

An Assessment of Mountain Pine Beetle Implications to the Kamloops Land and Resources Management Plan

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Executive Summary

The current mountain pine beetle (MPB) epidemic is affecting British Columbia's interior forests in an unprecedented way, and experts believe a significant part of the Kamloops Land and Resource Management Plan (KLRMP) area will be affected by dead pine stands. Some forest-related plan values (and related objectives and strategies) will be affected by these massive changes. Land managers' response to the epidemic will also have implications. For example, to capture economic losses caused by dead pine and wildfire, harvest levels were raised in the Kamloops Timber Supply area by 1.6 million cubic meters in 2004. This represents an increase of 62 percent over former harvest levels.

The assessment described in this report was carried out to determine how the MPB epidemic might affect the ability of society, government, plan stakeholders and the public to achieve the KLRMP vision, goals, and objectives. Prior to completing an analysis of impacts, those objectives and strategies that are affected by forest condition were identified – see Appendix 4 – for a description of the linkage between KLRMP objectives and strategies and forest conditions. Once forest-sensitive objectives and strategies were defined, locations of current and predicted impacts were overlain with the various resource management zones to determine whether or not an impact could be expected. It is important to note that it is possible for KLRMP objectives and strategies to be met while risk to values remain, and project consultants provided interpretation regarding where this might happen. Predicted locations of MPB impacts within the plan area were defined using data from the Ministry of Forests and Range (Eng et al. 2005), that describe locations of susceptible (mature) pine as well as predict the spread of mountain pine beetle until the epidemic runs its course by 2020.

At the outset of this project, potential impacts to plan values were discussed with agency representatives familiar with the plan area, as well as with forest licensee representatives who were able to offer insight related to their specific geographic knowledge. These interviews confirmed the project approach as well as providing suggestions regarding potential management solutions and actions. A Geographic Information System (GIS) analysis was then done to estimate current risks to values and objectives/strategies, and potential risks based on predicted conditions in 2010, 2015 and 2020. For values not related to water, risk was interpreted based on the proportions (percent) of Resource Management Zone (RMZ) areas burned by recent fires and anticipated to be killed by mountain pine beetle. Fire-affected areas were included as many of the impacts are similar to MPB impacts. The following types of RMZs were assessed based on percent area affected: Recreation and Tourism Zone, Settlement Zone, Critical Deer and Moose Winter Ranges, Old Growth Management Areas, Visually Sensitive areas and Protection Zone (Parks and Protected Areas).

Water-related values were assessed differently as they required a watershed approach. All watersheds in the plan area were assessed in order to address general resource management zone objectives, in addition to specific objectives outlined for community

watersheds and fish RMZs. Instead of percent area affected, the equivalent clearcut area (ECA) was estimated, which is an indicator of changes to runoff based on the age of forest stands. Thus, cumulative effects on hydrology were taken into account by including young forests created by recent harvesting and fires, as well as young forests created by MPB attack now and in the future. ECA was depicted in categories that correspond to risk of negative changes to stream channels and water quantity and quality.

Of all the values in the KLRMP, water-related values such as drinking water, flood control, and fish habitat are likely to be the most affected by mountain pine beetle. The modeling exercise done for this project showed two community watersheds with a very high equivalent clearcut area (Skowootum and Leonie Creek), in addition to Peterson Creek, which has an even higher ECA, due to the combined effects of MPB and recent fires. Another nine community watersheds have predicted ECAs that may be cause for concern. For the plan area as a whole, the most severe MPB impacts are on the west side of the North Thompson River, from as far north as Mahood Lake to Kamloops, on the north side of the Thompson River below Kamloops Lake (Tranquille, Deadman, and Bonaparte watersheds), and along the southern edge of the KLRMP area in the Nicola Valley. The majority of the watersheds in these areas have predicted ECAs of concern, with perhaps a third of those with ECAs at a level that will likely cause major negative impacts. For Fish Resource Management Zones, significant portions of the Mahood, Mann and Deadman River are of very high concern. Another four Fish RMZ watersheds are also at high risk of failure in achieving fisheries objectives.

KLRMP objectives and strategies related to Old Growth Management Areas do not appear to be affected at this strategic scale of analysis. However a ground survey to confirm OGMA status is recommended, and meeting plan objectives does not imply low risk to biodiversity. At least six landscape units appear to be at high risk of loss of old forest biodiversity. Similarly, Protection RMZs (Parks) are not strongly affected relative to plan objectives and strategies, though MPB is predicted to affect a significant amount of forest in a number of RMZs. New forestry roads surrounding some parks are likely to create a need for additional access management strategies. In the longer term, objectives and strategies may not be met without some type of intervention such as prescribed fire, fuel removal, and management for open forest conditions for Ponderosa pine and Douglas-fir OGMA within Protection RMZs. Other objectives and strategies related to habitat and wildlife are not compromised, except for moose, where specific measures for access management will be needed in harvest planning.

Mountain pine beetle will affect the visual landscape. Retention visual quality objectives will be difficult to maintain in some of the Recreation Tourism RMZs (Taweel and Lac Le Jeune) if the dead pine is salvage logged. Objectives and strategies to maintain and enhance recreational and tourism values, specifically within Blustery and Lac Le Jeune Resource Management Zones, are likely not achievable due to large areas of pine mortality predicted by 2020.

Recreational values associated with lakes are managed via a number of objectives and strategies in the KLRMP. Lakeshore visual quality objectives will likely be an issue for

some lakes, particularly with respect to salvage harvesting. Walk-in lakes for angling opportunities were not modeled by the consulting team, but were brought up as a concern by a number of interviewees related to the need for access management.

Settlement Resource Management Zones (areas of Crown Land surrounding communities) are largely unaffected by MPB relative to plan objectives and strategies.

The harvest of MPB-attacked pine stands will necessitate the building of new roads, which in some areas will significantly increase road access and road densities. Access management and access impacts are addressed in objectives/strategies in most RMZs throughout the KLRMP. In many, strategies recommend tools that can be used to address access risks but do not compel action. If extensive salvage proceeds without the use of tools recommended in the KLRMP, KLRMP objectives and strategies for values like water quality and fish will be placed at greater risk.

Management options and associated costs and benefits were summarized in five scenarios or options for next steps, some of which can be applied simultaneously. These scenarios are: 1) maintain the status quo (no change to the land use plan or portions of the plan); 2) make minor changes to the plan to maintain plan relevance; 3) make significant changes to the plan to address risk and changes posed by MPB; 4) undertake minor initiatives outside the plan to sustain plan objectives (for example increase government coordination); and, 5) undertake major initiatives outside the plan to sustain plan objectives (for example carry out coordinated harvest or access planning). These scenarios are presented as a starting point to guide possible next steps. Based on information provided through the GIS analysis and interviews with agency representatives, it appears that some level of management action will be required to maintain the KLRMP balance between economic, social and environmental values.

Depending on the values the interviewees were concerned with, support exists for both minor and major changes to the KLRMP to address changes brought by MPB. Most interviewed indicated a need to make major changes to maintain the intent and balance of the plan in light of natural disturbances and associated salvage harvesting. Additional influences noted were regulatory changes associated with a new results-based forestry framework. There was also strong support for new initiatives outside the plan to support the strategic resource management goals of the plan, such as improving government coordination.

This strategic-level analysis identifies KLRMP objectives and strategies that may not be met. However, the analysis describes risks and potential management solutions in broad terms. More information is required to understand and manage risk to some of the KLRMP values and objectives/strategies, and to support minor or major changes to the KLRMP. For example, assessment and monitoring work would help guide management decisions for those community and other watersheds that are predicted to have equivalent clearcut areas higher than 25 percent by the year 2020. A ground survey of actual conditions in Old Growth Management Areas would also be extremely valuable. More

information will help decision-makers make the social choices regarding acceptable levels of risk to water, fish, biodiversity and other KLRMP values.

Potential next steps and management options need to be explored by natural resource managers, First Nations, LRMP Monitoring Table representatives, other stakeholders and the public. Tools for achieving the KLRMP's strategic vision will need to be further developed prior to making changes to the plan. Time is of the essence in proceeding with this work, as the MPB infestation is increasing in the southern interior along with salvage harvesting to capture the economic value of the beetle-killed trees.

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1. Introduction

British Columbia is currently experiencing its largest recorded mountain pine beetle outbreak. This natural disturbance is causing widespread mortality of lodgepole pine (*Pinus contorta*), the Interior's most abundant commercial tree species. Other less abundant pine species are also affected, such as Ponderosa pine (*Pinus ponderosa*). The epidemic affects the ability to meet strategic land use goals, and creates challenges for forest resource managers in meeting approved land use plan objectives and strategies, at the same time as it reduces the certainty of meeting the long-term economic health of many communities. The Ministry of Forests and Range projects that 80 percent of the provincial lodgepole pine inventory could be killed by 2013 (Province of BC 2005).

In the Kamloops Land and Resources Management Plan (LRMP) area, approximately 20 percent (or 220,000 hectares) of the timber harvesting land base consists of mature, pine-leading stands (greater than 60 years of age) that are susceptible to mountain pine beetle. There are another 191,000 hectares of mixed forests with a component of mature pine, plus further areas of younger pine stands that may also be affected by MPB. Based on 2005 overview flights, over half (56 percent) of the pine leading stands greater than 60 years old have some level of attack in them. Ponderosa pine is also affected by MPB, and ponderosa pine-leading stands make up approximately 1 percent (or 3,700 ha) of the pine leading stands. The majority of this pine is older than 60 years (Ministry of Forests and Range 2006). Survey data does not distinguish between Ponderosa and Lodgepole Pine so the extent of Ponderosa Pine infestation is not known.

In addition to the continuing spread of mountain pine beetle (MPB), the Thompson-Okanagan region experienced major wildfires in 2002 and 2003, which also affected forest and non-forest values described in land use plans. In the Kamloops LRMP area there were five major fires (McGillivray, Venables, Vermillion Creek, McLure and Strawberry Hill) that burned over 56,200 ha, of which 26,900 ha were in the timber harvesting land base.

The goal of this project is to determine whether MPB is going to impact the ability of society, government, plan stakeholders and the public to achieve its strategic land use plan vision, goals, and objectives in the Kamloops LRMP area. In addition to describing impacts and risks, this assessment discusses options and mitigative strategies, and is produced to better inform all those with a stake in the Kamloops LRMP. The assessment is at a strategic level, and will also provide insight on where and how salvage operations can integrate measures to mitigate impacts on values and continue to attain goals in the plans.

This report provides information needed to meet Objective 4 of the provincial MPB action plan (Province of BC 2005) which states: "Conserve the long-term forest values identified in land use plans." The approach taken is seen as a template that can be applied to other LRMPs potentially affected by MPB. This assessment will provide a basis for communication with stakeholder groups and the public regarding changes to the

land base. An accompanying communications document “The Effects of Mountain Pine Beetle on the Kamloops Land and Resources Management Plan: Results of a Strategic Analysis” was also produced, to convey the current MPB situation and the outcomes of this analysis to managers, stakeholder groups and the public.

Forecasting the severity and location of impacts to plan values is critically necessary to ensure that salvage harvesting achieves the KLRMP objectives. The response to this severe natural disturbance is critical, since it is possible to increase the severity of impacts if this planning is not done. Forecasting is based on the assumption that 70 percent of the provincial volume of dead pine will be salvaged in the next 10 to 15 years. (Much of this timber would otherwise have been harvested over three or more decades, if the outbreak had not occurred.) The Kamloops Timber Supply Area MPB sub-committee has developed a strategy¹ that provides insight into the types of measures being discussed to address salvage and restoration.

This report helps supply the required information to assist in the development of an appropriate response for multiple values and interests.

2. Background Context

Mountain pine beetle is a natural disturbance agent, like wildfire, that shapes our forests and their diversity. Bark beetles such as mountain pine beetle are part of the ecology of BC’s forest ecosystems, but when these disturbances are at epidemic levels or outside their range of natural variability, they affect our economic and social well-being. This section gives background information regarding the impacts to forests and values described in land use plans, and the provincial measures being taken to address them.

2.1 Provincial Context

In response to the MPB epidemic, the province has worked with the federal government to develop a Mountain Pine Beetle Emergency Response: Canada-BC Implementation Strategy². The Implementation Strategy was created in September 2005 and outlines BC’s spending plan for \$100 Million contributed by the federal government. The strategy suggests that the funding be targeted for the following areas:

- o Fuel management treatments for communities and First Nations located in mountain pine beetle-infested areas: \$24.8 million;
- o Controlling the beetle’s spread in parks and areas along the outer edges of the infestation: \$24.4 million;
- o Economic development and diversification planning for impacted communities and First Nations: \$13.2 million;

¹ See: <http://www.for.gov.bc.ca/dka/kamloopstsbstrategy2006.pdf> for the TSA Strategy

² See: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm for details on the strategy.

- o Research and development of new wood products and markets, and research to assist forest management decision-making: \$13 million;
- o Forest cover data to assist forest management decision-making: \$10.9 million;
- o Ecosystem restoration: \$7 million;
- o Management of range issues: \$4.5 million; and
- o Co-ordination and administration: \$2.2 million.

BC's MPB Action Plan (2005 – 2010), guides and sets out the next steps to be taken – both immediate and five-year – for mitigating beetle impacts to forest values, communities and the provincial economy. The Action Plan has seven goals,³ most of which relate either directly or indirectly to the Kamloops and other LRMPs:

1. Ensure long-term economic sustainability for affected communities;
2. Maintain and protect public health, safety and infrastructure;
3. Recover the greatest value from dead timber before it burns or decays, while respecting other forest values;
4. Conserve the long-term forest values identified in land use plans;
5. Prevent or reduce damage to forests in areas that are susceptible but not yet experiencing epidemic infestations;
6. Restore the forest resources in areas affected by the epidemic, and;
7. Maintain a project management structure that ensures coordinated and effective planning and implementation of mitigation measures.

This report provides information in support of Goal #4, by assessing risks and outlining some potential management options.

2.2 Ecological Context

As noted above, the current mountain pine beetle epidemic is unprecedented in recorded history. While mountain pine beetle is a natural disturbance agent that has shaped interior forests of British Columbia for thousands of years, scientists believe the current attack is larger than previous pine beetle attacks, because of human effects on the ecosystem. Because of fire suppression, many of today's lodgepole pine forests are unusually old and particularly susceptible to beetle attack. Additionally, there may be more pine on the landscape as a result of the historic harvest preference of non-pine species such as fir and spruce, and the preference for pine in forest regeneration. With recent climate changes resulting in warmer winters, the moderating effect of cold winters on beetle outbreaks has been reduced. Since BC's central and southern interior appears to be warming at double the global average, and northern British Columbia at nearly three times the global average (BC MWLAP 2002), this provincial outbreak has departed from the historical pattern of beetle winter kills. The severe cold conditions that cause MPB mortality are not occurring, and are not likely to occur in future due to predicted further warming trends.

³ Goals taken from the Action Plan Summary (Province of BC 2005). The summary and full plan are found at: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/actionplan/2005/

The ecological effects of the current mountain pine beetle outbreak are expected to include:

- o A shift to a larger percentage of forest landscapes in early seral stages, with implications for biodiversity and old forest dependant species.
- o Loss of functional critical or core habitat for a variety of species.
- o Significant increases in wildlife trees (snags), coarse woody debris (CWD) on the forest floor, and large woody debris (LWD) input into streams. This short-term increase can be beneficial for many species that depend on these features for their life cycles, for example LWD is essential for diverse, healthy fish habitat, and many forest animals use CWD. However when the dead trees fall, the mobility of ungulates is expected to be restricted. The influx of large woody debris in streams may be excessive in some areas and negatively affect stream habitat. Over the longer term, the loss of large trees to MPB will have negative effects on supply of quality wildlife trees and CWD. Deficits in long-term LWD supply will have negative effects on channel stability and habitat complexity.
- o Potential changes in site conditions (i.e., becoming drier or wetter) will affect the selection of appropriate tree species for regeneration

The effects related to changes in watershed hydrology are outlined in Section 2.4.

