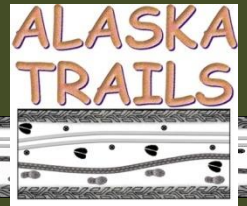


Alaska Trails

INTRODUCTION TO SUSTAINABLE TRAIL DESIGN



In this session we will discuss:



1. Definition of Sustainable Trail
2. Sustainable Design Concepts (8)

What is a sustainable trail?

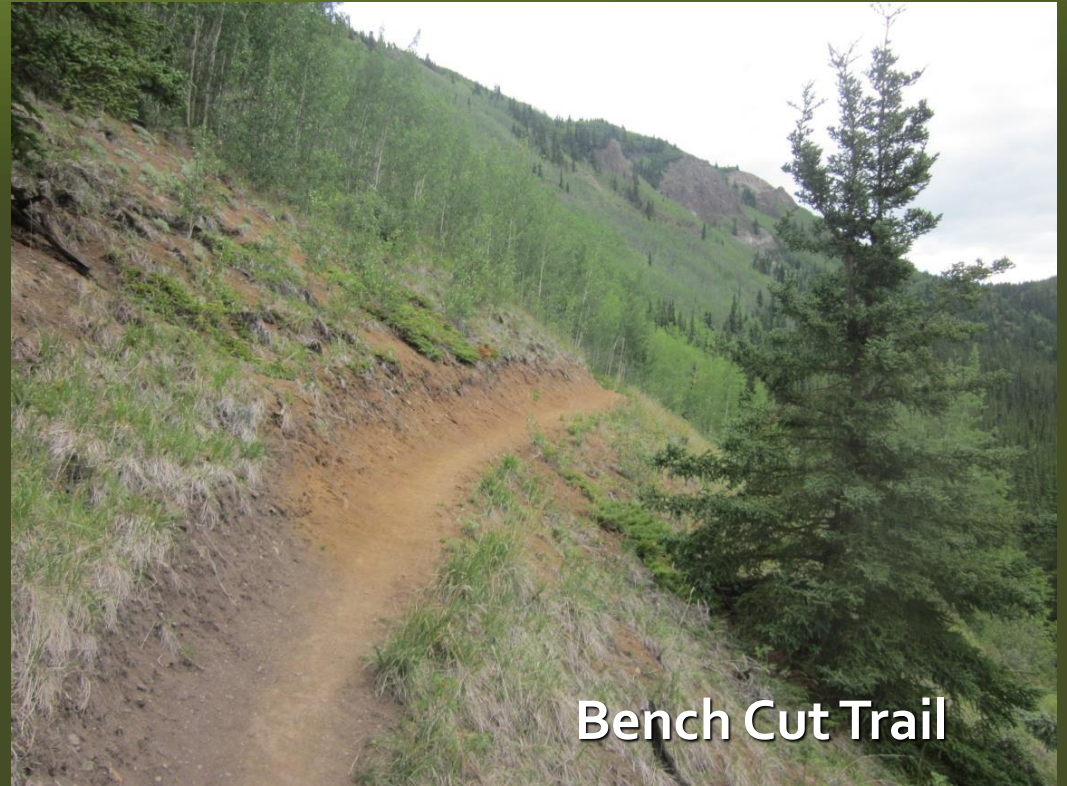
- ◆ A trail that conforms to its terrain & environment, is capable of handling its intended use without serious degradation, & requires minimal maintenance.



Are these sustainable?




Cap & Fill Trail



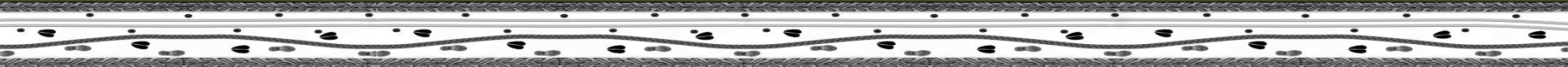
Bench Cut Trail

Concepts for a Sustainable Trail

- ✓ Planned & Designed
 - ✓ Contour Curvilinear Alignment
 - ✓ Controlled Grade
 - ✓ Integrated Water Control
 - ✓ Full Bench Construction
 - ✓ Durable Tread Surface
 - ✓ Regular Maintenance
 - ✓ Integrates Well into the Environment
- 

Concepts for a Sustainable Trail

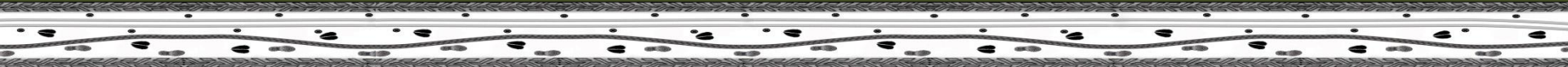
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PLANNED & DESIGNED

Concept:

Trail development is guided by Trail Management Objectives (TMO) and constructed to design parameters that support intended use with low impact to surrounding environment.



