A Quick primer on Low Volume Roads

- Purpose to access resources
- Traffic < 400 vehicles per day but with potential for high axel weight.
- High potential for negative effects on water quality if:
  - Not well planned or located.
  - Not properly designed or constructed
  - Not well maintained
  - Not constructed with appropriate and durable materials

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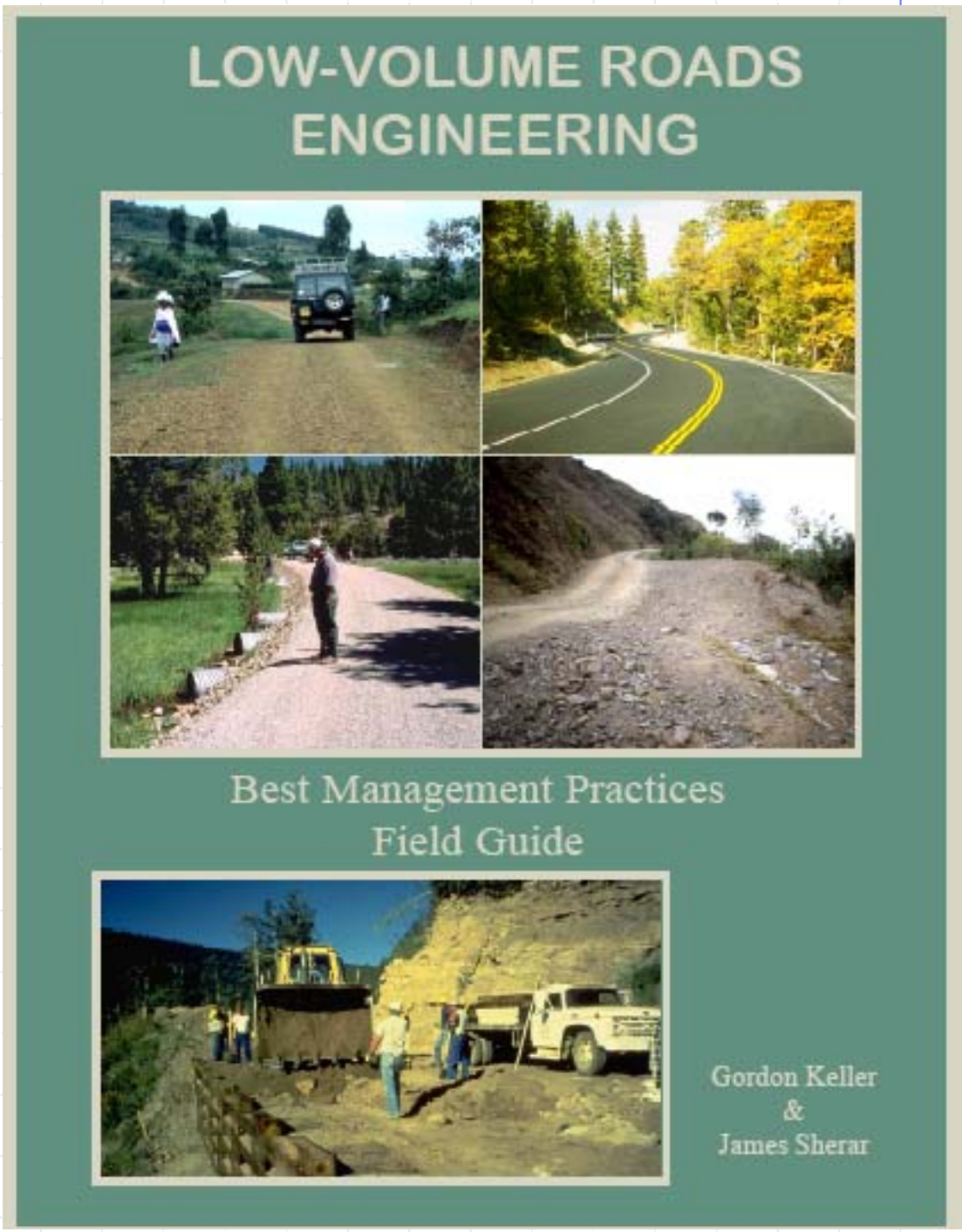
Reference