2.3 Incremental Impacts Associated with Salvage Harvesting

Additional indirect ecological impacts may also occur, related to the effects of salvage harvest. Salvage harvest can intensify the impacts of MPB in the following ways:

- o Accelerated timelines for most of the direct impacts listed above. More details on hydrologic effects are discussed below.
- o Increased road access, which results in reduced undisturbed core habitat for disturbance-intolerant wildlife species, and also changes predator-prey dynamics and hunting patterns.
- o Increased road density, which affects stream channels due to increased runoff and sediment.
- o Reduced stand structure due to loss of large live residual trees (pine and non-pine species), and loss of coarse woody debris in salvaged areas.
- o Increased landscape-level homogeneity where salvage is extensive, resulting in a loss of natural landscape complexity and variability in developing forest stands.
- o Loss or impacts to critical habitats.
- o Loss of natural barriers, allowing cattle access to sensitive habitats.

Peak flow risk (as described in the Interior Watershed Assessment Procedure (IWAP) – BC Ministry of Forests 1999) is calculated based on Equivalent Clearcut Area (ECA – i.e. the proportion of a watershed that is hydrologically equivalent to a recent clear-cut) and length of roads. Salvage of all MPB affected pine will result in increases in road systems, with the resulting diversions of intercepted groundwater and more rapid accumulation of runoff to the stream resulting from ditch-lines. Silt from those roads can increase siltation to streams. ECA will also be increased beyond that resulting from MPB

mortalities, as other species in mixed stands, and any understory, are cut during salvage, and green wood is harvested from the road alignments.

Surface Erosion risk (siltation sources) is calculated (BC Ministry of Forests 1999) based on length of roads near streams and stream crossings, both of which may be increased by MPB salvage. Any roads on steep or unstable slopes would increase landslide risk. The increased groundwater flows resulting from less evapotranspiration will increase that risk.

Where riparian areas are pine leading, full salvage of those reaches would result in a loss of future LWD input to the channel in both the long and short term. Harvest of any other species during salvage, and damage to under-story, will result in increased loss in shade, further reduced leaf litter, and decreases in vegetative bank strength. Loss of streamside vegetation can result in increased bank erosion and changes in stream morphology.

2.4 Hydrologic Risks and Potential Water-Related Impacts

Water-related issues are a major focus of this report, as the magnitude of changes to watershed hydrology are a key finding related to the MPB outbreak. This assessment done for all land use plan-related values indicates that water-related values will be the most highly affected. The dry climate, and water needs and effects on communities and agriculture make this a social and economic issue as well as an ecological issue.

Mortality of pine forests will have large hydrologic impacts in many watersheds within the Kamloops LRMP area. Dead pine no longer remove water by evapotranspiration, and the shade live trees provide to streams and snowpacks is greatly reduced. Peak surface and groundwater flows in heavily affected watersheds will be increased, with an earlier, more rapid runoff, and increased slide potential. Quicker runoff results in increased flood and erosion risks, and potential risks to water supply infrastructure such as dams and intakes. There are also implications for storage facilities, with questions regarding whether failure and replacement of existing storage will be precipitated by changes in the runoff pattern.

Adverse effects of a more rapid snowmelt and runoff include changes in channel morphology. Stream width and depth are determined by a variety of factors, including surficial geology, riparian vegetation strength, and the size of the mean annual flood (MAF) flow. Increased flood flows result in the channel banks being eroded to a size that will accommodate the larger MAF, with the eroded materials causing increased siltation in the stream, and increased requirements for water treatment. Siltation of spawning gravels and infilling of the deeper pools important to fish can also result. When the increased MAF is accompanied by loss of riparian vegetation, stream channels will become wider and shallower, with both fish habitat (loss of pools and undercut banks), and stream temperature implications, particularly at low flow times of year.

With riparian tree death, reduced leaf litter results in reduced organic litter available to support aquatic insect species depending on this food source. Direct insect inputs (i.e., fish

food from riparian areas) are also potentially reduced. Loss of shade, with increases in stream temperatures (or more accurately, greater temperature fluctuations), has implications for temperature-sensitive aquatic species. Potential impacts of increased temperatures include mortality, reduced habitat availability, and change in species composition for fish and other sensitive aquatic species. Increased light favours algae production and aquatic insects that depend on algae, and these species shifts are not necessarily favourable for fish.

While the peak flow effects will decrease after 10 to 20 years, the recovery period from changes in channel morphology and losses in fish habitat that may occur during this period can be much longer.

2.5 Impacts to Communities and Industry

As indicated by goal #3 in the Mountain Pine Beetle Action Plan (Section 2.1), the epidemic is creating a temporary increase in forestry activity to use dead trees before they decay and lose their commercial value. Depending on local site conditions, the timber can retain its value anywhere from five to 18 years after attack. The harvesting and salvaging surge is expected to begin decreasing by the end of the decade, with related impacts to communities that rely on forest harvesting and wood processing for employment. The lack of a sustained supply of lodgepole pine may negatively affect local economies in the longer term. Similarly, the timber industry sees benefits in the short term from increased harvesting levels, but is then also negatively affected by a reduction in sustainable harvest levels in the coming decades. Silviculture strategies, particularly fertilization of other forest types (e.g. spruce stands) to speed their growth, are being developed to deal with this mid-term shortage. However it is likely that some level of decrease to harvest levels will occur for several decades, with resulting impacts to the forest industry and communities that rely on it.

3. Approach and Methods

This project had a two phased approach, involving interviews and then a GIS analysis and interpretation of risk to plan objectives and values. This approach is intended to be generic to any plan area. The two phases were:

- 1) Interviews of government agency representatives and others, to identify LRMP-related issues, impacts, mitigative recommendations, or opportunities as a result of the Mountain Pine Beetle epidemic (and to some extent, recent fires). Fire-affected areas were included as many of the impacts are similar to MPB impacts.
- 2) A GIS analysis and interpretation was done subsequent to and guided by the interviews. Available information on pine location and mortality was used to assess plan RMZs and watersheds sensitive to forest condition. Outputs include an assessment of which RMZs and watersheds are affected, and which objectives/strategies are currently at risk of non-compliance.

3.1 Interview Methodology

Representatives from government were interviewed with respect to their areas of expertise and interest as defined by the KLRMP document. Some representatives from the forest industry were also interviewed, to capture their local knowledge regarding the effects of mountain pine beetle. A total of 14 interviews were held, with between one and four participants per interview. Further written comments were received from individuals unable to attend an interview. Interview sessions were grouped by KLRMP values - see Appendix 1 for full interview details. Maps were produced for the interviews that showed the pine (lodgepole and ponderosa) distribution, age, volume, and mortality as well as the current pattern of harvest, in relation to plan values and zones. These maps were produced to help the interviewees define the threats/opportunities to their interests. A standard set of questions was used, and provided to the interviewees in advance (Appendix 1), and after the interview, a summary was produced and sent to the interviewees for confirmation and amendment.

3.2 GIS and Qualitative Assessment Methodology

The GIS assessment and qualitative analysis of RMZ impacts is at a strategic level, and is based on modeling data and assumptions by Eng *et al.* (2005). The GIS analysis quantitatively describes the percent area (of the entire RMZ or of the forested area, depending on the value) affected by MPB or forest fire for each Resource Management Zone or watershed. This is done only for those RMZs that contain pine (both lodgepole and ponderosa pine) and that are sensitive to forest condition. A review of all plan objectives and strategies is completed to assess which were correlated to forest condition. Please see Appendix 4 for a listing of KLRMP Objectives/Strategies that were considered linked to forest conditions. For those linked RMZs or watersheds that have significant area covered by dead pine, a qualitative assessment is then made regarding how plan values and their related objectives and strategies are affected. The results provide insight regarding the affected KLRMP interests and values. A more detailed methodology for this analysis is described in Appendix 6.

The GIS analysis produced four maps for each RMZ. They represent a time series (from 2005-2020) showing the extent of MPB infestation. 2005 maps are based on existing data (measured mortality), whereas the 2010, 2015 and 2020 maps are predictions based on modeling forecasts (based on Eng *et al.* 2005). These maps indicate the percent of the entire RMZ with pine stands likely to be killed by MPB. Maps are based on the model (Eng *et al.* 2005), which predicts beetle behaviour, and contain assumptions about climate, rate of spread and other factors. These maps can be used as a tool to assess risk to the RMZ, and form the basis for the interpretation of whether or not the plan objectives and strategies will be met, but they may not precisely predict the timing, intensity or progression of beetle infestation. Subunits may experience either higher or lower levels

of infestation and timing of attack by MPB may differ from the model. Some areas containing pine may remain beetle-free for the 15-year period.

The following RMZs were rated based on the proportion of dead pine to the entire RMZ area: wildlife and settlement. Where the values were linked most directly to forests, the ranking is based on the forested area affected relative to the entire forested area within the RMZ. This was done for community watershed RMZs, fish RMZs, 3rd order watersheds, Visual Quality Objectives (VQOs), recreation and tourism, Class A and B lakes, Protection (parks) and Old Growth Management Areas (OGMAs) to ensure that risk to the value was not masked. Additional procedures for community watershed RMZs and fisheries RMZs are described in the Section 3.3 “Watershed Assessment Methodology”.

Many Old Growth Management Areas are small, e.g. less than the 16 hectare resolution provided by the model used (Eng *et al.* 2005). Therefore, the model was not used, and Vegetation Resources Inventory data was used instead to assess the pine within Old Growth Management Areas (OGMAs). Two time periods are presented: 1) current condition and 2) in 2020 when all the pine is forecast to be dead (the worst-case scenario). The OGMA maps provide the affected percentage of OGMAs by landscape unit and BEC zone.

3.3 Watershed Assessment Methodology

The analysis for community watershed RMZs, fisheries RMZs, and 3rd order watersheds was done taking into account the cumulative impacts of early seral forest. The analysis for 3rd order watersheds⁴ was done for the entire KLRMP area, to address water management in the General Resource Management Zones (see Appendix 6: Detailed Assessment Methodology). The maps and risk rankings for this analysis include early seral forest (<40 years of age) resulting from past harvesting, as well as recent fires and dead pine within the forested area. The ranking calculation is based on the percent of young forests from all these causes as a percentage of the entire forested area. At a strategic level this approximates Equivalent Clearcut Area (BC Ministry of Forests 1999). ECA is defined by the Ministry of Forests as “the area that has been harvested, cleared or burned, with consideration given to the silvicultural system, regeneration growth, and location within the watershed”. Consideration of the ECA was done because higher peak flows result from significant areas of early seral forest, and this effect diminishes as the forests age. To account for aging of forests in the forecasts, forested areas between 21 and 40 years of age were considered to be 75 percent recovered as compared to older forests. Forests less than 20 of age years were not considered to have recovered. Some larger community watersheds are composed of several smaller watersheds, and the 3rd

⁴ Watershed Atlas boundaries were used to define watersheds within the LRMP. Third order watersheds used in the Watershed Atlas are defined at a 1:50,000 scale. A third order watershed is one that contains a stream segment below the confluence of two second order streams. A second order stream is downstream from the confluence of two first order streams, which have no tributaries at a 1:50,000 scale.

order watershed ratings show which portions of community watersheds and larger fish RMZs are most affected.

The ECA was calculated by determining the area in the forested portion of the watershed covered by dead pine, plus the area of recent fires, plus the area in age class 0 (NSR) and age class 1, plus 25 percent of the area in age class 2 (21-40 year stands). Included spreadsheets of this analysis allow managers to separate projected cumulative impacts of MPB from other factors like fire, historical logging etc.

While all watersheds and stream channels vary greatly, the average effects of ECA changes were related to watershed risks as described below:

- 0-20 percent ECA: In this ECA range there are no detectible changes in water quantity or timing of flows. With good roads and riparian areas, and care on unstable slopes, no significant impacts will be seen.
- 21-30 percent ECA: In this range there are noticeable increases in peak flows that begin at around 20 percent ECA, and these are usually statistically significant by around 30 percent ECA. Streams nearing 30 percent ECA that have significantly weakened riparian areas may begin to experience localized bank erosion, minor changes in stream morphology, and some loss of pool depth, with some siltation during higher flows. Streams with a history of flooding may have increased flooding in higher flow years during the first 20 years after salvage.
- 31-50 percent ECA: In this range of ECAs, peak snow melt flows become noticeably earlier and more rapid, and with expanded road systems rain storm runoff is also increasingly higher and more rapid. There is a moderate risk, growing to high as ECA rises above 40 percent, that even in reaches with well established riparian areas an increased mean annual flood flow will cause significant channel changes, and significant loss of fish habitat will occur. Increasing bed loads will increasingly result in loss of pool depths, and in the infilling of alluvial reaches, with flow moving out of the established channel (avulsion). In streams with historically weakened or heavily MPB impacted and salvaged riparian zones avulsions are more likely to occur, and more likely to be major. Streams with a history of flooding will experience more extreme flooding in high flow years. Older dams or marginally designed road crossings will be increasingly stressed and more likely to fail in high flow years due to increased bedload and higher peak flows as ECAs rise above 40 percent
- 51-70 percent ECA: In this range of ECAs, it is probable that, even in watersheds with strong riparian areas, many channels will erode out or down to accommodate an increased mean annual flood flow, resulting in bed load movement infilling downstream pools and alluvial channels, and siltation impacting spawning gravels and water quality. Many channels in this range will suffer major losses in fish habitat, and in water quality during higher flows. Peak flows will usually be much more rapid and weeks earlier. Low flows may retreat to sub-surface flow.

Flooding problems in high flow years may occur even in streams that have not had a history of damaging floods. With increasing ECA in this range, the risk to road crossings, lower-standard dams, and problems with water treatment or intakes that cannot accommodate increased bed movement and peak flows becomes high, and failures in some become likely.

- >70 percent ECA major impacts to water quality, quantity, and timing of flows, fish low flows and habitat, and damaging flooding in high flow years.

Risks to the ability to deliver KLRMP Objectives in relation to mapped ECA estimates were calculated as follows in Table 1. More discussion and maps relating to these risks is found in Section 4.2.1 Results for Water. The watershed, fish, and community watershed maps in Section 4 are coloured to indicate the locations of the ranges of estimated ECAs in Watershed Assessment Units in the KLRMP area as the MPB epidemic proceeds to 2020. As per the discussion above, they indicate watersheds where challenges to meet objectives will be greatest, and those where it may not be possible to meet or achieve them.

Table 1: Risk of Not Achieving RMZ Objectives

<u>Risk of not achieving RMZ objectives at varying estimated ECAs</u>			
Estimated ECA	Community Watersheds	High value fish streams	Water & Fish in GRMZs
0-10 percent	Low risk	Low risk	Low risk
11-30 percent	Low to Moderate	Low to Moderate	Low
31-50 percent	Moderate to high	Moderate to high	Moderate to high
51-70 percent	Very high	Very high	Very high
>70 percent	Extremely high	Extremely high	Extremely high

4. Results

The following is a synthesis of the interviews, followed by an analysis of the GIS modeling and subsequent qualitative assessment of impacts.