Methods to achieve PLANNED & DESIGNED

- Land Managers direct the Trail Management Plan (TMP), being sure to include trail users in the decision-making process.
- Environmental assessment is necessary
- Permission is paramount
- Establish function & purpose of trail early
- Build for managed use

~~Denali Trails~~

Trail Design and Management Objectives (TMO)		Type (project or trail)	
Trail Name		Asset Number	
Type of User:	Bikes <input type="checkbox"/>	Walker <input type="checkbox"/>	Hiker <input type="checkbox"/>
Level of use	Guided <input type="checkbox"/>	Heavy <input type="checkbox"/>	Moderate <input type="checkbox"/>
Use Season	All year <input type="checkbox"/>	Winter <input type="checkbox"/>	Summer <input type="checkbox"/>
In Wilderness?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Closures? note: <input type="text"/>
Level of Difficulty:	Easiest <input type="checkbox"/>	Moderate <input type="checkbox"/>	Difficult <input type="checkbox"/>
	ADA <input type="checkbox"/>	ADA <input type="checkbox"/>	ADA <input type="checkbox"/>
Trail Specifications:	Tread width	inches	type: <input type="text"/>
	Sub-grade width	inches	
	Grade %:	average	% maximum <input type="text"/>
	Outslope	average	% maximum <input type="text"/>
	Clearing-trunks	width (ft)	
	Clearing-branches	width (ft)	height (ft) <input type="text"/>
	Tread obstacles:	none <input type="checkbox"/>	1-3" <input type="checkbox"/> 3"+ <input type="checkbox"/>
	Drainage structures:	Yes/No <input type="checkbox"/>	
	Cut/Fill:	1/2 <input type="checkbox"/>	3/4 <input type="checkbox"/> full <input type="checkbox"/>
	Back slope:	1/1 <input type="checkbox"/>	1.5/1 <input type="checkbox"/> other <input type="text"/>
	Fill slope:	1/1 <input type="checkbox"/>	1.5/1 <input type="checkbox"/> other <input type="text"/>
	Geofabric type:		
	Cast material over edge?		
	Reveg		
Maintenance and Construction Info:	Maint Frequency	Monthly <input type="checkbox"/>	Annual <input type="checkbox"/> Other <input type="checkbox"/>
	Method	Motorized <input type="checkbox"/>	Handwork <input type="checkbox"/> Hand Tools ONLY <input type="checkbox"/>
	Spring Opening		
	Wilderness	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Approved Machines:	none <input type="checkbox"/>	skidsteer <input type="checkbox"/>	generator <input type="checkbox"/>
	toter <input type="checkbox"/>	plate compactor <input type="checkbox"/>	helicopter <input type="checkbox"/>
		chainsaw <input type="checkbox"/>	other <input type="text"/>
Facilities:	Retaining Walls <input type="checkbox"/>	Drainage Structures:	
	Bridges <input type="checkbox"/>	Rolling Dips <input type="checkbox"/>	
	Signs: interp/general <input type="checkbox"/>	Drain Dips <input type="checkbox"/>	
	Hardening <input type="checkbox"/>	Drains: <input type="checkbox"/>	
	Trail Camps <input type="checkbox"/>	Underside <input type="checkbox"/>	
	Overside <input type="checkbox"/>	Rock <input type="checkbox"/>	
	Culverts <input type="checkbox"/>	Outslope <input type="checkbox"/>	
Notes:	<input type="text"/>		
	<input type="text"/>		
	<input type="text"/>		
Form Completed by:	<input type="text"/>		Date Modified: <input type="text"/>

T:\Trails Admin\Trails\Trails Management Handbook\ Trail Design and Management Objectives

Public Comment is critical!



