Oct 1 – Apr 15	High CO2 levels in summer
Catamount	Year round	Short cave
Baker Creek Cave System *Wheelers Deep, Ice, Halliday's, Crevasse*	April 1 – May 15 and September 15 – October 15	Vertical sections, advanced caving skills required.
Systems Key	April 1 – May 15 and September 15 – October 15	Vertical sections, advanced caving skills required
Broken	June 15 - October 15	High elevation
Snake Creek	September 15 – May 15	H passage closed year round

Notification to the public about these caves and open dates will be via the Superintendent's Compendium.

Additional caves may be opened or current open seasons may be adjusted pending outcomes of future surveys and will be documented via an updated wild cave management plan. Park staff will visit each of the permitted caves on an annual basis to monitor impacts.

4.8.3 Commercial use
If a group wants to guide clients through any of the permitted caves, a commercial use permit will be required, which includes showing proof of insurance. Commercial use will be allowed for up to two trips per month per cave. All rules for permitted caves (e.g., group size, trip leader age) will apply. The commercial use would be counted towards the one trip per week rule.

4.8.4 Recreational monitoring
The caves allowed for recreational use will be monitored to ensure that groups are not causing undue impacts in them. Photo monitoring may help to document impacts to caves. LAC photo points have already been established in some caves and will be revisited as time and funds permit. Cave registers will be placed in selected caves to help document cave use.

4.9 Data Gaps
The preparation of this Wild Caves and Karst Management Plan shows that data gaps exist in several areas (Table 7). These are areas that would be excellent for future proposals.

- Finish surveying and mapping selected caves (Baker Creek Cave System, several high elevation caves)
- Update all park maps to current cave mapping standards
- Complete basic cave inventories where needed
- Conduct detailed geologic and/or mineralogical inventories
- Complete baseline biological inventories where needed
- Conduct repeated biological monitoring at high elevation caves and selected other caves
- Conduct additional bat surveys, including internal cave surveys, installation of PIT tag arrays, and acoustical monitoring
- Conduct cultural inventories where needed
- Conduct paleontological inventories where needed

- Encourage scientific research projects that focus on:
    - iinvertebrate natural history
    - ice studies
    - microbiological studies
    - hydrologic studies
    - paleontological resources
- Complete cave climate study and continue monitoring as needed
- Repeat photo monitoring for LAC
- Update cave database
- Check for cave monuments and install where needed

Data Needs and Management for Wild Caves in Great Basin National Park

Table 7. Status of wild cave inventories and management for Great Basin National Park. Caves are listed alphabetically. **X= needed** due to lack of inventory or inventory is outdated or incomplete. Survey means that cave has been surveyed to professional standards. Map means that a map with plan, profile, and cross-section is completed. Basic refers to a simple inventory of what is seen in the cave on a brief trip. Biological inventory is conducted by professional biologists able to determine (often with taxonomist help) taxa down to species. Bats inventory is conducted by bat biologists over multiple seasons. Geological inventory is a detailed study of features and minerals by a professional geologist. Paleontological inventory is an assessment of fossil, bone, and other paleo resources by a professional paleontologist. Cultural inventory is conducted by trained cultural resource specialists to look for historic and prehistoric use of the cave.

CAVE NAME	WATERSHED	LENGTH /DEPTH (FT.)	ELEVATION (FT.)	DESCRIPTION	SURVEY	MAP	BASIC	BIOLOGICAL	BATS	GEOLOGICAL	PALEO	CULTURAL	Notes	Research?	Recreation?
Baker Creek Cave System (Each entrance treated as a separate cave)	Baker	4315 /238	~7,116	Intricate cave system with vertical drops and 4 entrances											
Crevasse	Baker	252 /126	7,080	Long fissure entrance		X	X		X	X	X	X	Seasonal recreational use	Y	Y
Halliday's Deep	Baker	4315 /238	7,185	Crawling passages	X	X	X		X	X	X	X	Seasonal recreational use	Y	Y
Ice Cave	Baker	677 /41	7,084	Occasionally has ice near entrance			X		X	X	X	X	Seasonal recreational use	Y	Y
Wheelers Deep	Baker	4315 /238	7,169	Contains perennial stream	X	X			X	X	X	X	Seasonal recreational use	Y	Y
Bristlecone	Snake	309/ 184	9,817	Rig off of a bristlecone tree	X	X	X		X	X	X	X		Y	N
Broken Cave	NFBW	108 /55	11,195	High elevation cave		X			X	X		X	Seasonal recreational use	Y	Y

CAVE NAME	WATERSHED	LENGTH /DEPTH (FT.)	ELEVATION (FT.)	DESCRIPTION	SURVEY	MAP	BASIC	BIOLOGICAL	BATS	GEOLOGICAL	PALEO	CULTURAL	Notes	Research?	Recreation?
Catamount Cave	Baker	~33 /~31	~7,150	Short enlarged fracture cave	X	X		X	X	X	X	X	Recreational use	Y	Y
Cats Meow Cave	SFBW	43+ /na	6,992	One small room				X	X	X		X		Y	N
Cave 24	NFBW	272 /48	9,613	Sinkhole entrance					X	X		X		Y	N
Chamber Cave	SFBW	~40 /na	8,849	One room with high ceiling				X	X	X	X	X		Y	N
Deep Fall Cave	Decathon	204 /130	10,936	Often plugged with snow and ice	X	X	X	X	X	X	X	X	Ice study needed	Y	N
Dip	NFBW	41 /17	7,660	Cave in small limestone outcropping				X	X	X	X	X		Y	N
Dome-Ice	NFBW	120 /na	11,182	Not visited since 1971	X	X	X	X	X	X	X	X		Y	N
Drumming	Lincoln	50 /20	8,600	In mine shaft at fracture					X	X	X	X		Y	N
Fox Skull	Snake	102 /11	6,555	Attracts a lot of wildlife					X	X	X	X		Y	N
Hiding Hole	Baker	61 /16	7,038	Small collapse			X	X	X	X	X	X	unstable	Y	N
High Hole	SFBW	~30 /na		Found in 2003	X	X	X	X	X	X	X	X		Y	N
High Pit	Dry Canyon	188 /72	11,552	Highest cave in Nevada	X	X	X	X	X	X	X	X		Y	N
Highland	NFBW	120 /na	11,251	Not visited since 1971	X	X	X	X	X	X	X	X		Y	N
Lehman Annex	Lehman	992 /56	7,248	Well decorated crawling cave					X		X	X		Y	N
Lehman Caves	Lehman	~11,000 / ~100	6,920	Longest cave in Nevada	In pro gre ss	In prog ress	X			X			Guided wild cave tours proposed in LCMP	Y	Y
Little Muddy	Lehman	1015	6,736	Belly crawling			X		X	X	X	X	Seasonal	Y	Y

CAVE NAME	WATERSHED	LENGTH /DEPTH (FT.)	ELEVATION (FT.)	DESCRIPTION	SURVEY	MAP	BASIC	BIOLOGICAL	BATS	GEOLOGICAL	PALEO	CULTURAL	Notes	Research?	Recreation?
		/25		maze; low oxygen levels									recreational use		
Lone Bat Cave	Snake	32 /na		Small one-room cave		X		X	X	X	X	X		Y	N
Long Cold	NFBW	721 /436	9,922	Deepest cave in NV; has ice	X	X	X	X	X	X	X	X	Ice study needed	Y	N
Lower Pictograph	Baker	162 /17	7,097	Contains many pictographs					X	X	X		Interpretive sign needed	Y	N
Miners Massacre	Lincoln	30+ /15	8,600	In mine					X	X	X	X		Y	N
Model Cave	Baker	1970 /147	7,028	Biologically most diverse	X	In Prog ress	X		X	X	X	X	Map needed for deeper sections	Y	N
Mountain View Cave	NFBW	53 /12	11,296	Scenic, high elevation cave					X	X	X	X		Y	N
Pine Cone	NFBW	354 /246	9,902	Narrow slot rappel			X		X	X	X	X	Could be open to public in the future	Y	N
Roaring Wind	NFBW	588 /129	9,928	Multi-level with rebelays	X	X		X	X	X	X	X		Y	N
Rockfall Cave	Baker	57 /41	7,097	Needs to be dug out to enter			X	X	X	X	X	X	Entrance partially filled	Y	N
Root Cave	Lehman	183 /31	6,907	Steep, narrow entrance		X			X	X	X	X		Y	N
Snake Creek	Snake	1682 /57	6,552	Varied passages and speleothems		X			X	X		X	Seasonal recreational use. H passage closed	Y	Y

CAVE NAME	WATERSHED	LENGTH /DEPTH (FT.)	ELEVATION (FT.)	DESCRIPTION	SURVEY	MAP	BASIC	BIOLOGICAL	BATS	GEOLOGICAL	PALEO	CULTURAL	Notes	Research?	Recreation?
Snow Cone	NFBW	66 /15	11,346	Contains snow year round				X	X	X		X		Y	N
Squirrel Springs	Snake	51 /23	7,215	Sumps during wet years					X	X	X	X		Y	N
Systems Key	Baker	1039 /94	7,195	Goes under Baker Creek					X	X	X	X	Seasonal recreational use	Y	Y
T Cave	Baker	33 /7	7,169	Short cave with two levels	X			X	X	X	X	X		Y	N
Upper Pictograph	Baker	185 /21	7,149	Pictographs and bats						X	X		Interpretive sign needed, harden surface or close road, rock art conservation	Y	N
Water Trough Cave	Can Young	144 /11	7,701	Biologically diverse; wear waders					X	X	X	X		Y	N
Wild Goose Cave	NFBW	118 /20	11,226	Access from steep ravine				X	X	X	X	X		Y	N

5.0 Surface Management

The surface above and near caves should be managed with cave resources in mind, as the surface and subsurface are interconnected.