4.1 Interview Results

Each interviewee was asked for insight on how mountain pine beetle, salvage harvesting and wildfire affected his or her resource value of interest. Detailed results are available in the appendices. Appendix 1 describes the interview process and lists the interviewees. Appendix 2 contains interview summaries listed by identified values, and Appendix 3 lists specific locations of concern to interviewees. Since the interviews preceded the GIS assessment, they helped to inform the analysis on where the greatest impacts/benefits were thought to be.

Interviewees were asked what actions (if any) they thought necessary to address the perceived risks and benefits posed by MPB- and fire-killed forests. Based on the interviews, mining interests did not see a need to change from the status quo. The response to MPB gives benefit to mining interests through improved roads to aid exploration. All other interests indicated a lack of satisfaction or confidence in the status quo in protecting and managing the risks to their interest. Interviewees associated with protected areas, agriculture and range, ecosystems, wildlife, and old growth management areas (OGMAs) indicated support for minor changes to the plan. Minor changes defined by the KLRMP include revision of wording, revised local level priorities, small changes to RMZ boundaries, refinements to objectives and strategies suggested by local level plans, and changes required to make the plan conform with provincial laws, regulations or policies. Comments made by interviewees regarding minor changes include: objectives well stated but unenforceable; pertinent sections of the plan replaced by the Government Actions Regulation⁵.

Interviewees representing water, fish, timber, tourism, settlement, visual landscape quality and transportation interests showed support for major revisions to the plan, representing a majority of those interviewed. Major changes as defined by the KLRMP may include large changes to RMZ boundaries, or major revisions to targets set out in the plan. Comments made by interviewees regarding major changes needed include: plan is unenforceable, toss it out; total rebalance needed; objectives not able to be met, need to rebalance; some objectives and strategies not practicable to implement (not feasible, interpretation issues etc.); create more measurable LRMP objectives to allow for greater accountability.

The desire to undertake major initiatives outside the plan was expressed by similar interests that support major changes to the plan. Comments made regarding major initiatives outside the plan include: significant shift needed in current approach; government coordination and leadership are needed. Examples of major initiatives requiring government coordination and leadership could be coordinated technical science information, coordinated access and salvage planning and management, and facilitation of integrated watershed planning for local planning teams, including planning to locate areas for retention from forest harvest to manage risks. Comments made regarding minor initiatives outside the plan also called for increased government coordination.

Interviewees questioned the rate of spread of MPB as described in the Eng *et al.* (2005) model. MPB appears to be spreading more quickly than described in that model. The Kamloops TSA MPB subcommittee supports this view (Kamloops TSA MPB Subcommittee 2006), and believe that the MPB attack will peak in 2008 – earlier than predicted by the Eng model.

The following two tables are summaries of opinions from interviewees regarding actions to take (if any) to address effects on plan values. The opinions solicited were based on interview assumptions (based on provincial modeling) that 80 percent of lodgepole pine

⁵ See: <http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/govact/gar.htm> for more details on GAR

greater than 60 years of age will be killed by the year 2013. 75 percent of this pine volume (within the timber harvesting land base) is expected to be harvested, and this percentage may be higher in the southern areas of the province. The interviewees were not presented with quantified information; hence the term “perceived” risk/benefit is used to reflect the lack of measured risk.

Table 2: Perceived Risks to KLRMP values, and actions recommended to address risks of MPB, recent wildfires and projected salvage harvesting.

Value	Risk	Potential Options to Address Risks						
		Rank ¹	Status Quo ²	Changes to Plan		Changes outside Plan		Opportunities ³
				Minor	Major	Minor	Major	
H/M/L/N								
Water	M – H			√		√	√	
Ecosystem	M – H		√		√		√	
Fish	M – H			√		√	√	
Tourism/ Recreation	L – H			√	√		√	
Agriculture/ Range	M – H		√			√	√	
Mining ⁴	N	√					√	
Wildlife (ungulates)	M		√		√		√	
Timber	H			√		√	√	
Visually Sensitivity	H			√		√	√	
Settlement	H			√		√	√	
Protected Areas	L		√		√		√	
OGMAs	M – H		√			√	√	
Transportation	H			√	√		√	

¹ Risk rankings: High/Moderate/Low/Nil; Further details on risk rankings for each interest are summarized in Appendices 2 and 3.

² Status Quo: Current plan and current legislated forestry requirements sufficient to maintain values and balance in the KLRMP.

³ A range of solutions was identified; see the “Opportunities” column in Appendix 2 for each value.

⁴ Mining value risk information received from B.C. Ministry of Energy, Mining and Petroleum; e-mail February 27, 2006.

Table 3: Perceived Benefits to KLRMP values, and actions recommended to realize benefits related to MPB, recent wildfires and projected salvage harvesting.

Value	Benefit Rank ¹ H/M/L/N	Potential Options to Achieve Benefits				
		Status Quo ²	Changes to Plan		Changes outside Plan	
			Minor	Major	Minor	Major
Water	N					
Ecosystem	N					
Fish	N					
Tourism/ Recreation	L					√
Agriculture/ Range	M			√		√
Mining ³	M – H	√				
Wildlife (ungulates)	N-L				√	
Timber Licensees	M					√
Visually Sensitivity	N					
Settlement	L					√
Protected Areas	N					
OGMAs	N					
Transportation	L				√	

¹ Benefit rankings: High/Moderate/Low/Nil; Further details on benefit rankings for each interest are summarized in Appendix 2.

² Status Quo: Current plan and current legislated forestry requirements sufficient to maintain values and balance in the KLRMP.

³ Mining value benefits and details received from B.C. Ministry of Energy, Mining and Petroleum; e-mail February 27, 2006.

4.2 GIS Analysis and Evaluation

4.2.1 Results for Water

As per Table 1: Risk of Not Achieving KLRMP Objectives (Section 3.3), the following discussion relates the risk to KLRMP fish, community watershed, and water objectives to the maps (Figures 1 to 8) of ‘ percent ECA in watershed assessment units.’

- 0-10 percent ECA: Low risk to LRMP water or fish objectives, no action required
- 11-30 percent ECA: For General RMZs, without significant fisheries values, 30 percent ECA is generally considered (e.g. in the IWAP: BC Ministry of Forests 1999) to be an indicator the watershed is on the border between low and moderate peak flow risks, with increases in peak flows becoming detectable. For General Management RMZs, watersheds in this category are still classed as low risk to LRMP objectives and strategies and require no immediate action. For both Fish and Community Watershed RMZs, those with estimated potential ECAs from 25 to 30 percent ECA should have a more detailed assessment. Risk is in the moderate range, and without careful planning and implementation some watersheds in the upper part of this ECA range may fail to achieve objectives of water quality, quantity, timing of flows, or protection of fish habitat.
- 31-50 percent ECA: This is a critical range for more detailed assessment, as it spans the range between being fairly certain of being able to achieve water related objectives if care is taken, and being at high risk of failing to achieve those objectives in many watersheds, even if careful planning is done
- 51-70 percent ECA: Many watersheds in this range will fail to meet fish or CWS/domestic/flooding water use objectives, as channel morphology will change in many, with loss of fish habitat. Snowmelt peak flows will be earlier, and more rapid, leading to increased water supply problems for fish and people during late summers. Water will become silty with higher flows. Careful planning and operations can reduce the number of basins in this range where objectives are not going to be met, or potentially reduce the severity of those impacts and how long they will persist.
- >70 percent ECA: Few in this range will continue to meet objectives for fish, or in the short or mid-term for CWS or domestic use.

Community Watershed RMZ

The Community Watershed (CWS) RMZ was included in the Kamloops LRMP to safeguard the domestic water supply watersheds for communities, ensuring the continuation of the availability of clean water at all periods of the year. Watersheds included in the CWS RMZ are only those that are used by a significant number of people for their domestic water supply. Attributes to be protected are water quality, quantity, and timing of flows. Clauses include ensuring existence of acceptable levels of water quality and quantity, and ensuring drinking water systems meet or exceed Canadian Drinking Water Quality Standards within maximum acceptable element concentrations

Changes to equivalent clearcut area can bring increases in stream siltation resulting in reduction of water quality for users, or an increase in the cost and difficulty of treatment required. Changes in channel morphology can necessitate repairing or replacing water system inlets. Timing of flow is important in many CWS RMZs, as demand is highest during periods of decreasing stream flows, and reservoir storage available may be non-existent or inadequate to fully capture spring runoff for later use, especially if peak snowmelt flows occur earlier and more rapidly. While decreased evapotranspiration has been documented to increase the water yield from de-forested watersheds, this has no beneficial results if the water is running off uncaptured earlier in the spring, with a resulting longer period of low flows during the summer.

The mapping and Table 4 below show estimated ECA in CWS in 2005, 2010, 2015, and 2020. Please note the column showing ECA described by Interior Watershed Assessment Procedures (IWAP) done in prior years. Many of the CWS in the Kamloops region had significantly lower 2005 ECA in the 2005 GIS model than in the 1997 to 2000 IWAPs. Therefore, the 2010 to 2020 ECAs should probably be revised up to reflect the more detailed IWAP results. More detailed assessment should be carried out on all CWS with GIS 2020 percent ECA figures over 20 percent.

Table 4: Kamloops LRMP Community Watershed projected GIS ECAs, with comparisons to IWAP ECAs

Watershed	IWAP %ECA	GIS 2005 %ECA	GIS 2010 %ECA	GIS 2015 %ECA	GIS 2020 %ECA	risk of not meeting objectives
Peterson Creek*		56	61	62	63	Very high
Skowootum Creek	32	23	43	46	46	Very high
Leonie Creek	28	25	40	45	46	Very high
Tranquille River	11	14	28	32	33	High
Nelson Creek*		26	29	30	30	High
Jimmies Creek	8/19**	4	15	22	24	High?
Hascheak	13/24**	7	13	18	20	High?

Watershed	IWAP %ECA	GIS 2005 %ECA	GIS 2010 %ECA	GIS 2015 %ECA	GIS 2020 %ECA	risk of not meeting objectives
Creek						
Russell Creek	10/12**	4	12	17	19	
McDougall Creek	13/17**	7	12	15	16	High?
Paul Lake	14/17**	7	13	15	15	
Paul Creek*		12	14	15	15	
Avola Creek		0	6	9	12	
Cornwall Creek*	36***	3	7	10	11	High?
Rosen Brook		2	2	2	2	
Currie Brook		0	0	0	0	
Toops Creek		0	0	0	0	

*fire contributes to ECA

**indicates approx 1998 IWAP/approx 2003 from FDP

***if Cornwall's ECA is taken as the IWAP ECA, in 2020 the ECA will be at approx. 40 percent

Any CWS with ECA over 30 percent will have increasing difficulty with water quality. In excess of 40 percent timing of flow may become significantly earlier, with late summer supply implications where current reservoirs are not adequate to catch the earlier flows, or where current low flow problems exist.

The above CWS are color coded in the maps (Figures 1 to 4) below to indicate the ranges of estimated ECAs as the MPB epidemic proceeds to 2020. In combination with the above table they indicate watersheds where challenges to meet objectives will be greatest, and those where it may not be possible to meet or achieve them. This percent ECA is due to MPB and also takes into account any recent (but not future) forest harvesting. At least three watersheds will be affected to the point that objectives and strategies may not be met.

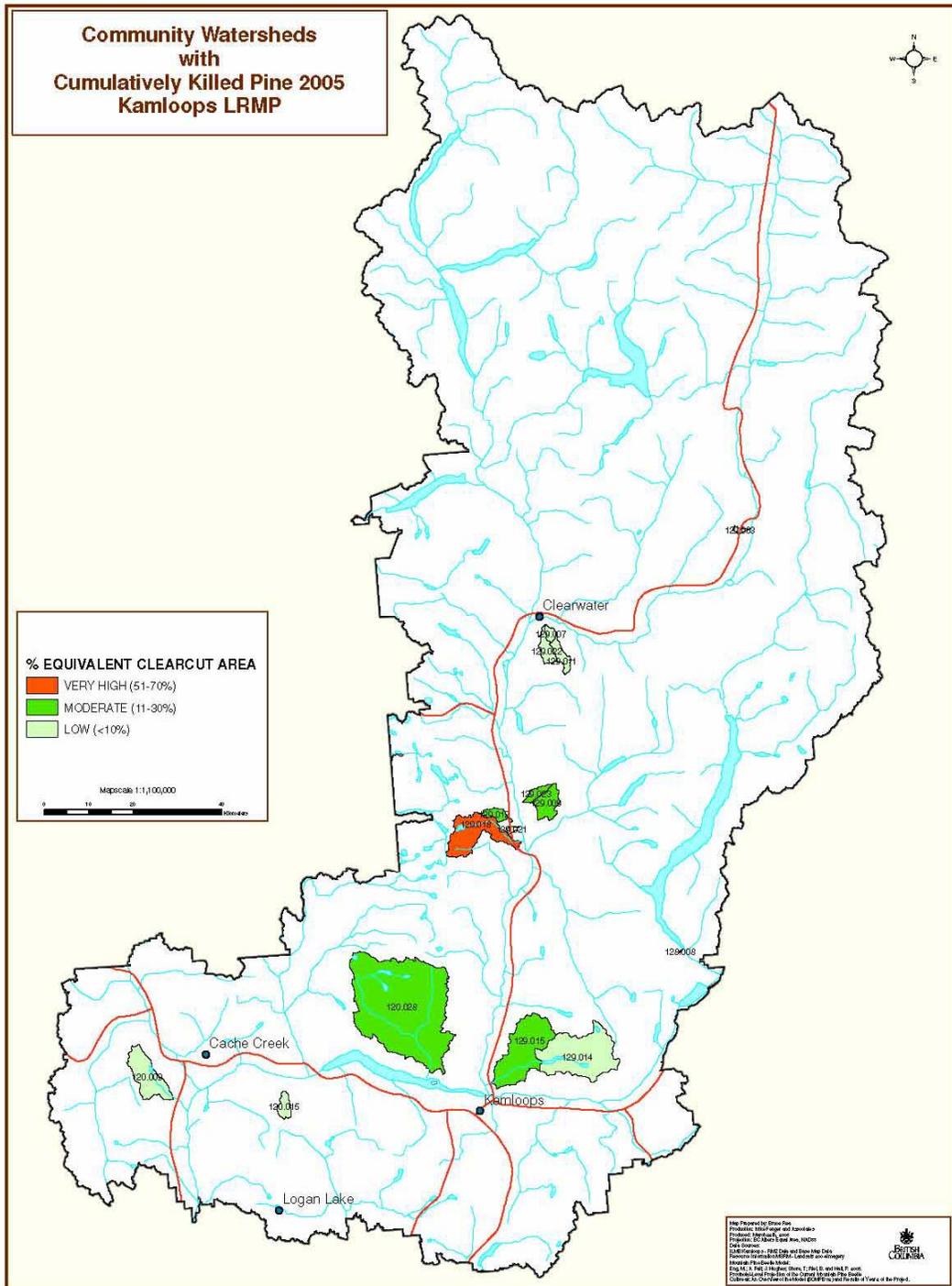


Figure 1: Current (2005) Percent Equivalent Clearcut Area for KLRMP Community Watersheds (all causes)