Agency planning documents vary

Concepts for a Sustainable Trail

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CONTOUR ALIGNMENT

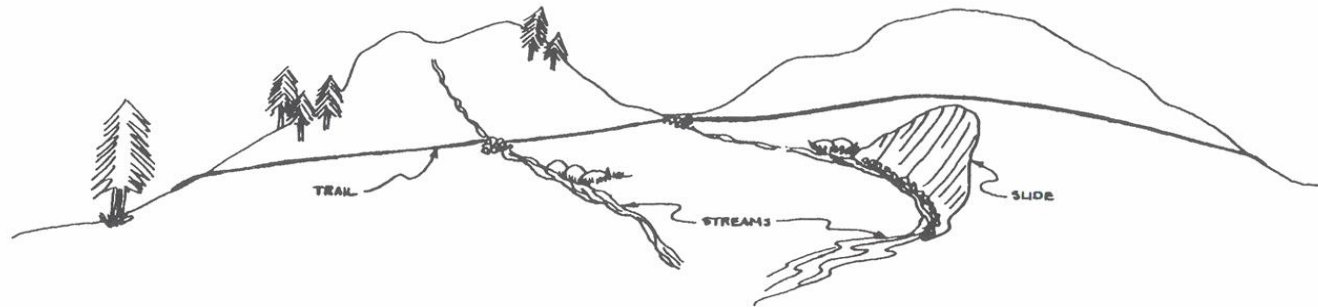
Concept:

Build trail side-hilling with topographical contour lines, not perpendicular to them.

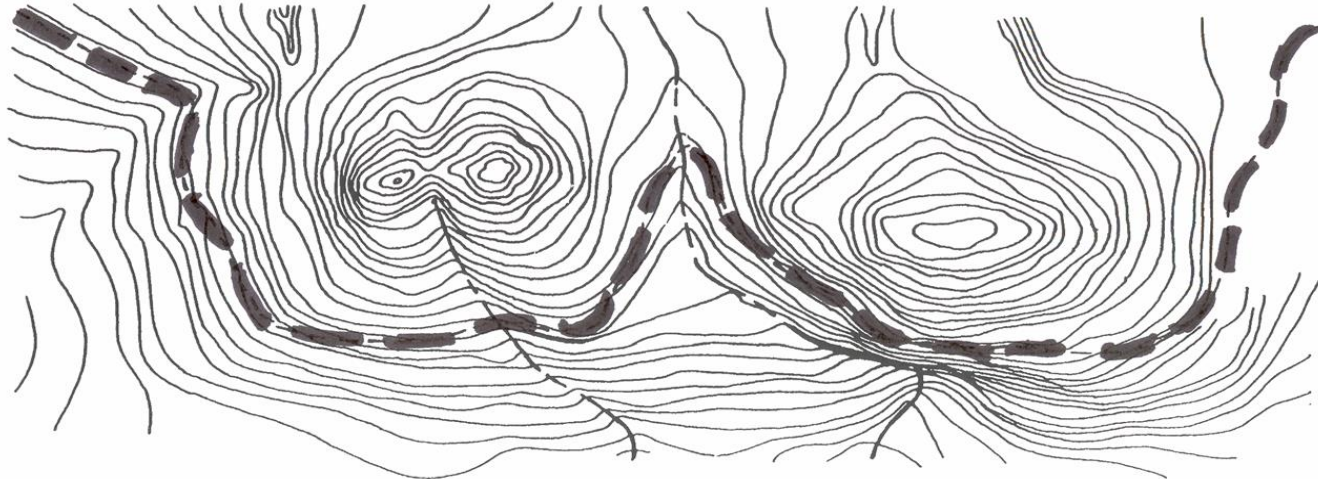
- ✓ reduces “fall-line” trails & over-steep grades
- ✓ controls grade in relationship to side-slope
- ✓ allows better management of drainage on trail
- ✓ promotes sheet flow
- ✓ conforms to the terrain, not imposed on it



Methods to achieve CONTOUR ALIGNMENT



TOPOGRAPHIC PROFILE OF TRAIL LAYOUT NOT TO SCALE.