5.1 Development

Limited development is present above wild caves. One cave goes underneath Baker Creek and the adjacent road (Systems Key). Two cave entrances are adjacent to a gravel road (Upper Pictograph, Lower Pictograph). No other development (e.g., buildings, utility corridors, roads) will be allowed above wild caves. Development at or near a cave entrances or upstream of cave entrances should only occur if no impairment will take place, and park staff determine that the benefits of the development outweigh the risks to the cave.

5.2 Prescribed Fires

Prescribed fire actions will avoid known cave entrances in a manner that minimizes potential direct, indirect, and cumulative effects to cave systems. Ignition methods which involve chemicals such as diesel fuel, gasoline, propane, and flammable gels, will be utilized in a manner which avoids the introduction of chemicals or foreign materials into caves. Management practices will be developed to minimize the amount of smoke that could enter caves. Prescribed fire should not be implemented within areas that could directly, indirectly, or cumulatively affect caves which contain bat roosts, as these caves are particularly sensitive to disturbance.

5.3 Use of Chemicals

<u>Fire retardant</u> has been shown to add nutrients to cave systems, which can affect cave biota. The Baker Creek-Grey Cliff area caves are especially susceptible due to the presence of perennial water in those caves and a high number of endemic cave organisms. No fire retardant or foam will be allowed within 100 m of perennial water or 50 m from a cave entrance (Figure 6). The GRBA Fire Management Plan will be revised to reflect this new no-retardant area.

No <u>water bucket drops</u> will be allowed over the entrances of Upper and Lower Pictograph Caves or on the adjacent road within 30 m of the cave entrances to avoid impacts to cultural resources at those caves.

If needed, <u>wrapping material (fire shelter wrap)</u> could be used to protect pictographs at caves where they occur as a short-term measure during a fire incident.

<u>Herbicides</u> are not currently used above most wild caves. If non-native plants that can be treated with herbicides are detected above the caves, Resource Management staff will review the herbicide information and decide if it can be delivered in a targeted manner to avoid impacts to cave resources.

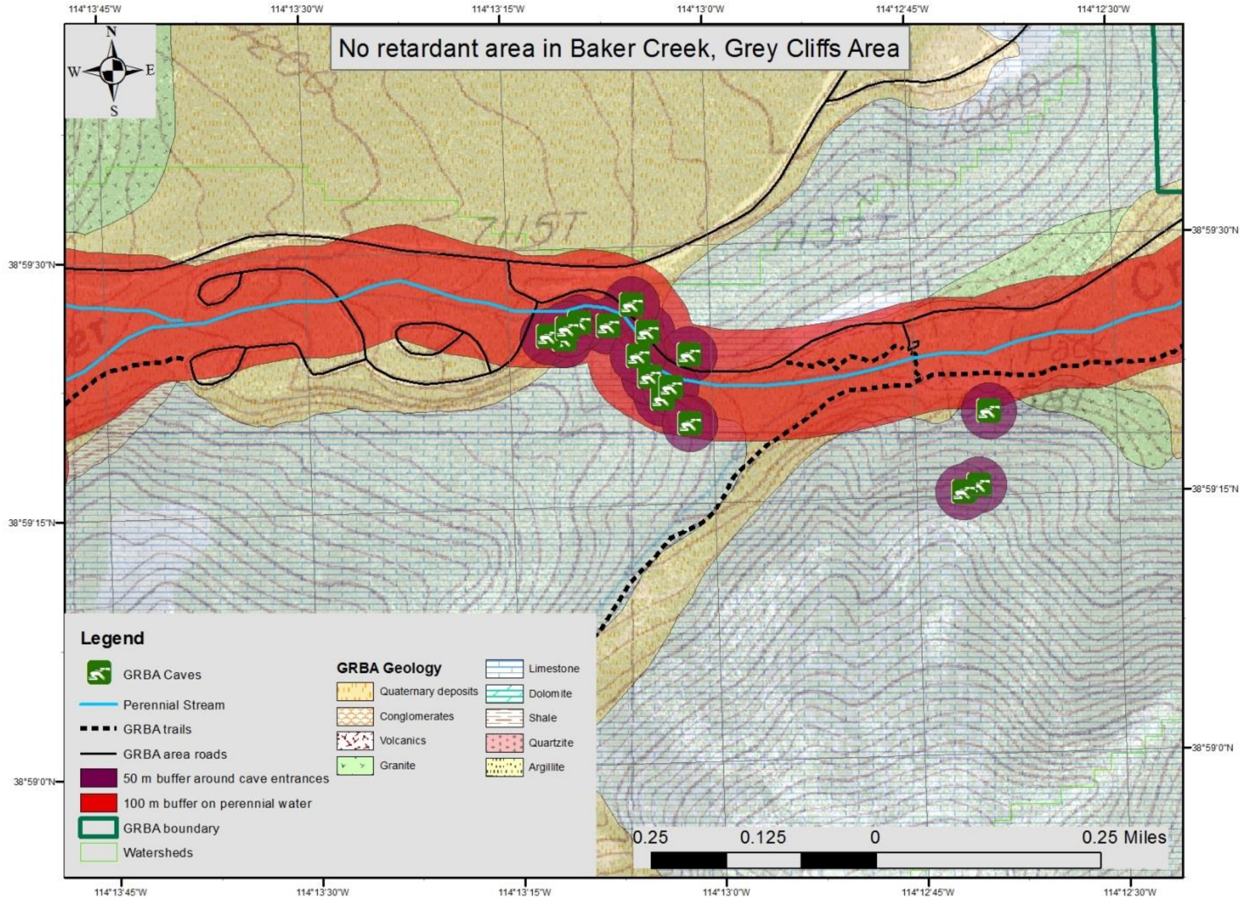


Figure 6. No retardant area for Baker Creek in the Grey Cliffs and Pole Canyon area.

6.0 Adaptive Management and Plan Updates

As more is learned about the wild caves, it is likely that additional management options may become available to help manage the caves with respect to the NPS mission.

Cave management decisions will be based on the most current knowledge and science available. If new knowledge or research shows a different result than what is in this plan, the plan will be modified.

In addition, earthquakes, flash floods, wildfires, or other events may cause a need to adapt this plan given the circumstances.

The Wild Caves and Karst Management Plan will be updated every five years or when a member of the GRBA Management Team asks for an update. The Chief of Resource Management is responsible for convening a meeting every five years to determine if and how the plan needs to be updated.

7.0 Plan Preparers

Name	Role
Gretchen Baker	Ecologist
Beth Cristobal	Environmental Protection Specialist
Bryan Hamilton	Wildlife Biologist
Margaret Horner	Biologist
Tom Kearns	Archeologist
Eva Jensen	Cultural Resources Program Manager
Ben Roberts	Natural Resources Program Manager
Kathleen Slocum	Biological Science Technician
Tod Williams	Chief, Science and Resource Management

Acknowledgements

Ron Bridgemon, former Lehman Caves National Monument guide
Maurice Churchill, Duckwater Shoshone Tribe RM
Cami McKinney, Timpanogos Cave NM
Matt Reece, former GRBA cave specialist
Jon Jasper, former GRBA cave specialist
Dale Pate, NPS Cave and Karst National Lead
Krupa Patel, former GRBA cave specialist
Doug Powell, USFS
Don Seale, former Sequoia-Kings Canyon NP cave specialist
Rebecca Urbanzyck, BLM
Jason Williams, NDOW

8.0 Literature Cited

Aley, T. 2013. Draft Groundwater tracing study at Great Basin National Park. Unpublished report. Great Basin NP files, Baker, NV.

Baker, G. M. 2015. Quantifying wildlife use of cave entrances using remote camera traps. Journal of Cave and Karst Studies, 77(3), 200-210. Available at: https://caves.org/pub/journal/PDF/v77/cave-77-03-04.pdf

Baker, G. 2016. New wildlife species added to cave list. The Midden 16(2): 2-3.

Baldino, C. R. 1998a. Identifying at-risk hibernacula in Great Basin National Park. Unpublished report available from Great Basin National Park Resource Management Branch.

Baldino, C. R. 1998b. Identifying cave roosts in Great Basin National Park. Unpublished report dated. Great Basin National Park Resource Management files:1-14.

Bell, G. L. 2012. Amazingly successful summer paleontology inventory. The Midden. vol. 2, (12), p. 1-3.

Bell, G. L. 2013. Pleistocene cave fauna found at Great Basin National Park. The Midden. vol. 1, (13), p. 4-5.

Bell, G. 2014. Paleoassessment of Cave 24. Great Basin National Park. Baker, NV. Park files.

Bell, G. 2015. Paleoassessment of Lehman Annex Cave. Great Basin National Park. Park files. Baker, NV.

Bell, G. L. 2015. Lehman Cave - Paleontological Assessment. Park files. Baker, NV. 2 p.

Bell, G. L. 2015. Paleoassessment of Root Cave, Great Basin National Park. Park files.

Bell, G. 2015. Paleoassessment of Snake Creek Cave. Great Basin National Park files.

Bell, G. 2015. Upper Pictograph Cave – paleontological assessment. Great Basin National Park files, Baker, NV.

Bradbury, J. W., S. L. Vehrencamp, K. E. Clifton, and L. M. Clifton. 1996. The relationship between bite rate and local forage abundance in wild Thompson's gazelles. Ecology (77):2237–2255.

Bridgemon, R. 1968. Bristlecone Cave: Nevada's highest. UAAC (University of Arizona Adventure Club) News 1(4): 2 p.

Bridgemon, R. 1961. Lehman Annex Cave. Arizona Cave 11(3):38-41.

Bridgemon, R. 1961. Root Cave. Arizona Caver 11(5):106.

Bridgemon, R. R. 1965. The caves of Baker Creek with reference to the Baker Creek Cave System, White Pine County, Nevada. Arizona Caver 2(4):43-79.

Bridgemon, R. 1965. Snake Creek Cave gated. Arizona Caver 2(5):5.

