

General Best Practices for Maintaining Terrain Stability

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The practices, measures, and tenure clauses summarized below are provided as general guidance, which NACFOR Coordinating Professionals will consider in business practices, site level plans, contracts, or licences and permits, as appropriate. They are not intended to replace, or substitute for, site-specific recommendations or measures prescribed in professional assessments or designs.

Road Construction

1. Maintain natural surface drainage patterns as much as possible.
2. Road width should be minimized, to a safe width, accounting for the planned use.
3. The road surface should be crowned to shed runoff, reducing erosion and the potential for redirected water on the road surface.
4. Culvert inlets and outlets should be armoured with coarse rock (>300 mm diameter) where required.
5. Where actual ground conditions encountered during road construction are different from those anticipated in a TSA, a Terrain Specialist should be consulted to determine if TSA recommendations should be revised.
6. Construction should be modified or suspended when there is abundant hill slope runoff occurring at the site, which is likely to occur during times such as spring break-up or periods of high runoff from prolonged heavy precipitation.
7. Where significant seepage is encountered, armoring of the cutslope is recommended to maintain cutslope stability and control erosion, and a field review by a qualified registered professional may be warranted commensurate with risk.
8. Road inspections should take place at least semi-annually, once in the fall and once (or more depending on circumstances) during spring runoff, for the first two years following road construction. Subsequent inspections should be carried out annually, or otherwise commensurate with risk.

Road Maintenance and Deactivation / Rehabilitation

1. Seasonal maintenance measures (back up cross ditches for all culvert locations and intermediate cross ditches/waterbars as appropriate at gullies and swales or other locations where additional runoff dispersion is warranted¹) should be established during periods of non-industrial use.
2. Regular road inspections, for additional required maintenance/work (possible ditch cleaning, culvert cleaning, or cross ditch improvement), should take place.
3. Temporary access: Full rehabilitation of the road prism should take place within the term of the licence. This includes full recontouring of the road prism and construction of waterbars on the recontoured surface. The rehabilitated roads should also be seeded or planted with an appropriate species mix.
4. Road Maintenance (Road Permit clause):
 - 5.01 The Permittee must regularly maintain and repair roads used or constructed and used under this Permit to ensure safe industrial use of those roads, including the use by third parties, in a timely manner and fashion by doing the following:
 - Drainage systems:
 - (a) ensuring that road surface and slope drainage systems (including ditches, culverts and road crowning, in-sloping and out-sloping) are functional at all times;
 - Surface grading:
 - (d) utilizing a grader to perform surface grading to the road, except for those roads with ballast rock surfaces, to . . .
 - (ii) provide proper road surface drainage and prevent water pooling on the road by shaping the surface crown or sloping the road surface as indicated by the character of the existing surface, and removing grader berms . . .
 - Winter and seasonal maintenance:
 - (i) ceasing all industrial use on the road or sections of the road that display any of the following conditions:
 - (i) rutting to the point that subgrade material mixes with surfacing material;
 - (ii) damage to the subgrade is occurring;
 - (iii) erosion of surfacing material.
5. Rehabilitation of Temporary Roads (Road Permit clause):
 - 7.01 . . . the Permittee must, before the expiry of the Timber Sale Licence, rehabilitate the area occupied by [the] road by:
 - (a) de-compacting compacted soils,
 - (b) returning displaced surface soils, retrievable side-cast and berm materials onto the area occupied by that road,
 - (c) placing woody debris on the exposed soils, and
 - (d) re-vegetating the exposed mineral soils.

¹ If appropriate drainage dispersion methods are not obvious, or the terrain is highly sensitive, then consultation with a terrain stability professional would be warranted for recommendations.

Timber Harvesting

1. Timber harvesting should be modified or suspended when there is abundant hillslope runoff occurring, such as during spring break up, or during periods of high runoff from heavy precipitation.
2. Machine use should be limited to areas where excessive scour, rutting, or compaction is avoidable. This would generally restrict machine use from areas of moderately steep or steeper slopes as well as any localized areas of wet, soft, or very loose soils. Some modified machine use (ex. hoe chucking) may be possible in these areas if excessive disturbance as described above is avoidable.
3. All natural drainage patterns (including all NCDs as well as gullies or dry swales) should be maintained and left free of excess debris (slash or soil) that could result in a redirection of seasonal surface runoff.
4. Trails should be minimized as practical, fully rehabilitated concurrent with harvesting and prior to the next spring freshet, and must not result in a significant concentration or redirection of runoff patterns from their natural courses prior to full rehabilitation. If there is to be a delay between harvesting and full rehabilitation, cross ditches located at all natural drainage paths and dry swales, and surface waterbars appropriately spaced, not more than ___ [e.g., 30] metres apart, should be constructed.
5. Skid trail rehabilitation:
 - 10.01 The Licensee must fully rehabilitate all excavated and bladed trails, as well as temporary roads and landings, and any other machine path that results in significant compaction and/or scouring of the ground surface which may result in the concentration and/or redirection of runoff. Rehabilitation must be conducted in the following manner:
 - (a) decompacting, including removing woody debris that is conducting subsurface moisture,
 - (b) placing fill material that was sidecast on the excavated portion of the trail,
 - (c) recontour the slope,
 - (d) re-establish natural surface drainage,
 - (e) place woody debris over exposed mineral soil, and,
 - (f) revegetate exposed mineral soil with Canada common #1 or like seed mix.

Additional References for General Best Practices

B.C. Forest Safety Council. 2011. **Steep Slope Resource Package – Supporting Guidance for Operating on Steep Slopes.**

<http://www.bcforestsafe.org/node/1938>

BCTS Skeena Business Area. Planning and Monitoring Steep Slopes for Ground Based Operations.

Ministry of Forests, Lands and Natural Resource Operations. 2009 (Revised: 2011). **Engineering Manual.** B.C. Min. For., Lands & Nat. Res. Ops, Engineering Branch, Victoria, B.C.

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B.C. Ministry of Forests. 2002. **Forest Road Engineering Guidebook.** For. Prac. Br., B.C. Min. For., Victoria, B.C. Forest Practices Code of British Columbia Guidebook.

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Chatwin, S.C., D.E. Howes, J.W. Schwab, and D.N. Swanston. 1994. **A Guide for Management of Landslide-Prone Terrain in the Pacific Northwest.** B.C. Ministry of Forests, Land Manage. Handb. No. 18 (2nd ed.). Victoria, B.C.

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