RELATIONSHIP OF TOPOGRAPHY TO TRAIL GRADE AND LAYOUT

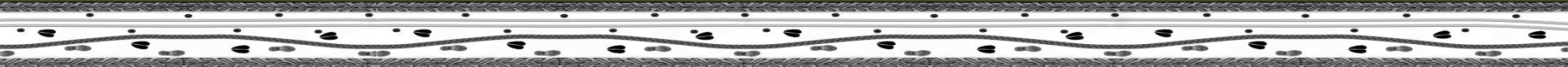
Contour curvilinear trails



Trail follows topography
instead of fighting it

Concepts for a Sustainable Trail

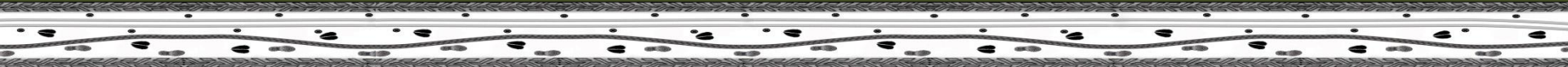
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CONTROLLED GRADE

Concept:

Through careful planning, design, and trail layout, controlled grade – at an average of 8-10%, always in relationship to the grade of the side-slope (and not exceeding the half-rule) – can help limit erosion of the tread surface



Methods to achieve CONTROLLED GRADE



Survey and design the trail to have a 8-10% average grade

Only exceed the 10% maximum grade:

- ✓ if the site conditions (soil type, side-slope) “accept” it
- ✓ for a distance of 50’ or less
- ✓ as less than 5% of total trail length