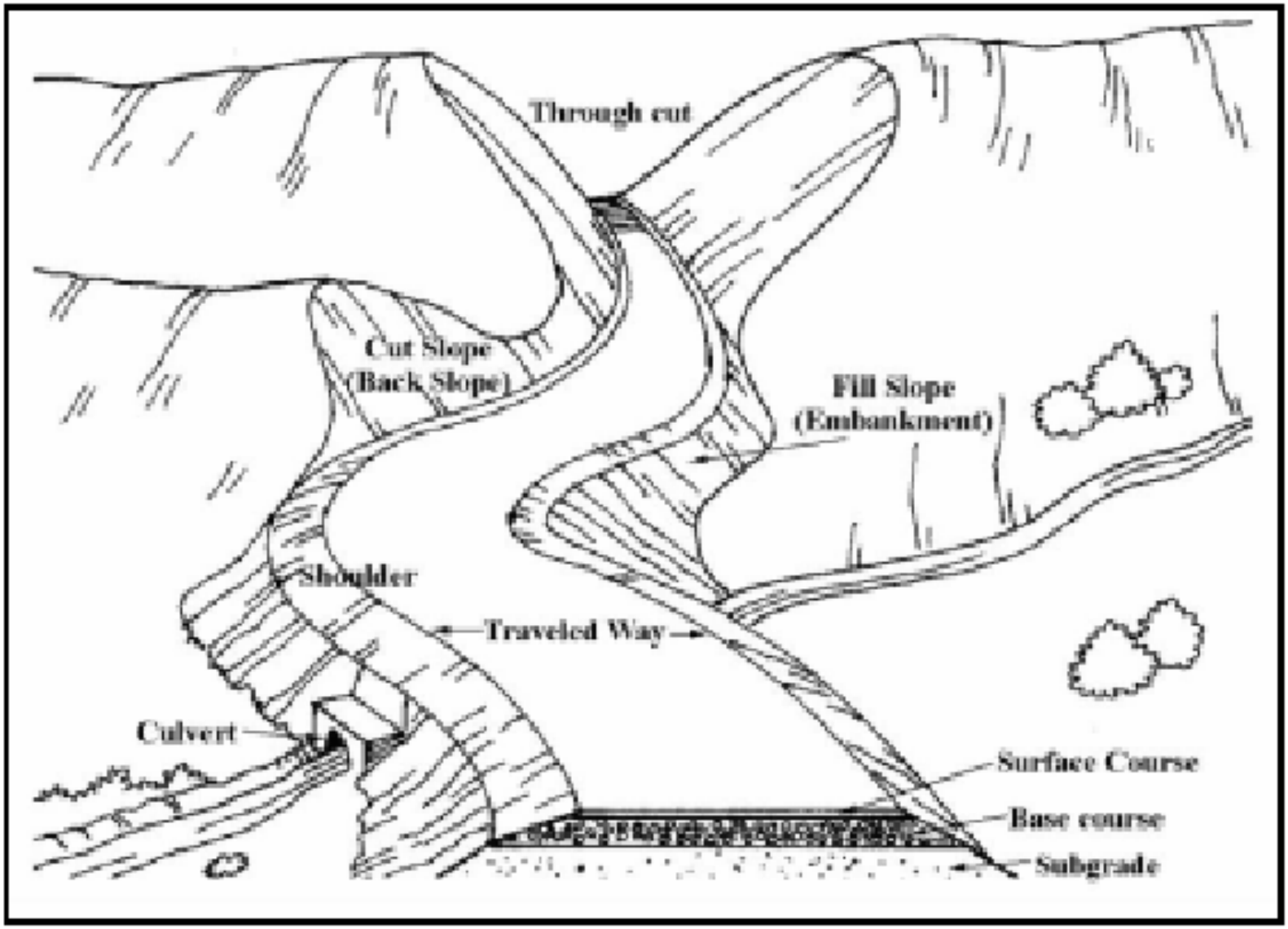
Keller, G and J. Sherar. 2003. Low-Volume Roads Engineering: Best Management Practices Field Guide.

