

OSI GUIDE TO ALPINE STEWARDSHIP

BEST PRACTICES FOR ALPINE TRAIL
MAINTENANCE AND RESTORATION

PRODUCED BY

Outdoor Stewardship Institute

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**Colorado
Fourteeners
Initiative**



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1: About This Guide

1.1 Acknowledgements

1.1.1 Thank You	<p>OSI would like to acknowledge the people and organizations that volunteered their time and resources to authoring, editing, producing and piloting these training materials. The majority of this information is based on pre-existing sources, including OSI Guide to Crew Leadership for Trails and Ecological Restoration, information from Leave No Trace Outdoor Ethics and resources compiled by staff from the USDA Forest Service, Colorado Fourteeners Initiative and Rocky Mountain Field Institute.</p> <p>The creation of this manual was made possible by a grant from the National Forest Foundation.</p>
1.1.2 Curriculum Committee Members of Original Edition	<p>Dan Williams, Volunteers for Outdoor Colorado; Ben Hanus, Miriam Venman-Clay, Tom Cronin, Eli Allan, Colorado 14ers Initiative; Geoffrey May, Wildlands Restoration Volunteers; Joe Lavorini, Rocky Mountain Field Institute; Loretta McElhinney, US Forest Service; John Giordanengo, Southern Rockies Seed Network; Mark Eller, Leave No Trace; Nicole Blaser, Anna Hendrick, Southwest Conservation Corps; Emily Olsen, National Forest Foundation</p>
1.1.3 Contributor Credits	<p>OSI would like to give special thanks to Eric Schwab, Loretta McElhinney, Dana Young, Mike Lara and the Colorado Fourteeners Initiative for the donation of illustrations and photographs.</p>

1.2 Purpose

	<p>The high alpine environments on Colorado's mountaintops are some of the most breathtaking and well-loved landscapes in the state. Yet their unique ecology is as fragile as it is beautiful, and with an ever-growing influx of visitors - especially on Colorado's 54 "fourteeners" - these iconic places are increasingly at-risk and require special attention when it comes to caring for and preserving these natural wonders.</p> <p>This manual was developed for sharing best practices for performing trail and restoration work in these delicate alpine environments. The information presented provides an overview of alpine ecology, the importance of following Leave No Trace principles when working in these areas, how to manage work crews and risk above tree line, and fundamental technical skills unique to working on alpine trails. The</p>
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manual is intended for any agency staff, youth corps or volunteer group performing work in alpine settings.

1.3 OSI Training Program

Guide to Alpine Stewardship is a training program offered by the Outdoor Stewardship Institute (OSI), a program of Volunteers for Outdoor Colorado. Information about OSI's other leadership and stewardship training opportunities can be found at www.voc.org.

2 : Alpine Resource Overview

2.1 Unique Characteristics of the Alpine Environment

2.1.1 Colorado's Alpine Environment

Life survives at the outer and upper extremes in the alpine environment - it has been rigorously selected and adapted to the harsh conditions that surround it. The more severe the environmental conditions, the more pronounced are the adaptations for plant and animal survival.

- Colorado's Alpine Environment
 - 3% of Colorado's landmass, 1% of lands in contiguous 48 states.
 - Wind- Recorded at over 200 mph, 75 mph gusts common.
 - Low effective precipitation: Although precipitation increases with altitude, much comes in the form of snow which is blown off the alpine by high winds.
 - Ultraviolet Radiation – Twice as much UV radiation and 25% more light than at sea level.
 - Temperature Extremes – Recorded as cold as -70° F.
 - Growing season for flora – 3 months or less.

2.2 Alpine Flora

Plant life in the alpine has many unique adaptations in order to succeed in the harsh environment. These include:

2.2.1 Chemical adaptations (Anthocyanins)

- Many alpine plants are marked with the distinctive red color of anthocyanin pigments in stems and leaves.
- Anthocyanins are a product of carbohydrates stored in the roots from the previous growing season. When rapid growth begins in early spring, part of the carbohydrate is incorporated into new plant tissue, part into anthocyanins.
- Anthocyanin production is an important factor in cold-hardiness, an essential adaptation at high altitudes. Anthocyanins are capable of converting incidental light rays into heat to warm the plant tissues. Plants which have an abundance of anthocyanins endure cold better than greener plants.
- You may see more vibrant reds during years with more sunlight and dry weather because of the increase in sugar

	<p>concentration in plants' vascular fluid, triggering the plant to release more anthocyanins in a last-ditch effort to gather up energy to get through the winter.</p>
<p>2.2.2 Short Stature (Dwarfism)</p>	<ul style="list-style-type: none"> • Almost all alpine plants are tiny in size. We often say that the best way to enjoy the alpine is to lie on your belly. This is a good way to view the tiny plants. • This small size is advantageous to alpine plants. • Keeps them both snuggled low to the ground and out of the worst of the alpine weather. • Requires less energy for the production of plant tissue so that more energy can be utilized for seed development. This dwarfing typically involves only the growth shoots (or the green part of the plant) making the flowers seem larger in proportion.
<p>2.2.3 Preformation of buds</p>	<p>Flower buds of alpine plants often begin early in the previous year's growing season, (sometimes several years before) and are usually well-formed by the end of the summer so they are safely protected before the winter sets in.</p> <p>Preformation of buds means that the buds are standing at ready to burst forward at the first sign of warming temperatures. Early flowering provides the major part of the meagre summer warmth for ripening seeds, a process which requires heat that flowering does not. The alpine has a very short growing season. The growth of the plant, as well as the setting and ripening of seeds require the warmth of summers, but with the preset bud formation, the flowering does not require the full warmth of summer. This allows the maximum time to ensure that the seeds have plenty of time to ripen thus protecting plant reproduction.</p> <p>Early growth is also made possible because of the large amounts of starches and sugars stored as carbohydrates in below-ground parts during the previous summer's growing season. Alpine plants are a little like icebergs – a tiny percentage of the plant is above the ground, much like the small percentage of icebergs that show above the surface of the ocean. Some cushion plants that are 4" in diameter are 40 years old and have a 6 foot tap root. The root not only stores the abundant carbohydrate, but also probes for deep water sources and anchors the plant against the constant winds.</p>

When the plant is dormant during the winter's low temperatures, the reserve of starches and sugars are not reduced. As temperatures warm in spring, the accumulated carbohydrates are converted for rapid growth. During this period, the plant is using its food faster than it can be made through photosynthesis and the carbohydrates stores are depleted. Many plants may even grow at a deficit until its growth is about 75-90% complete for the season, then plant growth or expansion slows and the stores are replenished. By the onset of dormancy in the fall, the underground carbohydrates are back up to the highest level of the year.

This fact gives us a clue as to the best times of the year to transplant alpine plants for revegetation purposes.

Transplant during the spring and fall when the roots contain substantial carbohydrate stores, helping the plant establish itself. This will help the transplant fight the stress of being moved and being exposed to the elements (even briefly).

2.2.4 Perennial Growth Forms

Most alpine plants are perennial.

- A perennial plant lives more than two years.
- An annual plant germinates, flowers and dies in one year.

Being perennial is advantageous for alpine plants. With the short growing season, it would be very difficult for a plant seed to germinate, produce stems, leaves, flowers and produce viable seeds for a new crop of plants within a single growing season. A perennial plant can just add to what is already established, depending on a stable root system. They are also able to survive without flowering if the season is particularly bad. In the alpine some plant are ten to fifteen years old before they ever flower.

Figure 1: The Old Man of the Mountain/Alpine Sunflower (*Hymenoxys grandiflora*) typically spends its first 6-8 years of life producing only leaves and storing reserves in its thick underground root. Unlike sunflowers at lower elevations (annuals), the alpine sunflower compensates for the short, cold winters by being a long-lived perennial. Photo by Mike Lara



2.2.5 Leaf and flower orientation

There are whole habitats that exist in the alpine environment known as cushion plant communities. These plants are the perfect example of leaf and flower adaptations in alpine plants. These small low growing mats allow the wind to flow over them much as wind over an airplane wing. At the same time, there is maximum exposure of leaf surface for photosynthesis. Temperatures are often several degrees higher on the inside of a cushion plant than on the outside, the colder it is outside, the greater the difference. The outer parts of the cushion slows the impact of the wind on the inner part and reduces its drying effect. The tightly packed branches also allow the plant to catch blown in dirt which together with old leaves, absorbs moisture and contributes to soil building and stabilization.

Figure 2: Big-Rooted Spring Beauty (*Caytonia megarhiza*).
Photo by Loretta McElhiney



Radial Symmetry or “rosette growth” like the Big-Rooted Spring Beauty may be even less exposed to desiccating winds than a cushion plant since it may be flatter to the ground. It grows in the warmer air at the soil’s surface, receiving direct sunlight as well as reflected heat from beneath. There is little or no vertical separation between the leaves, thus a happy balance is attained between the greatest exposure to light and the least exposure to cold, wind damage and drying. Water coming from the roots has the shortest possible distance to travel to the leaf tips.

Radial Symmetry is also especially efficient for plants whose moisture, lights and nutrients come from all directions. In the alpine, there are no trees or large shrubs to shade or to commandeer soil moisture.

2.2.6 Nonflowering Plants

- Lichens, mosses, and clubmosses all have minimal requirements for survival.
- Lichens
 - Formed from a fungus and an alga; fungus forms tough outer layers while the inner layers contain algal cells enmeshed in fungal threads.
 - Sponge-like ability to absorb more than their own weight of water after a spell of dry weather.
- Mosses

	<ul style="list-style-type: none"> ○ Mosses too are sponge like. Mosses curl their leaves tightly against the stem when dry (like in the first picture), unfolding them to absorb moisture through the whole leaf surface during rain or heavy dew. ○ Mosses are non-vascular plants that absorb water and nutrients mainly through their leaves and harvest carbon dioxide and sunlight to create food by photosynthesis. Mosses reproduce using spores, not seeds and have no flowers.
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2.2.7 Grasses & Sedges	<p>Grasses and sedges have narrow leaves and stems, which helps them resist strong alpine winds</p> <p>Grass flowers are reduced to the essentials – no bright petals or cupped sepals, just reproductive parts enclosed in a simple protective envelope.</p>
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2.3 Alpine Fauna

