

# Designing and Building Sustainable Hiking Trails

## Purpose

To give an idea of what is involved in building a hiking trail that provides a venue for physical activity while having a limited environmental impact.

## Overview

More than a third of the land in New Mexico is public. Much of this land surrounds rural communities, providing a perfect place for local residents to be physically active. Some small New Mexico towns have successfully built robust tourism economies by capitalizing on the recreational opportunities that public lands have to offer. Not all public lands provide easy access for people of varied skill levels when it comes to hiking. Some communities may be adjacent to public land, but without trails or a trailhead to make for easy access. When designing, building, and signing trails, it is important to keep in mind the people who will be using it. Use this guide for ideas and inspiration. It is not a thorough handbook for trailbuilding. Anyone looking for such a handbook should read the [Trail Construction and Maintenance Notebook](#). There are other resources listed at the end of this guide.

## Trail Design

A trailbuilder has two primary goals: keep people on the trail and keep water off it. Water will erode trails faster than anything else – even in the desert. Nearly all trail design features are drainage features. Among the many reasons to keep water off the trail is that hikers do not want to walk on wet trails. They will walk around puddles. This eventually leads to widened and braided trails. Walking off trail creates even more erosion and causes frivolous harm to the sensitive desert ecosystem. A single step, for example, can easily damage [cryptobiotic soil](#). It can take as much as fifty years for cryptobiotic to recover.

A well-designed trail will require less maintenance in the long run. Always be sure to incorporate landscape features – such as slopes or cliff faces – into the trail design instead of working against them. This will make for a longer lasting and more attractive trail. Utilizing the landscape's natural drainage features will reduce the number of drainage features that you need to build yourself. When gazing out at a section of land where you plan to build a trail, imagine yourself as a drop of water. Where would you flow if you landed on the trail? Your goal is to get that drop of water off the trail as quickly as possible.

### *Sustainable Trails...*

- Support current and future use with minimal impact to the area's natural systems
- Produce negligible soil loss or movement while allowing vegetation to inhabit the area
- Recognize that pruning or removal of certain plants may be necessary for proper trail construction and maintenance
- Do not adversely affect the area's wildlife
- Accommodate existing use while allowing only appropriate use
- Require little rerouting and minimal maintenance

National Park Service, Rocky Mountain Region, 1991



Most land agencies and regions have accepted best practices if not specific guidelines for trail design and construction. Always be sure to consult these before planning and designing a trail.

## Trail Grade

Steep, challenging trails are exciting for some hikers. For others they may be intimidating. To make trails inviting to inexperienced as well as experienced hikers, they should not have a grade of more than twelve percent. Above this, they not only make for strenuous hikes, they are also difficult to maintain. Steeper grades exacerbate erosion. On the other hand, trails in low lying flat areas tend to collect water. Whenever possible, build trails by “sidehilling,” or cutting a flat bench into the side of a hill. Then cut a slight outslope by angling the trail downhill so that water runs across and off the trail rather than down it.

## Trail Surface

Clear away any duff, humus, and topsoil to expose the more durable mineral soil beneath. Mineral soil provides a firmer surface for walking, discourages water infiltration, and makes it more difficult for plants to reclaim the trail. Gravel or other aggregates are a temporary fix for wet sections of trail. It will likely wash out within a season. Gravel on a hiking trail is a good indication that it was built in a place where it shouldn't have been.

## Trail Corridor

A trail is more than a path on the ground. It is a three-dimensional tunnel through a landscape. Most hiking trails should be about six feet wide by eight feet high. Think about this tunnel as you clear the corridor of any brush, fallen or standing trees, loose rock, or other debris. Remove any branches that reach into the trail corridor by clipping them at the base, where they emerge from the trunk. This creates a neater, more natural appearance. It also reduces the chances that someone will get what is affectionately known as an “eye kabob.” Be sure to remove all clipped branches from the trail so as not to create any [punji sticks](#) that could puncture bicycle tires or injure a hiker that sits or falls in the trail. Be sure to patrol existing trails once each year to clear any re-grown brush and trees that have fallen into the corridor and to check for any drainage problems.



*Trails that are cut into the side of a hill with a slight outslope, such as this one near Cuba, are less likely to be damaged by erosion.*



## Grade Dips

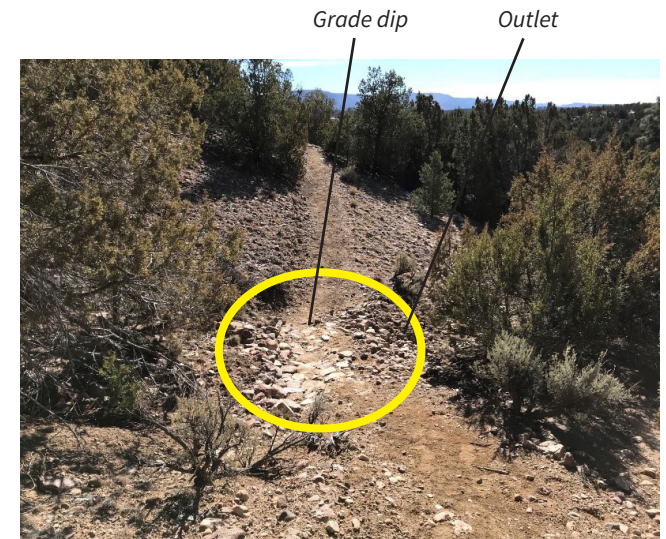
A grade dip is a slight grade reversal in a trail. A trail is going down, then it suddenly goes up for a few yards, then it continues down. This creates a dip in the trail that catches water. Complete the grade dip in order to funnel water off the trail by adding an outlet to the downslope side. Natural grade dips occur in some places. You can also create them in areas where they are needed, such as when a spring seeps onto the trail.