Bridgemon, R. R. 1966. Hydrological observations in the Baker Creek Cave System, White Pine County, Nevada. Arizona Caver 3:21-36.

Bridgemon, R. R. 1967. Baker Creek Cave System, White Pine County, Nevada (Final Report on Grotto Project). Arizona Caver 4:2-10.

Derkarabetian, S., & Hedin, M. 2014. Integrative taxonomy and species delimitation in Harvestmen: A revision of the Western North American genus Sclerobunus (Opiliones: Laniatores: Travunioidea). PloS one, 9(8):e104982. Link

Disney, R.H.L., S.J. Taylor, M.E. Slay & J.K. Krejca. 2011. New species of scuttle flies (Diptera: Phoridae) recorded from caves in Nevada, USA. Subterranean Biology 9: 73-84. Available at: http://www.pensoft.net/journals/subtbiol/article/2511/abstract/

Desert Research Institute. 1968. Final reports on the Lehman Caves studies to the Department of the Interior, National Park Service, Lehman Caves National Monument. The Laboratory of Desert Biology, Desert Research Institute, Reno, Nevada. 57 pp.

Elliott, P.E., Beck, D.A., and Prudic, D.E., 2006, Characterization of surface-water resources in the Great Basin National Park area and their susceptibility to ground-water withdrawals in adjacent valleys, White Pine County, Nevada: U.S. Geological Survey Scientific Investigations Report 2006-5099, 156 p.

Fant, J., J. Kennedy, Powers, Jr., and W. Elliott. 2009. Agency guide to cave and mine gates. Bat Conservation International.

Halford, K.J., and Plume, R.W., 2011, Potential effects of groundwater pumping on water levels, phreatophytes, and spring discharges in Spring and Snake Valleys, White Pine County, Nevada, and adjacent areas in Nevada and Utah: U.S. Geological Survey Scientific Investigations Report 2011-5032, 52 p.

Hall, E. R. 1946. Mammals of Nevada. Reno, Las Vegas, London: University of Nevada Press. 710 p.

Halliday, W. R. 1954. The Baker Creek Caves, Nevada: Preliminary investigations. Technical Note #3, Salt Lake Grotto, National Speleological Society.

Halliday, B. 1955. Speleological confusion at Baker Creek, Nevada. NSS News 13(6): 4.

Harrington, M. R. 1937. Archeological report. Southwest Museum. Great Basin National Park files, Baker, NV.

Hammerson, G. A., M. Kling, M. Harkness, M. Ormes, and B. E. Young. 2017. Strong geographic and temporal patterns in conservation status of North American bats. Biological Conservation 212:144-152.

Harwood, D. 2015. Sign in: The writing on the Wall. The Midden. vol. 1, (15), p. 6-7.

Hiscock, J. 1979. Trip report. Fox Skull Cave. Cave files, Great Basin National Park.

Hose, Louise. 2018a. Notes on the geology of Lehman Caves from a November 2017 Reconnaissance Trip – Part I Geologic Setting. Report for Great Basin National Park. Baker, NV. 13 p.

Hose, Louise. 2018b. Notes on the geology of Lehman Caves from a November 2017 Reconnaissance Trip – Part II Cave Geology. Report for Great Basin National Park. Baker, NV. 18 p.

Ihlo, C. M. 2013. Predicting the Spread of White-Nose Syndrome in Bats: A Strategy for Prioritizing Resources. Masters project submitted in partial fulfillment of the requirements for the Master of Environmental Management degree: Nicholas School of the Environment Duke University: 1-38.

Jasper, J. 2000. Paleo-hydrology and airflow studies of Lehman Caves, Nevada. Great Basin National Park files, Baker, NV. 10 p.

Klimchouk, A. B. 2007. Hypogene speleogenesis: hydrogeological and morphogenic perspective. National Cave and Karst Research Institute, Special Paper 1, Carlsbad, New Mexico, USA.

Krejca, J. K. and S. J. Taylor. 2003. A biological inventory of eight caves in Great Basin National Park. White paper, Park files.

Lachniet, M. S., and C. M. Crotty. 2017. Lehman Caves are likely older than 2.2 million years. Report to park from Department of Geoscience, University of Nevada-Las Vegas.

Lange, A. 1952. The Baker Creek Caves. Stanford Grotto 2(9): 47 pages.

Lange, Arthur L. 1954. Phreatic floor slot in Model Cave, Nevada. Science 120:1099-1100.

Lange, Arthur L. 1958. Stream piracy and cave development along Baker Creek, Nevada. Western Speleological Institute Bulletin Number 1. Santa Barbara, CA.

Maher, S. P., A. M. Kramer, J. T. Pulliam, M. A. Zokan, S. E. Bowden, H. D. Barton, K. Magori, and J. M. Drake. 2012. Spread of white-nose syndrome on a network regulated by geography and climate. Nat Commun 3:1306.

McGee, D. 2011. How old is Lehman Cave? The Midden. vol. 2 (11), p-3-5. http://www.nps.gov/grba/parknews/upload/2011wintersmall-2.pdf (accessed 21 February 2014).

McLane, A. 1978. Alpine caves in the Snake Range. Cave Lights (9):11-13. Reproduced in SpeleoDigest 1978, Ed. By John E. Cooper (71):138-139.
McLane, A. 1989. Rock art in the Snake Range. p. 14-15.
Mead, J. 1980. Letter to park about paleontology of Lost River Passage. Park files, Baker, NV.
Miller, E. L., and P. B. Gans. 1993. Geologic map of the Wheeler Peak and Minerva Canyon 7.5' Quadrangle, White Pine County, Nevada. Department of Geology, Stanford University, unpublished, OF93.
Land, L., Veni, G., Joop, D. 2013. Evaluation of Cave and Karst Programs and Issues at US National Parks. National Cave and Karst Research Institute. Report of Investigations 4. Carlsbad, New Mexico.
McClane, A. 1969. High Pit, White Pine County, Nevada. NSS News 27(11): 145.
McLane, A. 1989. Rock art in the Snake Range. P. 14-15.
Muchmore, W. B. 1962. A new cavernicolous pseudoscorpion belonging to the genus *Microcreagris*. Postilla 70:1-6.
National Parks Conservation Association. 2009. State of the Parks: Great Basin National Park. A Resource Assessment. http://www.npca.org/about-us/center-for-park-research/stateoftheparks/great_basin/GRBA-Web.pdf (accessed 20 February 2014).
National Park Service. 2000. Baseline Water Quality Data Inventory and Analysis – Great Basin National Park. Technical Report NPS/NRWRD/NRTR-99/246. Water Resources Division. Fort Collins, CO.
National Park Service. 2003. Great Basin National Park Geologic Resources Evaluation Scoping Meeting Summary. Geologic Resources Division. Lakewood, Colorado.
National Park Service. [no date]. Great Basin National Park – Cave Resource Condition Report. Physical Sciences, Division of Resource Management. Baker Nevada.
National Park Service. 2013. Great Basin National Park website. Endemic Animals. http://www.nps.gov/grba/naturescience/endemic-animals.htm (accessed 20 February 2014).
National Park Service. 2015. Foundation document: Great Basin National Park. U.S. Department of the Interior. 52 p.
NPSpecies website. Information on Species in National Parks, Part of IRMA. https://irma.nps.gov/NPSpecies/Search/SpeciesList (accessed 20 February 2014).
NSS Convention Guidebook 1975
Orr, P. C. 1952. Tentative identification. Lehman Caves, N. P. Nevada Collection, Cal-Neva Speleological Survey 1952, Western Speleological Institute, Santa Barbara Museum of Natural History. Letter from Great Basin National Park files, 1 page.
Palmer, A. N. 1991. Origin and morphology of limestone caves. Geological Society of America Bulletin, 103(1): 1-21.
Palmer, A. N. 2007. Cave geology. Dayton, Ohio: Cave books. 454 p.
Paul, A.P., C. E. Thodal, G. M. Baker, M. S. Lico, and D. E. Prudic. 2014. Preliminary geochemical assessment of water in selected streams, springs, and caves in the Upper Baker and Snake Creek drainages in Great Basin National Park, Nevada, 2009. U.S. Geological Survey Scientific Investigations Report 2014-5108, 33 p. Available at: https://pubs.usgs.gov/sir/2014/5108/
Pierson, E. D., and W. E. Rainey. 1998. Distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii* in California. BMCP Technical Report Number 96-7.
Porter, Megan. 2003. Microbiological survey of Halliday's Deep, Great Basin National Park. Brigham Young University. Unpublished. Great Basin NP files, Baker, NV.
Rozaire, C. 1964. The Archaeology at Lehman Caves National Monument. Nevada State Museum Report.
Rumm, C. K. 1987. A spelunking guides' guide: Little Muddy Cave. Park files, Baker, NV.

Santucci, V. L., A. L. Koch, and J. Kenworthy. 2004. Paleontological resource inventory and monitoring, Mojave Desert Network. National Park Service Technical Information Center (TIC), Denver, Colorado, USA. Document D-305.

Shakun, J.D., Burns, S.J., Clark, P.U. and Cheng, H. 2011. Milankovitch-paced Termination II in a Nevada speleothem?. Geophysical Research Letters. vol. 38, L18701.

Shear, W.A. 2007. Cave millipeds of the United States. V. The genus *Idagona* Buckett & Gardner (Chordeumatida, Conotylidae, Idagoninae). Zootaxa 1463: 1-12. http://www.mapress.com/zootaxa/2007f/zt01463p012.pdf

Shear, W. A., S. J. Taylor, J. J. Wynne, J. K. Krejca. 2009. Cave millipeds of the United States. VIII. New genera and species of polydesmid millipeds from caves in the southwestern United States. Zootaxa 2151:47-65. Link

Sheps, Lilian. 1972. The effects of photoperiod and some microenvironmental factors on plant growth in Lehman Cave, Nevada. Bulletin of the National Speleological Society, 34(1): 14-25.