	<p>Animals have also adapted to the harsh alpine climate.</p> <ul style="list-style-type: none"> • Life cycles may be stretched over several seasons, larval stages being accomplished over several summers instead of a month. • The size of litters or broods produced in summer is reduced, usually to one. • Maturation at a quickened rate. <p>Physiological adjustments may occur in metabolisms that make it possible to remain either part or all of the year in this rigorous environment.</p>
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2.3.1 Insects	<p>Black flies, mosquitos, grasshoppers, ladybugs.</p> <p>Insects are extremely important as pollinators on the tundra. Especially flies. At lower altitudes bees are the primary pollinators, but bees are immobilized at temperatures below 50 degrees F. With their lower energy requirements and ability to work under restricted condition, flies assume considerable importance in the alpine region.</p>
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2.3.2 Reptiles & amphibians	<p>The summer is so short and the temperatures stay cold enough that cold blooded reptiles or amphibians cannot live in the alpine. During</p>
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	<p>the summer you may find a western terrestrial garter snake or tiger salamander. But that is very rare.</p>
<p>2.3.3 Birds</p>	<p>The number of birds on the alpine tundra is relatively small.</p> <p>Ptarmigan (Figure 3) are the only birds that lives on the tundra all year.</p> <p>Adult ptarmigan sit out a storm in relative security, they typically nestled in the snow in a group, so individuals lose little of their body heat. In a tight circle, they expose even less surface in proportion to mass. In addition, ptarmigan’s legs and feet are so heavily feathered in the winter that they look like they are wearing pantaloons, giving both foot-warmth and snowshoes to cross the snow.</p> <p>Figure 3: White-tailed Ptarmigan (<i>Lagopus leucura</i>). Photo by Loretta McElhiney</p> 
<p>2.3.4 Large mammals</p>	<p><i>Mountain Goats</i></p> <p>There is no evidence that mountain goats (Figure 4) inhabited Colorado during historical times, and they should be considered non-native to the state. Likewise, most authorities consider mountain goats to be an introduced species in Colorado.</p>

Figure 4: Mountain Goats (*Oreamnos americanus*) on Mt. Eolus.
Photo by Dana Young



Mountain Goats are herbivores and seek high altitudes to avoid predators. Their hooves are adapted to the rugged slopes by being flexible, like rubber, so they can jump from rock to rock. Mountain goats have thick white fur to keep them warm in the winter and shed one of their layers during the warmer summers. The skeleton of a mountain goat is arranged such that all four of its hooves can fit on a ledge only 6 inches long and 2 inches wide! That's smaller than a dollar bill!

Mountain goats are not goats. They are more related to antelope and are part of the Bovidae family. Males are called billies, females are called nannies, and babies are called kids. The mountain goat changes its social groupings seasonally. They live in big groups in the winter, and smaller groups, or alone in the summer. The male goats are dominant during breeding season. However, during the non-breeding season, the adult females are dominant. Mountain Goat hierarchies are determined early by the kids' playing behavior. The stronger more dominant kids become the leaders of their group.

Based on observations of interactions between mountain goats and Rocky Mountain bighorn sheep, mountain goats are often the more aggressive and dominant species and appear to be capable of displacing bighorns. They have sharp horns that can puncture the side of other goats or even bighorns. They can also be quite

aggressive to humans so try to keep your distance as they will help themselves to your food!

Bighorn Sheep

Key elements of suitable bighorn habitat include steep, broken terrain, which serves as escape cover, and vegetation types that provide high visibility and forage such as grasslands and alpine tundra. Bighorns (Figure 5) are primarily grazers, but also consume browse (woody substances). It has special hooves, an excellent sense of balance, and strong legs that help the bighorn climb the steep, rocky mountains. They are not well adapted to deep snow, therefore winter snow pack can limit distribution and survival. Their digestive system acts as a survival mechanism. A complex, four-part stomach allows sheep to gain important nutrients from hard, dry forage. They eat large amounts of vegetation quickly and then retreat to cliffs or ledges. Here they can thoroughly re-chew and digest their food away from possible predators.

Lambs are born April through July, with the peak in late May and early June. A single lamb is the norm. Lambs can climb as well as their mothers when they are only a day old. Ewes usually live to be 10 to 12 years old. Rams seem to have a somewhat higher mortality rate.

In the fall, the rams compete for ewes by having butting contests. They charge each other at speeds of more than 20 mph, their foreheads crashing with a crack that can be heard more than a mile away. These battles may last as long as 24 hours. **A Rocky Mountain bighorn ram's horns can weigh 30 pounds (14 kilograms) - more than all the bones in his body combined.** Females (ewes) also have horns, but they are of smaller size.

Figure 5: Rocky Mountain Bighorn Sheep (*Ovis canadensis*) on Kit Carson.
Photo by Loretta McElhiney



The development of Colorado's high country increasingly blocks bighorn migration, weakening herds by denying them genetic diversity.

2.3.5 Small mammals

There are significantly more small mammals that remain in the alpine year round. They survive the winter by storing food, hibernation, or incessant hunting.

Pika

Pika (Figure 6) are small members of the rabbit family. Their ears have diminished in size to small round ones that are not as likely to freeze. In addition, they have fur on the soles of their feet, a nonskid device aiding their purchase on precipitous rock surfaces.

Pika dens are often discovered by the stacks of hay at the doorstep. Pika begin preparing food for the winter by mid-July and continue until all available food is snow covered.

Pika gather inordinate amounts of Alpine Avens because those same anthocyanins help to prevent mold and bacterial growth in their food stores. Until Alpine Avens are completely dry, they are poisonous to Pika.

Figure 6: American Pika (*Ochotona princeps*).
Photo by Dana Young



Pika have been observed to be active during every month of the year and there is no evidence that they hibernate. They have to spend the months of July thru September storing enough food for nine or ten months. A Pika's vegetarian diet is not high in calories and they must fill their stomach almost hourly to meet their energy needs. During the long alpine winter this can be a challenging proposition. In order to obtain maximum food value, Pika, like rabbits, are able to reingest their fecal matter, which is high in protein content and energy value.

Pika also preserve body moisture in dry climates by depositing almost crystalline uric acids, leaving a white nitrogenous salt deposit on boulder surface.

Pika females will give birth to a litter in the spring. She will immediately get pregnant again and if that first litter does not survive (predation, cold, disease), she will deliver the second. If the first litter does survive, her body reabsorbs the fetuses.

Marmots

Marmots (Figure 7) like ptarmigans are comparatively large animals. Relatives of the woodchuck, marmots eat themselves FAT in the summer and hibernate all winter, body temperatures sinking almost to 32 °F. They emerge in late spring, sprawling on a warm rock surface in what seems to be blissful enjoyment of sunshine and warmth.

Figure 7: Yellow-bellied Marmot (*Marmota flaviventris*).
Photo by Loretta McElhiney



2.4 How is This Information Useful for Trail Work?

Although all of these plants and animals have adapted well to their harsh environment, they have not adapted well to the presence of humans and especially the large numbers who seek out the 54 highest points in Colorado known as the Fourteeners.

It is amazing how many times you will hear hikers say “the trail is slick, I’m just going to walk on the grass.” Maybe you will have a volunteer who doesn’t understand why we can’t broadcast our waste soil, or stand off the trail to cut tread. Now you have the knowledge to explain, that it really isn’t just grass like we have in our neighborhood parks. These plants, insects, and animals live at the outer and upper extremes in the alpine environment because they have been rigorously selected and adapted to the harsh conditions. But they have not adapted to the presence of humans. We need to recognize that we are visiting their home and take care not to destroy it.

Stay on trails and durable surfaces – **Five footsteps** can be enough to kill some alpine plants.

Keep your distance from wildlife.

Keep dogs on a leash.

Never feed the wildlife.

Keep voices low so that others can experience the joys of nature.

Carry out human and dog waste from the alpine environment. Alpine plants will die within weeks if shielded from sunlight by litter.

And in the words of the Lorax, *"Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."* (Dr. Seuss)

2.5 Wilderness Character and Regulations



Many of the alpine environments in Colorado are part of designated, "Big W" Wilderness areas. In 1964, Congress established the National Wilderness Preservation System under the Wilderness Act. In accordance with this act, federal land management agencies preserve the wilderness character and natural condition of these lands and provide opportunities for primitive recreation.

Wilderness areas are intended to be places where undeveloped nature takes precedent, where, according to the Wilderness Act of 1964 "the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain."

Agencies such as the US Forest Service put specific management objectives and regulations in place to meet the requirements of the Wilderness Act. Anyone recreating or working in Wilderness should be aware of the following:

- No mechanized equipment.
 - Wilderness regulations prohibit the use of motorized equipment or mechanized transport. This means no vehicles, chainsaws, generators, or other automated tools, no mountain bikes, game carriers, or wheelbarrows.
- Group size limits.
 - There are often group size limits in Wilderness. Most Wildernesses have a group size limit of 15 persons in any one group or a combination of 25 people and pack or saddle animals in any one stock group.
- Leash Laws

-
- Leash laws are common in Wilderness. Dogs are to be under the physical restraint of a leash. There is an exemption for working stock dogs or dogs used for legal hunting purposes.
 - Registration and Permits
 - While not required in all areas, registration is strongly advised. In some Region 2 (R2) wildernesses registration is required and will be posted at the wilderness trailhead, and – currently, R2 has two wildernesses where overnight camping is limited by a permit system (the Indian Peaks Wilderness and the Maroon Bells-Snowmass Wilderness).
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3: Leave No Trace for Alpine Environments

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3.1 Introduction

Alpine wildlands are diverse and beautiful. They are also fragile. Many undesirable impacts in alpine areas such as Colorado's Fourteeners can be directly linked to recreational activities. Much of this damage could be prevented or minimized by practicing Leave No Trace techniques.

Leave No Trace is an internationally known education program. The program revolves around seven principles: Plan Ahead and Prepare, Travel and Camp on Durable Surfaces, Dispose of Waste Properly, Leave What You Find, Minimize Campfire Impacts, Respect Wildlife and Be Considerate of Other Visitors. Designed to reduce the damage caused by recreational activities, these principles can be applied anywhere, whether you are in an alpine setting or a city park.

Unfortunately, many popular mountain ranges have been heavily impacted by recreational use. In the worst cases, trails braid their way across meadows, campsites are barren, fire rings dot the lakeshores and non-native plants overrun trail corridors. Many of these impacts could have been reduced or eliminated through careful traveling and camping. You can help minimize future impacts on the lands you love by knowing and practicing Leave No Trace techniques.

3.2 Plan Ahead and Prepare



High mountain environments can be extremely hazardous and demand physical and mental preparation to recreate or work in safely. Build Leave No Trace into your plans by picking a destination that is appropriate for your group and by allowing yourself plenty of time to travel and camp with minimal impact to the land, wildlife and others. Be prepared to sit tight or turn back when you experience inclement weather, sense danger or sustain an injury. Other considerations include:

- Gather information about your destination and activity.
- Follow regulations for allowable group size and obtain needed permits.
- Communicate expectations within your group.
- Check the forecast and bring the proper equipment including appropriate water resistant layers, footwear, enough food

and water for your planned trip and any technical gear needed such as crampons and ice axes.

Alpine Tip: When planning group activities in alpine areas, always inquire about group size limitations in advance. Recreation managers or visitor center staff can fill you in on pertinent regulations and suggest destinations suited to your needs.