USDA Forest Service/USAID.

http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.htm

Reproduction of this Field Guide is Encouraged!




Through cut
Cut Slope
(Back Slope)
Fill Slope
(Embankment)
Shoulder
Traveled Way
Culvert
Surface Course
Base course
Subgrade

Objectives of Best Management Practices for Road Construction and Maintenance

- Produce a safe, cost effective, environmentally friendly, and practical road design that is supported by and meets the needs of the users;
- Protect water quality and reduce sediment loading into water bodies;
- Avoid conflicts with land use;
- Protect sensitive areas and reduce ecosystem impacts;

- Maintain natural channels, natural stream flow, and maintain passage for aquatic organisms;
- Minimize ground and drainage channel disturbance;
- Control surface water on the road and stabilize the roadbed driving surface
- Control erosion and protect exposed soil areas;
- Implement needed slope stabilization measures and reduce mass wasting;
- Avoid problematic areas; and
- Stormproof and extend the useful life of the road.

Road planning and Environmental Analysis

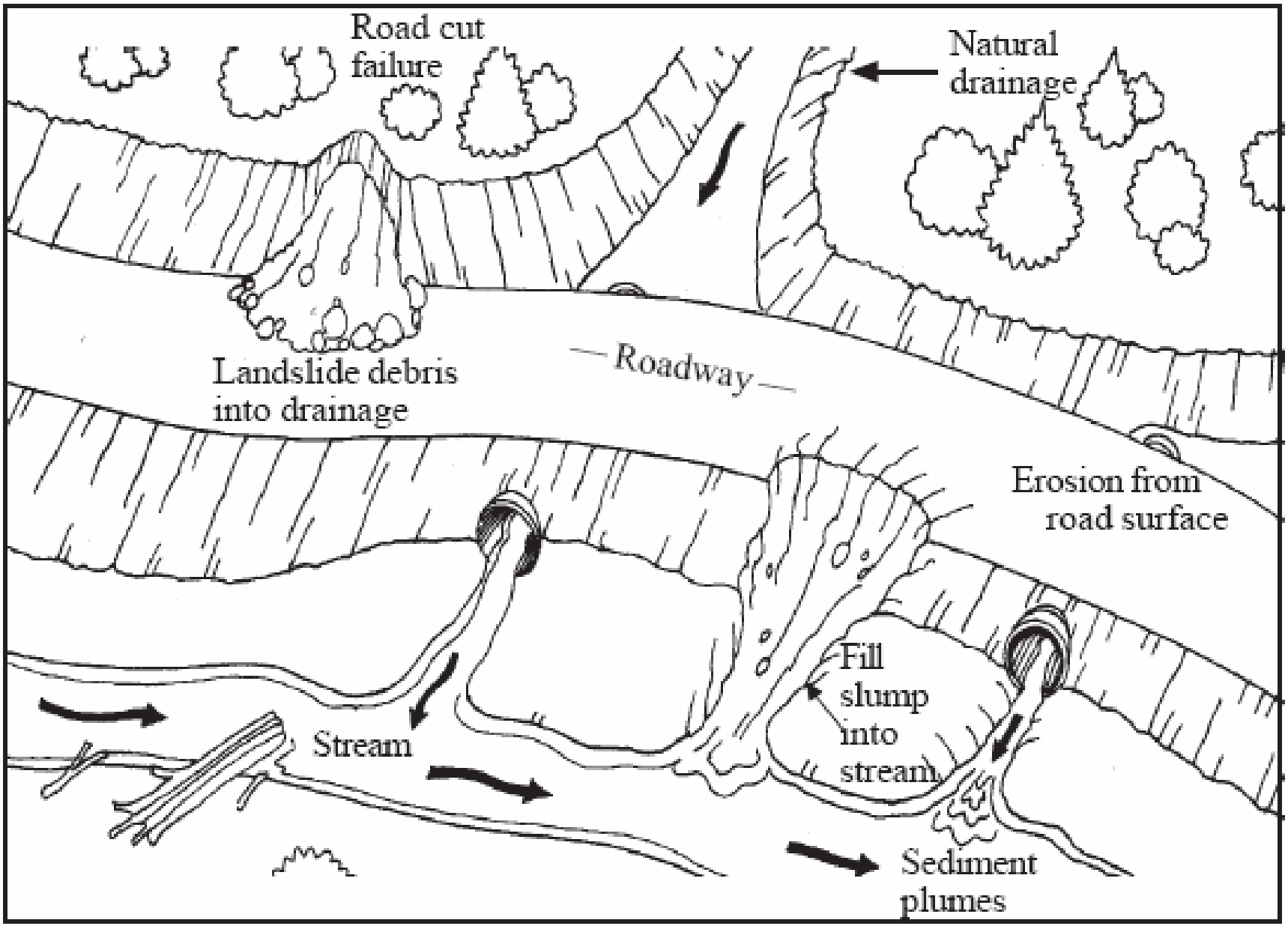
- Recommended
  - Use the EA early during project planning.
  - Involve all parties affected by the project. Emphasis lots of two way communication between all parties.
- Avoid
  - waiting until problems develop before doing an EA.
  - getting lost in the EA Process.