Sherwin, R. E., J. S. Altenbach, and D. L. Waldien. 2009. Managing Abandoned Mines for Bats. Bat Conservation International, Inc.

Soulages, R. 1966. A preliminary survey of eastern Nevada bat caves. Great Basin Grotto. National Speleological Society. 60 pp.

Stark. N. 1969. Microecosystems in Lehman Cave, Nevada. National Speleological Society Bulletin 30 (3): 73-81.

Steward, J. 1938. Basin-plateau aboriginal sociopolitical groups. Smithsonian Institution Bureau of American Ethnology Bulletin 120. U.S. Government Printing Office, Washington. Reprinted 1997 by The University of Utah Press, Salt Lake City.

Tweet, J. S., V. L. Santucci, and T. Connors. 2016. Paleontological resource inventory and monitoring: Mojave Desert Network. Natural Resource Report NPS/MOJN/NRR—2016/1209. National Park Service, Fort Collins, Colorado.

Taylor, S. J., and Holsinger, J.R., 2011. A new species of the subterranean amphipod crustacean genus *Stygobromus* (Crangonyctidae) from a cave in Nevada, USA Subterranean Biology, 8: 39-47.

Taylor, S. J., J. K. Krejca, and M. E. Slay. 2008. Cave biota of Great Basin National Park, White Pine County, Nevada. Illinois Natural History Survey, Champaign, Illinois. Center for Biodiversity Technical Report 2008 (25) 398 p. Available at: http://www.nps.gov/grba/naturescience/cave-life.htm

Taylor, S. J., J. K. Krejca, M. E. Slay, and T. L. Harrison. 2009. Milbert's Tortoiseshell, *Aglais milberti* (Lepidoptera: Nymphalidae): A facultative trogloxene in alpine caves. Speleology Notes 1:20-23. Available at: http://speleologynotes.eduTrexler, Keith A. 1966. Lehman Caves—Its human story. Unpublished park report, Great Basin National Park files, Baker, NV.

Unknown. 1959. Salt Lake Grotto completes Lehman Caves project. Unknown publication. p. 52.

Unrau, H. D. 1990. A history of Great Basin National Park. US Department of the Interior, National Park Service. 708 pages.

Veni, G. 2002. Revising the karst map of the united states. *Journal of Cave and Karst Studies*, *64*(1), 45-50.

Vilkamaa, P., H.Hippa, and S. Taylor. 2011. The genus *Camptochaeta* in Nearctic caves, with the description of *C. prolix* sp. n. (Diptera, Sciaridae). ZooKeys 135:69-75. Link

Welch, A.H., Bright, D.J., and Knochenmus, L.A., eds., 2007, Water resources of the Basin and Range carbonate-rock aquifer system, White Pine County, Nevada, and adjacent areas in Nevada and Utah: U.S. Geological Survey Scientific Investigations Report 2007–5261.

Wells, Susan J. 1990. Archeological survey and site assessment at Great Basin National Park.

Went, F. W. 1969. Fungi associated with stalactite growth. Science 166:385-386.

Wheeler, S. M. 1938. Archeological and paleontological studies at Lehman Caves National Monument, Nevada. Report to Superintendent. 23 p.
White-Nose Syndrome Website. http://whitenosesyndrome.org/ (accessed 20 February 2014).

Appendix A: Lehman Caves National Monument Proclamation

LEHMAN CAVES NATIONAL MONUMENT, PROCLAMATION (NO. 1618), JANUARY 24, 1922

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

[No. 1618—Jan. 24, 1922—42 Stat. 2260]

WHEREAS, certain natural caves, known as the Lehman Caves, which are situated upon partly surveyed lands within the Nevada National Forest in the State of Nevada, are of unusual scientific interest and importance, and it appears that the public interests will be promoted by reserving these caves with as much land as may be necessary for the proper protection thereof, as a National Monument.

NOW, THEREFORE, I, Warren G. Harding, President of the United States of America, by virtue of the power in me vested by section two of the Act of Congress approved June eight, nineteen hundred and six, entitled, "An Act for the preservation of American antiquities", do proclaim that there are hereby reserved from all forms of appropriation under the public land laws, subject to all prior valid adverse claims, and set apart as a National Monument, all tracts of land in the State of Nevada shown as the Lehman Caves National Monument on the diagram forming a part hereof.

The reservation made by this proclamation is not intended to prevent the use of the lands for National Forest purposes under the proclamation establishing the Nevada National Forest, and the two reservations shall both be effective on the land withdrawn but the National Monument hereby established shall be the dominant reservation and any use of the land which interferes with its preservation or protection as a National Monument is hereby forbidden.

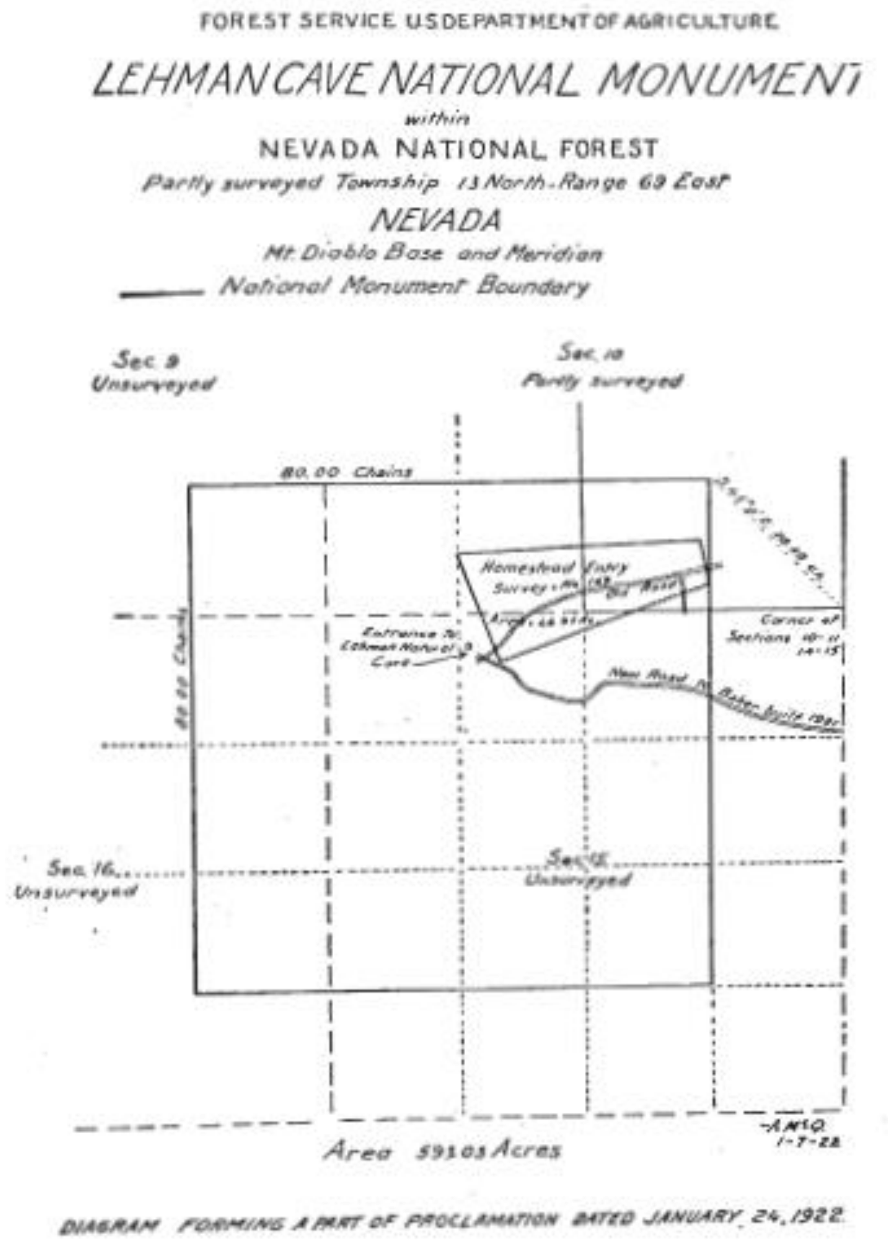
Warning is hereby given to all unauthorized persons not to appropriate, injure, deface, remove, or destroy any feature of this National Monument, or to locate or settle on any of the lands reserved by this proclamation.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this twenty-fourth day of January, in the year of our Lord one thousand nine hundred and twenty-two, [SEAL] and of the Independence of the United States of America the one hundred and forty-sixth.

WARREN G. HARDING.

By the President:
CHARLES E. HUGHES,
Secretary of State.


FOREST SERVICE US DEPARTMENT OF AGRICULTURE
LEHMAN CAVE NATIONAL MONUMENT
within
NEVADA NATIONAL FOREST
Partly surveyed Township 13 North - Range 69 East
NEVADA
Mt. Diablo Base and Meridian
National Monument Boundary
Sec. 9
Unsurveyed
Sec. 10
Partly surveyed
80.00 Chains
Homestead Entry
Old Road
Corner of
Sections 10-11
14-15
Entrance to
Lehman Natural
Cave
New Road
Sec. 16
Unsurveyed
Unsurveyed
Area 593.03 Acres
DIAGRAM FORMING A PART OF PROCLAMATION DATED JANUARY 24, 1922

Appendix B: Great Basin National Park Designation

Public Law 99-565
99th Congress

An Act

To establish a Great Basin National Park in the State of Nevada, and for other purposes.

Oct. 27, 1986
[S. 2506]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Great Basin National Park Act of 1986.

SHORT TITLE

SECTION 1. This Act may be known as the "Great Basin National Park Act of 1986". 16 USC 410mm note.

ESTABLISHMENT

SEC. 2. (a) In order to preserve for the benefit and inspiration of the people a representative segment of the Great Basin of the Western United States possessing outstanding resources and significant geological and scenic values, there is hereby established the Great Basin National Park (hereinafter in this Act referred to as the "park"). 16 USC 410mm.