3.3 Travel and Camp on Durable Surfaces



What effect does a footstep have? The answer is, it depends. A footstep means different things to meadow grass, a gravel riverbank or an alpine flower.

Durable surfaces are surfaces that are minimally affected by camping and hiking. They include rock outcrops, sand, gravel, trails, dry grasses, snow or water. They are places with little or no vegetation or areas where your tracks will be wiped clean by melting snow or high water.

Vegetated lakeshores and the banks of small streams are fragile and easily eroded. Animals need access to water and may be frightened away if you are camped too close to their traditional source. Camping near water can also lead to accidental contamination by wash water, food scraps and human waste. For these reasons, it is imperative that you camp at least 200 feet (70 adult steps) away from water sources.

Alpine Tip: In highly used areas, durable surfaces are typically manmade, such as a trail. Concentrating use on these surfaces minimizes disturbances to soils and vegetation.

Do not camp in alpine tundra. Rather, always set up campsites below tree line. Camping within trees ensures less exposure to the elements and limits harsh impacts to fragile alpine vegetation.

3.4 Dispose of Waste Properly

“Pack it in, pack it out” is a familiar mantra to seasoned wildland visitors. Every user of recreation lands has a responsibility to clean up before he or she leaves. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash and garbage, including all of your leftover food. Otherwise conscientious people sometimes leave items like banana peels or orange rinds behind with the mistaken

belief that they will rapidly decompose. In fact, these items can remain intact for several years, creating a visual blight and adding an unnatural element to the landscape.

Human waste is especially problematic in sensitive environments. The four objectives of proper human waste disposal are:

- Avoid polluting water sources.
- Eliminate contact with insects and animals.
- Maximize decomposition.
- Minimize the chances of social impacts.

Improper disposal of human waste can lead to water pollution, the spread of illnesses such as giardia, and unpleasant experiences for those who follow.

In sub-alpine areas, digging a cat hole at least 6 inches deep is usually the best method for properly disposing of solid human waste. However, in alpine environments, there is often not enough soil for cat holes, and the arid, cold environment limits their effectiveness. Instead, the preferred method—and one that may be required by land managers in some alpine areas—is to pack out solid human waste.

Liquid waste can also impact the alpine world. The salts in urine will attract animals, so it's a good idea to seek out a barren or rocky place to pee—otherwise, small critters may destroy fragile plants that they would usually ignore. Similarly, be careful to dispose of cooking water and other wastewater at least 200 feet (70 adult paces) from streams or lakes.

Alpine Tip: To deal with solid human waste, a good option is to use a commercial device designed for the job, such as a WAG Bag. As noted above, in some alpine areas visitors are required to pack out all solid human waste—these products provide an easy-to-use solution, including puncture-proof storage and chemical agents that eliminate odors.

3.5 Leave What You Find

People visit wildlands for many reasons, among them to explore nature's mysteries and surprises. While many visitors are offended by finding litter in these wild areas, ecologists, botanists, archaeologists and other scientists are actually more concerned about impacts that impair the function of natural ecosystems, affect rare species or destroy the historical record.

Discovering evidence of the past such as old trappers' cabins, rock art or antique glass is exhilarating, and you may be tempted to take home souvenirs. But on public land, such structures and artifacts are protected by the Archaeological Resources Protection Act and the National Historic Preservation Act and should not be disturbed. These include seemingly insignificant potsherds, arrowheads, logging or railroad equipment, even trash dumps from 50 or more years ago. It is illegal to excavate, disturb or remove these resources from any public lands. Observe but do not touch them.

Alpine Tip: For Native American tribes across the Rocky Mountain Region, some places and objects found in the wild hold profound sacred meaning in their religious beliefs and ceremonies. You may stumble upon circles of rocks forming medicine wheels or old tipi rings while out in the mountains. The cultural value of these sites can be damaged or destroyed by careless behavior. Avoid camping near rock art panels, historic structures, rock alignments, ruins and scatters of chipped stone or potsherds. Show respect for Native American culture and leave these objects where you found them.

3.6 Minimize Campfire Impacts

The natural appearance of many recreation areas has been compromised by the careless use of fires and the demand for firewood. Campfires are beautiful by night. But the soot-scarred fire rings—often overflowing with ashes, partly burned logs, food and trash—are unsightly by day. More importantly, campfires can and do ignite wildfires.

Carry a stove, pot, matches and sufficient fuel to cook all meals. Build fires only when conditions are right—the danger of wildfire is low, dead and downed wood is plentiful, and there is sufficient time to prepare the fire site, burn all the wood to cold ash, and clean up so the next visitors can enjoy an unspoiled view.

Alpine Tip: Fires are inappropriate in fragile environments where plant growth is extremely slow. In some alpine areas they are banned entirely, and for good reason. For example, wood from arctic willow or alpine krummholz, which may be hundreds of years old, will burn only a few short minutes. In those few minutes, you destroy habitat and rob the environment of critical nutrients.

3.7 Respect Wildlife



Encounters with wildlife inspire tall tales and long moments of wonder. Unfortunately, wildlife around the world faces threats from loss and fragmentation of habitat, invasive species, pollution, over-exploitation, poaching and disease. Protected lands offer a last refuge from some, but not all, of these problems. Consequently, wild animals need recreationists who will promote their survival rather than add to the difficulties they already face.

Some important guidelines to keep in mind include:

- Always watch or photograph animals from a safe distance to avoid startling them or forcing them to flee. Do not follow or approach them.
- Don't disturb wildlife (i.e. by shouting to get their attention) to get a better photo.
- Don't encircle or crowd wildlife, or attempt to pick up a wild animal. Young animals, removed or touched by well-meaning people, may be abandoned by their parents.
- Notify a game warden if you find an animal in trouble. Often these animals are sick or injured and should be left alone to reduce the risk of spreading disease.

Never feed wild animals—feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers. Headlines are made when wildlife is attracted to humans and their food. Bears get the most attention for tearing into tents, coolers and cars in search of a meal, but in reality, rodents and birds are probably going to be the wildlife you have the most interactions with while camping in the mountains. These animals pose little threat to human safety, but their presence can be a nuisance, they can be vectors for disease, and their reliance on human food is a detriment to their own well-being.

Dogs may not be allowed in alpine areas—be sure to learn about and abide by the regulations regarding pets for each location you visit.

Alpine Tip: Alpine fauna are mostly made up of small, ground dwelling species not used to canine-like predators, so it's important to keep dogs leashed. This is not only for the safety of the wildlife, but also for the protection of pets as wild animals can carry disease such as rabies.

3.8 Be Considerate of Other Visitors



Today, we must share wildlands with people of all recreational persuasions. There is simply not enough country for every category of enthusiast to have exclusive use of trails, lakes, rivers and campgrounds. Yet the subject of outdoor etiquette is often neglected. Outdoor recreationists are reluctant to examine their personal behaviors, least of all in wildlands where, to many, a sense of freedom is paramount.

Respect other visitors and protect the quality of their experience. Even remote wildlands are under increasing use pressure. Chances are that you will run into other visitors when you travel through the mountains. Some people visit wildlands to enjoy quiet and solitude. Others come for camaraderie. Some come for the adventure of climbing, others for the relaxation of fishing. People are looking for a variety of things from their wilderness visit, and your presence affects the quality of both their experience and yours.

Alpine Tip: Simple courtesies such as offering a friendly greeting on the trail, stepping aside to let someone pass, waiting patiently for a turn or preserving the quiet, all make a difference. On steep and strenuous mountainous trails it's especially important to afford the right of way to the uphill traveler whenever possible. Recreators should also compromise when they can. For example, you may enjoy listening to music while hiking, but others seeking quiet and solitude would have their experience impacted by this. Simply using earbuds or headphones would allow for both a music listener and a solitude seeker to enjoy the alpine the way they want to.

4: Alpine Risk Management

4.1 Introduction

The term “risk” includes three concepts: the hazard, the possible outcomes, and the likelihood. A hazard is a situation that can cause harm to a person. An outcome is the resulting injury due to a hazard. The likelihood describes the level of probability of the outcome.

For example, one of the possible risks of standing in front of the group to teach this course is that the instructor could step on a loose rock (hazard) and sprain his or her ankle. The instructor may experience pain, need to go to the doctor, and could even miss a paid work day (outcomes). However, the likelihood is low.

Once we understand the risks of any particular activity, we can think about how to mitigate, or lessen the likelihood of each. If the severity of the outcome and the likelihood are both low, we may choose to do nothing to mitigate the risk. But if the severity is high (even if the likelihood is low), we will probably choose to take some mitigation action. For example, when operating a vehicle on icy winter roads, an accident could cause death for the driver. Although the likelihood is relatively low, the severity is high: we will both adhere to safety standards already in place (following the rules of the road, wearing our seatbelts) and implement some new ones ourselves (driving slowly and cautiously.)

A Hazard is defined as the “potential for harm.” In practical terms, a hazard is an unsafe act or unsafe condition that, if left uncontrolled, can result in an injury or illness.

Risk Assessment is the qualitative and quantitative estimate of risk associated with various aspects of a trail maintenance project and should be completed and reviewed before performing trail maintenance. The risk assessment process should also be internalized and practiced continuously by Independent Stewards while working on the trail. Most agencies and organizations will have a formal Risk Assessment form that volunteers must complete prior to performing trail maintenance. In addition to the information presented in this section, a common risk assessment form, called a Job Hazard Analysis (JHA), can be found in Appendix A of this manual.

An Emergency Plan should be in place for each day you are on the trail. The object of this plan is to provide volunteers with the information to adequately respond in the event of an accident or

emergency. The plan may consist of the following elements: communication, medical response, evacuation, and follow-up. The sponsoring agency or volunteer organization may already have a plan in place. If available, obtain a copy and carry it with you. An example of an emergency plan can be found in Appendix B of this manual.

Personal Protective Equipment (PPE), such as gloves, boots, hardhats, safety glasses, hearing protection, long sleeves and pants, must be used as appropriate for the task or if required by the sponsoring agency or organization.

Risk management is a cognitive process of identifying, assessing, and mitigating risks or hazards. A risk assessment can provide a systematic approach that allows the ranking of risks. The level of risk is determined by three factors:

1. What is the Hazard?
2. What is the likelihood that the Hazard will occur?
3. What is the severity of the potential outcome of the Hazard?

Once you have identified and assessed the hazards of an activity, you can think about how to mitigate or lessen the likelihood or probability of severe consequences by developing abatement actions or controls and making decisions about how to implement them. The decisions should be reevaluated and revised as needed if the situation or conditions change.