Clinometer

Inside View

Degrees

Good for any work

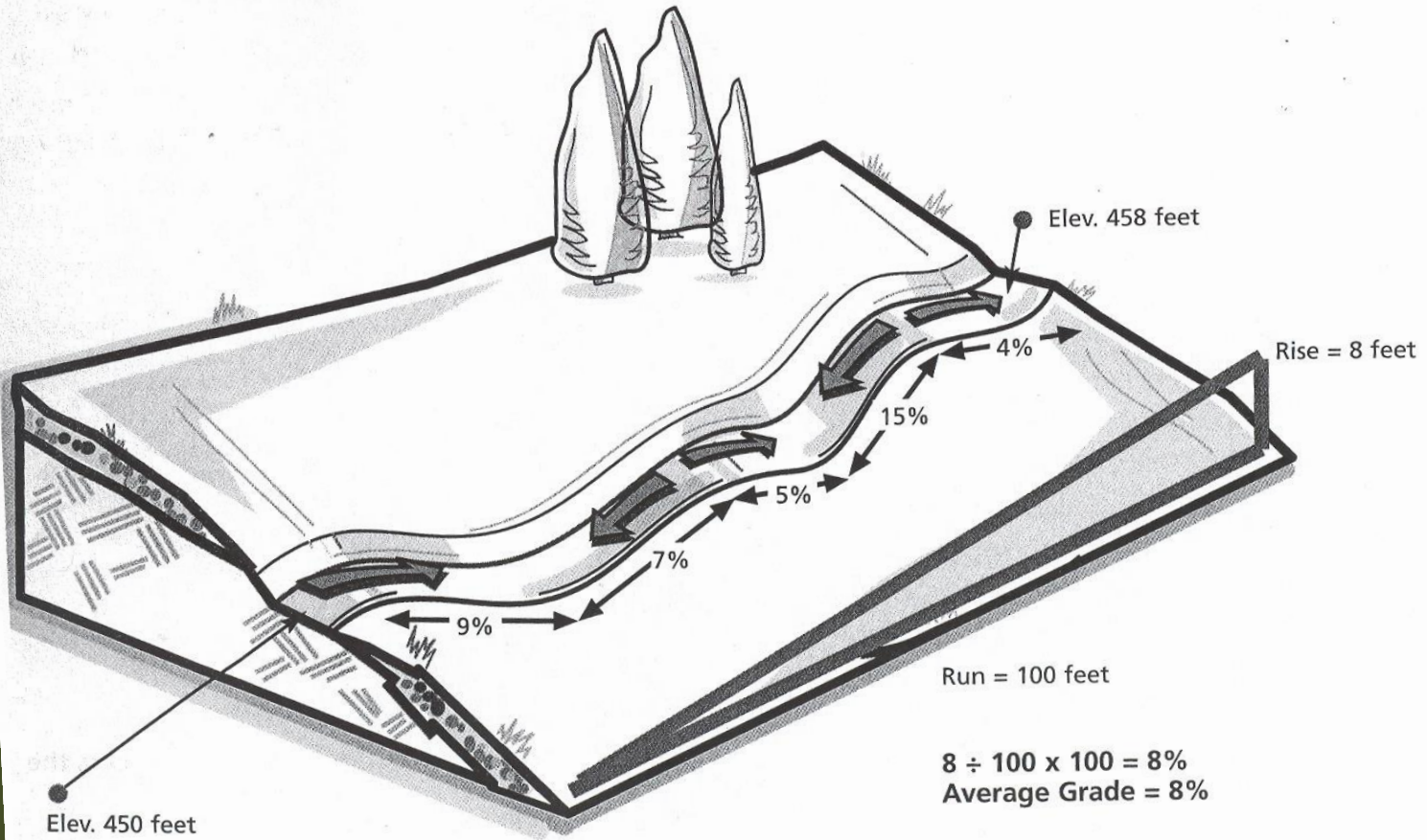


% Grade

What we want ↑

Average Grade

Average Trail Segment Grade





8 % Grade

Concepts for a Sustainable Trail

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INTEGRATED WATER CONTROL

Concept:

Use alignment, not structures, to shed water off the tread surface and maximize sheet flow; water control designed into the alignment reduces dependence on water bars or drains, which can fail.



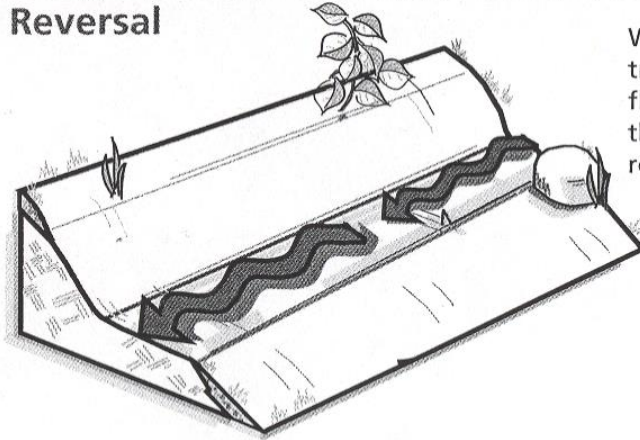
Methods of INTEGRATED WATER CONTROL

- Grade Reversals or Rolling Grade Dips at frequent intervals
- Drop in & rise out of drainages to shed water and prevent capture
- Create an *outslope* to promote sheet flow