## Waterbars

Waterbars, like grade dips, move water and sediment off the trail. Waterbars are more disruptive than grade dips, less effective, and more difficult to build and maintain. Use grade dips whenever possible. A waterbar is a line of rocks “set” (partially buried in the soil so that they will not budge when kicked) across the trail at a 45° to 60° angle. To be effective, it needs to extend beyond the trail twelve inches on both sides. Dig a “swale,”



Waterbar on a trail in Cuba, NM.



An example of a grade dip.

a teardrop shaped funnel, just uphill of the waterbar to catch water and direct it off the trail before it hits the bar itself. The swale is what actually moves the water from the trail. The waterbar is there to protect the swale.

## Other Specialized Features

There are dozens of other specialized structures that trailbuilders use to minimize erosion on hiking trails. Climbing turns, switchbacks, and steps enable trails to climb steep slopes without causing excess erosion. [Retaining walls](#) hold scree and dirt in place. Bog bridges cross persistently wet, swampy areas. Refer to the Resources section at the end of this guide for information on when and how to install these features.

## Signage & Reassurance Markers

Trail signs provide information about trail names, direction, destinations, and distances. Place them at the trailhead and at all trail junctions. Trails designed for less experienced hikers should have more information on their signs.

Reassurance markers are indications that a hiker is still on the trail. These prevent people from getting lost and causing damage by tromping about off trail. Some trails are straightforward and easy enough to follow without reassurance markers. Many are not. Even if a trail is easy to follow when it is first built, it will not be after a number of years of deferred maintenance. As with most other things, there is usually more enthusiasm for building new trails than for maintaining those that already exist.



Reassurance markers take many forms. Oftentimes it is a blaze of paint or a plastic tag on a tree. Some trails, such as the Continental Divide Trail, use branded, easily recognizable tags. In days past, people (trailblazers, literally) would create a blaze by slicing a section of bark from a tree with an axe. Some trailbuilders still use this method. Two blazes or tags stacked on top of each other signify a trail junction or a sharp turn. Whatever you use to mark a tree, place it at eye level, on both sides. Spread the markers out so that when you stand at one marker, you can clearly see the next one in the distance.

Use cairns to mark a trail in places such as scree fields where there are no trees to blaze. Cairns are large, tiered, conical stacks of rocks. They should be at least three feet tall and nearly as wide across the base. To make cairns extra obvious, top them off with a distinctive capstone. As with blazes, a person standing at one cairn should be able to see the next one in the distance. Don't confuse cairns with [rock stacks](#) or rock ducks. Take these down and scatter the rocks whenever you encounter them. These are confusing to hikers and harmful to the landscape.

Make sure to have a signage plan before placing signs or reassurance markers on a trail. Many land agencies have strict guidelines when it comes to signage. It is also important for signage and markers to have a consistent look. For example, you wouldn't suddenly switch from blue paint blazes to white plastic markers. You might, however, switch from blue blazes to cairns if a trail rises above treeline and crosses a scree field.



*A cairn marks a trail on Escudilla Mountain near the boundary between Arizona and New Mexico.*



*Plastic trail marker on the Continental Divide Trail in El Malpais National Monument.*



## Lessons Learned

When constructing the School Overlook Trail in Cuba, Step Into Cuba partnered with the Bureau of Land Management (BLM) to create a trail on public land from conception to completion. Step Into Cuba volunteers identified the land and flagged a preferred route. A BLM archaeologist and other specialists conducted an inspection. They determined that it crossed neo-lithic sites and would have to be realigned in some places. The BLM then completed an Environmental Assessment to ensure there would be no damage to wildlife, archaeological sites, or the environment. The BLM also supplied a trail build plan that Step Into Cuba volunteers followed during construction.

Step Into Cuba volunteer coordinators arranged several build days to complete the project. They contacted volunteers from previous trail build projects as well as youth groups and board members from Nacimiento Community Foundation, a local non-profit. Each group received training for the techniques required for each section of trail on which they would be working. The School Overlook Trail utilizes cairns on the lower section as well as on a sandstone crossing and has a bench cut switchback section to climb the final hill. The teams also learned to build retaining walls, manage grade dips to control erosion, assess and clear the trail corridor, and construct v-gate passages for users to access the trail but keep grazing animals out.

The experience brought the community together. Users enjoy the trail and the school utilizes it for educational events. Step Into Cuba volunteers learned new skills and the community has a beautiful trail.



*Volunteers construct the bench cut trail ascending the final hill of the School Overlook Trail.*



*Flagging the School Overlook Trail along an old BLM road.*



*Cairns guide hikers along the School Overlook Trail.*

## Other Resources for Designing and Building Trails in New Mexico

- [American Trails Resource Library](#)
- [New Mexico Youth Conservation Corps](#)
- [Rocky Mountain Youth Corps](#)
- [Trail Construction and Maintenance Notebook](#)



## **Questions? Comments?**

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