4.2 Alpine Job Hazards

Work in Alpine environments comes with many specific hazards. High altitude, rugged terrain, physical labor and remote locations all create a unique blend of risks that those working in these environments need to be able to assess and mitigate. The following is a list of specific examples to be aware of:

4.2.1 Altitude

Working at high altitudes of 8,000 feet or more can exacerbate risks commonly associated with outdoor labor, many of which are included in this section. Individuals performing physical tasks may experience the onset of symptoms such as dehydration and fatigue much faster than normal at high elevation. In addition to maintaining hydration, carrying extra food and taking rest breaks as

	needed, learn to recognize signs of altitude sickness such as dizziness, fatigue and headaches.
4.2.2 Dehydration	Always carry adequate water and stay hydrated. At least 2 liters per person, is recommended per day.
4.2.3 Hypothermia	Come to the project adequately prepared with warm clothing. Warm-when-wet materials such as wool and thermax are some of the best types of clothing. Be sure to carry to the work site several layers (including a warm hat and gloves), rain gear and a complete set of dry clothing. It is not uncommon to have snowstorms in the area during any month of the year.
4.2.4 Lightning	Conditions change quickly in the mountains and afternoon thunderstorms are common. Plan to be off high, exposed ground by early afternoon. If caught in a lightning storm, drop everything and move immediately to lower sheltered ground.
4.2.5 Lightning	Conditions change quickly in the mountains and afternoon thunderstorms are common. Plan to be off high, exposed ground by early afternoon. If caught in a lightning storm, drop everything and move immediately to lower sheltered ground.
4.2.6 Protecting the Public	When performing maintenance on any trail that is open to the public, how to successfully manage trail users in a work zone and protect them from harm is an important consideration. Posting signs informing hikers that they are approaching a work area, or stationing spotters to halt and inform the public of hazardous situations can help raise their situational awareness. Crews should take precautions to avoid creating rock fall. If a rock becomes dislodged, warn anyone who might be below by yelling continuously and as loud as possible "ROCK, ROCK, ROCK!" And point at the rock until rock comes to a complete stop then yell "CLEAR."
4.2.7 Rock Slides and steep terrain	You may be working on steep talus slopes. Natural rockfalls are common. Heavy, sturdy, lug-sole boots are a must for preventing ankle and foot injury due to falling rocks. If you hear the "ROCK!" warning quickly identify the rock and watch it, moving out of its path. Never move blindly.

4.2.8 Snowfields	Colorado has some beautiful year-round snowfields. Although beautiful, they can be dangerous. If any new snow falls, they are apt to slide. Take precautions if you must cross a snowfield.
4.2.9 Giardia	Perhaps one of the most common yet avoidable backcountry threats is Giardia. Giardia is a parasite found in most lakes, streams and rivers of Colorado. Your best protection is not to drink water from these sources. If you plan to drink this water, however, use a water filter or iodine tablets for all your drinking water. You can also bring the water to a rolling boil for at least five minutes to ensure all the parasites have been killed.
4.2.10 Wildlife Encounters	Make sure your presence is known in the backcountry to avoid surprising wildlife. Store food, garbage and toiletries properly. If you are hypersensitive to insect stings, be sure to inform others you are working with and carry medication if your physician recommends it. Wear insect repellent and check clothes frequently in tick country.
4.2.11 Working Safely with Rock	Rocks are useful for building trail structures and are a common feature in alpine trail work. They are heavy, inanimate objects that obey gravity. Not surprisingly, many injuries can occur when performing rock work. Gloves, sturdy work boots and long pants should be worn when working with rock. Always wear safety glasses when chiseling, hammering, or trimming rock.

4.3 Job Hazard Analysis and Safety Talk

A Job Hazard Analysis or safety talk should be conducted with a work crew before performing any tasks for the day. Frequently, Land Management Agencies will require that a specific Job Hazard Analysis (JHA) form is reviewed before work begins. An example JHA can be found in the appendix of this manual. If no JHA is provided, the following checklist paired with the topics listed in section 4.2 can help to organize an appropriate safety talk.

- If working with volunteers, have all individuals completed a liability waiver or volunteer agreement as required?
- Make sure everyone has appropriate Personal Protective Equipment such as boots, clothing, eye and ear protection, helmet and gloves.
- Does everyone have lunch and enough water?

-
- Does everyone have sun protection (hat, sunscreen, sunglasses, and lip balm?)
 - Discuss the project goals, specifications, and context.
 - Specify the length of hike and type of work to be performed.
 - Explain any site- or project-specific hazards.
 - Ask that persons with specific health concerns notify you about them in advance. Some items you should know about include: back problems, allergies (insect, plant, and medication), diabetes, heart and lung problems, epilepsy, and other serious physical conditions.
 - Ask if anyone has emergency medical training. Ask if anyone is certified in CPR or Wilderness First Aid. Establish primary and secondary medical chain of command within the stewards.
 - Explain the daily safety plan and the chain of communication for the project. If available, select someone to act as an alternate leader to start the safety plan process should you become incapacitated.
 - Explain "Coming Through!" or "Bumping By" and practice it at all times.
 - Demonstrate why safe working distances are important. Be sure that people working near a hazard (chipping stone, lumber cutting, etc.) stay at a safe distance and are wearing eye and/or ear protection.
 - Hardhats should always be worn if there is any risk of head injury or if required by the agency.
 - Demonstrate how to lift with the legs and not with the back. Get help and/or tools to move heavy objects or leave the situation and report it later.
 - Reiterate through the day the need to drink water, even when they may not be thirsty (try to drink water every 15-30 minutes). By the time you feel thirsty, you may already be dehydrated. Enforce water breaks by taking them throughout the day.
-

5 : Working in the Alpine with Minimal Impact

5.1 Introduction

The following is to be used as an educational tool, field guide, and reference on how to construct and/or maintain trail in Colorado's alpine with the least amount of impact to the fragile communities that exist there. This information has been compiled by Colorado Fourteeners Initiative senior field staff with over 40 years' experience collectively building trails, along with many of CFI's long-time partners.

Following the guidelines in this section should help set you and your crew up for success. Building trail is not something easily conveyed on paper or in the classroom. You will often run into unfamiliar situations as working in the field constantly presents new challenges. In these instances, stop, think, and **USE YOUR BEST JUDGEMENT**.

5.2 Crew and Worksite Management

When overseeing crews in an alpine environment, the typical standards for crew management apply albeit with some additional considerations. In many ways, trail projects in high mountain settings are similar to those in lower elevations. The primary premise of building sustainable trails that work in harmony with the environment and provide an enjoyable recreation experience remains consistent. However, the alpine presents its own set of unique challenges that must be considered by crew leaders. Alpine projects are remote, high elevation, are highly variable climatically, and steep in gradient. Work crews also have a responsibility to protect hikers moving through their work sections. These factors combined necessitate additional skills for effective, responsible crew management.

5.2.1 Tools for the Alpine

Trail and restoration work in the alpine is similar to projects completed in other environments, however there are a few additional tools that can prove invaluable in working above treeline.

Rock Moving Devices (austins, rock nets and slings)

As rock will be the main material for structure building in Alpine environments, Crews should ensure enough rock moving devices are available and that all crew members are familiar with their safe and appropriate use.

Mini-pick

A mini pick is a hand-held tool similar in functionality to a pick mattock. It is extremely valuable in rock work, where it can be used in confined spaces to excavate and fine-tune foundations for rock structures.

Dirt bags/Tarps

Dirt Management is critical in the Alpine, and crews need to bring along tools for storing and moving waste material. Light, flexible canvas bags and tarps are often more practical than buckets, especially when travelling long distances on foot.

Rock shaping tools

Though the best option is usually to make your hole fit your rock, rather than shape the rock to fit into a specific space, quick trimming and shaping of rock using chisels and other tools can occasionally help create the right fit when piecing together structures. Be aware of time taken. If a crew member is spending too much time (more than a few minutes) trying to shape a rock, it's best to go rock shopping for something different.

5.2.2 Communicate with and protect trail users

Effective communication is imperative to a safe and successful project. Communication with trail users can help to ensure a safe working environment, while also helping to inform the public about the importance of Leave No Trace principles and to promote a stewardship ethic. Here are some suggested ways of protecting and communicating with trail users:

- Post temporary signs at your worksite, basecamp or at the trail head.
 - These signs make trail users aware of your presence, can be representative of your organization or could provide more detail about the project.
- Post a spotter.
 - When your project site is in an area that poses risks to trail users above or below, use a spotter to stop trail users until given an "all clear" indication from the trail crew.
- Take opportunities to educate trail users.

	<ul style="list-style-type: none"> ○ Talk to hikers about who you are and what you're doing, and discuss items such as the importance of staying on the trail etc..
<p>5.2.3 Site Selection</p>	<p>When planning trail and/or restoration work in an Alpine setting, many considerations must be taken into account.</p> <ul style="list-style-type: none"> ● Group size <ul style="list-style-type: none"> ○ <i>The scope of the work depends directly on the size of the volunteer group.</i> ● Group competence <ul style="list-style-type: none"> ○ <i>Does your group have the skills necessary to accomplish required tasks?</i> ● Availability of materials needed <ul style="list-style-type: none"> ○ <i>Can you source materials onsite, or will they require mobilization to the work area?</i> ● Evaluate hazards for the safety of BOTH hikers and trail crew <ul style="list-style-type: none"> ○ <i>See Risk Management Section</i> ● Consider the total net gain <ul style="list-style-type: none"> ○ <i>Are your efforts and presence at any particular worksite going to cause more resource damage than they are good?</i>
<p>5.2.4 Managing your worksite for minimal impact</p>	<ul style="list-style-type: none"> ● Tool, Pack, and Body Placement (Breaks/Lunch, Etc.) <ul style="list-style-type: none"> ○ Establish an area to stash packs, gear and tools on stable, durable surfaces outside of the trail corridor. ● WALK ON ROCKS whenever possible. ● Communicate amongst each other when moving thru shared work spaces to STAY ON THE TRAIL. ● CHECK your site, before you WRECK your site! <ul style="list-style-type: none"> ○ Actively clean-up and manage your worksite throughout the day to minimize impact. ● KNOW BEFORE YOU GO. <ul style="list-style-type: none"> ○ Have a purpose and/or destination whenever it is necessary to walk across tundra. ○ DIRT MANAGEMENT is Extremely Important.

- NO Broadcasting soil in the alpine.
 - Temporarily store soil in dirt bags; on tarps, or in the existing tread.
- ALWAYS KEEP EXCAVATED SOIL OFF TUNDRA.
 - Alpine plants will die within days if shielded from sunlight.
- Upon completing project if you have residual soil to get rid of consider the follow options in the order below:
 - A. Can it be used for restoration?
 - B. Can it be used in another structure?
 - C. Should it be saved for future use?
 - D. Spread it on the existing trail
- However, be mindful of the trail grade and what is below where you are placing the soil. [e.g., will the soil wash down and inundate a staircase below it during the next rain event?] Additionally, do not lay the soil in such a way it will turn the trail into a mud pit. Hikers will then walk out onto the tundra to avoid the mud.
 - E. Hike it out of sight and place it in crevices in talus

5.3 Trail Construction, Maintenance and Restoration Techniques

Performing trail construction and maintenance in Alpine settings requires specific techniques to be used in order to protect the surrounding resource from damage. This section details specific techniques to be used above tree line.