(b) The park shall consist of approximately seventy-six thousand acres, as depicted on the map entitled "Boundary Map, Great Basin National Park, Nevada," numbered NA-GB 20,017, and dated October 1986. The map shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior, and the Office of the Superintendent, Great Basin National Park, Nevada. Public information.

(c) Within 6 months after the enactment of this Act, the Secretary of the Interior (hereinafter in this Act referred to as the "Secretary") shall file a legal description of the park designated under this section with the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate. Such legal description shall have the same force and effect as if included in this Act, except that the Secretary may correct clerical and typographical errors in such legal description and in the map referred to in subsection (a). The legal description shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior. Public information.

(d)(1) The Lehman Caves National Monument, designated on January 24, 1922, by Presidential proclamation under the authority contained in the Act of June 8, 1906 (34 Stat. 225) is hereby abolished and the lands incorporated within the Great Basin National Park. Any reference in any law, map, regulation, document, record, or other paper of the United States to such national monument shall be deemed to be a reference to Great Basin National Park.

(2) Any funds available for purposes of the national monument shall be available for purposes of the park.

ADMINISTRATION

Conservation.
Fish and fishing.
Wildlife.
16 USC 410mm-1.

SEC. 3. (a) The Secretary shall administer the park in accordance with this Act and with the provisions of law generally applicable to units of the national park system, including the Act entitled "An Act to establish a National Park Service, and for other purposes," approved August 26, 1916 (39 Stat. 535; 16 U.S.C. 1-4). The Secretary shall protect, manage, and administer the park in such manner as to conserve and protect the scenery, the natural, geologic, historic, and archaeological resources of the park, including fish and wildlife and to provide for the public use and enjoyment of the same in such a manner as to perpetuate these qualities for future generations.

(b) The Secretary shall permit fishing on lands and waters under his jurisdiction within the park in accordance with the applicable laws of the United States and the State of Nevada, except that he may designate zones where, and periods when, no fishing may be permitted for reasons of public safety. Except in emergencies, any regulations prescribing such restrictions relating to fishing, shall be put into effect only after consultation with the appropriate State agency having jurisdiction over fishing activities.

(c) After notice and opportunity for public hearing, the Secretary shall prepare a management plan for the park. The Secretary shall submit such plan to the Committee on Interior and Insular Affairs of the United States House of Representatives and with the Committee on Energy and Natural Resources of the United States Senate within three years after the enactment of this Act. Such plan may be amended from time to time. The plan shall include, but not be limited to, provisions related to grazing within the park to the extent permitted under subsection (e) and provisions providing for the appropriate management of fish and wildlife and fishing within the park in accordance with subsection (b). Such provisions shall be adopted only after consultation with the appropriate State agency having jurisdiction over fish and wildlife.

(d) Subject to valid existing rights, Federal lands and interests therein, within the park, are withdrawn from disposition under the public lands laws and from entry or appropriation under the mining laws of the United States, from the operation of the mineral leasing laws of the United States, and from operation of the Geothermal Steam Act of 1970, as amended.

30 USC 1001 note.

(e) Subject to such limitations, conditions, or regulations as he may prescribe, the Secretary shall permit grazing on lands within the park to the same extent as was permitted on such lands as of July 1, 1985. Grazing within the park shall be administered by the National Park Service.

(f) At the request of the permittee, or at the initiative of the Secretary, negotiations may take place at any time with holders of valid existing grazing permits on land within the park, for an exchange of all or part of their grazing allotments for allotments outside the park. No such exchange shall take place if, in the opinion of the affected Federal land management agency, the exchange would result in overgrazing of Federal lands.

(g) Existing water-related range improvements inside the park may be maintained by the Secretary or the persons benefitting from them, subject to reasonable regulation by the Secretary.

(h) Nothing in this Act shall be construed to establish a new express or implied reservation to the United States of any water or water-related right with respect to the land described in section 2 of this Act: *Provided,* That the United States shall be entitled to only that express or implied reserved water right which may have been associated with the initial establishment and withdrawal of Humboldt National Forest and the Lehman Caves National Monument from the public domain with respect to the land described in section 2 of this Act. No provision of this Act shall be construed as authorizing the appropriation of water, except in accordance with the substantive and procedural law of the State of Nevada.

(i) In order to encourage unified and cost-effective interpretation of the Great Basin physiographic region, the Secretary is authorized and encouraged to enter into cooperative agreements with other Federal, State, and local public departments and agencies providing for the interpretation of the Great Basin physiographic region. Such agreements shall include, but not be limited to, authority for the Secretary to develop and operate interpretive facilities and programs on lands and waters outside of the boundaries of such park, with the concurrence of the owner or administrator thereof. State and local governments.

ACQUISITION OF LAND

SEC. 4. (a) The Secretary may acquire land or interests in land within the boundaries of the park by donation, purchase with donated or appropriated funds, or exchange, but no such lands or interests therein may be acquired without the consent of the owner thereof. Lands owned by the State of Nevada or any political subdivision thereof may be acquired only by donation or exchange. 16 USC 410mm-2.

(b) Lands and waters, and interests therein, within the boundaries of the park which were administered by the Forest Service, United States Department of Agriculture prior to the date of enactment of this Act are hereby transferred to the administrative jurisdiction of the Secretary to be administered in accordance with this Act. The boundaries of the Humboldt National Forest shall be adjusted accordingly.

AUTHORIZATION OF APPROPRIATIONS

SEC. 5. (a) Not more than $800,000 are authorized to be appropriated for development of the park. 16 USC 410mm-3.

(b) Not more than $200,000 are authorized to be appropriated for acquisition of lands and interests in land within the park.

Approved October 27, 1986.

LEGISLATIVE HISTORY—S. 2506:

SENATE REPORTS: No. 99-458 (Comm. on Energy and Natural Resources).
CONGRESSIONAL RECORD, Vol. 132 (1986):
Sept. 30, considered and passed Senate.
Oct. 6, considered and passed House, amended.
Oct. 9, Senate concurred in House amendments.

Appendix C: Overview of Park Caves

This section presents information about each of the known park caves. It is organized by watershed, with a short description and a map for each watershed. Caves are then listed alphabetically by watershed (**Error! Reference source not found.**). **Error! Reference source not found.** provides an erview of cave locations.

This section redacted for public viewing under the Federal Caves Resources Protection Act of 1988.

Appendix D: Survey and Mapping Standards

Survey standards have been developed to minimize impact on park caves and maximize the quality of the data gathered during the survey. The survey team will consist of a person on lead tape, an instrument reader, and a sketcher. All survey teams will adhere to the following standards:

<u>Point</u>
The survey member on point determines the survey route that is taken through the cave by placing stations throughout the cave on fixed cave features. Stations will be chosen based on ease of instrument reading from one station to the next, and at optimal distances for the sketch based on the complexity of the passage. For conservation purposes, speleothems will not be used as stations unless there is no other viable alternative. Survey stations will be marked by a single point using a permanent marker. Station names will not be written at the station to avoid unnecessary impact to cave resources. It is important to have permanent stations throughout the cave to provide a fixed point of reference for the surveys and inventories. Speleothems will not be marked as permanent stations and will only be used if there is no other viable alternative. Temporary stations will be preceded and followed by permanent stations.

Multiple stations will be set in long passages and rooms to increase the accuracy of the sketch. Stations will be set at all junctions and leads throughout the cave to facilitate tie-ins and make the survey more straightforward.

Distances will be recorded in either decimal feet or meters. Survey tapes will be read to the nearest hundredth of a foot or the nearest centimeter depending on the unit of measurement for the cave system (e.g. 7.25).

The survey member on point is also responsible for passage reconnaissance, backsights, and holding target light on station for the instrument reader to read foresight. The light that is held on station should be a single point and of a distinctive color so that the instrument reader can be sure they are shooting to the correct light.

<u>Instruments</u>
DistoX lasers will be tested to see if they are within 0.5 degrees of accuracy. If not, they will be recalibrated.

Compass and clinometer readings will be taken to the nearest half degree (e.g. 105.5°). Clinometer readings will be read with the + or – sign depending on the angle of measurement. Backsights will be taken on every shot to increase the accuracy of the survey. The foresight and backsight for every shot must agree to within two degrees. If the readings differ by more than two degrees the readings will be retaken. In some cases retaking the shots will not provide agreement due to the presence of metal (e.g. metal gate) or if one of the stations is difficult to read shots from. In these circumstances either two frontsights or two backsights will be taken depending on which reading is considered more accurate by the instrument readers and sketcher.

Loops greater than 500ft in length must have a closure error of ≤ 1%. Loops less than 500ft must have a closure error of ≤ 2%.

Book

All sketchers surveying in park caves must be pre-approved by the GRBA cave management staff. Prospective sketchers will submit copies of their previous work and then park will use evaluation protocols to determine if their work meets park standards. Sketchers will be given an evaluation sheet by the Cave Specialist which will provide feedback on how the sketch and book components can better adhere to park standards. This will ensure that all sketches and subsequent maps for park caves fit park standards.

The cave management team will give sketchers designated letters to use for new stations before entering the cave. The sketcher will record all notes, numbers, etc. that accompany the sketch. Clear and legible notes are essential to drafting accurate cave maps. The Sketcher should use an appropriate scale for the cave (e.g. small passage 20ft = 1in., large passage 50ft = 1in.). The stations must be marked accurately and labeled clearly on the sketch. If the scale changes in the notes at any point during the survey, the change must be clearly indicated. All surveys will have completed cover sheets with the following information: park name, cave name, section (if applicable), survey date, name of person on book, instruments, point, and inventory, compass and clinometer numbers for foresight and backsight, total length surveyed, and the data entry date/initials.

