STEWARDSHIP PLAN
Part 4
Trail Construction and Maintenance

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Revised by: New Document Date: NA

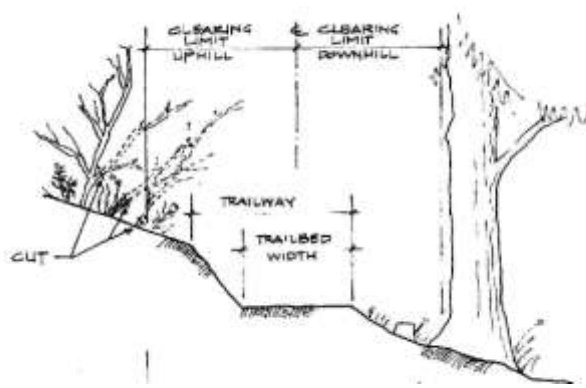
Reserves Chairman ____________ Date: ____________

REVISION HISTORY

Revision	Major Changes
0	Creation of Document by Al Wagar

Trails involve rather few issues--a walking (or riding) surface, clearance, grade, location and alignment, and, especially, handling water. But, these occur in a gazillion combinations.

Surface(s). The ideal surface is neither muddy nor dusty, is quiet underfoot, and lasts for years. In many cases, the native soil is quite acceptable, once layers of organic matter are removed and water issues have been handled. A step up is to surface with compacted gravel, ideally with something like 5/8-inch-minus or 3/4-inch-minus crushed rock. (The "minus" means it includes everything that will go thru a mesh of the designated size, thus having "fines" that bind it together. Without the fines, gravel tends to scatter, Also, crushed rock compacts much better than rounded gravel from streams.) For Shoreline's parks, main trails probably need to be graveled. (Impervious pavements may concentrate water and create erosion problems, especially on hillsides in our prevalent glacial sands, and are probably appropriate only for highly developed portions of parks, as around playground areas, ball fields and tennis courts.) Photo at right shows temporary forms being used to control width and depth of gravel. Note that trail surface is ***outsloped***, tilting slightly to left.



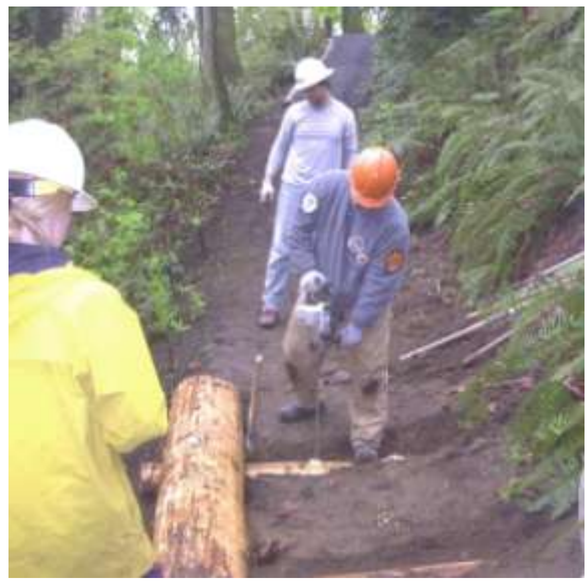
Clearance. Vegetation needs to be removed back a foot or two on each side of a trail as well as eight or more feet above the trail surface so people can progress along it without snagging clothing or brushing against wet foliage. To avoid stubs that can stab people or cause profuse re-branching, woody branches need to be cut back nearly flush with larger stems or very close to the ground.

Grade is a trail's steepness and is usually expressed as units of elevation gained or lost per 100 units of horizontal distance. For any but short pitches, grades over 20 percent should usually be avoided. But, in steep country, compromises may be needed to avoid excessive trail length or switchbacks, steps, etc.

Location and alignment. The ideal trail makes it easy for users "to do the right thing." So, if it takes them rather directly to where they want to go, most people will stay on a trail rather than walk in the dust or mud or trample the vegetation. Other things equal, put trails on well-drained soils rather than wet areas and, if possible, don't tempt people to short cut by having lower trail segments or desired destinations visible from upper segments or by creating tight curves. Using switchbacks to stack trail segments above each other invites shortcutting that often tears up soils and vegetation and creates an erosion channel.

A deeply-rutted shortcut across the switchback shown at left has been blocked with brush. But another will likely develop unless additional obstacles make shortcutting difficult.

Simply laying a trail atop or cutting it into the native soil is not always adequate and such structures as curb logs, retaining walls, and cribbing can keep trails in place. Boardwalks, bridges, or other structures may be needed to get people across wet areas, streams, and ravines.



