

## WTA Skills Building Clinic

WJS/mbh

### **Are you comfortable with?**

Finding good mineral soil?  
Finding good wood for construction projects?  
Building drain-dips?  
Building water-bars?  
Building check-dams?  
Cleaning puncheon/bridges?  
Cleaning culverts?  
Cleaning ditches?  
Digging ditches?  
Brushing?  
Lopping?  
Re-grading trail?  
Building turnpikes?  
Building rock walls?  
Fixing mud-holes?  
Installing curb-logs?  
Working switchbacks?  
Moving large rocks and logs?  
Building stream-crossings?

### **Exercises**

- Practice tool lecture.
- Construct a check-dam.
- Construct a water-bar.
- Re-grade a stretch of trail.
- Brushing and lopping.
- Finding good fill.
- Finding a good piece of wood.

## **The Ideal Trail**

The ideal stretch of pedestrian trail is two feet wide and has a gentle **out-slope** (the outside edge of the trail is lower) to allow water to run off. There are no roots or rocks protruding from the trail and there are no limbs or plants hanging into the **trail-way**. For trails built on a hillside the **back-slope** (the hillside on the uphill side of the tread) should be approximately 45°.

## **Real Trails**

Because of declining trail maintenance funding, very few of our trails meet the ideal standards outlined above. Many of our trails are washed-out and filled with exposed roots and rocks. Out-slopes are rare and **berms** along the outside edge are common. Many trails have not been properly brushed for years so they are overgrown with brush. Small firs, slide-alder and vine maple are growing in the **trail-way** and limbs are hanging across the trail. You'll find rotten **puncheon**, collapsed or missing bridges, washed-out **turnpikes**, clogged **culverts**, **drainage ditches** full of silt and large **blow-down** blocking the trail.

## **Trail Maintenance Seasons**

**Very early season** - Logging out.

**Early season** - Clean-out existing drainage structures. Catalog future projects.

**Mid season** - Brushing and Lopping. New projects.

**Late season** - New projects.

## **Some Basic Terminology**

**Back-slope** - The excavated bank on the uphill side of a trail-way.

**Bench** - The flat, excavated portion of a hillside that comprises the trail-tread.

**Berm** - A raised outside edge along a trail.

**Blow-down** - A fallen tree across the trail.

**Borrow** - Fill material taken from a site other than the trail-way excavation. Good borrow pits can be found beneath root balls from fallen trees.

**Clearing limits** - The distance to the either side of and above a trail-way from which brush and limbs must be cleared.

**Culvert** - A drainage structure composed of rock, wood, metal or plastic that passes beneath a trail to allow the flow of water from the inside to the outside edge.

**Drain dip** - A depression built into the trail to guide water off the tread.

**Duff** - Ground cover consisting of organic matter such as needles, leaves, twigs, etc.

**Fill** - material used to fill a structure such as a turnpike or check-dam. Fill material may be anything from large rocks to fine mineral soil. Don't use duff or clay!

**Grade** - Slope of trail measured as feet rise/100 feet run.

**Inside edge** - On a hillside trail this is the up-hill side of the trail.

**In-slope** - The inside edge of the trail is lower than the outside edge.

**Mineral soil** - Soil that has little or no organic matter.

**Outside edge** - On a hillside trail this is the down-hill side of the trail.

**Out-slope** - The outside edge of a trail being lower than the inside edge to promote drainage.

**Puncheon** - A wooden walkway that allows trail users to pass through wet areas.

**Root-apron** - A large collection of exposed roots.

**Settling basin** - A deep rock lined pit placed in front of a culvert to allow silt to settle out before entering the culvert.

**Slough** - Silt and organic debris that have slid down onto the trail.

**Switchback** - A sharp reversal in the direction of the trail, allowing the tread to maintain a reasonable grade as it climbs a steep hillside.

**Tread** - The travel surface of the trail.

**Trail corridor** - The full area of the trail including the tread and the zone on either side of the tread from which brush and limbs must be removed.