An EIGHT Step Environmental Analysis Process and Its Associated Outputs

1. Identify the Project	Identify the purpose and need of the proposed action. Develop a goal to provide a framework for EA.
2. Scoping	Identify the issues, opportunities, and effects of implementing the proposed action.
3. Collect and Interpret Data	Collect data. Identify probable effects of project implementation.
4. Design of the Alternatives	Consider a reasonable range of alternatives. Usually at least three alternatives are considered. Include a No-Action Alternative. Consider the mitigation of negative impacts.
5. Evaluate Effects	Predict and describe the physical, biological, economic, and social effects of implementing each alternative. Address the three types of effects -- Direct, Indirect, and Cumulative.
6. Compare Alternatives	Measure the predicted effects of each alternative against evaluation criteria.
7. Decision Notice and Public Review	Select preferred alternative. Allow for review and comment by the affected and interested public.
8. Implementation and Monitoring	Record results. Implement selected alternative. Develop a monitoring plan. Insure that EA mitigations are being followed.

Road Planning Issues to consider

- Slope position and risk of slope failure
- Risk of road-stream crossing failure
- Stream channel proximity and sediment delivery to water bodies and riparian areas.
- Groundwater and surface water regimes.
- Wildlife, fisheries and aquatic habitats



The many ways roads can be "connected" to streams and contribute sediment. Keep roads away from streams to protect water quality as well as reduce road maintenance and damage.

Road Planning Issues to consider

- Human disturbance
- Road density
- Exotic species

Design road to be usable when needed. (after a Natural disaster)

- Identify areas of historic or potential vulnerability: unstable slopes, areas subject to flooding, ...
- Avoid areas of high natural risk: landslides, rock-fall, steep slopes (>60%), wet areas and saturated soils.

Design road to be usable when needed.

- Avoid construction in narrow canyon bottoms or on flood plains
- Design critical bridges or culverts with armored overflow areas near the structure to withstand overtopping, or have a designed failure point that is easy to repair or oversize the structure to maximize capacity (minimize risk).