The sketcher will complete the following for each survey:

1. Plan View

Plan views will be drawn to scale on graph paper, with a protractor and a ruler. The cave name, survey date, scale, north arrow, and page number will be marked on each page. The plan view should concentrate mostly on floor detail. Room names will be included on the sketch when known. If non-standard symbols are used in the sketch, a legend will be included. Indications will be made to show what any unsurveyed passage does (e.g. too tight, 2' x 4', "to the Fungus Junction", etc.) Passage dimensions will be drawn to scale, and ceiling heights will be noted at regular intervals. Triangulation can be used in areas of the cave where ceiling height is difficult to determine. Left, right, up, and down (LRUD) data will be estimated in the up-survey direction, at the "to" station. LRUD data will be taken by the same person throughout the whole survey to ensure consistency in estimations.

Sufficient sketch detail should be included of the area surrounding the cave entrance to put the entrance in context. The sketch will contain adequate floor and ceiling detail that is consistent throughout the sketch, stations clearly marked on plan and profile, and clear indications to show what all unsurveyed passage and leads do. Ceiling heights, pit depths, cave elevations and water depths should be marked on the sketch.

2. Profile View

A profile sketch represents the longitudinal view of the cave passage on the survey line. It is necessary when there is a significant vertical component (high angle) to the survey shots and should be done in horizontal passages where the relief is noticeable. The type of profile should be clearly noted on the sketch (e.g. extended, projected, idealized).

The profile should accurately depict ceiling height changes, floor changes, height of the station above the floor, formations such as stalagmites, stalactites, soda straw areas, rocks, boulders, bedrock, and other important features that will relay more information about the passage being sketched. All ceiling leads and survey stations with station names will be plotted on the sketch.

3. Cross-Sections
Cross sections will be drawn whenever the passage morphology changes significantly. If the passage remains constant, cross sections will be drawn at every fifth station or at every 100 feet. The cross-section should contain sufficient floor and ceiling detail. The directional view of the cross-sections will be included on the plan view sketch.

<u>Large Passages and Rooms</u>
Splay shots, room circumference surveys, and radial surveys should be used for surveying large passages or rooms to increase the accuracy of the sketch. Circumference surveys are conducted along the perimeter of rooms, or at wide spots in passage-ways (Figure 1). Half the length of each circumference survey should be subtracted from each day's total survey length to yield more accurate cave lengths. Splay shots are single survey shots taken to the opposite passage wall. Radial surveys are comprised of a series of shots taken from one central point (Figure 2). From this central point, several shots are taken to various corners and features in the room. Radial survey and splay shot lengths should also be removed from the survey at the end of the survey trip (On Station, 1994).

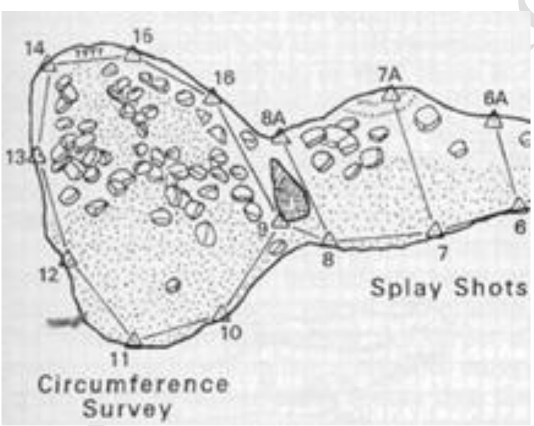


Figure 1. Circumference and Splay Shots (On Station, 1994)

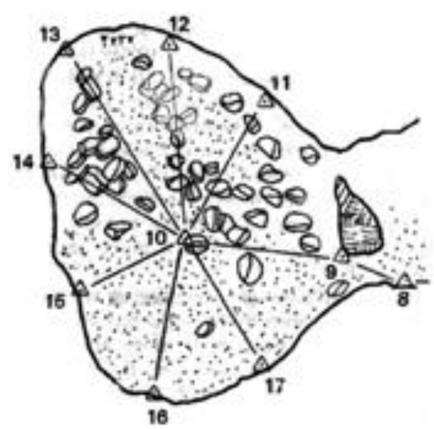


Figure 2. Radial Survey (On Station, 1994)

<u>Communication</u>:
Clear communication is important to producing accurate surveys and sketches. The following communication strategies will be used in conducting surveys in the park:

The person on lead tape and the team members taking compass and clinometer readings will communicate the measurements to the sketcher who will then repeat the numbers back to ensure

accuracy. This is extremely important since mistakes often occur from mishearing numbers in tight passages, and losing survey time from having to redo shots when the instrument reader erroneously assumes the sketcher has recorded the numbers.
The team member holding the target light on station will say "on station" when they have the light in place so that the instrument reader can ensure that she/he is focusing the shot on the correct light source at the correct location.

Mapping Standards:
Complete and detailed maps are important for gaining accurate scientific and management data in park caves. For this reason, cave maps must be at least as good as the sketch and should not be simplified. Simplifications can be made for recreational uses if necessary after the original map has been completed and stored in park files.

Maps must contain the following components to be considered complete:

- North arrow (a clear designation of both true north and magnetic north is optimal).
- Scale Bar (not a ratio scale such as 1:600, or a written scale such as 1" = 20', since maps will be reduced or expanded as necessary).
- Vertical Control with bar scale and clearly labeled type (e.g. extended profile, expanded profile, idealized profile), and cross-sections with directional marks.
- Legend or an identification of which set of standard cave symbols was used.
- Cave Name with GRBA designation (e.g. BC-09, Dynamite Cave) and park name, county and state, cartographer and members of survey group, date surveyed, and type of survey.
- Total surveyed traverse of cave with units (no UTM's or exact location info on the map due to sensitivity of cave location information protected under the 1988 FCRPA).
- Marked survey stations since the map will be used by the park for scientific and management purposes.
- All maps must show a clearly marked entrance or connection to the rest of the cave system.
- A zero datum labeled near the cave's dominant entrance. The zero datum for park caves will be the brass cap near the entrance.

Appendix E: Cave Inventory Form

Biology (continued)

Vertebrate
Bat_______________________________________
Bat Guano_________________________________
Bat Scratches______________________________
Bones (Specify) ____________________________
Other Mammals_____________________________
Mammal signs______________________________
Reptiles___________________________________
Birds_____________________________________
Scat______________________________________
Animal Tracks______________________________
Other_____________________________________

Cultural

Artifacts
Charcoal/ash/fire____________________________
Petroglyphs_________________________________
Pictographs_________________________________
Other______________________________________
Historic items_______________________________
____

Graffiti (record graffiti/approximate age)
____
____

Paleontology

Cenozoic
Bat bones___________________________________
small mammal_______________________________
large mammal_______________________________
Teeth______________________________________
Other______________________________________
____

Bedrock
Fossils_____________________________________

Notes

____
____
____

Indicate station where found; if no station, use landmarks

Great Basin National Park
Cave Inventory Form

Cave Name___________________ Inventory Date______________
Location____
Stations Inventoried___________________________________
Recorder____
Other Personnel______________________________________
____

Computer entry date__________ Data entry person______________
Notes____

Obstacles
Crawl (anything difficult for a rescue litter)_______________________
____
Un-roped Climb or Chimney___________________________
____
Pit Requiring Rope (describe rigging, rope length, pit depth, quality of rope)____________________________________
____
____
Other____

Water
Surface Moisture______________________________________
Dripping____
Flowing _______________________________(estimate discharge)
Pool (note size)________________Water temp & time___________
Water quality:____

Airflow
Airflow____
(Indicate direction and velocity. Example B45 to B46; faint)

Flora
Species in cave_______________________________________
Species near cave entrance______________________________
____

Notes

Time:___Soil temp:_____Air temp:_____Relative humidity______
____
____

Geology

Bedrock
Limestone/Marble____
Dolomite____
Scallops____
Chert____

Other Mineralogy
Manganese____
Clay (note color)____
Corrosion residue (note color and thickness)__________________
Other____

Floor (!note every station must have at least one floor feature!)
Sediment/Soil____
Breakdown____
Bedrock____
Secondary Deposits____
Pit____

Speleogens
Bubble trail/Ceiling channels ________________________________
Cupola(s)____
Ceiling vent____
Ceiling pendants/boneyard_____________________________________
Floor vent____
Other____

Speleothems

Calcite
Boxwork____
Calcite Coating____
Calcite Crust____
Column____
Conulite____
Drapery____
Flowstone____
Folia____
Helictite____
Mammillaries____
Pearl____
Popcorn____
Raft____
Raft Cone____
Rim____
Rimstone Dam____
Shelfstone____
Shield (incl. # @ each stat.)_________________________________
Spar
- Dogtooth____
- Nailhead____

Splash Ring____
Stalactite____
- Bulbous____
- Turnips____

Soda straw____
Stalagmite____
Other____

Aragonite
Anthodite____
Bush____
Frostwork____

Gypsum
Coating____
Cotton/Hair/Needle____
Crust____
Flower____
Rimmed vent ____
Other____

Hydromagnesite
Balloon____
Crinkle Blister____
Moonmilk____

Biology

Invertebrates
Beetles____
Centipede____
Crickets____
Diplurans____
Flies____
Harvestman____
Isopod____
Millipede____
Pseudoscorpion____
Spiders____
Springtails____
Other____
Microbial Colonies (color/size)_______________________________

Indicate station where found; if no station, use landmarks

5/20/18

Appendix F: Caving Job Hazard Analysis (JHA)

JOB HAZARD ANALYSIS - FORM 1.1

JOB HAZARD ANALYSIS (JHA)		**Date: 11/19/15**	☐ New JHA ☒ Revised JHA
Park Unit: Great Basin National Park	**Division:** Planning & Resources	**Branch:** Natural Resources	**Location:** Earth
JOB TITLE: Wild Cave Entry		**JHA Number: NRMCave-1**	**Page _1_ of _5_**
Job Performed By:	**Analysis By:** G. Baker/B. Roberts	**Supervisor:**	**Approved By:** Tod Williams
Required Standards & General Notes:	Call-in time established prior to the trip; Back travel country plan; Trip leaders must be trained and prepared for trip type. First aid kit located along travel route. Never enter a cave alone. Perform GAR to assess team skill level.		
Required PPE:	UIAA approved helmet, 3 light sources, knee-pads , elbow-pads, gloves, boots with good soles and ankle support, warm clothing, chemical heat pack, compact first aid kit, three forms of communication required.		
Tools & Equipment:	Side-mounted pack, adequate drinking water, adequate quick-energy food supply, extra batteries, watch, cave maps, compass, hand-line.		