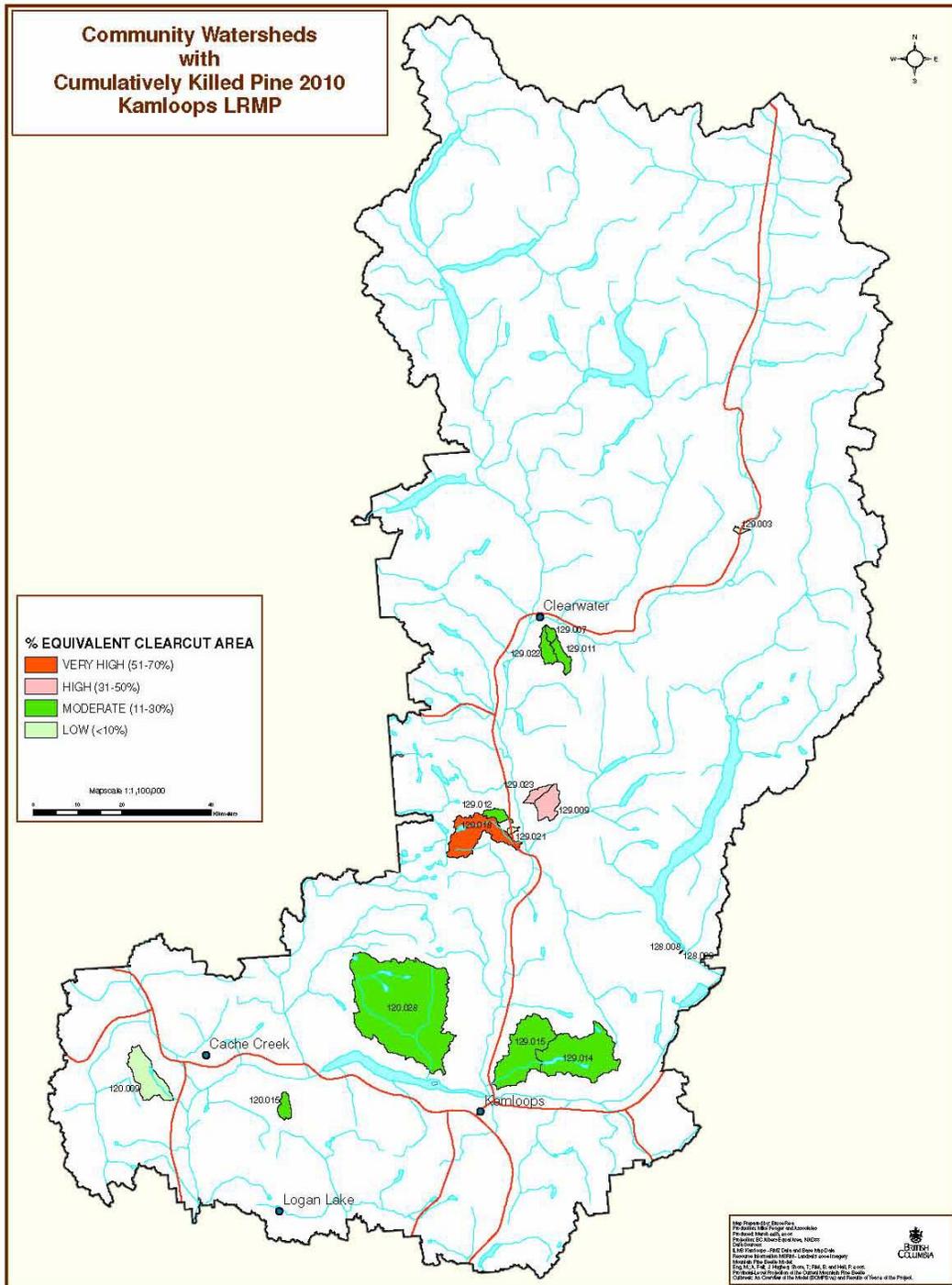


Figure 2: Projected 2010 Percent Equivalent Clearcut Area for KLRMP Community Watersheds (all causes)

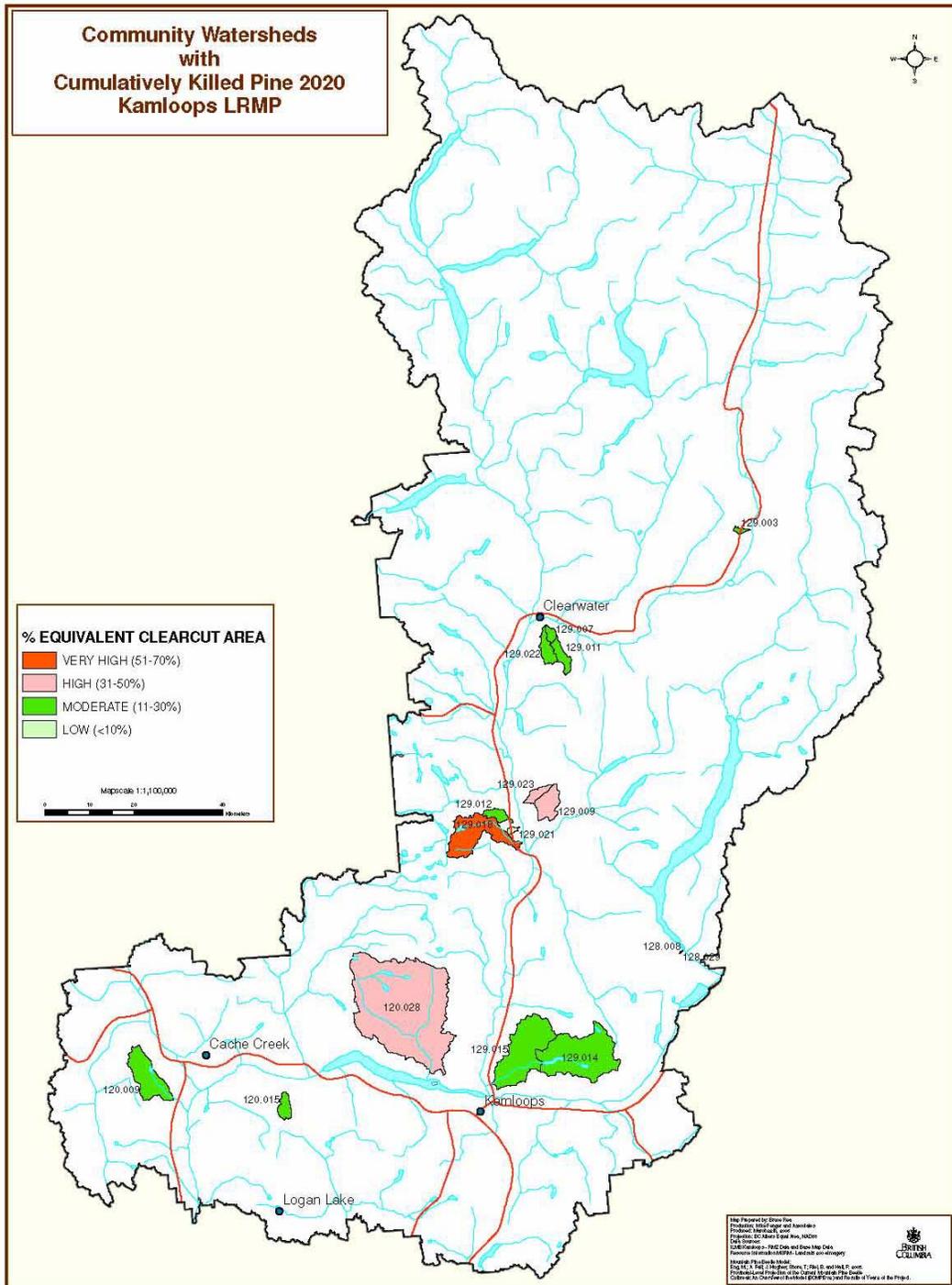


Figure 4: Projected 2020 (post epidemic) Percent Equivalent Clearcut Area for KLRMP Community Watersheds (all causes)

General Resource Management Zone Fish & Water Related Objectives

In the Kamloops LRMP, objectives and strategies for water management and fish are listed in section 2.1 under water management, to ensure existence of acceptable levels of water quality and quantity, maintain natural stream flow regime within acceptable limits, minimize risk to lives and property from flooding and erosion, and protect aquatic ecosystems. Under riparian management, the objectives are to maintain and/or restore the integrity and function of streamside riparian vegetation to provide for bank and channel stability, long-term supply of large organic debris, suitable stream temperatures and input of nutrients, by managing riparian areas, including streams, wetlands and lakes in accordance with the Forest Practices Code and the Kamloops and Clearwater District Lakeshore Management Guidelines, or other applicable management tools or agency agreements. For inland fisheries, the objective is to protect and maintain the genetic diversity of wild fish stocks. For anadromous fish, objectives are to maintain, rebuild or enhance salmon stocks to historic levels, maintain and/or enhance steelhead populations, maintain the genetic diversity of wild fish stocks, and maintain the physical and biological diversity of fish habitats. Strategies include ensuring adequate instream flows to maintain fish stocks, encouraging inter-agency/public co-operation to achieve harmony within each community, and maintaining watershed integrity and stability through appropriate local level planning, management practices and rehabilitation. A significant objective is the avoidance of irreversible human-made changes to fish-producing habitats.

The most severe impacts of the MPB in the Kamloops LRMP area are on the west side of the North Thompson, from as far north as Mahood Lake to Kamloops, on the north side of the Thompson River below Kamloops Lake (Tranquille, Deadman, Bonaparte), and along the southern edge of the KLRMP area in the Nicola Valley. The majority of the watershed assessment units in these areas show projected ECAs of over 30 percent, with perhaps a third of those in the 50-70 percent range. To the east of the North Thompson/Clearwater, both the Raft and Barriere rivers should have more detailed assessments done, as portions of those watersheds show potential 2020 ECAs over 30 percent.

A table of the most severely affected watersheds is given below, with numbers matching to map polygons.

Table 5: Kamloops LRMP mapped 3rd order watersheds with 2020 ECA over 40 percent

Watershed Polygon	Within Larger Watershed	2005 GIS ECA	2010 GIS ECA	2015 GIS ECA	2020 GIS ECA
349	LNTH	86	87	87	87
393	DEADMAN	23	65	78	78
397	BONAPARTE	6	48	73	76
498	GUICHON	1	32	53	72
460	GUICHON	7	50	68	70
375	LNTH	20	50	66	69
357	DEADMAN	15	40	62	68
463	THOMPSON	15	45	63	68

Watershed Polygon	Within Larger Watershed	2005 GIS ECA	2010 GIS ECA	2015 GIS ECA	2020 GIS ECA
213	CLEAR WATER	0	4	42	67
405	STHM	65	66	66	67
367	DEADMAN	19	54	64	65
482	GUICHON	7	50	62	65
352	DEADMAN	14	41	60	64
447	THOMPSON	62	62	63	63
288	LNTH	9	38	60	63
362	DEADMAN	6	44	60	63
321	LNTH	5	46	63	63
497	GUICHON	7	44	50	62
249	MAHOOD	19	43	58	62
337	BONAPARTE	22	43	57	62
252	MAHOOD	21	41	58	62
356	LNTH	42	52	59	62
347	LNTH	43	54	60	61
468	GUICHON	9	37	55	61
401	DEADMAN	7	41	56	61
273	MAHOOD	9	36	54	60
266	MAHOOD	19	40	56	60
256	UNTH	20	35	50	60
479	GUICHON	5	36	55	59
394	DEADMAN	10	43	53	59
473	BONAPARTE	7	36	54	58
373	SHUL	57	57	57	57
453	GUICHON	3	35	54	57
366	LNTH	22	45	54	56
317	LNTH	17	41	54	55
490	LNIC	14	39	52	55
342	BONAPARTE	12	38	52	54
488	STHM	13	37	53	54
477	GUICHON	11	34	49	53
382	BONAPARTE	28	47	52	53
331	BONAPARTE	15	35	49	53
262	MAHOOD	33	43	49	52
329	BONAPARTE	13	32	46	52
499	LNIC	1	40	51	51
370	DEADMAN	13	36	48	51
281	MAHOOD	2	27	44	50
450	THOMPSON	3	31	45	50
322	LNTH	13	33	46	50
345	BONAPARTE	33	48	49	49
470	GUICHON	20	36	46	49
374	DEADMAN	12	35	47	48
257	LNTH	20	36	46	48

Watershed Polygon	Within Larger Watershed	2005 GIS ECA	2010 GIS ECA	2015 GIS ECA	2020 GIS ECA
451	GUICHON	5	32	45	48
472	GUICHON	11	31	44	47
379	DEADMAN	37	47	47	47
365	ADAMS	27	40	46	47
330	BONAPARTE	11	28	45	47
376	LNTH	17	38	46	47
464	THOMPSON	6	30	44	47
438	THOMPSON	43	44	44	46
335	BONAPARTE	14	33	43	45
435	THOMPSON	3	28	42	45
407	BONAPARTE	12	37	43	45
456	BONAPARTE	4	30	43	45
425	BONAPARTE	1	21	38	45
476	GUICHON	2	25	41	45
380	DEADMAN	13	37	43	44
471	BONAPARTE	6	26	40	44
396	LNTH	27	40	44	44
496	LNIC	8	29	41	44
484	STH	30	37	43	44
406	DEADMAN	7	30	40	43
333	LNTH	25	38	42	42
206	UNTH	42	42	42	42
371	LNTH	12	36	41	42
486	STHM	9	31	41	42
214	CLWR	0	3	29	41
387	BONAPARTE	10	30	38	40

The maps (Figures 5 to 8) below are coloured to indicate the ranges of estimated ECAs as the MPB epidemic proceeds to 2020. In combination with the above table and discussion they indicate watersheds where challenges to meet KLRMP objectives will be greatest, and those where it may not be possible to meet or achieve them. Areas in pink and red have levels of ECA that are cause for concern as they are likely to affect KLRMP water management objectives and strategies. Watershed Atlas boundaries were used, and where watersheds extend across plan boundaries, the entire watershed is depicted, thus Figures 5 to 8 depict a slightly larger area than the KLRMP area.