5.3.1 Considerations for quarrying materials safely, with minimal impact

What is Below You?

- Often in the alpine we are working on very steep slopes. Before starting to move a rock assess what is BELOW you
 - especially hikers on the trail, co-workers, etc.

Communicate

- CLEARLY communicate your intentions to those with whom you are moving the rock, and anyone that may be working below BEFORE moving anything.

Consider every rock before moving it

- Rocks provide habitat for alpine flora and fauna. Where rocks are scarce, they may provide a specific microclimate necessary for a particular plant species to thrive. In talus fields, rocks provide shelter for Pika, marmots, and other wildlife.

No Trundling!

- Never let a rock fall unassisted downslope.
- Out-of-control objects are one of the greatest risks on alpine projects!

Rolling and/or flipping vs. rock netting?

- If avoidable DO NOT roll (or flip) rocks over tundra and fragile plants, instead net them.
- Carrying netted rocks is an effective means of utilizing volunteer "(wo)manpower" and a great way to get everyone involved.
- Rolling or flipping rocks through talus and over bedrock is perfectly acceptable and often more efficient.

5.3.2 Sourcing rocks for construction

- Source your rocks from ABOVE you whenever possible!
- Choose rocks appropriate to your project/structure (Figures 8-9)

Check Step:

- At least two flat sides, clean face, smooth stepping surface, ~8-12" rise, ~18"+ run, no fractures, fine grain granite is best

Gargoyles (Cribs):

- Medium-Large, Angular, Pointy, Menacing stones that will funnel hikers through the center of your structure
- Consider the "contact" with your step when looking for gargoyles
- Whenever possible choose rocks with Lichen

Check Dam:

- Aesthetic qualities are less important
- Maximum soil retention is MOST IMPORTANT!

- Ideally find a rock that is about ~6in wider on either side than the eroded trail it will be placed
- However, this is a fine balance. Keep in mind "the more it goes out, the more it blows out!"

Backwall:

- Think bricks thru shoeboxes as far as size and shape

Figure 8: A few types of rocks you might encounter while rock shopping. The best rocks are almost perfectly rectangular (excellent), but you will find most have some minor irregularities can be accommodated (good). However, some rocks have such irregular shapes (poor) and/or are too thin (bad) to be used easily. Select the best rocks to avoid problems with fit and structure stability problems.

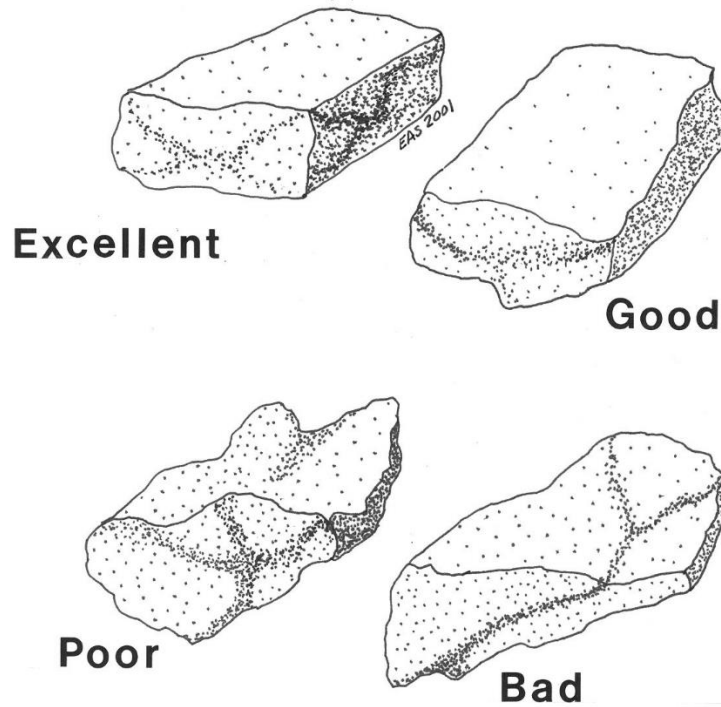
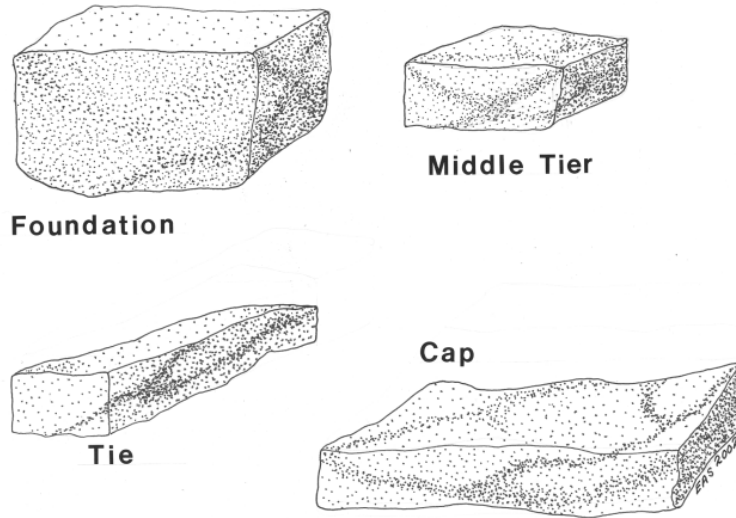


Figure 9: Generalized examples of the four different types of rocks used in building a retaining wall. The foundation rocks are solid and may often be some of the largest; the rocks used in the middle tiers are average-sized to smaller rocks; and the tie stones are typically the narrowest. Cap stones may come in a variety of shapes, but they must be large enough to span two or more middle tier rocks and be massive enough to provide a stable wall top.



5.3.3 Common alpine trail and restoration structures and techniques

The following represent fundamental structures and techniques for accomplishing trail and restoration work in the alpine.

Check Step

A Check Step (Figures 10-11) is a rock or timber step placed in or across the trail tread and designed to act as both a low dam (to slow water flowing down the trail) and as a step for trail users (americantrails.org).

Figure 10: An example of a rock check step built on an alpine trail. Using a single large rock to span most or all of the tread width helps ensure that the step is not blown out or otherwise compromised under heavy foot traffic. Setting large, angular rocks as gargoyles on either side helps prevent hikers from cutting around the structure.

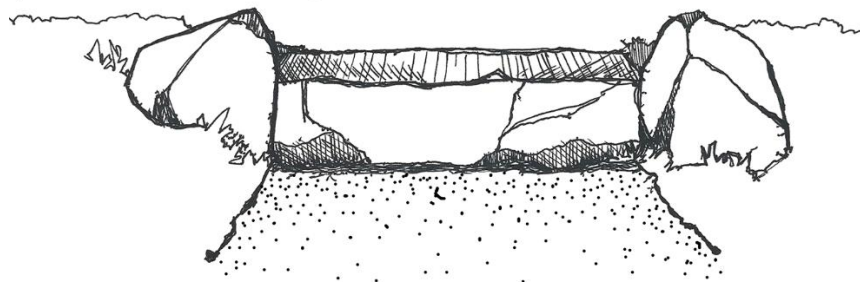
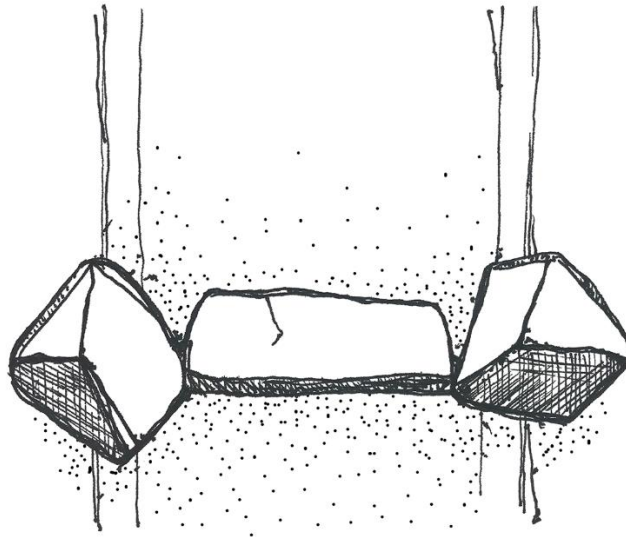


Figure 11: Top view of check step.



Constructing a Check Step:

- Build Check Steps to a “jump set” standard.
- Carefully excavate your foundation to be slightly insloped, and use extra care to not blow out the front edge by compromising the undisturbed mineral soil below the face of the rock.
- Remember to **MANAGE YOUR DIRT!**
- If possible set your rocks **LICHEN SIDE UP.**
- Bury step rock at a minimum depth of 1/3 the total thickness of the rock.
- Set your gargoyles with the best contact possible.
- “High and Outside” is preferred, with as much surface area (or as many points of contact) as possible.
- Fill using **PROPER FILLING TECHNIQUES.**
- Ideal crush size = Tennis Ball or less
- Start by meticulously filling **ALL** voids by hand.
- **NEVER** fill from the front! **EVER.**
- **NEVER** crush rocks on top of your step.
- **DO NOT** overfill **OR** under fill.
- Use your best Judgement.

- Too much fill will inundate the structure and trail just below it over time with crush.
- Too little will leave a “lip” on the backside of the step. This can lead to off trail hiking as people walk around the check step or it will become a tripping hazard for hikers.
- JUMP TEST!
 - Stand on your step and jump heavily on it.
 - It should not move AT ALL.
 - If it does continue fill until any movement is resolved OR re-set if necessary.

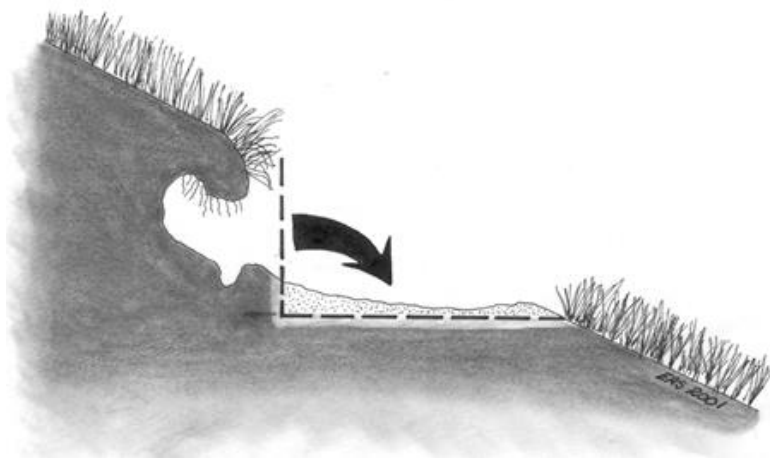
Backwall

Water flowing across a steep backslope causes soil loss and transport, resulting in soil deposition (Figure 12), root structure damage, and ultimately the destruction of tundra flora.