Sequence of Job Steps	Potential Hazards	Safe Action or Procedure
Planning Cave Trip	Lack of leadership and communication. Failing to establish a reliable surface watch and reasonable call-in time. Planning a caving trip that will exceed the abilities of any team member. These abilities include physical condition, technical skills and psychological aspects.	1) One person for each trip will be designated as the trip leader. This person is responsible for providing leadership and clear communication concerning safety, minimizing impact to the cave resource and achieving the trip goals. Ensure that trip plans are within the range of all team members. 2) Discuss trip plans with team members and make sure each member understands the trip plans, is prepared to meet the challenges of the trip in terms of physical condition, technical skills and psychological aspects. 3) Establish a reliable surface contact person and reasonable call-in time. 4) Ensure designated surface watch and LE informed when conducting surveys in remote sections of cave and/or backcountry caves.

JOB HAZARD ANALYSIS - FORM 1.1

JHA—CONTINUATION SHEET	**JHA number: NRMCave-1**	**Page _2_ of _5_**
Sequence of Job Steps	**Potential Hazards**	**Safe Action or Procedure**
Preparing Equipment	Not bringing proper equipment to achieve the planned objectives.	Trip members will make sure they have the proper personal equipment for the trip. Trip leader will supply protocol-specific checklist of necessary equipment.
	Equipment worn, broken or inoperable due to lack of proper maintenance.	Each trip member is responsible for regularly checking, cleaning and ensuring their caving equipment is in proper working order.
	Team member not knowing how to properly use caving equipment.	All team members will have the training and knowledge as to proper usage of each piece of equipment used for their specific trip.
Entering Cave	Entrance Zone Animals	While in the cave entrance area be alert for skunks, venomous snakes, spiders, and other wildlife. Avoid treading on accumulated guano or middens.
	Rock fall	Due to high fluctuation in temperature and moisture, some entrances areas can be prone to loose rocks. Move carefully and thoughtfully so as not to dislodge rocks.
Horizontal Caving (general)	Exposed climbs	Always use three points of body contact on cave surfaces to minimize risk of falling. Where feasible, use a hand-line or belay.
	Slippery surfaces / Falling	Wear good traction boats and a caving helmet with a chinstrap. Move in a controlled manner to avoid falling. When climbing, test all holds to ensure that they can withstand the force being placed upon them.
	Low/small areas	Trip leaders should ensure all members are able to negotiate low/small areas on caving route. Remain calm and think through what one must do to get passage is key. Never descend head-first through low/small areas that slope steeply downward.

JOB HAZARD ANALYSIS - FORM 1.1

JHA—CONTINUATION SHEET	JHA number: NRMCave-1	Page 3 of 5
Sequence of Job Steps	**Potential Hazards**	**Safe Action or Procedure**
Horizontal Caving (general	Exertion / Exhaustion	Discuss length and duration of trip prior to heading into the cave. Team member need cave-specific physical conditioning. Push your endurance limit in gradual increments. Avoid overloading your pack; be creative to reduce weight and bulk. Prior to the trip, the trip leader should inquire about people with known physical conditions and treatment needs. Groups should avoid overexertion, and should stop at least every hour to eat and drink. Group speed should be tailored to the slowest member of the team. Should the trip become too much for one team member, the trip plan will be modified to assure the safety of all members. Perform a GAR prior to cave entry.
	Temperature related issues	Ensure team members are appropriately dressed for continued movement – a long-sleeved shirt and durable pants are usually sufficient and prevent overheating. Ensure team members have cold temperature clothing in their packs such as a balaclava and long-sleeved polypropylene shirt. Explain to team members about the colder temps while not moving and the necessity of wearing these items to prevent hypothermia. Keeping clothing dry.
	Dehydration	Team members will hydrated before entering the cave and carry sufficient water or electrolyte replacement drinks during the trip to maintain a proper hydration and avoid cramps.

Appendix G: Cave Rescue Standard Operating Procedures (SOPs)

Following is a method to manage a cave rescue situation. **These are guidelines only!** Each cave rescue is unique and will dictate necessary procedures. It is highly recommended that personnel responding to a cave rescue have National Cave Rescue Commission (NCRC) training. More information is available at http://ncrc.info/. All cave rescues should be run under the Incident Command System (ICS).

A. COLLECT NECESSARY INFORMATION

- Write down initial report (e.g., group overdue, person injured).
- Gather additional information as needed.

B. NOTIFY APPROPRIATE EMERGENCY AGENCIES

- Always notify the Agency Having Jurisdiction (AHJ) first. In Great Basin National Park, call Lake Mead Dispatch: 702-293-8998. In other areas of White Pine County, call the Sheriff's Office (911), followed by the land agency having jurisdiction (BLM-775-289-1800; USFS (775-289-3031), Cave Lake State Park, etc.) or private property owner, if applicable.

C. NOTIFY CAVE RESCUE PERSONNEL

- Start calling personnel capable of conducting the cave rescue. Use the Eastern Nevada Cave Callout List.

D. CONTROL SCENE AND CAVE ENTRANCES

- First qualified agency person is ***Incident Commander (IC)*** and is in charge until relieved.
- Establish an ***Entrance Control*** at cave opening to ensure that nobody enters without permission. Entrance Control initiates an Entrance Log to document all personnel and equipment, destination, and time in and out.

E. OBTAIN INFORMATION ABOUT THE INCIDENT

- Interview the reporting person and any available caving party members; DO NOT LET THEM LEAVE!
  - Mechanism of injury (fall, entrapment, etc.)
  - Patient condition
  - Patient location
  - Cave passage description (map available?)
  - Obstacles/hazards/vertical components
  - Resources necessary
- Is it safe to send personnel into the cave (breakdown collapse, flooding, bad air, etc.)?
- For an overdue party, send a quick 2-4 person *Search Task Force* into the cave.
- For a known injured person, send in a 3 to 5 caver ***Initial Response Task Force (IRT)*** into cave to investigate and report back via runner or via field phones when established by Comm-1.

F. ESTABLISH AN INCIDENT COMMAND POST

- Ideal location: easily accessible location between arriving responders and cave entrance. Does NOT have to be at the cave entrance!
- Staffed by representatives from key agencies, others as needed.
- As needed, IC assigns people to fill functions. Should be cavers with cave rescue training.
    - Planning Section Chief—develops plans for managing the situation
    - Operations Section Chief—directs above-ground and below-ground activities
- Get table, chairs, white board/flip chart, etc. Consider getting tent or tarp.
- Document actions to help organize and optimize resources.

G. ESTABLISH PERSONNEL AND EQUIPMENT STAGING AREAS

- Plans Chief assigns a ***Personnel Coordinator*** – can be from any agency.
    - Identifies area between point of arrival and ICP
    - Establishes system for identifying personnel and their abilities
    - Assigns personnel to teams
- Plans Chief assigns an ***Equipment Coordinator*** – can be from any agency
    - Identifies appropriate area between point of arrival and CP
    - Establishes system for identifying and cataloging equipment Assigns equipment to teams as requested.

H. ESTABLISH COMMUNICATIONS

- *ABOVE GROUND*
    - Establish ***Commo Recorder*** position in Incident Command Post to log all communications
    - Establish radio and/or phone communication link between ICP and Staging Area Managers
- *IN-CAVE*
    - Test radio contact
    - Send cave phones and commo wire into cave with 2-caver ***Communications Team (Comm-1)*** to establish communications between CP and the patient location.

I. ESTABLISH UNDERGROUND COORDINATOR (UC) POSITION

- ***Underground Coordinator*** should be strong caver with cave rescue training.
- Responsible for entire evacuation process, so needs to move freely through the passage. Reports to Ops Chief.

J. AS INDICATED BY SEARCH/IRT REPORT, BEGIN CREATING TEAMS

- People should be sent in as teams with a designated Team Leader whenever possible. Number the teams as there may be several sent in with similar functions.
- Team mission is identified by Planning.
    - Team is assembled by the Personnel Coordinator, the Team Leader is identified, team is sent to the Equipment Coordinator for necessary items.
    - Team is briefed by Planning and Operations.
    - Team Leader reports to Ops or UC on regular basis and whenever status of team mission changes.
- Send in 2-person ***Medic Task Force*** with heat packs, space blanket and other critical supplies.

- Send in 3-5 people ***Evac Task Force*** with patient packaging equipment. Reassign IRT/Search members to Evac Task Force as needed.
- Consider sending in additional Evac Teams and Comm Teams as personnel become available.
- Consider need for ***Rigging Teams***. Must be led by person experienced with technical rescue.
-

K. KEEP COMMUNICATIONS FLOWING

- Adjust plan as necessary
- **Document all actions and communications!**
- Ensure that all personnel entering the cave have proper PPE and are capable of responding in a cave environment.
- Prepare for patient evacuation to surface personnel (order helicopter or ambulance as necessary)
- Prepare for rescuers to exit cave (have food ready)

L. FOLLOWING PATIENT TRANSFER TO EMS PERSONNEL OUTSIDE CAVE, LOG ALL CAVE RESPONDERS OUT OF THE CAVE. **Entrance control** is one of the last positions to be removed. Turn over all logs and documentation to IC.