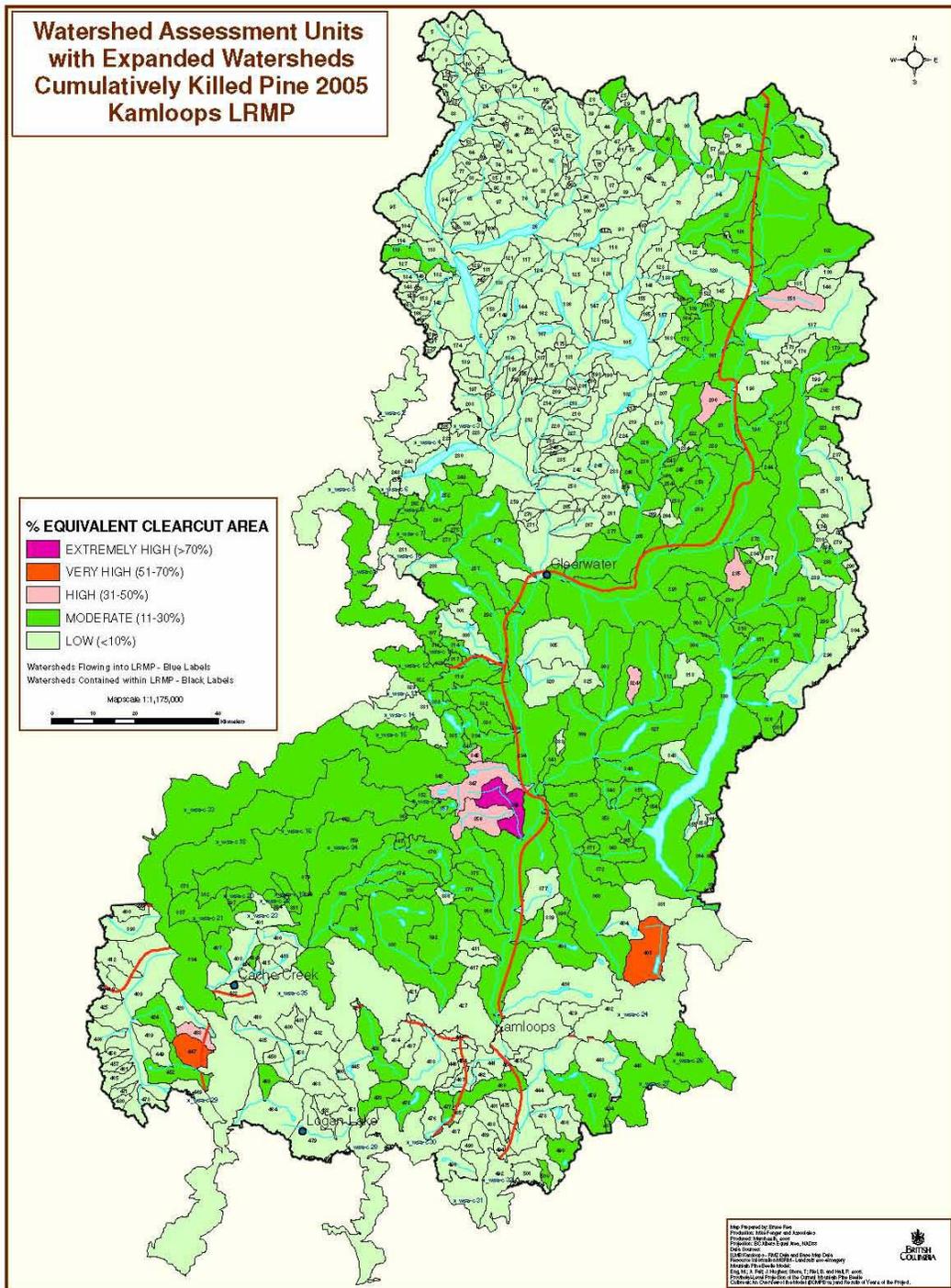


Figure 5: Current (2005) Percent Equivalent Clearcut Area for Watersheds in the KLRMP (all causes)

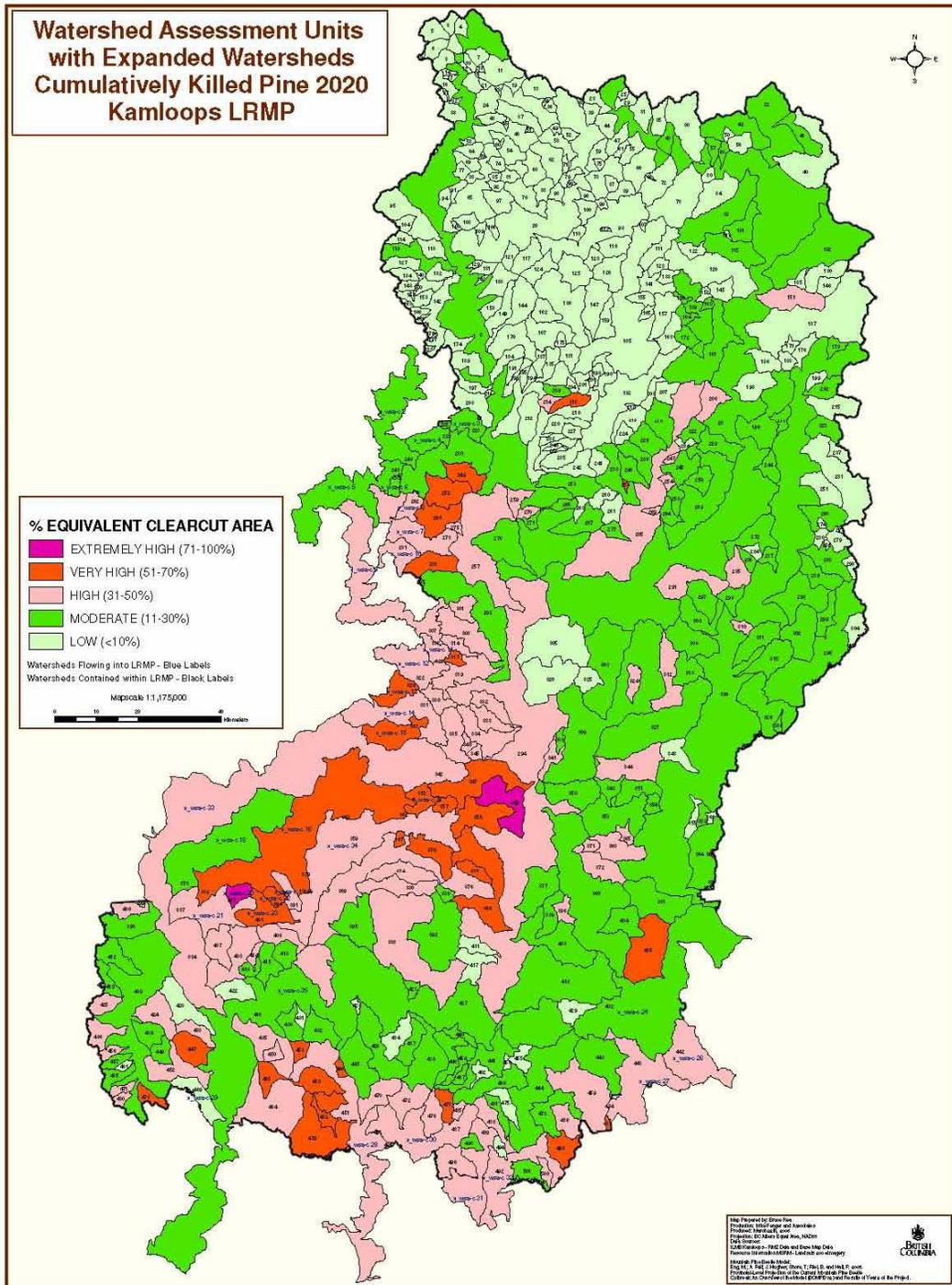


Figure 8: Projected 2020 (post-epidemic) Percent Equivalent Clearcut Area for Watersheds in the KLRMP (all causes)

4.2.2 Results for Fish and Aquatic Habitat

In the Kamloops LRMP, fish values were addressed by listing high value fish streams. Objectives and strategies to protect and enhance fisheries were placed in the General Resources Management Zone (GRMZ) section. The fish objective that will be most difficult to achieve is the avoidance of irreversible human-made changes to fish-producing habitats. This was interpreted to mean maintain channel stability and channel morphology, which will become difficult with salvage operations in watersheds with projected ECAs over 30 percent. In the 50 percent to 70 percent projected ECA range, the scale of operations for salvage will be such that not producing harmful changes to fish habitat by the operations may not be possible, especially if salvage includes riparian areas.

The KLRMP also provides direction to protect streamside and riparian areas in order to: maintain and/or restore the integrity and function of streamside riparian vegetation to provide for bank and channel stability, long-term supply of large organic debris, suitable stream temperatures and input of nutrients

Potential impact mechanisms of the MPB to fish and fish habitat are discussed in Section 2.4 “Hydrologic Risks and Potential Water-related impacts”, and Section 3.3 “Watershed Assessment Methodology”, describes potential stream changes linked to differing levels of Equivalent Clearcut Area, and describes categories used to determine whether failure in meeting objectives in any given watershed is likely or probable.

The full list of watersheds/streams assessed is found in Appendix 6: Detailed Assessment Methodology. Of the listed streams, the Mahood, Mann and Deadman all have significant portions of their watersheds with projected 2020 ECAs in the 51-70 percent range, with most of the remaining sub-basins in the 31-50 percent range, and will likely see failure in achieving their fisheries objectives. The Bonaparte will see nearly as heavy impacts. Listed watersheds with significant portions of their watersheds in the 31-50 percent range include Louis Creek, Raft, Barriere, and Tranquille rivers. These are also at high risk of failure in achieving fisheries objectives. Further assessment should be done for the above, and for any other of the fish sensitive listed streams with a predicted 2020 ECA in excess of 25 percent.

The maps above (Figures 5-8) are coloured to indicate the ranges of estimated ECAs as the MPB epidemic proceeds to 2020. They indicate watersheds where challenges to meet objectives will be greatest, and those where it may not be possible to meet or achieve them.

4.2.3 Results for Old Growth Management Areas

Old Growth Management Areas (OGMAs) were included in the KLRMP as part of the biodiversity management provisions. These areas perform multiple functions in addition to old growth retention. For example, they assist in delivery of reserve requirements

detailed in objectives and strategies for other wildlife species. They also provide protection for rare ecosystems, support protection of viewscapes associated with class A and B lakes, and help provide additional protection for sensitive riparian corridors. Landscape units and BEC zones provide a mechanism to apply the higher-level plan old growth objectives. Individual OGMAs are spatially located and mapped.

For the purposes of strategic analysis, two maps were generated. One map shows the individual OGMAs, and their size, number and distribution. A second maps shows the condition of each landscape unit, based on the proportion of pine over the entire amount of area within the OGMAs in that unit. Many OGMAs in Kamloops appear to contain mixed species or other species than pine.

Figure 9 shows OGMA locations in the KLRMP, and the map in Figure 10 shows the worst-case scenario, to determine whether the pine mortality would affect OGMA objectives. At this strategic level it does not appear so. However, interviewees indicated a need for a ground survey to confirm and monitor OGMA status. A replacement policy is expected to be implemented if more than 10 percent of the OGMA is salvage harvested. This stand level policy direction requires accurate location of OGMA boundaries and contents beyond what is currently available.

The above assessment does not address risk to old forest biodiversity. The ecosystem objective in the plan aims to maintain viable populations of all species across the landscape within their existing geographic range. Significant loss of older forests across the landscape as well as from within OGMAs will bring a higher risk to old forest dependent species. Low Biodiversity Emphasis Options are acknowledged as being high risk to biodiversity as they contain lower amount of area in older forest. Many of the old growth areas may be ‘recruitment OGMAs’, so though termed old growth, old growth structure may be in short supply.

The Bonaparte and Upper Guichon Landscape Units (both of which are low Biodiversity Emphasis Option LUs) are forecast to receive high and moderate mortality within their collective OGMAs. This places these Landscape Units at high risk of loss of old forest biodiversity, as defined by the Ministry of Environment (MWLAP 2000) (though not necessarily as defined under the KLRMP). In addition to the Bonaparte and Upper Guichon Landscape Units, it is likely that the Nehalliston, Lower Bonaparte, Tranquille, and Hat Creek Landscape Units (see Table 6) are or will become high risk. This means they will experience significant decline in some populations and are likely to experience some species extirpations (i.e. local extinction of species) due to the lack of mature and old forest. Lack of redundancy in habitats will mean that any changes due to natural stand replacing events will likely result in further local extirpations. Extensive areas of early seral forest will create imbalances in habitat supply through time. This risk factor may contribute to semi-permanent and/or regional extirpations if the risk level is long lasting and/or the area covers a significant portion of a given population’s range. Risk to some areas can be potentially mitigated with careful salvage harvest planning. Depending on local conditions, re-attainment of older forest structures can be accelerated through

thinning and/or planting appropriate species, particularly when connectivity and species-specific needs are met, though this solution may take decades to bear fruit.

Table 6: Old Growth Management Areas Affected by Pine Mortality. The shading indicates the Landscape Units at highest potential risk

Landscape Unit Name	OGMA Hectares with the LU	Biodiversity Emphasis Option	Severity Potential Based on %pine
Upper N. Thompson	6,289	INTERMEDIATE	LOW
Albreda	5,490	LOW	LOW
Thunder Blue	9,555	LOW	LOW
Tum Tum	9,355	INTERMEDIATE	LOW
Avola	8,808	LOW	LOW
Raft	10,748	LOW	LOW
Clearwater	16,982	LOW	LOW
Clearwater	16,982	LOW	LOW
Mad	7,778	LOW	LOW
Vavenby	2,986	LOW	LOW
Mica	6,769	LOW	LOW
Nehalliston	5,162	INTERMEDIATE	MODERATE
Cayenne	6,487	INTERMEDIATE	LOW
Dunn	6,335	HIGH	LOW
Barriere	16,324	LOW	LOW
Adams Lake	12,043	LOW	LOW
Dunn	6,335	HIGH	LOW
Darfield	3,695	INTERMEDIATE	LOW
Bonaparte	3,089	LOW	HIGH
Adams Lake	12,043	LOW	LOW
Skull	4,891	LOW	LOW
Deadman	13,239	INTERMEDIATE	MODERATE
Louis Creek	5,886	HIGH	LOW
Heffley	5,123	INTERMEDIATE	LOW
Lower Adams	3,491	INTERMEDIATE	LOW
Lower Bonaparte	6,777	INTERMEDIATE	MODERATE
Tranquille	3,525	INTERMEDIATE	MODERATE
Campbell	9,382	INTERMEDIATE	LOW
Hat Creek	6,574	INTERMEDIATE	MODERATE
Lac du Bois	2,507	HIGH	LOW
Dewdrop	3,106	HIGH	LOW
Ashcroft	14,185	HIGH	MODERATE
S. Kamloops	5,188	INTERMEDIATE	MODERATE
Upper Guichon	5,563	LOW	MODERATE
Stump Lake	1,936	INTERMEDIATE	MODERATE

4.2.4 Results for Specific Habitat/Wildlife Resource Management Zones

The Kamloops LRMP plan identifies six Special Resource Management Zones (SRMZs) for habitat and wildlife management zones. They are:

1. North Thompson Caribou General (H1)
2. Battle Bluffs Wildlife Habitat (H10)
3. Skull Wildlife Habitat (H11)
4. Skwilatin Wildlife Habitat (H12)
5. Dewdrop-Rousseau Wildlife Management Area (H13)
6. Skull Wildlife Management Area (H14)

North Thompson Caribou General (H1) and the remaining Habitat and Wildlife SRMZs are shown on figures 11 and 12 below. Because little change is seen over the time period we show only the 2005 and 2020 maps. We have chosen to address caribou separately in the report as they are found in the northern part of the plan and occupy wetter ecosystems than the remaining habitat/wildlife RMZs. Caribou are discussed at the end of this section.

The overall objective for these Habitat and Wildlife Management SRMZs (except caribou) is to maintain natural diversity of plant and animal life. Specific strategies for Skwilatin Wildlife Habitat (H12) have emphasis on moose habitat while Skull (H11 and H14) emphasis is on mule deer habitat. Access management is also a key strategy in these units. Separate area specific management plans have been prepared for both Skull and Dewdrop Rousseau consistent with KLRMP objectives and strategies.

These areas are within dry forest and grassland, and fires would have been a common occurrence in these ecosystems pre-European contact. Generally speaking, ground fires killed the understory conifers, maintaining these stands in open forest conditions. Plants and animals in these types of ecosystems have evolved and adapted to take advantage of fire.

The fires of 2003 burned through the two Skull SRMZs. KLRMP plan amendments were proposed to facilitate salvage and protect the habitat values of the area. The amendments were supported and adopted by the KLRMP monitoring group. The fire was considered by many professionals to be outside the range of natural variability (due to fuel build-up) as the fire was not an understory burn, but rather a large intense crown fire, killing most of the trees growing on the site.

The two Skull SRMZs (H11 and H14) are currently in the extremely high category of area affected, with over 70 percent of the area impacted by fire. The model does not account for fir beetle mortality after the fire; therefore it is likely that more trees will die over the next few years. Battle Bluffs (H10), Skwilatin Wildlife Habitat (H12) and Dewdrop-Rousseau Wildlife Management Area (H13) currently have less than 10 percent impacted by MPB and wildfires. The model predicts that MPB activity in these areas

will continue to increase and by 2020 all will be in the moderate percent area affected category (11-30 percent).