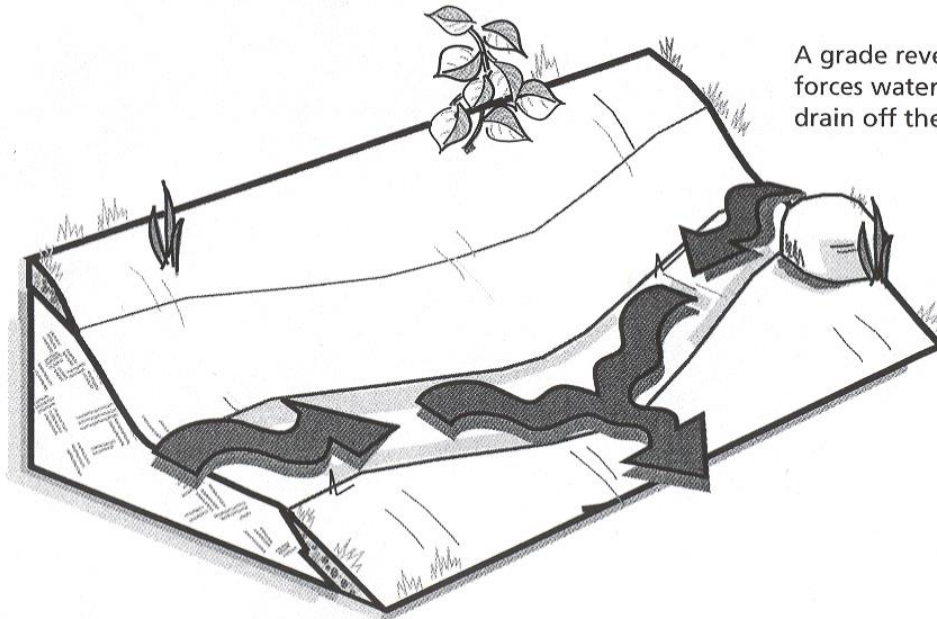


Grade Reversals

Grade Reversal



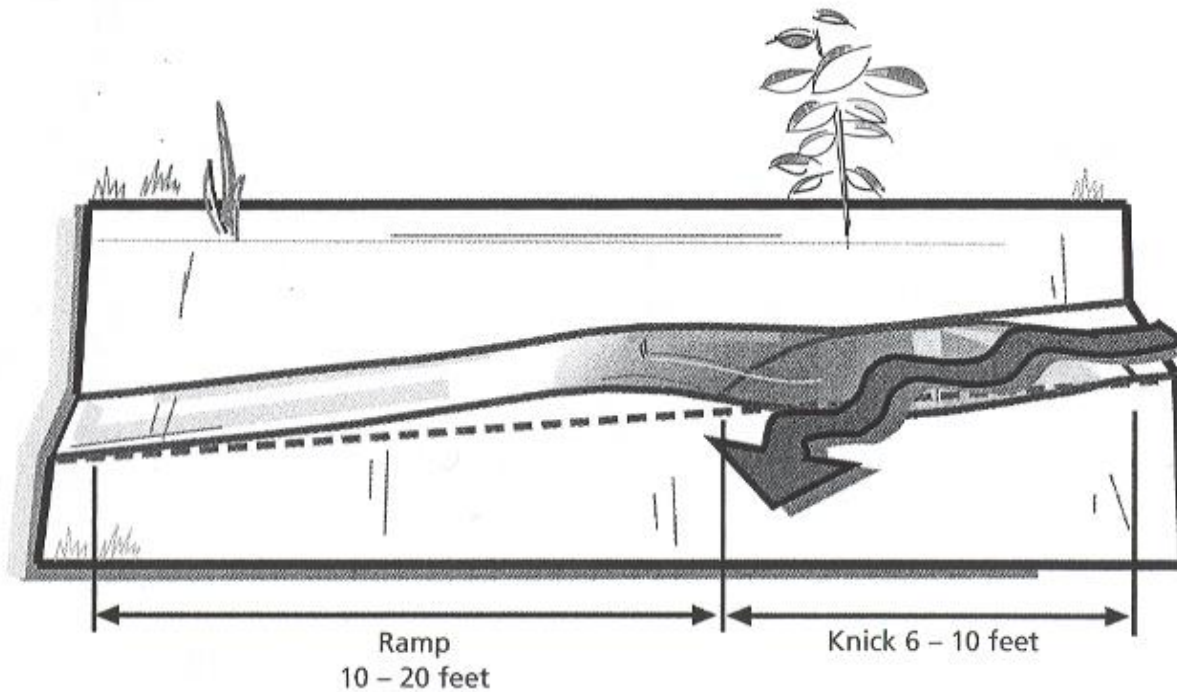
Water may become trapped on trail and flow long distances if there are no grade reversals.



A grade reversal forces water to drain off the trail.