Design road to be usable when ne

- Provide roadway surface drainage. Rolling grades, broad based dips, sloping or crowned profile

Design road to be usable when needed

Design road to be usable when needed

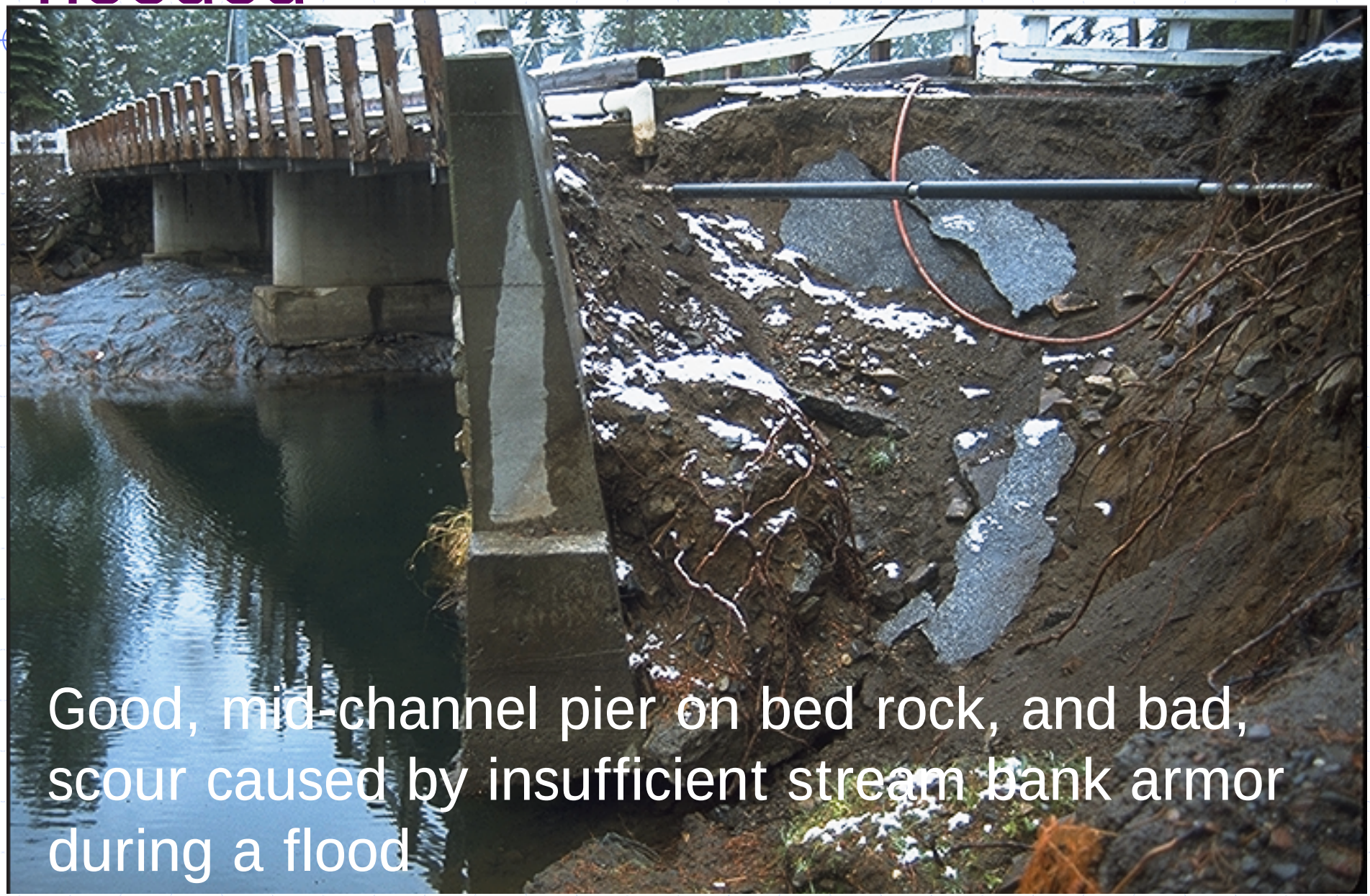
- Use simple fords or vented low water crossing for small or low-flow stream crossings instead of culvert pipes which are more susceptible to plugging and failure. With fords protect the entire wetted perimeter of the structure, protect the downstream edge of the structure against scour and provide fish passage where needed.