**Turnpike** - A structure used to carry a trail across ground that is usually saturated with water. Logs or rocks embedded along the sides of the tread hold fill material in place to form an elevated travel surface.

**Water bar** - A drainage structure composed of an out-sloped segment of tread leading to a rock or log barrier embedded at an angle across the trail. Water across the slope will be diverted by the out-slope or by the barrier.

**Windfall** - See blow-down.

## Common Trail Problems

Problem	Why is it a problem?
<b>Berms</b> - a raised hump on the outside edge of the trail often caused by vegetation.	<b>Berms</b> trap water on the trail and lead to erosion. This makes the berm even higher and causes more water to be trapped on the trail and even more erosion.
<b>Blow-down</b> - a log or logs that have fallen across the trail.	Large <b>blow-down</b> on steep hillsides can be very difficult to get around. Horses often can not cross them and hikers will beat a path around them. Fallen logs may be unstable and pose a serious hazard.
<b>Drainage/Erosion</b> - Water is pooling on or running down the trail eroding it.	Water pooling on the trail leads to the formation of <b>mud-holes</b> and water running down the trail erodes the tread exposing roots and rocks.
<b>Mud-holes</b> - a mixture of <b>duff</b> and water churned up by trail traffic.	To avoid <b>mud-holes</b> hikers will try to go around them. This kills vegetation alongside the trail and makes the <b>mud-holes</b> larger.
<b>Overgrowth</b> - plants growing over the trail.	<b>Over-growth</b> on the inside edge of the trail, particularly slide alder and vine maple force trail users to the outside edge of the trail causing <b>trail slump</b> . <b>Over-growth</b> on the outside edge of the trail leads to the formation of <b>berms</b> that trap water on the trail.
<b>Slough - Duff</b> or soil sliding into the trail from the <b>back-slope</b> .	<b>Slough</b> makes trails narrower and forces hikers to the outside edge of the trail leading to increased <b>overgrowth</b> on the inside edge of the trail and <b>trail slump</b> .
<b>Social Trails</b> - Unplanned, non-maintained boot-beat paths.	Because <b>social trails</b> are unplanned they often have serious drainage problems. The most common types of social trails are <b>switchback</b> cuts. These lead to trail erosion.
<b>Trail Slump</b> - When there is an obstacle on the uphill side of a trail such as <b>slough</b> , a <b>root-apron</b> or <b>overgrowth</b> , hikers walk on the outside-edge of the trail and cause it to migrate down-hill.	<b>Trail slump</b> can move users off of structures such as <b>turnpikes</b> or <b>puncheon</b> and into <b>duff</b> -filled areas leading to mud-holes. On steep hill-sides <b>trail slump</b> moves users off the <b>bench</b> and down onto the steep hillside creating a falling hazard.

## Dealing with Common Trail Problems

### Berms

Berms are a very common trail affliction. How you should respond to them depends on their cause. Many berms are caused by the root-balls of plants growing on the outside edge of the trail. Ferns in particular collect duff around their dense root systems. When practical, remove plants and berms from the outside edge of the trail. Some berms may be the result of erosion of the trail-bed by water being trapped on the trail. In this case the berm can be removed to restore the out-slope, but the construction of drain-dips, water-bars and/or check-dams is likely the easier solution.

### Blow-down

We are rarely called upon to remove fallen logs from across trails. This is usually done as early in the season as possible by land managers. If you do encounter blow-down make sure you know the land manager's wishes and your own skills before proceeding. Our agreement with the Forest Service prohibits us from sawing out logs that are greater than 8" in diameter without a special bucking permit. The real issue isn't as much the size of the log as the potential for bind. Sawing a log that is under a lot of tension can be dangerous even if it is a small log so make sure you are comfortable with what you are doing -- if not, leave it. Some land managers such as those at Cougar Mountain want fallen logs left on the trail to discourage mountain bikers.

### Drainage/Erosion

After brushing and lopping, correcting drainage problems is one of our highest priorities. Leaving them unattended will lead to further trail erosion, but before jumping into a massive water-works project take time to study the problem carefully first. Building new drainage structures can be fun, but is also time consuming and may be unnecessary.