It is likely that some of the mortality modeled in the Dewdrop-Rousseau Wildlife Management Area is due to ponderosa pine being killed. If the beetle mortality is patchy within these units, it will create canopy gaps, provide standing dead trees, and structural diversity, all of which will benefit species that would naturally be utilizing these habitats. Mortality of trees along the grassland/forest ecotone will also benefit wildlife by expanding grasslands and creating more diverse structure.

In general, one can conclude the MPB activity within these SRMZ may actually be beneficial to the values identified and the objectives and strategies would not be at risk. If road densities and impacts are addressed in salvage operations and salvage operations' focus is only on dead or susceptible lodgepole pine, there should be no significant impacts on the RMZs related to achieving the KLRMP objectives and strategies.

The key objectives/strategies for the North Thompson Caribou General SRMZ (H1) relate to maintaining viable caribou populations and ecosystem health. Timber harvesting guidelines were provided in the plan to address caribou habitat needs, namely old growth attributes related to lichen productivity and availability within the ESSF and ICH biogeoclimatic zones. Harvesting is allowed in caribou habitat. A Caribou Sub-Committee has been examining changes to the plan based on new information and better science than used in 1995 when the plan was developed.

For this analysis, caribou habitats were divided into early and late winter, consisting of 33 separate polygons ranging in size from 3,588 ha to 27,313 ha. The maps show that one polygon is rated moderate (11-30 percent pine mortality) over the time period, while the remaining 32 remaining in the low category (less than 10 percent pine mortality) – with the exception of one polygon that increases to a moderate rating by 2015. Because little change is seen over the time period, only the 2020 map is depicted (Figure 13). The MPB infestation and pending salvage will have no impact on meeting objectives and strategies in the plan, nor the values for which they were established. However, it is important to recognize that any changes proposed by the Caribou Sub-Committee have not been considered in this assessment, as work done by this committee is not yet endorsed by the LRMP table.

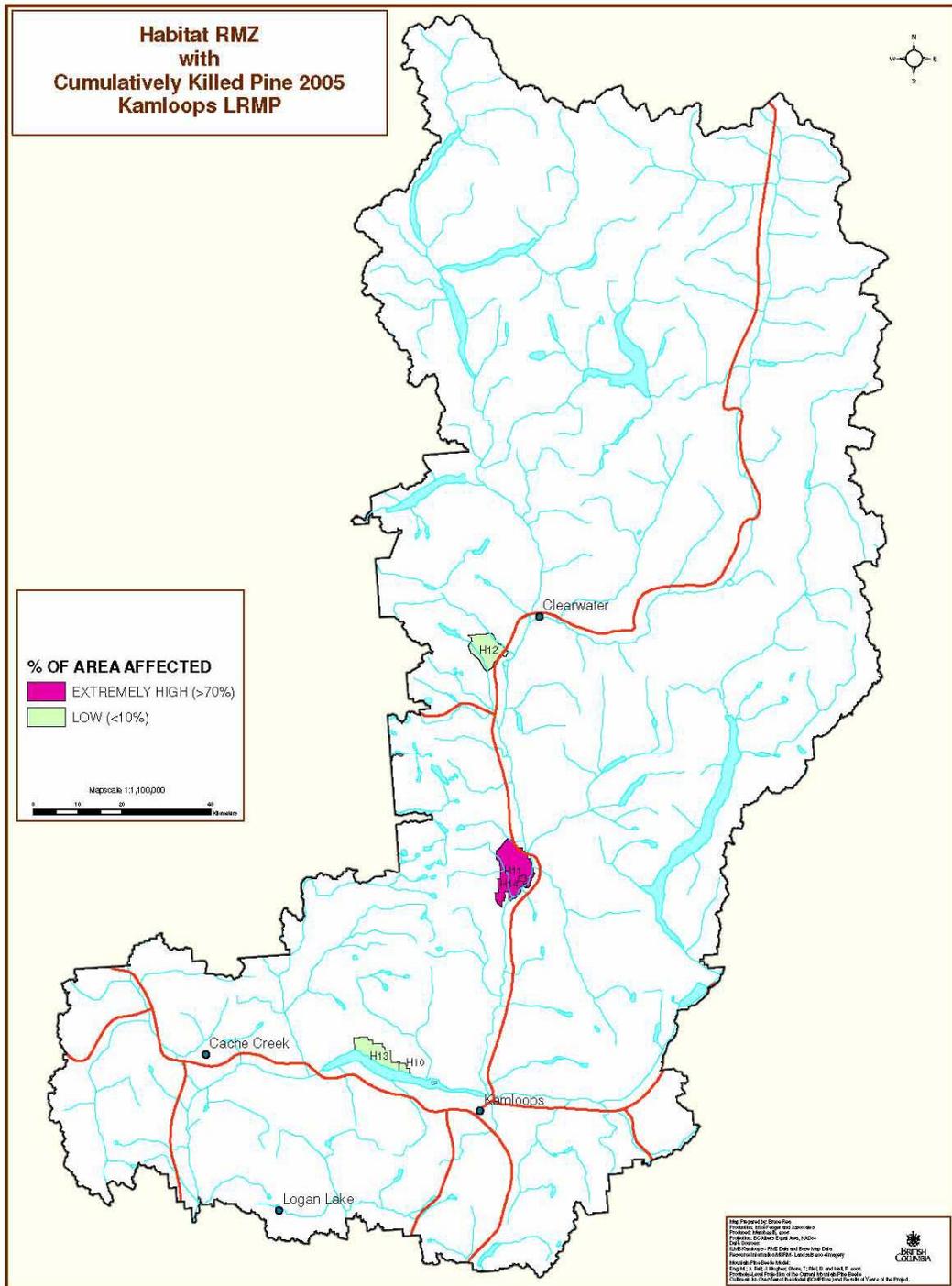


Figure 11: Current (2005) Percent Area Affected in Habitat RMZs

4.2.5 Results for Critical Deer Winter Range Resource Management Zones

The plan identifies critical mule deer winter range within which cover and forage are to be maintained or enhanced to benefit deer. Snow interception cover (25 percent as identified in the plan) is provided mainly by older Douglas-fir. Forage is maintained or enhanced by silviculture prescriptions that maintain mature Douglas-fir and provide a matrix of closed canopy and openings. The objectives and strategies within this zone are generally met through selective harvesting but there is provision for small block clear-cutting (five hectares) where uneven aged management cannot be practiced. There is also a provision for salvage harvesting to deal with dead timber within this zone through a 2003 plan amendment. There is no similar provision to deal with pine salvage where clearcutting exceeds five hectares.

Most of the mule deer winter ranges are located in the south part of the plan area. A total of 36 Winter Range Assessments Units (WRAU) were analyzed – see Figures 14 to 17. Some winter ranges are continuous and extend over large tracts of land, like those north of Kamloops Lake, while others are small and fragmented. These units range in size from less than 100 ha to a maximum of over 28,000 ha.

In 2003, all 36 assessment units would have less than 10 percent of the forested area impacted by dead pine. However when you factor in the winter units that burned during the 2003 fires, 6 of the assessment units now move from low to higher categories of potential impacts. This is best seen in Table 7.

Table 7: Critical Deer Winter Range Assessment Unit (WRAU) Ratings

% Area Affected Categories	2003 Number WRAU pre fire	2005 Number WRAU	2010 Number WRAU	2015 Number WRAU	2020 Number WRAU
Extremely High (>70%)	0	2	2	2	2
Very High (51-70%)	0	0	1	1	2
High (31-50%)	0	1	1	1	0
Moderate (11-30%)	0	3	6	8	10
Low (<10%)	36	30	20	24	22

The critical mule deer winter ranges are generally associated with the dry lower elevation Douglas fir forests or mixed Douglas fir forests. Therefore one would not expect significant areas impacted by MPB activity. We speculate that some of the winter ranges have moved to the moderate percent area affected category (11-30 percent) due to the model predicting mortality of ponderosa pine or combination of lodgepole and ponderosa pine mortality within a unit.

The total forested winter range area in the plan is in excess of 156,000 hectares, and approximately 8,000 hectares were affected by the 2003 wildfires. This amounts to less than 5 percent of the overall winter range RMZ area. The model predicts that by 2020, 14 of the 36 winter range assessment units will be in the moderate and higher categories – this amounts to approximately 40 percent of the units. It appears that fire has had an impact on at least 6 of the 14 assessment units. The two in the extremely high percent area affected category are the direct result of the 2003 wildfires.

Winter range management is a balance between cover and forage. The MPB killed areas within the winter range will provide the forage areas, while cover is provided by mature Douglas-fir. The KLRMP objectives and strategies will be met without plan amendments or other actions, as these winter ranges consist mainly of non-pine species and therefore are not at risk to MPB. Mortality of pine should not reduce habitat value to deer.

Harvesting, including salvage harvesting, can achieve similar outcomes for forage production as wildfires/MPB mortality, and can be compatible with deer winter range management. The distribution of pine within these winter range units would dictate where the salvage harvesting would happen. Proposals to clear-cut areas greater than five hectares would be contrary to the objectives for this zone. It is our understanding that this size restriction is one of the objectives that will not continue forward as Higher Level Plan for the purposes of the Forest and Range Protection Act (FRPA - see Appendix 5); hence it may be less of an issue. We assume that some salvage of lodgepole pine will require clearcuts of larger than five hectares, unless some dead pine is left standing. To address the issue the plan can be amended to allow clearcuts of greater than five hectares, or the FRPA guidance can simply be followed, as there is a lack of science to support the five-hectare maximum requirement.

Depending on the extent of the pine within these units, it may be difficult to meet the 25 percent of the forested area for snow interception requirement within some sections of these winter ranges, if salvage logged. The plan lacks clarity on the size of area to which the 25 percent cover requirement applies - i.e., the total winter range or smaller assessment units. The 25 percent snow interception requirement is being carried forward as a Higher Level Plan objective under FRPA (see Appendix 5). There is also concern that salvage operators will want to harvest non-pine species to improve salvage economics. In some situations this may compromise cover requirement objectives and strategies. Salvage harvesting will also increase road access; however the KLRMP objectives and strategies relating to critical deer winter range could still be met as long as access is managed.

In summary the model suggests that MPB will not have a significant impact on critical deer winter range related to achieving the objectives or strategies. If salvage harvesting is a recommended practice on winter ranges, then the 5 hectare maximum clearcut size and the 25 percent cover requirement in the plan needs to be clarified, or these strategies may not be met on some areas in the plan. The risks to habitat values will not be compromised with minor deviations from these specific numerical values.