Maintain road to be usable when needed

- Perform scheduled maintenance to be prepared for storms.
  - Ditches are clean and armored.
  - Channels are free of debris and brush that can plug structures.
  - Shape roadway surface to disperse water rapidly.
  - Give attention to areas of water concentration.

A geotextile backing behind a loose rock slope buttress to provide a filter for drainage and prevent movement of fine soil into rock and eventually streams.

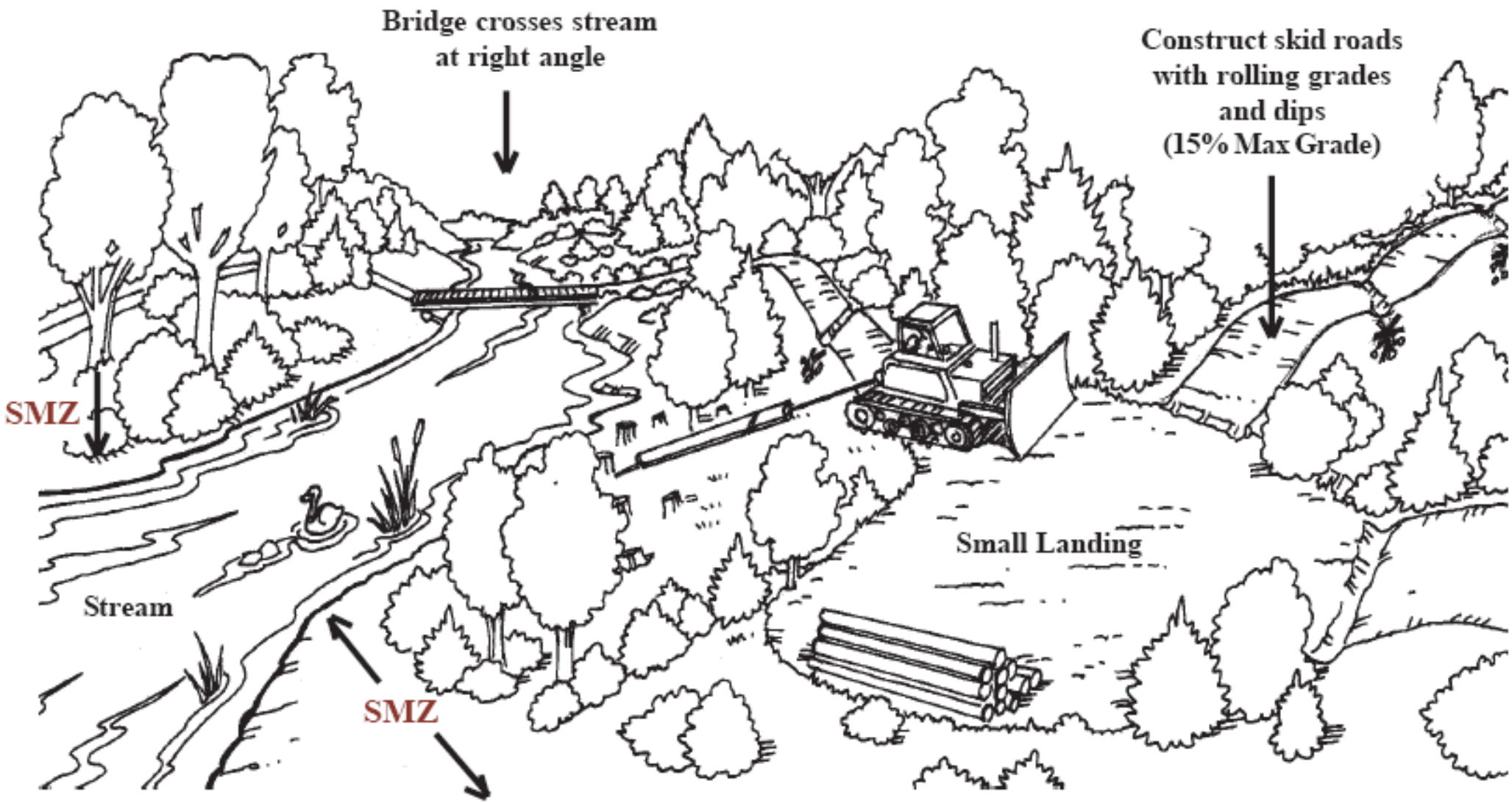
Design road to be usable when needed



Good, mid-channel pier on bed rock, and bad, scour caused by insufficient stream bank armor during a flood

Streamside Management Zones

Limit Streamside Management Zone (SMZ) activity



Winch logs from the SMZ. Construct small safe, efficient landing. Minimize activities in the SMZ. Keep landings and skid roads out of the SMZ.

Landings and skid trails

- Construct landing with enough slope to drain properly but not exceed 5%.
- Locate landings to avoid skidding patterns that concentrate water from skid roads onto the landing or off the landing into streams.
- Maintain landings prior to and during periods of wet weather to avoid erosion problems.
- During and after operations are completed, rehabilitate landings and access roads with water diversions structures and erosion control measures.

Stabilize skid roads and trails after use with water bars and apply a ground cover or other erosion control measures.

Practices to avoid

- Getting construction debris in lakes and streams.
- Using mechanized equipment within the SMZ
- Road or landing construction within the SMZ.
- Contaminating forest soils with fuel and oil.
- Cutting trees that shade the stream and cool the water.

Landings and skid roads

- Design and locate main skid roads and trails before logging operations begin.
- Design and locate skid roads to follow the contour of the natural terrain.
- Winch logs from the SMZ or areas of steep slopes to avoid equipment movement in this area.
- Locate skid roads in such a way that water from the skid trail is not concentrated into the log landings or creeks.
- Cross Natural drainages at right angles with skid roads. Cover approaches with logging slash.
- Cover bare ground with logging slash after operations