M. CONDUCT A DEBRIEF. Ensure rescuers are capable of getting home safely.

N. Write up Incident for American Caving Accidents report. https://caves.org/pub/aca/

Appendix H: Wild Cave Recreational Permit Information

Nine wild (undeveloped) caves at Great Basin National Park are open by permit for recreational use. All other wild caves are closed except to research and management uses. Recreational permits will be approved for those who can demonstrate cave conservation ethics and their experience with horizontal and vertical caving techniques and equipment.

Permits must be returned at least two weeks prior to the cave trip. No more than one wild cave permit per week will be issued for each cave. Groups entering wild caves are limited to a minimum of three and a maximum of six persons. Those who qualify and are interested can complete the attached Cave Permit application. Applications may be returned via email or letter. For further information please contact Gretchen Baker, at 775-234-7541, or by email at Gretchen_Baker@nps.gov

Many of the permitted wild caves in the Park are important hibernacula and maternity roosts for various species of bats including four National Park Service Sensitive species: long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), western small-footed myotis (*Myotis ciliolabrum*), and Townsend's big-eared bat (*Corynorhinus townsendii*). Due to the disturbance caused by human use, the permitted caves that are used by sensitive bat populations will only be open to public entry during the dates listed below pursuant to Title 36, Code of Federal Regulations, Section 1.5 (a) (1). The following open dates are subject to change based on annual variations in use by bats and other cave species:

Cave	Dates Open	Notes
Little Muddy	Oct 1 – Apr 15	Crawly maze cave with bad air in summer
Catamount	Year round	Short cave with chimney
Baker Creek Cave System *Wheelers Deep, Ice, Halliday's, Crevasse*	April 1 – May 15 and September 15 – October 15	Vertical sections for all but Ice entrance, crawling passages; Wheeler's Deep has stream passage
Systems Key	April 1 – May 15 and September 15 – October 15	Vertical section and lots of crawling
Broken	June 15 - October 15	Small cave at high elevation
Snake Creek	September 15 – May 15	Variety of passage types, including crawling and walking; H passage closed year round

GENERAL CAVING GUIDELINES

Permits

1) An approved permit is required to enter all wild caves. Only the cave(s) listed on the permit may be entered.
2) Recreational cave permits will be issued by the Chief of Natural Resource Management or Cave Specialist.
3) Permits must be applied for at least two weeks prior to the trip.
4) No more than one permit per week will be issued for each cave.
5) All permits will be picked up in person and signed by all group members.
6) A mandatory pre-trip cave conservation discussion with the cave specialist or designated Resource Management staff is required for entry into the wild caves in the park.

Cave Fauna

1) It is the responsibility of all cavers to minimize disturbance to cave flora and fauna.
2) Many caves contain important maternity colonies or hibernacula for bats. If a colony is encountered, cavers will leave the area immediately. Cavers may move past solitary bats that are sleeping or resting on a wall or ceiling, but should be quiet, move quickly, and avoid shining their lights on the animal. Note: Lights with red filters have been shown to disturb bats less and may be appropriate in some situations.
3) Cave invertebrate and microbe populations are extremely sensitive to disturbance. They can be inadvertently harmed by moving rocks, leaf litter, and other organic matter that provides important habitat to these organisms. Cavers should be very careful to avoid this.
4) Cavers must have clean, decontaminated clothing, boots, and cave gear in order to prevent contamination through the introduction of new organic material into the cave systems within the park.

Rules & Guidelines

The following rules will be adhered to by everyone entering the caves at Great Basin National Park (violations of these rules will result in the loss of future visitation privileges and/or fines or imprisonment, depending on the severity of the infraction):

1) No alcohol or tobacco products are allowed in the caves.
2) Liquid or solid human wastes may not be left in any cave (in wild caves use pee bottles and burrito bags - double one-gallon zip-locked bags with baking soda).
3) No speleothem, cave fauna, plant, fungus, or other natural, historical, paleontological, or archeological artifact may be handled, damaged, or removed from any cave.
4) No marks or writing of any kind may be left on any cave wall or feature.
5) No carbide lamps or the fuel for them may be brought into the caves.
6) No hammering or breaking of cave walls or formations that block leads.
7) No camping or campfires are allowed in any cave.
8) No domestic animals are allowed in park caves at any time.
9) Installing bolts is strictly prohibited unless written permission has been granted.

10) Cavers must remove all traces of food that they bring into the caves.
11) Clothing that may produce excessive lint is not allowed.
12) All equipment, supplies, trash, and clothing that are taken into a cave must be removed by the cavers at the end of the trip. Of particular importance is the removal of all spent batteries due to the toxic nature of these items.
13) All cave keys must be returned to park staff within 24 hours after the cave trip.
14) Any accident or violation of these rules must be reported immediately to park staff.
15) Written permission from the park superintendent or a designee is **required** to enlarge a constriction or dig through a breakdown or cave fill, determined on a case-by-case basis. Alterations must have a strong justification. Permission can only be granted upon demonstration that all impacts can and will be mitigated using the proper NEPA documentation.

<u>Safety Requirements</u>

1) Trip leaders must be at least 18 years of age. They are responsible for the safety and actions of their group members, and should gear activities towards the least experienced member of the team. All cavers must be at least 12 years of age.
2) Cave trips are limited to 3-6 people in a group. Single person cave trips are not allowed within the park for safety reasons.
3) Each caver must have:
   - A UIAA-approved helmet with four-point suspension and a chin strap
   - A primary mounted light source
   - A secondary light source that can be mounted if required
   - A third back-up light source
   - Lug-soled, ankle-supporting boots with non-skid soles
4) Each caver is recommended to have:
   - Kneepads
   - Spare batteries and bulbs for each light source
5) For vertical caves, each caver must have their own descending and ascending gear and should be able to demonstrate their knowledge upon request. Each member of the group should be able to perform a changeover from rappel to ascent and ascent to rappel while in the middle of the rope.
   Note: Gear should not be passed up and down rope drops.
6) Dust masks should be worn in any cave containing significant amounts of dust or feces.
7) Any climb with more than 10 feet of exposure should be belayed.
8) Each group entering a park cave must have a surface contact who knows where they have gone and when they are expected back. The surface contact will call Lake Mead Dispatch at 702-293-8808 if a cave group is overdue.

Permit Package

GRBA Cave Permit #______________________

Permit Approved: Yes__________ No__________

By:__________________________Title:__________________________on: _____________

Explanation/Additional Requirements:

____

____

____

Permission is requested to enter the following cave:__________________________________

Purpose of Trip: Recreation________ Management (describe)_________________________

Date of trip: ________________________Expected Time Underground: ________________

Trip Leader: ____________________ Phone: (main)____________(backup)____________

Address: ____

Party Members:

2)____

3)____

4)____

5)____

6)____

Vehicle License Number(s):

1.) ____________________ State: _____

2.) ____________________ State: ____

Emergency Contacts (Names and Phone Numbers)

1.) ____
2.) ____

I, the signed participant, agree to the following conditions:

1.) Participants on this trip will abide by the wild cave permit restrictions and guidelines for Great Basin National Park.

2.) Those entering the cave system(s) at Great Basin National Park are doing so at their own risk.

3.) The National Park Service will not be held liable for any personal injury, damage, or death resulting from the cave trip.

4.) Participants who damage natural resources (including, but not limited to, graffiti, permanent marks, destruction and/or removal of natural and cultural resources) will be subject to prosecution under the 1988 Federal Cave Resources Protection Act and will receive penalties of up to one year in prison and a maximum fine of $10,000.

Name (Printed)	Signature	Date
TRIP LEADER.)____________	__________________________	_______________________
2.)________________________	__________________________	_______________________
3.)________________________	__________________________	_______________________
4.)________________________	__________________________	________________________
5.)________________________	__________________________	________________________
6.)________________________	__________________________	________________________

BACKGROUND INFORMATION (To be completed by *trip leader* for horizontal caves and by *each member* for vertical caves):

NAME:____

Commercial Caves/Cave Tours ____

____

____

Wild Cave Systems____

____

____

____

____

Do you have any vertical caving experience?____________
If so, please describe____

____

____

____

TRIP REPORT

This trip report is mandatory. Please return with your key or future permits will not be granted.

Cave:____

Date Entered:____

Time Entered:_______________________________________

Time Exited:____

Total Number of People who entered Cave:________________

Comments: (Please report any vandalism, cave condition, gate condition, bats or other cave biota, etc)

WNS Decon Certification

Please read the following and provide certification about the status of your gear (includes clothing, footwear, and all caving gear).

Incoming Gear

Gear that has been used in any cave, other than the one you will be entering on the current trip, must be cleaned and decontaminated before entering the cave. If gear has ever been in a WNS or *Geomyces destructans* area, it is not allowed inside any GRBA cave, regardless of decontamination.

Disinfection of Gear between Park Caves

Gear that has been used in any cave in the park must be cleaned and decontaminated before being used in any other cave in the park. See the latest decontamination protocols at:
https://www.whitenosesyndrome.org/static-page/decontamination-information

Disinfection of Outgoing Gear

Gear that has been used in any cave in the park must be cleaned and decontaminated before leaving the park.

Certification:

I, the signed participant, certify that I have read and understand GRBA procedures for minimizing the risk of spreading WNS to, from, and among the caves of GRBA and that all clothing, footwear, and gear I will be using during cave activities I am participating in is clean and decontaminated. I understand that if any gear is found that does not meet these standards, it will not be allowed into the cave and may result in revocation of permit or access.

Name (Printed) Signature Date

TRIP LEADER.)____________ __________________________ _______________________

2.)_______________________ __________________________ _______________________

3.)_______________________ __________________________ _______________________

4.)_______________________ __________________________ ________________________

5.)_______________________ __________________________ ________________________

6.)_______________________ __________________________ ________________________

Wild Caves and Karst Management Plan

National Park Service
U.S. Department of the Interior

Great Basin National Park
100 Great Basin National Park
Baker, NV 89311

www.nature.nps.gov

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

EXPERIENCE YOUR AMERICA ™