Rolling Grade Dips

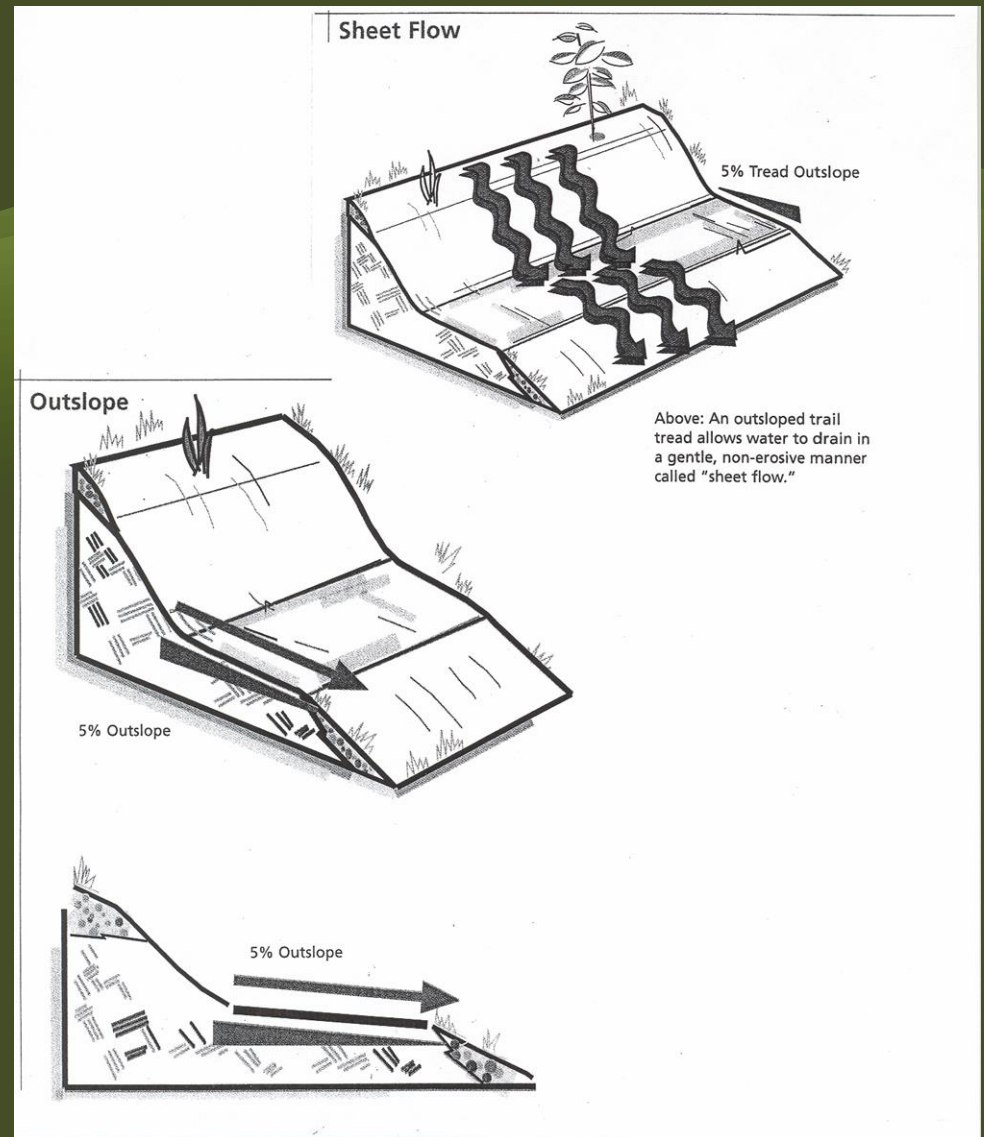


They are *not* water bar drains!

Outslope

3%-5% is standard for hiking trails

Less for wheeled traffic



Concepts for a Sustainable Trail

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FULL BENCH CONSTRUCTION



Concept:

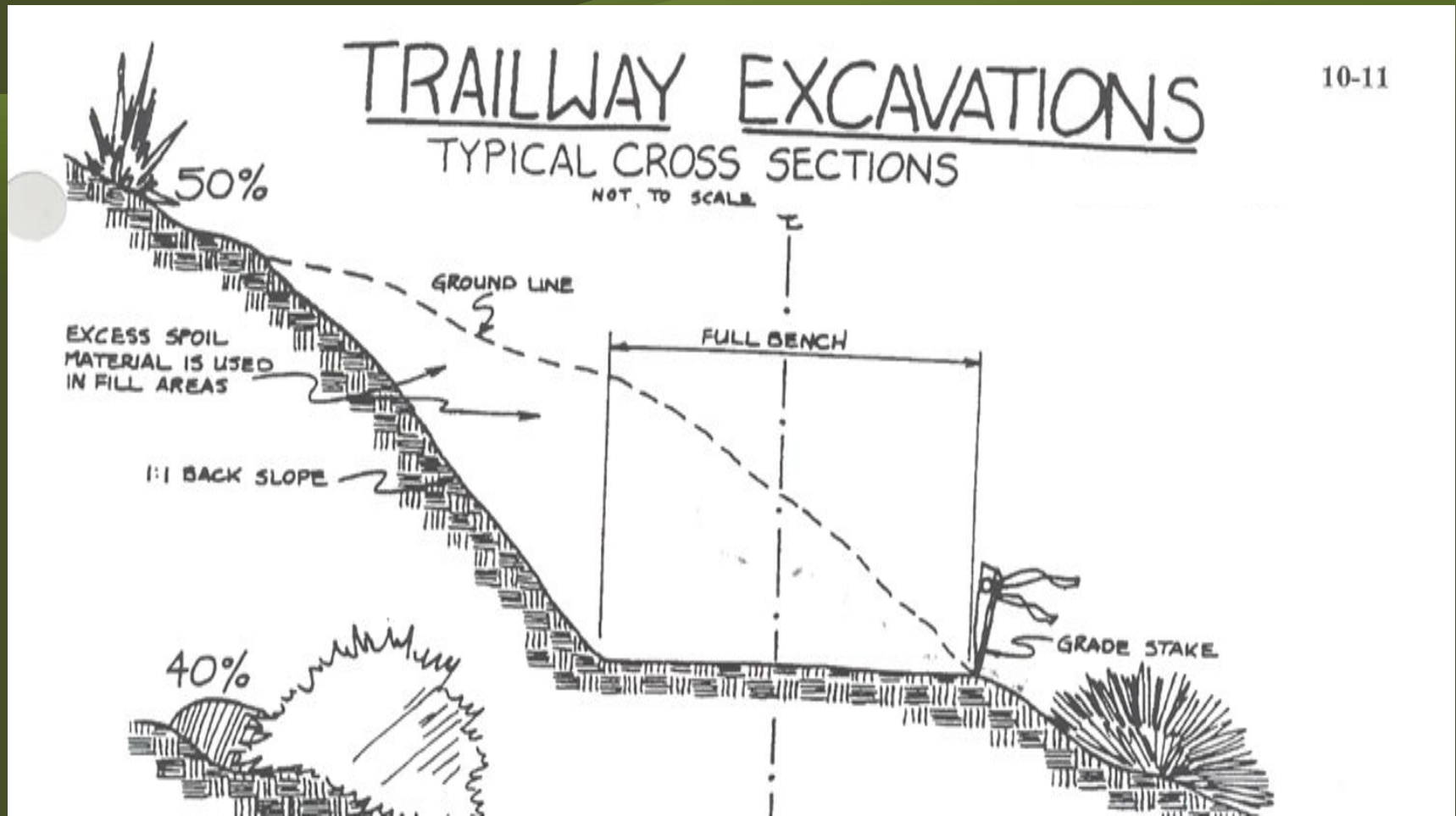
Full bench trail on a side-hill provides the most compact tread surface possible, encourages sheet flow, does not trap water on trail, and eliminates the potential for tread slump failure.