Unlike in environments below tree line, crews rarely re-cut backslope in the alpine, as this destroys fragile plant life and soils. Instead, a Backwall should be used to support eroded Backslope.

A Backwall (Tundra Support Wall) is a stabilization and retaining structure most commonly constructed of rock whose purpose is maintaining the integrity of the backslope by stabilizing the tundra and thereby preventing further erosion (*14ers.org*).

Figure 12: Backslope erosion creates soil deposition, causing the loss of valuable alpine soil, exposing roots and damaging tundra. Backwalls are the appropriate maintenance solution in alpine environments.



Constructing Back Wall:

- Backwall is a SET feature, not a rubble structure! (Figure 13)
- Carefully excavate your foundation to be slightly in-sloped, and using extra care to not blow out the front edge.
- Remember to **MANAGE YOUR DIRT!**
- First tier should be almost completely buried.
- Exaggerate the batter into the slope as you build up.
- Use your largest rocks at the base and within the lower tiers and taper in size as you build upward.
- If possible set your rocks **LICHEN SIDE OUT**.
- Be mindful to avoid **RUNNING SEAMS**.
- Thoroughly fill each tier as you build up.
- Build your wall to the height that which it is snugly supporting the tundra at the top tier. The last rocks may need to be hammered or forced in to achieve this.

Figure 13: Example of a well-constructed and set back wall supporting Alpine Tundra.



Alpine Drainage

Drainage along alpine trails can be CHALLENGING! Unlike other environments, commonly used drainage structures are usually avoided due to the risk of soil deposition smothering the low growing alpine tundra plants. Do not ever construct drainage structures unless specifically instructed to do so.

Remember: The ultimate goal on any trail is to create and maintain sheet drainage, where the water moves in smooth sheets, rather than rivulets or channels, across the trail

On the rare occasion you are instructed to construct drainage structures CAREFUL SITE SELECTION IS ESSENTIAL!

- There are some areas of resiliency to deposition in the alpine environment (Willows, talus slopes, rock ribbons, etc.).

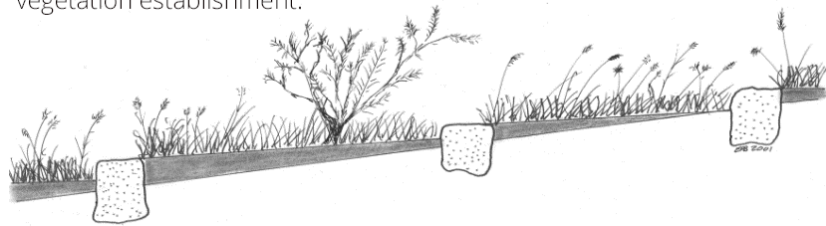
- If none of these areas are available, keep the water and sediment ON THE TRAIL.
- Slow it down by installing Check Steps.
- THEN divert it off the trail at the first RESILIENT location.

Check Dams:

A Check Dam is an earthen stone, or log dam used to slow erosion in a washed-out trail or gully. Recommended primarily for use in trail reclamation or revegetation (*americantrails.org*).

As the water slows down at the check dam, sediment will be deposited behind it, building up a terrace of soil behind the structure. In this way, gullies can be filled up (Figure 14), instead of continually deepening with each new rainstorm or snowmelt. At the same time, check dams allow water to seep into the soil instead of flowing over the land. In Alpine restoration, Check Dams are used to close and revegetate social trails and unsustainable routes.

Figure 14: The sediment terraces built up behind checkdams promote vegetation establishment.



The materials and methods used to construct check dams will vary depending on access to the site and the availability of local materials. Structures can be made of locally collected rock or logs (Figure 15), or from purchased materials such as straw bales or straw wattles. As rocks are the most readily available source material in the Alpine, the following considerations should be made when building rock Check Dams.

Figure 15: Example of logs used as check dams to help close and restore a section of braided trail.



Constructing Check Dams:

- Aesthetic qualities are less important than with Check Steps.
- Maximum soil retention is **MOST IMPORTANT!**
- Ideally find a rock that is about ~6in wider on either side than the eroded trail it will be placed.
- Carefully excavate your foundation to be slightly in-sloped, and using extra care to not blow out the front edge and the sides.
- However, this is a fine balance. Keep in mind “the more it goes out, the more it blows out!”
- Remember to **MANAGE YOUR DIRT!**
- If possible place your rocks **LICHEN SIDE UP.**
- Bury step rock at a minimum depth of 1/3 the total thickness of the rock.
- Backfill and install transplants.

Borrow Pits:

A Borrow Pit is a method of sourcing fill material (most commonly soil) from another location within the vicinity of your worksite. The fill is excavated, bagged, and then transported to where it is needed.

Using Borrow Pits:

- Find a location out of sight from the trail.
- When determining how large to dig your pit, consider first what fill material is available to restore it. You may determine that you can't fill one big pit, but instead can refill several small ones.
- Carefully remove any vegetation that could be used for transplants at the borrow pit site.
- Depending on the vegetation type and circumstance either:
 - Walk the same path to/from when moving dirt (flag if necessary).
 - E.g., Moving soil through tall plants easily damaged or trampled (Corn Lillies, Ferns, Etc...)
 - Walk only on durable surfaces (rocks).
 - ALWAYS THE PREFERRED OPTION!
- Disperse with each trip to/from.
 - E.g., Moving soil through more resilient and less delicate plant communities
- When finished with the borrow pit, rehab and fill it as best you can using "earth rocks" (unsightly rocks excavated from your project site), sticks, logs, and other debris to naturalize.

Transplanting:

Transplanting "plugs" harvested from native plants is the primary method of alpine trail and a tundra re-vegetation.

Consider the aspect and soil type that which the plant currently resides and the one that it will be re-located to. **MATCH YOUR LANDSCAPE**

Plants for transplanting include sedges, grasses and rushes.

- Forbs should be avoided.
- Nothing with taproots should be used.

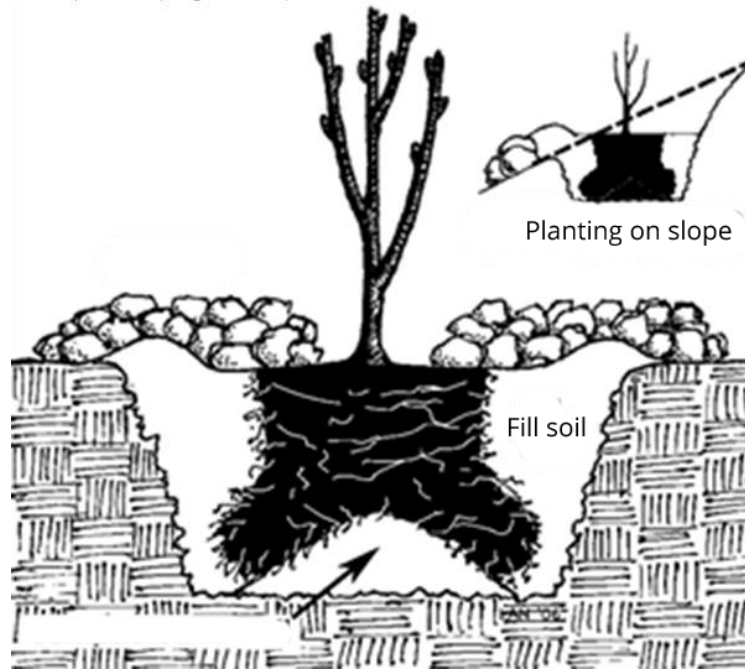
Harvesting Plugs:

- Harvest transplants 200+ft from and out of sight of the trail.
- Ideally harvest plugs that are ~8" in diameter.
- Cut the root ball in clean cylindrical shape with as little taper as possible.

Planting Plugs (Figure 16):

- Dig planting holes twice the diameter of the plug and slightly deeper than the extracted plugs.
- Keep your soil from the hole you dug for the transplant to refill the hole you created when harvesting the plug.
- After harvesting plugs quickly place the plant in the hole (roots can desiccate rapidly, especially in direct sunlight on a hot day).
- Hold the plant in place while you backfill with the excavated soil. Gently pack the soil into the hole, firm it into place as you fill, and avoid any large air pockets. The soil should be packed firmly enough to eliminate root-killing air pockets and the likelihood of settling, but not compacted so hard that it prohibits the penetration of water and plant roots.
- If the plant was planted on a slope or in a drainage, the uphill end of the berm can be left open to allow water to flow into the catchment.
- If possible water the plant to help relieve the stress of planting, to settle the soil and to eliminate any air pockets. Replace any sinkholes around the transplant with new soil to cover up the roots.

Figure 16: Planting transplants. Placing rocks around the transplanted plug can help catch water and create a wind break.



Restoring Your Worksite

Ideally the finished project should appear as if it has always been there. Think of it as if the trail were lasered in from space, with no evidence of on the ground work in the area even having occurred. The title of this training after all is "Working in the alpine with minimal impact."

Remember to Check Your Site, Before You Wreck Your Site!

- Throughout the project actively manage your impact and clean things up as they present themselves rather than waiting until they have all accumulated into one GIANT overwhelming mess!
- Remember the less impact you make to begin with, the less you have to clean up.

Worksite Restoration Practices:

- Disperse ALL "earth rocks" out of sight.
 - These are the unnatural looking rocks that are unearthed in the excavation process.
 - DO NOT PILE THEM ON THE SIDE OF THE TRAIL!

-
- Flip over any disturbed rocks as a result of your work to sit LICHEN SIDE UP.
 - Restore ALL impacted quarry paths.
 - “Tundra Fluffing”
 - Sounds silly but it works
 - In areas of tundra impacted by trampling, soil, rocks, etc. lightly “fluff” it back up by vigorously moving your hand through it in a side to side motion to clear it of small debris and make the plants stand taller.
 - MAINTAIN A NATURAL AESTHETIC.
 - DO NOT LINE THE TRAIL WITH STICKS, ROCKS, LOGS, ETC (Unless instructed to do so).

DOES THE FINAL PRODUCT LOOK NATURAL, WITH LITTLE IMPACT?