- Construct skid roads of grades of 15% or less except for short distances where 30% grades are acceptable.
- Decommission skid roads after timber removal operations

Geotextiles can be used to stabilize a muddy road surface

- The most common approach to firming up a muddy road is to add gravel. Although this can occasionally be effective, there is a saying in the trade that "adding a bucket of gravel to a bucket of mud just gets you a bigger bucket of mud." There is much truth to this quip, as adding something to a muddy road often has little effect, and can sometimes make matters worse because of increased agitation of an already sticky situation.
- Geotextile fabrics can effectively eliminate muddy conditions on a road by keeping gravel surface materials from mixing into the road base as wheel loads push the road surface materials down. If you are building a road through an area of known weak soil condition or have a road that turns to soup after each rain, plan on using a geotextile under the road surface for a permanent solution when possible. If you have a few sink holes here and there and have to make them passable during the spring, try adding stone. But be prepared to add enough to do the job completely or you can expect to end up with nothing more than just a bit more mud.

WHAT IS A GEOTEXTILE ?

- Any permeable textile material used to increase soil stability, provide erosion control or aid in drainage. (if it is made of fabric and buried in the ground it's a probably a geotextile.) Geotextiles have been in use for thousands of years dating back to the Egyptian Pharaohs. These early geotextile applications were basically natural fibers or vegetation mixed directly with soil.

- Modern geotextiles are usually made from a synthetic polymer such as polypropylene, polyester, polyethylenes and polyamides. Geotextiles can be woven, knitted or non-woven. Varying polymers and manufacturing processes result in an array of geotextiles suitable for a variety of civil construction applications.

Print yourself a copy, read and carry with you of:

- Keller, G and J. Sherar. 2003. Low-Volume Roads Engineering: Best Management Practices Field Guide. USDA Forest Service/USAID. http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.htm