At right, a curb log is being installed to support the edge of a trail, with "dead man" logs embedded in the trail to help support the curb log. After holes were bored using a gas-powered drill, 3-foot sections of rebar were driven to pin the logs together and into the soil. Not all curb logs need dead-man support.

Handling water. A major trails issue is to control water using outsloping and sometimes drain dips, water bars, ditches, culverts, etc, (Need to "think like water," i.e., what would water do here? Keeping water volumes and velocities low is critical because water's cutting power goes up as the cube of velocity and the size of material it can carry goes up as the 6th power of velocity, that is, doubling water's velocity creates an 8-fold increase in its cutting power and a 64-fold increase in the size of material it can carry!)

As illustrated on the prior page, trails traversing hillsides should be slightly ***outsloped*** (at 2 to 4 percent) with the outer edge a bit lower than the inner edge. Most water will then run off rather than along the trail.

On steep grades where water may run down the trail in spite of outsloping, drain dips or water bars are used to interrupt the flow and conduct water off the trail, usually with a rock apron placed to dissipate the energy of the diverted water so it doesn't cause erosion. A section of split cedar was used for the water bar shown at right. Steep sections may also use ***check steps*** (next page) or sometimes

other kinds of steps such as box steps (below) or steps of stone or concrete to hold the soil in place and reduce the water flow as well as to help people negotiate the steepness.

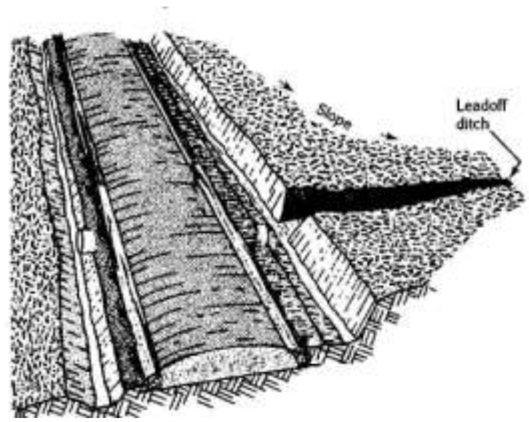
In the Puget Sound basin the glaciers left us many sands that drain so well that runoff may not be a problem, but they also left layers of clay that do ***not*** let water through. Springs or

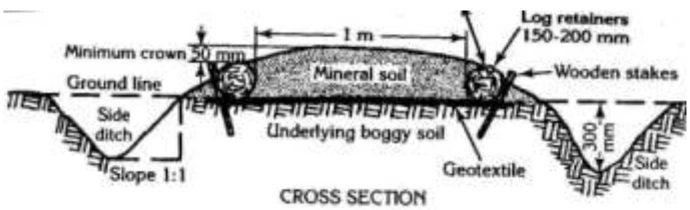
seeps usually develop on hillsides where a layer of clay is exposed. Instead of percolating further, the water emerges, often creating muddiness like we encountered on our field trip through the Innis Arden Reserve. So, what can we do about mud? One answer is "Learn to love it" like these

volunteers from Tahoma High School.

To dry such areas, it may be necessary to install culverts to convey the water across and beneath the trail, often with a ditch (next page) on the uphill side to intercept water all along a seep area.

Except for sands, water softens and weakens soils, and one approach is to use turnpikes (causeways) to both spread the load from traffic and allow drainage under the walking surface.





A turnpike consists of a row of logs or rocks on each side of the trail surface, usually with a layer of geotextile on the soil between the rows. It is often partly filled with spall (rocks of about 4- to 6-inch diameter), sometimes covered with another layer of geotextile, over which a layer of gravel is added, compacted, and slightly crowned, with middle higher than the logs or rocks at the sides. Photo (above right) shows completed turnpike in background and partly completed turnpike in foreground.

References

Trail building resources

U. S. Forest Service booklet *Trail Construction and Maintenance Notebook*
http://www.fs.fed.us/eng/pubs/htmlpubs/htm04232825/

International Mountain Biking Association
http://www.imba.com/resources/trail_building/

Student Conservation Association
http://www.mountaineersbooks.org/searchproducts.cfm

Local non profits that build trails with volunteers

Washington Trails Association
http://www.wta.org/

Volunteers for Outdoor Washington
http://www.trailvolunteers.org/

Mountains To Sound Greenway Trust
http://www.mtsgreenway.org/volunteer/projects/trail-work/trail-work

Backcountry Bicycle Trails Club
http://www.bbtc.org/trailwork/

Trail Tools

Ben Meadows
http://www.benmeadows.com/

Forestry Suppliers
http://www.forestry-suppliers.com/

Terra Tech
http://www.terratech.net/