Appendix A: Example Job Hazard Analysis Form

U.S. Department of Agriculture Forest Service JOB HAZARD ANALYSIS (JHA) References-FSH 6709.11 and -12 <i>(Instructions on Reverse)</i>	1. WORK PROJECT/ACTIVITY	2. LOCATION			3. UNIT																																					
	General field work and trail maintenance – CFI Adopt-a-Peak trail maintenance crew	Colorado - Statewide			Rocky Mountain Region																																					
	4. NAME OF ANALYST	5. JOB TITLE			6. DATE PREPARED																																					
	McElhiney	Forestry Technician			January 2018																																					
<table border="1"> <tr> <td></td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> <td></td> </tr> <tr> <td>1</td> <td>H</td> <td>H</td> <td>H</td> <td>S</td> <td>S</td> <td rowspan="5"> Final Hazard Rating Significant </td> </tr> <tr> <td>2</td> <td>H</td> <td>H</td> <td>S</td> <td>S</td> <td>M</td> </tr> <tr> <td>3</td> <td>H</td> <td>H</td> <td>S</td> <td>M</td> <td>L</td> </tr> <tr> <td>4</td> <td>H</td> <td>S</td> <td>M</td> <td>L</td> <td>L</td> </tr> <tr> <td>5</td> <td>S</td> <td>S</td> <td>M</td> <td>L</td> <td>L</td> </tr> </table> <p> H = HIGH S = SIGNIFICANT M = MEDIUM L = LOW </p> <p> Probability A= Common or repeating occurrence B= Known to occur or "It has happened" C= Could occur, "I've heard of it happening" D= Not likely to occur E= Practically impossible </p> <p> Consequences 1= Fatality or permanent disability 2= Lost time injury or illness 3= Medical treatment 4= Incident report only 5= None </p>						A	B	C	D	E		1	H	H	H	S	S	Final Hazard Rating Significant	2	H	H	S	S	M	3	H	H	S	M	L	4	H	S	M	L	L	5	S	S	M	L	L
	A	B	C	D	E																																					
1	H	H	H	S	S	Final Hazard Rating Significant																																				
2	H	H	S	S	M																																					
3	H	H	S	M	L																																					
4	H	S	M	L	L																																					
5	S	S	M	L	L																																					
References: <ul style="list-style-type: none"> • FSH 5109.17 Fire and Aviation Management Qualifications Handbook • FSH 7100 34.1 Fleet Management Qualifications • NWCG Training Course S-130/190 Basic Firefighter/Introduction to Fire Behavior • PMS 461 Incident Response Pocket Guide 																																										
7. IDENTIFY TASKS/PROCEDURES STEPS REQUIRED TO PERFORM THE TASK IN THE SEQUENCE THEY ARE CARRIED OUT.	8. POTENTIAL HAZARD LIST THE POTENTIAL RISK HAZARDS THAT COULD CAUSE INJURY / DAMAGE WHEN THE TASK IS PERFORMED	9. PROBABILITY	10. CONSEQUENCES	11. RISK LEVEL L S M H	12. HAZARD CONTROLS FOR EACH HAZARD IDENTIFIED LIST THE CONTROL MEASURES REQUIRED TO ELIMINATE OR MINIMISE THE RISK OF INJURY																																					
Everything We Do!	Safety attitude and fear of reprisal.	D	5	L	All individuals will participate in and support an environment where valid safety concerns can be raised and addressed without fear of judgement or reprisal. If at any point, a job is deemed unsafe, workers should feel entitled to stop until the appropriate PPE or equipment is available, or until the right conditions exist to get the job done safely.																																					
DRIVING – 2WD/4WD & Trailers	All vehicle associated hazards	D	4	L	Only properly licensed and trained individuals shall have the privilege of driving government vehicles. Insure equipment is properly equipped and up-to-date																																					

					on regular maintenance check, maintain safe speeds, wear safety belts. Only qualified and authorized personnel shall be permitted to tow trailers. [HSC Chapter 12, Fleet Manager Guidelines.]
Back Country Travel, Pack Weight	Becoming lost or injured, back injury or bodily injury due to excessive pack weight	D	3	M	Always carry required personal protective equipment (PPE) when traveling in the backcountry. Hazard tree awareness is crucial when working and traveling in areas that have been affected by insect activity. Always wear a hard hat in these areas, regardless of conditions. If lost, contact unit dispatcher (see contact information under “Medical Emergencies”); select sheltered area and stay put; gather fuel for warming fire before dark; warmth and liquids are more important than food; put out visual markers if available. [HSC 11.2] Pack Weight- for persons up to 150lbs. not to exceed 40% of body weight or 50lbs., whichever is less. For persons between 150lbs. to 200lbs., not to exceed 33% of body weight or 67lbs., whichever is less. [HSC 52.4, 52.41, 52.42]
Working in backcountry and at high altitudes	Water quality; exhaustion; altitude sickness	D	3	M	Proper training; daily safety sessions; quality equipment; required PPE; carry extra clothing layers and rain gear; rests and breaks as needed; maintain hydration; carry water purification system. Learn signs and symptoms and treatment of altitude sickness and heed warnings. [HSC 11.2, 54.3]
Water Quality in backcountry	Water Quality, dehydration, infection	D	3	M	Proper fitness; regular safety sessions; carry required PPE for backcountry travel. Proper footwear and foot care. Boots- lace-up leather, with ankle support and lug soles. Use warm-up and stretching exercises. Maintain safe walking distance between people, carry tools on downhill side, test and use secure footing, never run. [HSC 11.2, Chapter 18]
Hiking to work area	Blisters; tripping; falling; cuts from tools; exhaustion	B	3	H	Proper fitness; regular safety sessions; carry required PPE for backcountry travel. Proper footwear and foot care. Boots- lace-up leather, with ankle support and lug soles. Use warm-up and stretching exercises. Maintain safe walking distance between people, carry tools on downhill side, test and use secure footing, never run. [HSC 11.2, Chapter 18]
Lightning & Thunderstorms	Electrical storm hazards	A	1	H	Regular safety sessions; always be alert to changing weather conditions, avoid grouping people together, maintain low profile away from tall objects, learn proper lightning position and assume when necessary, learn proper treatment for victims. Do not

					use radios or cell phones during a thunderstorm, put down all tools. [HSC 54.3]
Cold hazards	Hypothermia	C	3	M	Regular safety sessions; recognition of hypothermia-producing weather conditions and preparation for such. Know signs, symptoms and treatment of hypothermia. Maintain fitness and recognize risk factors. Avoid activities that increase risk factors. Always anticipate bad weather and carry proper clothing. Prevent dehydration, eat balanced diet and carry high energy snacks. [HSC 54.22]
Solar Ultraviolet Radiation	Sunburn, melanoma, retinal damage	C	3	S	Regular safety sessions. Keep exposed skin to a minimum- wear a hat, bandanna, long pants and long-sleeved shirt. Wear sunglasses rated at 100% UV protection. Use protective sunscreen and lip protection. [HSC 54.11]
Hot Weather conditions	Heat stress, heat exhaustion, heat stroke	E	3	L	Regular safety sessions. Individuals ability to heat tolerance is related to fitness, hydration, illness, medications and fatigue. Maintain fitness, drink plenty of water, take breaks as necessary. Know signs, symptoms and treatment of heat related illness. [HSC 54.21]
Assisting Visitors & search and rescue	Workplace violence, Hazardous search and rescue scenarios, weather, terrain	D	4	L	Consider personal safety first. Be aware of your surroundings. Get and maintain 1 st Aid and CPR training, carry 1 st Aid kit and blood borne pathogen kit at all times. [HSC 21.2, 21.21, 21.22, Chapter 51 & 52]
Public contacts	Workplace violence, potential for physical danger	C	4	M	Consider personal safety first. Be aware of your surroundings and unusual or abnormal behaviors and activities. Assess situation & have plan for getting out of situation; stay calm; if potential exists for physical confrontation – LEAVE AREA! Abide by check-in/check-out procedures. Maintain communication – use radio, cell or satellite phone to report incident and/or request assistance. Avoid potentially dangerous natural or human caused situations. Avoid contacts after dark. Public contact and/or FPO training. [HSC Chapters 51, district check in/check out procedures, HSC 25.3]
Protecting the Public	Rock fall, work site dangers, slips, falls	C	2	S	Be aware of where members of the public are, where they travel and where they stop for rest breaks. Post lookouts if materials are to be moved above where members of the public may be. Have radio communication between spotter and work crew. Be aware of approaching traffic; post lookouts on busy trails or in dangerous situations; post signs at

					trailhead and where visitors enter project area warning of potential dangers associated with the worksite; keep all tools and personal gear secured off the trail to ensure a safe path for visitors to pass through; communicate up the line “hiker coming through” when visitors are approaching the work site. Set down your tool and evaluate your work location to determine the safest way for visitors to pass. If necessary, ask members of the public to wait a few minutes while materials are secured and the travel route is cleared of hazards. Keep the public informed. Let them know where the potential hazards are as they approach a work site.
Wildlife encounters	Bears, badgers, mtn lions, big game, etc.	D	3	M	Regular safety sessions. Know and avoid habitat areas and aggression signs; properly store food, garbage, toiletries; keep camp clean: be aware of surroundings–don’t surprise animals; make noise while traveling through areas of concern. [HSC 53.7]
Insects – ticks, bees, wasps, hornets, spiders	Allergic reactions; infections	C	3	S	Carry effective insect repellent; check clothing and body frequently, especially when traveling through brushy areas; carry physician prescribed drugs if allergic. [HSC 53.2, 53.4, 53.6]
Hazarous Materials	Potential illness/personal injury	E	3	L	Regular safety sessions. Do not approach potentially hazardous materials. Know how to identify potentially hazardous materials such as meth lab trash dumps, do not approach, report immediately to the local sheriff via phone or have information relayed via radio. [HSC Chapter 60]
Responding to Medical Emergencies	Life threatening and non-life threatening injuries	D	2	S	All crews will carry a well supplied 1 st aid kit, cell phone, satellite phone and radio. A vehicle will be kept at the trailhead for emergency evacuation at all times that crews are present on the project. Emergency Contacts (LIFE THREATENING) Immediately contact the county Sheriff and or 911 (see attached document for numbers) Satellite Phone: Dial and Immediately identify that “This is an Emergency Call from a Satellite Phone” Cell Phone: Dial 911 – Immediately identify that “This is an emergency!” (Cell phone 911 calls may not show up on County switchboard as an emergency)