- 1) Look for pre-existing drainage structures first: clean out drainage ditches, day-light (un-plug) culverts, clean out drain-dips and water-bars, look for plugged streams uphill from the trail that may be diverting water away from another drainage structure.
- 2) Consider building a drain dip before trying anything fancy. Drain dips are quick and easy to teach to volunteers. Many drain dips can be dug in the time it takes to build one water-bar.
- 3) If large volumes of water are expected or if the trail has heavy use or horse traffic, consider building a water-bar. Your choice of materials (wood or rock) will depend upon local materials, but a well-built rock water-bar is usually the most durable.

### Mud-holes

**What causes a mud-hole?** Mud-holes are a combination of duff and water. Most commonly a dead, rotting tree is buried in the trail. When trail tread is composed of wet,

rotting organic matter, foot traffic grinds it up to produce mud. To avoid the mud-hole hikers try to go around it. In most cases this just makes the mud-hole wider. Hikers also try throwing sticks, logs and duff into the mud-hole. This just adds to the problem.

**How to fix a mud-hole.** Determine how extensive the mud-hole is. Stick a tool handle into the mud-hole (McLeods are good for this) and see how deep it can be pushed. Repeat to find the boundaries of the mud-hole. The bigger the mud-hole, the more difficult it is to clear up:

**Not so bad** - The simplest mud-hole is just a low spot in a trail where duff and water collect. These can be fixed by scraping out the mud and adding a drain-dip or filling the low spot with mineral soil.

**Bad** - A more difficult problem is caused by deeper duff pockets. This is often the result of a very large rotten tree buried in the tread. If not too extensive these can also be dug out and refilled with mineral soil, but be prepared to do a lot of digging and haul a lot of rocks and mineral soil. Fill the hole with larger rock first, then smaller rocks, then mineral soil.

**Really bad** - Sometimes a mud-hole is just too deep and too long to be completely dug out. Here a good solution is to build a turnpike. Turnpikes are very labor intensive and take some planning. You shouldn't tackle a turnpike unless you've prepared for it ahead of time. You'll need good logs (preferable fresh red cedar), a near-by source of large rocks and mineral soil, lots of buckets and lots of people.

**The worst** - In large areas that are chronically wet, muddy and difficult to drain the solution is to build a puncheon bridge over the muck. Building puncheon bridges require lots of preparation and special skills and we build them only at the request of the land manager. They require materials to be brought to the site including sills, stringers, decking, re-bar and nails; and special tools such as carpentry saws, sledge hammers and drills.

## **Overgrowth**

This is our most common problem and the most labor intensive to correct. When confronted with the daunting task of brushing and lopping out a stretch of trail please remember these basic rules:

- 1) Throw all cuttings on the downhill side of the trail as far out-of-sight as possible.
- 2) Give the uphill side of the trail the most attention. Plants and trees growing here (particularly slide alder and vine maple) will force people downhill and lead to trail slump.
- 3) When removing trees cut them as close to the base as possible.
- 4) Cut all branches flush with the trunk of the tree. Start with a small undercut so that the falling limb won't peel off a long strip of bark.

- 5) Don't leave stobbs from woody shrubs like thimble berry, salmon berry, etc. Even large bracken fern can leave nasty stobbs.
- 6) Smear tree stumps with dirt or bury them if possible so they don't stand out.
- 7) In forested areas you're likely to find many small firs growing in the trail corridor. Rip them out by their roots and throw them downhill.
- 8) When brushing during peak wildflower season use some discretion. Many hikers don't like seeing all the pretty flowers being massacred!
- 9) Pay special attention to Devil's club. It likes to grow in wet areas so when ever you cross a stream or piece of puncheon look around for Devil's club and kill it all.

## **Slough**

Slough tends to drive people to the outside edge of the trail leading to trail slump. When left in place plants and seedlings will also start to take root in the slough area. When you see slough re-grade the trail and restore the back-slope.