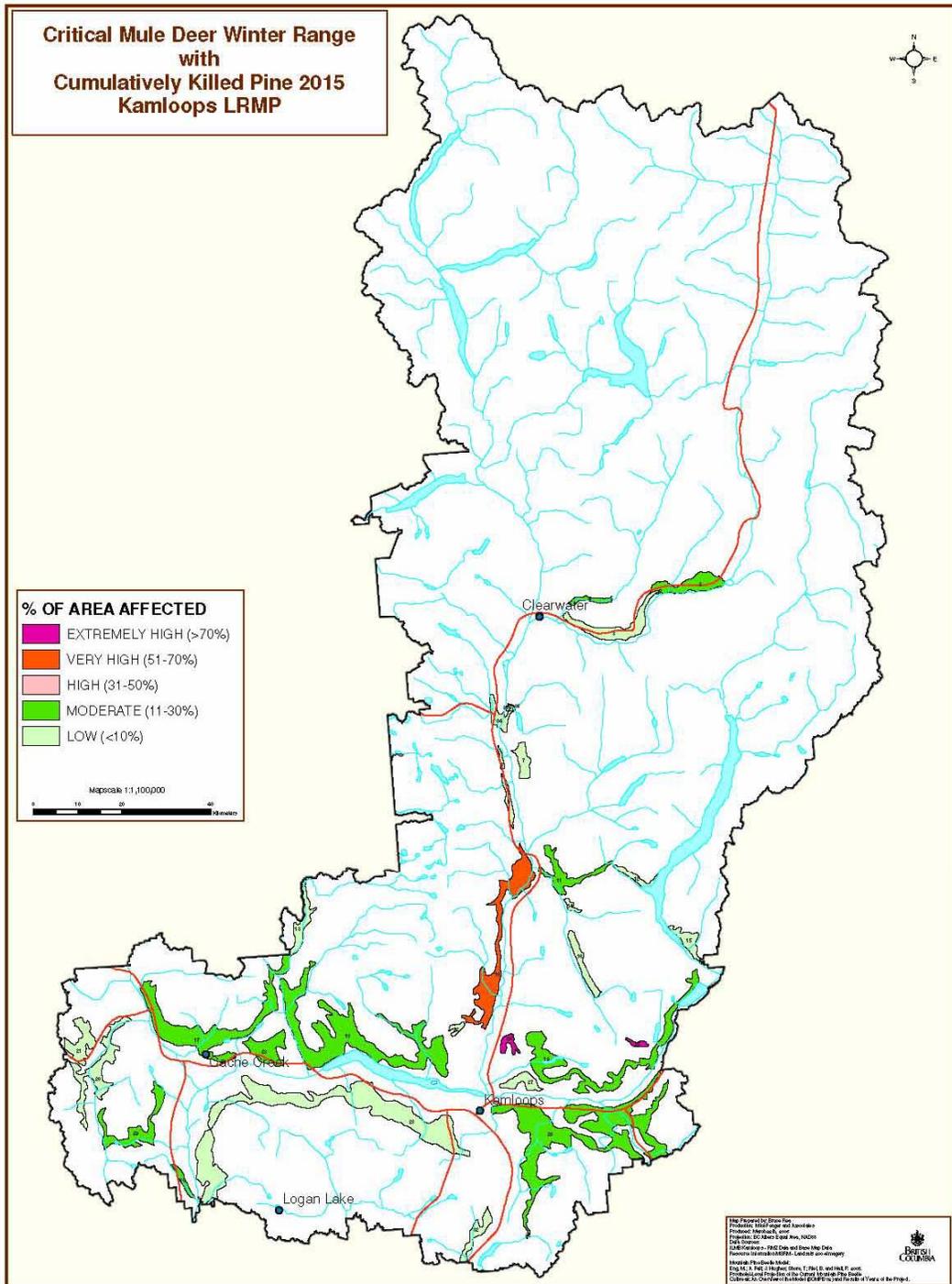


Figure 16: Projected 2015 Percent Area Affected in Mule Deer Winter Ranges

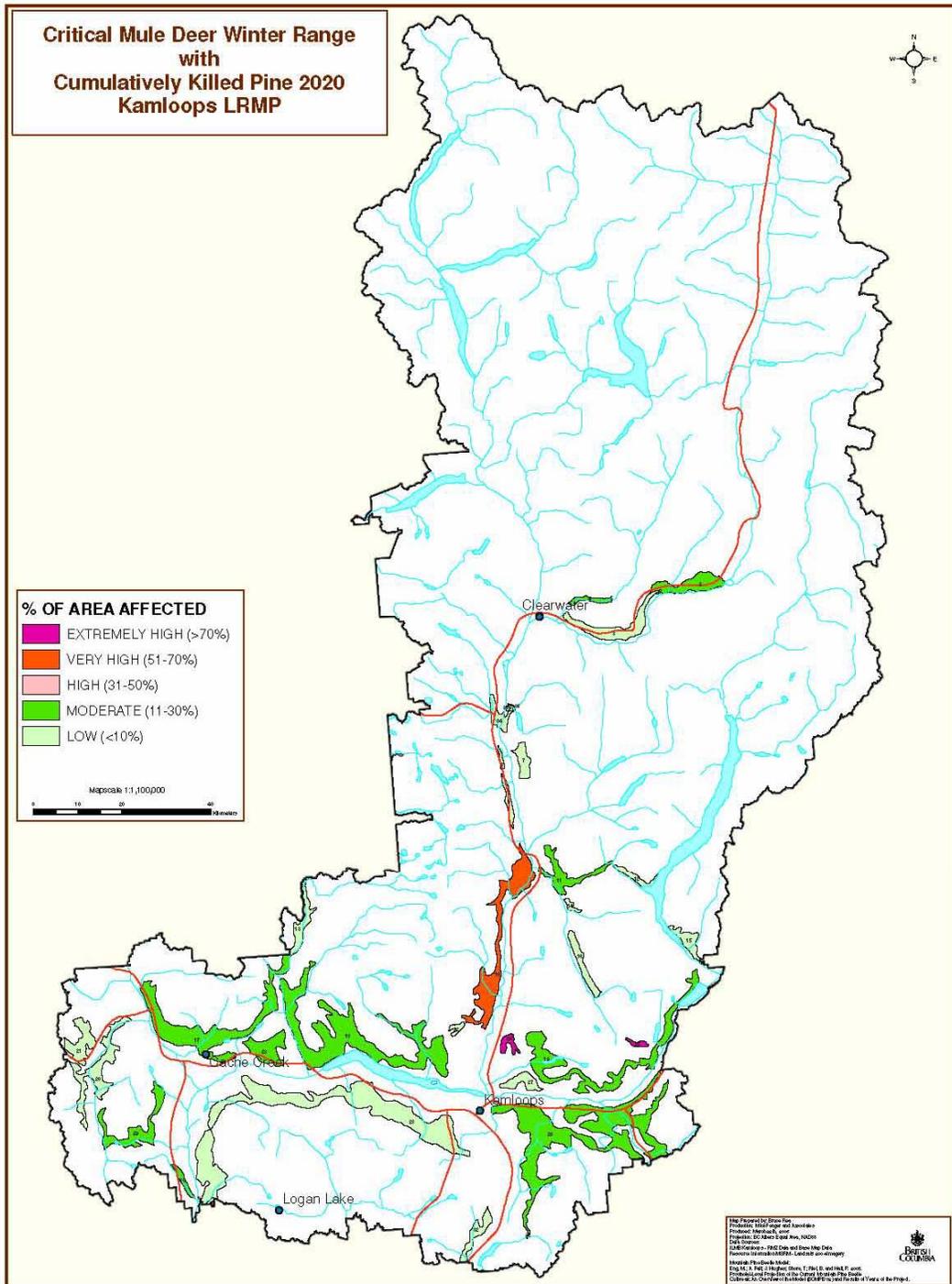


Figure 17: Projected 2020 (post-epidemic) Percent Area Affected in Mule Deer Winter Ranges

4.2.6 Results for Critical Moose Winter Range

The plan identifies critical moose winter range, within which strategies and objectives are to maintain suitable forest cover attributes with respect to thermal cover, forage and visual screening. Access management planning is also identified as a strategy.

A total of 43 Moose Winter Range Assessment Units (MWRAU) were analyzed. The model predicts significant changes in the percent of area impacted within the MWRAU's from 2005 to 2020 – see figures 18 to 21. The results are summarized in Table 8.

Table 8: Moose Winter Range Assessment Unit (MWRAU) Ratings

% of Area Affected Categories	2005 Number MWRAU	2010 Number MWRAU	2015 Number MWRAU	2020 Number MWRAU
Extremely High (>70%)	3	3	3	3
Very High (51-70%)	0	0	0	0
High (31-50%)	0	3	6	9
Moderate (11-30%)	4	18	19	18
Low (<10%)	36	19	15	13

The table shows that in 2005 only seven (16 percent) of the 43 MWRAU are in the moderate and higher categories, but predicts that by 2020, 30 of the 43 MWRAU (or 70 percent) will be in the moderate and higher categories. Though these numbers seem alarming, one must recognize that these forests are generally within areas that historically had large stand replacement fires, and moose did well under such conditions, primarily due to the improved forage conditions. It is reasonable to assume that the objectives and strategies associated with this RMZ can be met with the assumption that the salvage harvesting can be planned to somewhat mimic historic burn conditions. The increase in access will have to be addressed in order to maintain moose populations. Screening of key forage areas within wetlands can be achieved on most sites where there is a conifer understory or by simply leaving buffers around key areas. Dead pine trees can be left on the landscape to meet certain objectives. However, early operational planning to address cover and screening requirements is essential if objectives and strategies are to be met.

Due to the increased salvage harvesting that is likely to occur on moose winter ranges, it is important that access planning be undertaken. The plan identified the need to develop access management guidelines in 1995, but to date little progress has been made. In view of the rapid rate of expansion of MPB into the moose RMZs, it is important that this initiative be completed otherwise there significant risk that other objectives and strategies will fail.

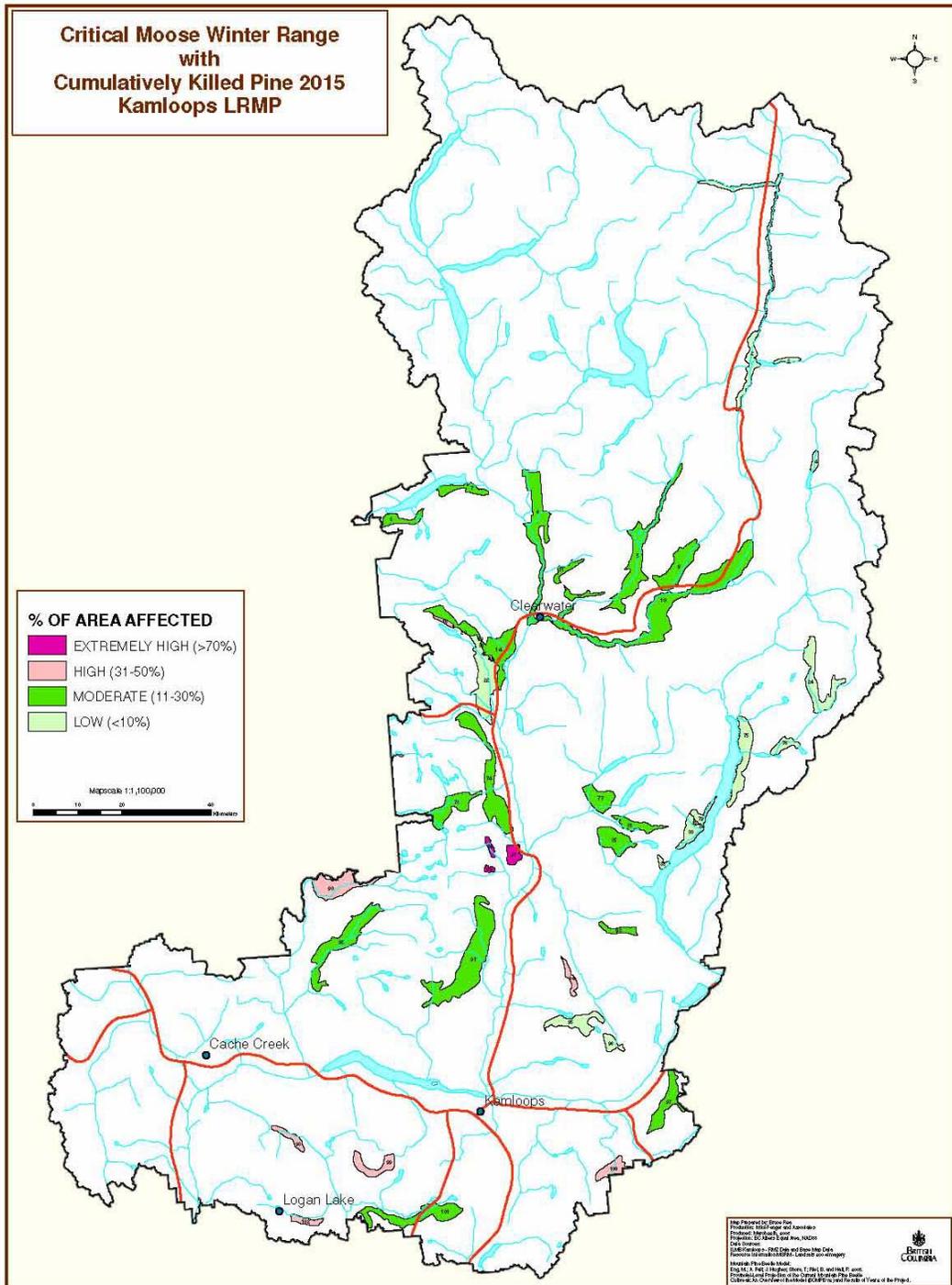


Figure 20: Projected 2015 Percent Area Affected in Critical Moose Winter Range

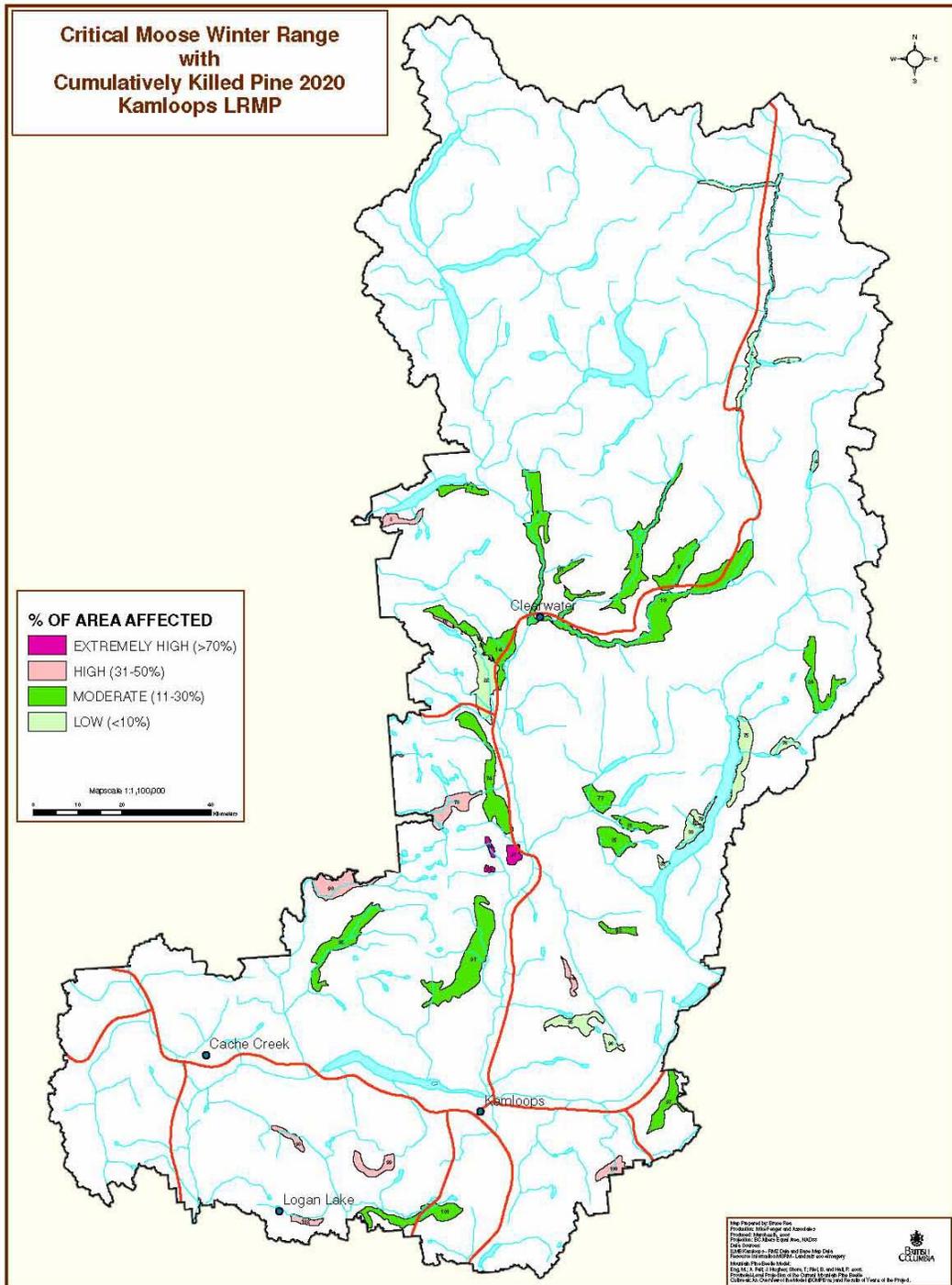


Figure 21: Projected 2020 (post-epidemic) Percent Area Affected in Critical Moose Winter Range

4.2.7 Results for Recreation and Tourism Resource Management Zones

The Recreation and Tourism resource management zones are areas where there are significant opportunities for recreation and tourism management. These RMZs include the following:

R1 Alan Creek	R9 Taweel
R2 Bischoff Lakes	R10 Thompson Rivers
R3 Blustery	R11 Tod Mountain
R4 Bone	R12 Tod Mountain (Controlled recreation area)
R5 Clemina	R13*
R6 Lac Le Jeune	R14 North Blue
R7 North Thompson Glacier	R15 Thunder
R8 Smoke	

Note, polygon R13 does not exist on any map but is in the plan as “Lakes Area.” No assessment was done for this unit as no boundary for the unit could be found, but it is in an area with heavy MPB activity. The plan mentions Akehurst, Caverhill, Latremouille, Lynn, Meadow and Thuya Lakes without relating them to a specific RMZ.

The objective for the Recreation and Tourism RMZs is to maintain and enhance recreational and tourism values. The other key consideration is maintaining viewscales to a standard that does not detract from the recreational enjoyment. Viewscales will be further discussed in Visually Sensitive Areas in Section 4.2.8.

Within Recreation and Tourism RMZs there are four categories of recreational activity: Higher Use, Natural Environment, Backcountry, and Remote. Each category has objectives and strategies to capture the intent of each. The Higher Use area is the most accessible, with the greatest modifications allowed, while the Remote is the least developed with more restrictions on development. Each of the above listed RMZs has been assigned to one or more category of recreational activity. Some of the RMZs have specific strategies, generally around current use and access.

The assessment and maps (see Figures 22 to 25) indicate that all 14 RMZs are currently in the low area affected category, i.e., less than 10 percent of the forested area impacted by MPB and wildfires. The model predicts that by 2020, five of the 14 recreation tourism areas will have more area affected: Taweel (R9), Tod Mountain (R11), and Thompson Rivers (R10) will be in the moderate category (11-30 percent of the area is affected). Blustery (R3) will increase to high percent area affected (31-50 percent) while Lac Le June (R6) will move to the very high percent area affected category (51-70 percent).

Taweel (R9) (in the Moderate risk category of 11-30 percent of the forested area affected) is in the Natural Environment category and would still provide recreation and tourism opportunities in a natural environment. The area is adjacent to the Taweel Protected areas, which should complement activities within the RMZ. However when one considers that model predictions for 2020 show that some Visual Quality Objective

(VQO) polygons in this area are in the high percent area affected category (31-50 percent), it may be difficult to meet the VQO retention objective/strategy (see the Figure 29 in Section 4.2.8).

Thompson River (R10) (Moderate category: 11-30 percent of area affected) is also in the Natural Environment category and is located along the valley bottom, including the portion that runs through Kamloops and Kamloops Lake. In this zone, the ponderosa pine is forecast to be killed by MPB. Dead ponderosa pine in this valley bottom provides natural structure, and until trees become hazardous, dead trees actually benefit the natural environment objectives. It is unlikely that significant salvage harvesting is being contemplated, as markets for ponderosa pine are limited. Objectives and strategies for this RMZ can be achieved however there are specific areas within this RMZ where the Visual Quality Objectives (VQOs) of retention are at risk due to MPB. They are located in the corridor south of Cache Creek and between the Trans-Canada Highway and the Thompson River west of Kamloops (see Figure 29 in Section 4.2.8).