					<p>Emergency contacts (non-life threatening): Contact the county sheriff (see attached document for numbers) Satellite Phone: Dial and Immediately identify that “This is an Emergency Call from a Satellite Phone” 1. Cell Phone: Dial 911- Immediately identify that “This is an emergency” (possibility exists that you could get a different county other than expected) Call the local Forest Service Station (See attached document for numbers) With any injury contact the Ranger District as soon as possible to inform of incident and complete necessary documentation. See <u>“Field Site Medical Emergency and Evacuation Plan”</u> [HSC 21.20-21.22]</p>
Abandoned mines	mine openings, rock falls, collapse of unstable rock; rotten mine timbers, oxygen deficient atmosphere. Abandoned explosives, hazardous materials	D	4	L	Use caution when walking near or around abandoned mine sites. Do Not enter abandoned mine openings or mine buildings. If a mine opening is found and is not signed or the sign is damaged, please report this to the Dolores Ranger District Office. [HSC 22.81d]
High Altitude Working	Pulmonary edema; Acute Mtn. Sickness, Exhaustion	D	3	M	Proper training; awareness of signs, symptoms and treatments; carry extra food and water; carry water filter. [HSC 54.3]
Working With Tools	Bodily injuries	C	3	S	Proper training; use gloves, long pants, long-sleeved shirt, protective eyewear, and sturdy hiking or work boots; make sure you are familiar with and know how to operate all tools you might use. If there is uncertainty as to the use of any tool, check with a supervisor/leader and learn proper operating techniques prior to using that tool; carry tools on downhill side w/ sharpest edge facing down; store tools safely; never use broken or damaged tools; use the most appropriate tool for the job. [HSC 41.01-41.42.1]
Lifting	Back strain	C	2	S	Use proper lifting techniques; bend knees when lifting; lift with legs and not with back; do not exceed your personal ability; “eyes to the sky” – look upward to keep balance and better alignment; do not twist or turn while carrying a heavy load. [HSC 39.64]

Rock Work	Bodily injuries	C	2	S	Proper training; use gloves, protective eyewear, long pants and longsleeves, sturdy hiking or work boots (full leather, over the ankle, lug soles); use correct lifting techniques; allow no workers below rocks being moved or used.
Transporting Rocks to worksite -rolling, pissanting, carrying, rock litters	Runaway rocks, smashed body parts, back injury	B	2	H	Communicate with other workers and visitors below – use “clear out below” and “all clear above” commands when transporting rocks; steep slopes – stay below rock and slide it on a flat side, put pressure on uphill side of rock; lower angle slopes – roll rock away from you using proper lifting technique; use two or more people when loading rock into rock litter. If a rock gets loose, no matter its size – yell “ROCK, ROCK, ROCK...” as loud as possible and continually until the rock has come to a complete stop. Once the rock has come to a complete stop yell “CLEAR”.
Lifting/Shifting Rock	Back injuries, muscle strains, smashed feet	B	2	H	Use proper lifting technique; wear protective boots; do not hesitate to move rock in intervals; avoid lifting or rolling if shifting is possible.
Use of Rock Bars	Bodily injuries from rock or rock bar	B	2	H	Communicate constantly; never use bent or broken bars; never cross bars; do not mix hands and bars; keep hands in “open grip” position to prevent smashed fingers.
Breaking, shaping, chipping rocks	Bodily injuries, eye damage, smashed body parts	B	2	H	Wear protective eyewear, hardhats, long-sleeves and long pants; ensure others in the area have on eye protection; tape or coat handles for better grip; stop hammer when visitors approach; keep mouth closed to prevent chipped teeth; keep free body parts away from areas where hammer may glance.
Moving rocks in holes or depressions	Bodily injuries; back strain	B	2	H	Use tools and leverage as much as possible; move slowly, avoid jerking rock or rocking it side to side; measure and shape holes before inserting rock.
Constructing rock structures on busy trail	Injuries to visitors	C	3	S	Be aware of approaching traffic; post lookouts on busy trails or in dangerous situations; post signs where visitors enter project area; move tools and gear off the trail to ensure a safe path for visitors to pass through; communicate up the line when visitors are approaching.
Using/Operating Tram and Griphoist System	Personal injury due to inattentive use or lack of knowledge.	C	1	H	See Tram and Griphoist JHA Crewmembers using griphoist and highline system must be trained in tram use and must be familiar

					with the safe working load limits and safety features of all components in the system. All workers in close proximity to highline operations must wear all required PPE.
Bear Encounters	Injury or mauling	D	2	S	DO NOT RUN – when you run you look more like prey to a bear; do not threaten the bear; talk to the bear in low soft tone and slowly back away at an angle; pretend you are not afraid; avoid surprises; be aware of wind direction – if the wind is in your face the bear may not smell you; use noise makers and talk loudly while you work to avoid an encounter. [HSC 53.71]
Fitness	Bodily injury; muscle strain; exhaustion; dehydration; fatigue	D	3	M	Stretch before and after each hike; take adequate food and water breaks; be aware of your surroundings; take a reasonable amount of time to complete tasks to ensure safety and awareness. [HSC 52.2]
Camping	Exposure to high winds, cold, lightning, falling trees, rising waters, rock fall or slides, animal encounters.	D	2	S	Carefully select your campsite. Look up, look around. Sites should be free of; widow makers, snags or other overhead hazards, leaning green trees, danger from rolling rocks and slides, danger from flash floods or rising waters, known animal problems or signs (tracks, scat, scrapes, kills and claw marks) . [HSC 11.22, 53.71] If spike camping above treeline. Conduct safety session. Carefully plan. Know the weather forecast. If lightning is likely, defer spike camp usage. If storm begins to move in, consider changing your plans and descending to below treeline base camp. Select site sheltered from high winds and away from any lone tall objects. Assume lightning position within tent if lightning is near. Avoid touching wet tent material or any metal object such as tent poles or stakes. Avoid grouping tents too close together, keep a distance of twice the height of nearest tent. Communicate during storm by calling out to each other to ensure each others safety. [HSC 54.23]
Base Camp Sanitation	Illness, infection	C	2	S	Provide adequate and convenient supply of treated water. Containers must be CLEARLY labeled as potable/drinking water and non-potable/Do Not Drink. Containers should be kept in separate designated storage locations. Provide sanitary facilities for preparing and storing food.

					<p>Camp must have a First Aid Kit available. A vehicle will be kept at the trailhead for emergency evacuation at all times that crews are present on the project.</p> <p>Crew members are encouraged to maintain reasonable standards of personal hygiene and housekeeping. Take effective measure to prevent flies, rodents and other insects and animals from infesting camp.</p> <p>Trash removal from camp must be frequent enough to prevent overflow, fly breeding, and odor.</p> <p>Clean and sanitize kitchens surfaces daily. Keep subsistence supplies carefully and properly stored and protected from weather, flies, and rodents.</p> <p>Keep toilet facilities clean and sanitary.</p> <p>[HSC 55.11]</p>
Communication	Poor radio transmission	C	4	M	<p>Inform supervisor of schedule of work activities. Include destination, date & time of departure and return. Provide, as appropriate, a contact where your family or supervisor can reach you in case of an emergency.</p>
<p><i>The hazard analysis has been well designed and it will favorably change either physical conditions or personnel behavior during the conduct of this work activity. The risk has been assigned has the appropriate probability and severity and provides mitigation and contingency plans appropriate for the level of identified risk.</i></p>					
13. LINE OFFICER SIGNATURE		14. TITLE		15. DATE	

Appendix B: Field Site Medical Emergency and Evacuation Plan

JHA Instructions (References-FSH 6709.11 and .12)

The JHA shall identify the location of the work project or activity, the name of employee(s) involved in the process, the date(s) of acknowledgment, and the name of the appropriate line officer approving the JHA. The line officer acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Block 8: Identify all known or suspect hazards associated with each respective task/procedure listed in block 7. For example:

- a. Research past accidents/incidents.
- b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.
- c. Discuss the work project/activity with participants.
- d. Observe the work project/activity.
- e. A combination of the above.

Block 12: Identify appropriate actions to reduce or eliminate the hazards identified in block 8. Abatement measures listed below are in the order of the preferred abatement method:

- a. **Engineering Controls** (the most desirable method of abatement). For example, ergonomically designed tools, equipment, and furniture.
- b. **Substitution.** For example, switching to high flash point, non-toxic solvents.
- c. **Administrative Controls.** For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.
- d. **PPE** (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills, and portable water pumps).
- e. A combination of the above.

Block 13: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE.

Blocks 14 and 15: Self-explanatory.

Emergency Evacuation Instructions (Reference FSH 6709.11)

Work supervisors and crew members are responsible for developing and discussing field emergency evacuation procedures (EEP) and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

- a. Nature of the accident or injury (avoid using victim's name).
- b. Type of assistance needed, if any (ground, air, or water evacuation).
- c. Location of accident or injury, best access route into the worksite (road name/number), identifiable ground/air landmarks.
- d. Radio frequencies.
- e. Contact person.
- f. Local hazards to ground vehicles or aviation.
- g. Weather conditions (wind speed & direction, visibility, temperature).
- h. Topography.
- i. Number of individuals to be transported.
- j. Estimated weight of individuals for air/water evacuation.

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned work leader and crew members, acknowledge participation in the development of this JHA (as applicable) and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE	DATE	SIGNATURE	DATE
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

FIELD SITE MEDICAL EMERGENCY AND EVACUATION PLAN

Project Name: _____

Work Site Location: _____

Include legal description _____

To prepare for an emergency which requires first aid, and/or immediate evacuation of personnel due to? Serious illness or injury, the following information should be predetermined, and available to all crew members:

DESIGNATED FIRST AID PROVIDER (S):

(At least one person on each crew should be designated to provide first aid)

COMMUNICATION PROCEDURES TO FOLLOW IN THE EVENT OF AN EMERGENCY:

MEANS OF COMMUNICATION: _____

(Radio, cell phone, EPIRB, etc.)

RADIO CHANNEL: _____ PHONE NUMBER: _____

HOME BASE: _____

HOME BASE EMERGENCY COORDINATOR: _____

EMERGENCY SERVICES:

AMBULANCE: _____ PHONE NUMBER: _____

HOSPITAL: _____ PHONE NUMBER: _____

(Air evacuation should be obtained through the PSICC dispatch, if needed.)

EMERGENCY EVACUATION TRAVEL ROUTES: Attach map with roads for evacuation to main highway to above hospital (and heliports, if appropriate) highlighted.

CREW MEMBERS SHOULD PROVIDE THE FOLLOWING WHEN CALLING FOR ASSISTANCE:

- Nature of injury or accident (do not broadcast victim(s) name(s);
- Type of assistance needed;
- Number, and (for air transport) estimated weight, of persons to be transported;
- Location of injured, using landmarks identifiable on ground and/or map;
- Current information about weather and travel hazards/obstacles.

Crew should remain in contact with home unit until evacuation team arrives, if possible

References

Fisher, C., Pattie, D. L., & Hartson, T. (2000). *Mammals of the Rocky Mountains*. Edmonton: Lone Pine Pub.

Gellhorn, J. G. (2002). *Song of the alpine: the Rocky Mountain tundra through the seasons*. Boulder, CO: Johnson Books.

Seuss. (2017). *The Lorax*. London: HarperCollins Children's Books.

Zwinger, A. H., & Willard, B. E. (1996). *Land above the trees: a guide to American alpine tundra*. Boulder: Johnson Books.