## **Social Trails**

The most common types of social trails you are likely to encounter are switchback cuts. Switchback cuts immediately turn into drainage problems so they should be discouraged. The only way to stop further foot traffic on a switchback cut is to completely fill it in. Just placing a log or a few rocks on either end will not work. People will step over them or throw them aside. You must make the cut a very unattractive option. If the trail edge on the uphill side of the switchback is broken down, place a curb log and fill it in, then block the whole length of the cut with one or more large dead trees with many branches. The final result should totally camouflage the former shortcut. Consider transplanting ferns or other shrubs. Likewise when dealing with braided trails in high alpine meadows or around alpine lakes the trails to be removed must be completely filled with debris and/or re-vegetated.

## **Trail Slump**

Trail slump is often caused by overgrowth on the uphill side of the trail or by slough from the back-slope covering the inside edge of the trail. These types of obstructions force people to the outside edge of the trail making it migrate down hill over time. Sometimes you'll find several parallel trails forming a terraced effect along a hillside as users have moved further downhill to avoid an obstruction. The cure is to remove the obstruction, either removing slough or brushing back overgrowth on the uphill side, and to re-establish the tread in its former location and fill in the newly formed tread. In some cases trail slump is caused by root-aprons. This can be a very difficult problem to solve because root-aprons are difficult to remove involving lots of digging and chopping.

## **Finding Good Fill**

Look for fill as close to the work-site as possible. Depending upon the nature of the problem there may be good soil in the **back-slope** or in the tread itself just up trail or down trail from the area to be filled. One of the best places to find fill is from nearby stream beds. They are often filled with loose, sandy soil. Climb up and down the length of

the stream looking for natural log or rock dams that have collected sand or gravel behind them. You may also use a **borrow-pit**. Dig a large hole near the work site and hope that you find a good layer of mineral soil beneath the duff. You can also let a tree dig the hole for you. Look for an over-turned tree whose root ball has left a large hole in the ground. Here you'll usually find lots of good soil.

### **Finding Good Wood**

Probably the best source of construction material are "leaners". These are trees whose root balls have been upset and are about to fall over. They are still green, but will die soon. If you can find a Western Red Cedar leaner that's just the right size for your project that's the best. Alaskan Yellow Cedar is also a good choice. If you can't find a leaner you may choose to either fall a small tree or look for one that is down already. When selecting a downed tree choose one that is as fresh as possible and that has not been in direct contact with the ground. Don't select rotten or moss covered logs. Silver firs are very common and can also be used for small scale construction projects (water-bars, check-dams, etc). Please don't fall trees unless you are very comfortable with what you are doing. If you do fall one do it far away from the trail and away from the volunteers. Falling is not a spectator sport.

### **References:**

- Lightly on the Land by the SCA by Mountaineer Books (1996)**
- Trail Construction and Maintenance Notebook by USDA/USFS (1997)**

## **Annual Maintenance Check List**

### **Brushing and lopping:**

- Know your clearing/brushing limits.
- All cuttings go on the down-hill side as far out of the trail-way as possible.
- Cut branches flush with trunk of tree.
- Smear cut ends with dirt so they don't stand out.
- Don't leave stobbs.
- Open hillsides are the worst areas and need to be brushed at least once a year.
- Saw out any blow-down less than 8" in diameter from the trail.

### **Restore tread:**

- Remove slough from trail.
- Return trail to its proper width.
- Remove organic matter/duff.
- Remove protruding roots and rocks.
- Restore out-slope of trail.
- Remove berms from outside edge of trail.

### **Drainage:**

- Clear drainage ditches of silt and debris - make them bigger, deeper and wider.
- Clear plugged culverts.
- Clear drain-dips.
- Clean/reset water-bars.
- Remove logs/debris from outside edge of trail if they're hindering run-off.
- Add drainage structures as needed such as drain-dips, water-bars and check-dams.

### **Miscellaneous:**

- Clear puncheon, turnpikes, curb logs and bridges of dirt and plants.
- Drive down nails sticking up on puncheon.
- Block off social trails such as cuts on switchbacks.
- Remove trash near trailheads.