



OMINECA REGION

GUIDELINES FOR WATERSHED PLANNING

1 Purpose

To provide hydrological considerations when planning salvage harvest/logging to address the current spruce beetle outbreak. Proper management of watershed resources will minimize the risk of:

- channel destabilization,
- loss of fish habitat,
- increased channel sedimentation,
- increased landslide activity,
- elevated water tables,
- potential damage to forest road surfaces, cuts and fills, and drainage structures,
- loss of soil and site productivity, and
- loss of water quality.

2 Background

The hydrologic response of forested watersheds to disturbance is influenced by the scale and intensity of the disturbance, the weather, the geophysical setting, as well as conditions of the forest cover and understory. As this current outbreak progresses so will discussion about the need to “salvage harvest” marketable standing dead trees killed by spruce beetle. Harvest, of any kind, must balance optimizing market value in the timber, protect green spruce for midterm timber supply, and safeguarding non-timber values including aquatic ecosystems and watershed hydrology. In light of this, the following hydrology-related changes and management options are presented for consideration as a component of FLNRO’s document series for the spruce beetle outbreak in the Omineca Region. Although the extent of spruce mortality and potential salvage logging may be significant in many watersheds it is important to balance the management response to ensure non-timber values are maintained. Salvage harvest and road construction can exacerbate any potential hydrological response to the beetle outbreak.

3 Hydrologic Change Associated with Stand Mortality and Salvage Logging

A reduction in forest canopy can result in:

- increased water reaching, stored in, and flowing from hillslopes,
- earlier onset of spring snowmelt,
- increased spring and total annual streamflow volumes,
- earlier onset of summer low flows due to early snowmelt,
- more rapid streamflow response to storms,
- increased surface erosion.

The magnitude of hydrologic change will depend on:

- the severity and time since attack,
- presence, density and extent of secondary structure,
- the extent of salvage logging within stands and across a watershed,
- the occurrence of fire,
- the physical characteristics of the watershed,
- the amount of impervious surfaces such as roads and associated ditch lines, and
- the weather.

If attacked stands are left to deteriorate naturally, any hydrologic change that occurs will be gradual as trees turn from green to yellow and red, drop their needles, lose fine branches, and eventually fall to the ground. At the same time, remaining over story will function normally or thrive and understory will release due to increased light levels and reduced competition for nutrients, both of which can lead to increased evapotranspiration rates. In contrast, logging (of any kind) can result in an immediate change to a hydrologic system. For example, logging will physically remove the dead standing spruce, and therefore eliminate any role they might provide through shade or canopy interception of precipitation. In addition, logging activities can affect the hydrologic system through:

- removal of non-spruce species and understory coniferous regeneration,
- changing the amount and distribution of fine and coarse woody debris,
- site preparation with resulting disruption of soil hydrology and potential for erosion, and
- the conversion of subsurface to surface runoff along roads and skid trails.

The duration of hydrologic change associated with the IBS outbreak will depend on:

- whether the entire over story has died or been logged,
- the amount of ground disturbance,
- the presence, age, and density of advance regeneration, and
- the regeneration delay.

4 Watershed Planning Expectations

To mitigate the effects of the IBS outbreak on water and watersheds, the following recommendations should be considered by forest resource planners where practicable:

- conduct salvage harvesting and road construction occur in watersheds where ground surveys have identified that understory regen is below current stocking standards and over story is composed of 80+% spruce.
- salvage log in stages by using a variety of cutting intensities and retention strategies, distributed over the landscape, to desynchronize runoff,
- avoid sensitive terrain and soil types and develop erosion control plans,
- minimize harvesting within riparian areas,
- maintain a diversity of cover types and minimize post-harvest reforestation delays through single tree or patch retention to protect advanced regeneration as well as non-coniferous forest vegetation,
- leave fine and coarse woody debris in openings where possible to trap snow and also delay surface runoff,
- develop watershed management strategies that will maintain other forest resource values,
- construct, inspect, maintain and deactivate roads to ensure natural surface and shallow subsurface drainage remain intact,
- upgrade drainage networks on permanent roads prior to salvage logging as necessary to accommodate expected increases in peak flows,
- monitor for road erosion and remediate,
- minimize road construction and site disturbance,
- consider available regional watershed evaluation findings which include watershed-based hazard indices for riparian, sediment and peak flow,

- follow harvesting recommendations on alluvial fans where they are encountered (*Land Management Handbook* 57),
- identify and consider fisheries sensitive and temperature sensitive watersheds harvest level and riparian requirements,
- increase collaboration with resource management agencies to communicate and discuss issues, hazards, and risks in watersheds affected by IBS beginning with the identification of watersheds where downstream risks to public safety and infrastructure could be increased along with risk to aquatic life and community values.

For additional information on spruce beetle management, please contact your local FLNRO office.



Literature Cited

Amoroso, Mariano M., K. David Coates, and Rasmus Astrup. "Stand recovery and self-organization following large-scale mountain pine beetle induced canopy mortality in northern forests." *Forest Ecology and Management* 310 (2013): 300-311.

Biederman, Joel A., Andrew J. Somor, Adrian A. Harpold, Ethan D. Gutmann, David D. Breshears, Peter A. Troch, David J. Gochis, Russell L. Scott, Arjan JH Meddens, and Paul D. Brooks. "Recent tree die-off has little effect on streamflow in contrast to expected increases from historical studies." *Water Resources Research* 51, no. 12 (2015): 9775-9789.

Cheng, J. D. "Streamflow changes after clear-cut logging of a pine beetle-infested watershed in southern British Columbia, Canada." *Water Resources Research* 25, no. 3 (1989): 449-456.

Moore, R. D., and D. F. Scott. "Camp Creek revisited: streamflow changes following salvage harvesting in a medium-sized, snowmelt-dominated catchment." *Canadian Water Resources Journal* 30, no. 4 (2005): 331-344.

Nordin, L., 2008. *The Bowron River watershed: A synoptic assessment of stream and riparian condition 20–30 years after salvage logging*. BC Ministry of Forests and Range, Research Branch, Victoria. BC Extension Note No. 86. <http://www.for.gov.bc.ca/hfd/pubs/docs/En/En86.htm>.

Slinski, Kimberly M., Terri S. Hogue, Aaron T. Porter, and John E. McCray. "Recent bark beetle outbreaks have little impact on streamflow in the Western United States." *Environmental Research Letters* 11, no. 7 (2016): 74010-74020.

Winkler, Rita, Sarah Boon, Barbara Zimonick, and Dave Spittlehouse. "Snow accumulation and ablation response to changes in forest structure and snow surface albedo after attack by mountain pine beetle." *Hydrological Processes* 28, no. 2 (2014): 197-209.

Wilford, D.J., Sakals, M.E., and Innes, J.L. 2005. Forest management on fans: hydrogeomorphic hazards and general prescriptions. B.C. Min. For., Res. Br., Victoria, B.C. Land Manage. Handb. No. 57.