FULL BENCH TECHNIQUES

- Cut & excavate a full bench to width designated by TMO
- Follow flag-lines & check grades
- Excavated material can be broadcast or hauled to concealed site
- Be sure to cut back-slope for “angle of repose”



Cut-Away View of Full Bench







Concepts for a Sustainable Trail

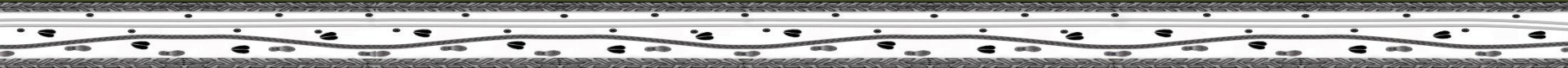
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DURABLE TREAD

Concept:

Ensure long-term durability of tread surface by utilizing on-site native material or importation of material to rectify poor drainage or tread surface, especially on flat ground and when full bench is not possible.



DURABLE TREAD



Whenever possible, use native mineral soil from on-site fill sources (gravel bars, fill pits), while minimizing damage to the resources.

Other Methods to Achieve DURABLE TREAD



Boardwalk



Puncheon



Gravel Cap & Fill



Geo-Block?



Running Plank



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REGULAR MAINTENANCE

Concept:

Even sustainable trail requires maintenance!
However, sustainable planning, design and construction **DRAMATICALLY** reduces the amount of maintenance needed.



Planning for REGULAR MAINTENANCE

The TMO should indicate:

- ✓ Level of priority the trail has
- ✓ Level of maintenance the trail needs
- ✓ Standards to which the trail is to be kept



Planning for REGULAR MAINTENANCE



Being able to accurately predict maintenance tasks allows land managers to plan for volunteer, service learning or professional crews to fill the need.

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INTEGRATES WELL INTO THE ENVIRONMENT

Concept:

Trail does not destroy the feel, aesthetics or ecological integrity of the environment that it becomes a part of. Its character should strive to enhance natural features rather than destroy them. Trail draws user into the the landscape.



INTEGRATING INTO ENVIRONMENT



SUSTAINABLE TRAIL MAXIMS

1. Remember history – there are lessons to be learned and successes to model.
2. Always strive for **sustainable**.
3. Plan, design, build and maintain for the long-term – think 100 years...
4. As a trail-user, be involved!



Finally, Evaluate & Analyze

Take time to evaluate successes and failures along the way and after project completion.





When things go well, take a break...

And don't forget to celebrate a job well done!



Happy Trails!



Alaska Trails Workshop - Girdwood 2006

Thank you! Questions?

ALASKA TRAILS

Thank you to our partners !