Tod Mountain (R11) (Moderate category: 11-30 percent of area affected) is in the Natural Environment category and due to its proximity to Kamloops, strategies focus on maintaining multiple use, reasonable access, and to provide opportunities for special resource commercial development. Part of the site was burned in 2003 and salvage logged. Objectives and strategies appear to be met, and there are no preservation objectives for visuals identified for this area.

Blustery (R3) (High category: 31-50 percent of area affected) is in the Backcountry Category and has objectives and strategies to maintain the wilderness character, and general minimum road standards. These objectives and strategies may not be attainable based on the amount of area that would be affected if salvage harvested under current practices.

Lac Le Jeune (R6) (Very High category: 51-70 percent of area affected) is in the Natural Environment Category and is managed to maintain the area's recreational attributes, including a natural quality of environment. The area is within a much larger area of MPB activity. There is a high risk that the objectives and strategies will not be met for this RMZ.

The model predicts that currently some of the Visual Quality Objective (VQO) polygons in this area are in the high category (31-50 percent of the area is affected), and continue in the high category into 2020. If salvage harvesting is contemplated it may be difficult to meet the VQO objective within Bluster (R3) and Lac Le Jeune (R6).

In summary, objectives and strategies may not be achievable in the majority of the Recreation and Tourism RMZs. The visual objective for retention appears to be the most constraining, however there is provision in the KLRMP (Appendix 8) where forest health issues can override landscape criteria. If one utilizes this exemption criterion, then there are only two RMZs where objectives and strategies likely cannot be met. They are Blustery and Lac Le Jeune. Lac Le Jeune is most at risk, further compounded by heavy

MPB activity in the surrounding areas. The model shows both RMZs move from the low category (10 percent) in 2005 to a moderate category (11-30 percent of the area is affected) in 2010 after which time it becomes more difficult to meet KLRMP objectives and strategies for recreation and tourism related to VQOs.

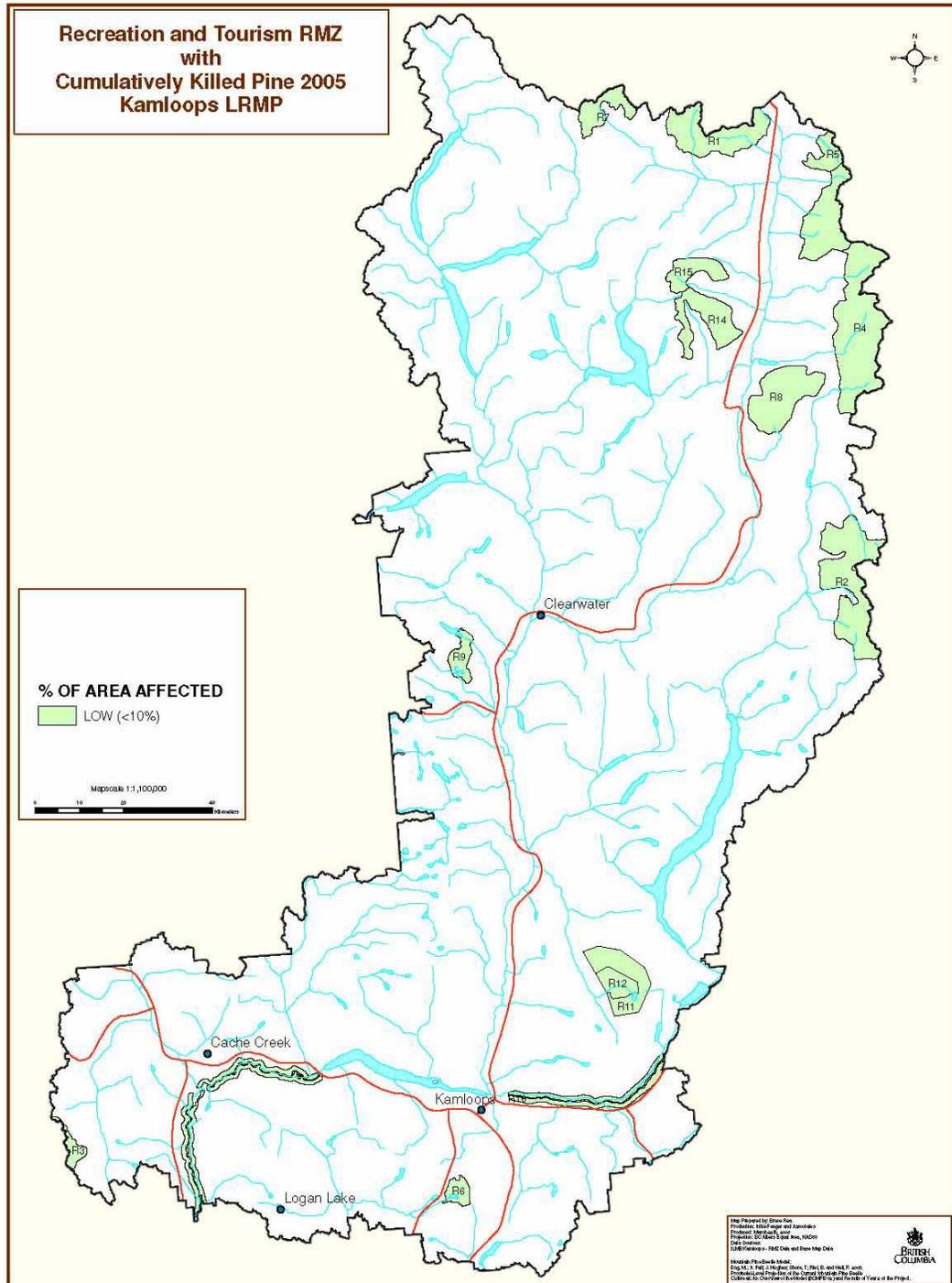


Figure 22: Current (2005) Percent Area Affected in Recreation and Tourism RMZs

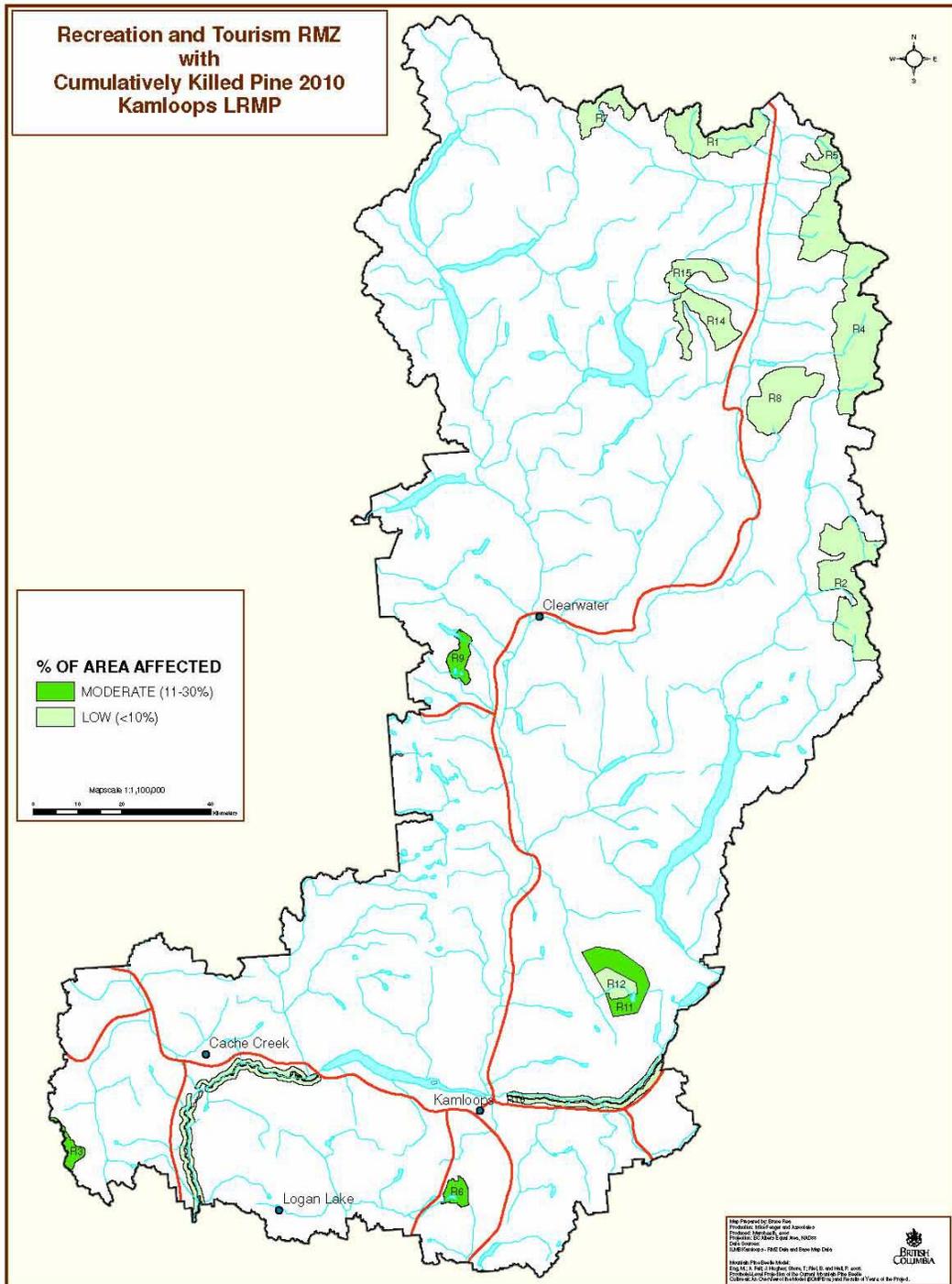


Figure 23: Projected 2010 Percent Area Affected in Recreation and Tourism RMZs

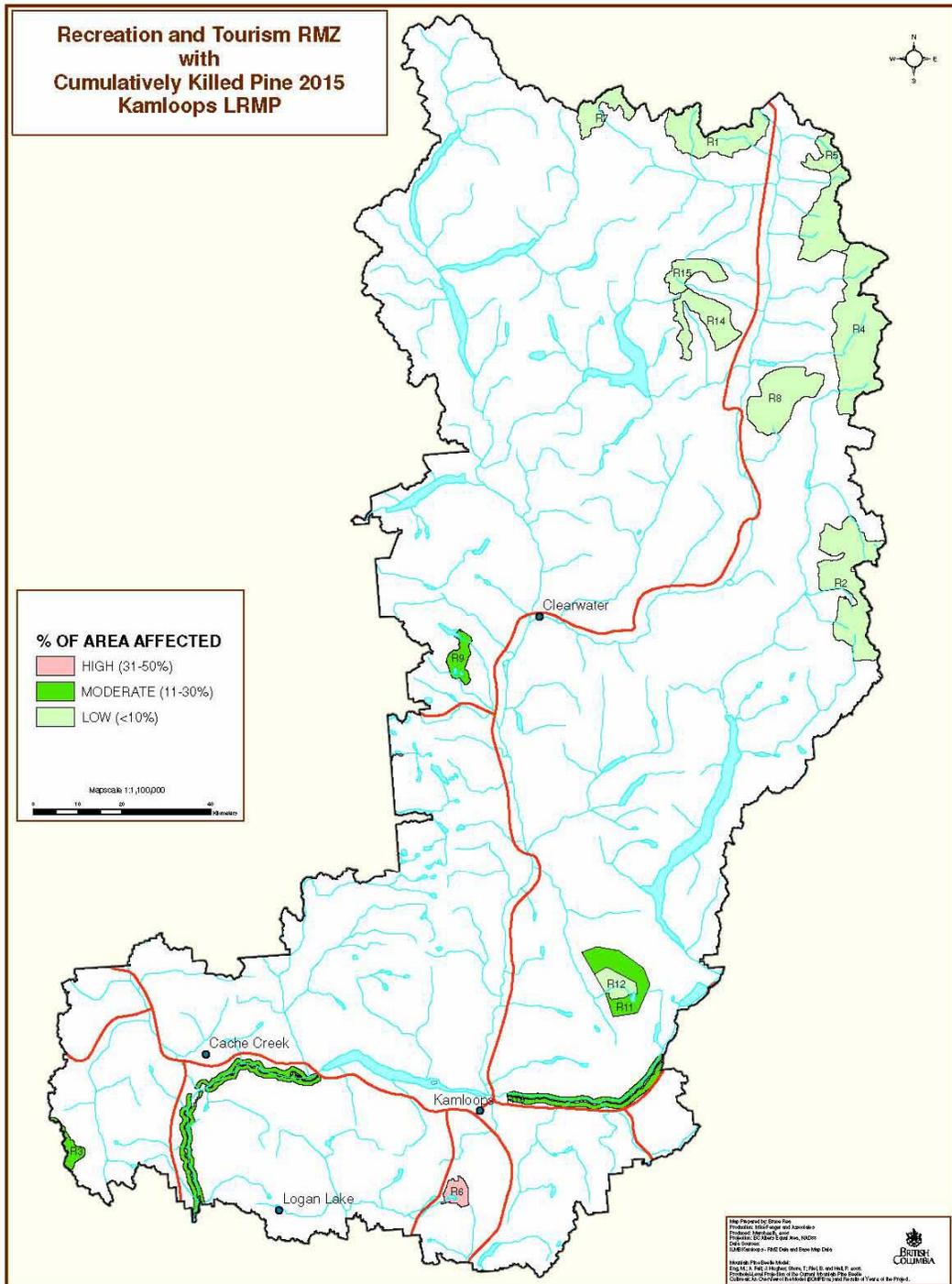


Figure 24: Projected 2015 Percent Area Affected in Recreation and Tourism RMZs

4.2.8 Results for Visually Sensitive Areas

Visually sensitive areas in the plan are defined as viewsheds or viewsapes visible from communities, public use areas and travel corridors or viewpoints identified through a variety of referral or planning processes. Maintaining viewsapes and establishing Visual Quality Objectives are strategies/objectives for the Tourism and Recreation RMZ as mentioned in Section 4.2.3 of the KLRMP. The primary objective of management in visually sensitive areas is to ensure that the levels of visual quality expected by society are achieved on Crown land in keeping with the principles of integrated management. There is a provision in the plan (KLRMP Appendix 8) for forest health considerations to override landscape criteria, but there are no specific details on what this would entail.

We assessed polygons where retention is the visual quality objective (VQO). The definition for retention is: “changes are not visually evident in the characteristic landscape. They may be visible but are not recognized as manmade alterations.” Leaving dead pine on the landscape would meet the definition.

Due to the large number of visual quality polygons, we have chosen to address those where the retention VQO will likely not be met. We do provide the caveat that there is a forest health exemption provision in the plan, however it may not be well known to the public.

We have assumed that where less than 30 percent of the forested area within a polygon is affected by MPB it will be possible to meet the visual quality objectives. Further detailed assessment on the ground is required to confirm this assumption. It is further assumed that with greater pine mortality it will become more difficult to meet the retention objective. In the high, very high, and extremely high percent area affected categories it will not be possible to meet retention objectives with salvage logging. We speculate that it may even be challenging to meet Partial Retention VQOs in polygons in the higher percent area affected categories, where salvage logging is taking place.

Based on these assumptions, the retention VQO objectives are currently met; however by 2010 the model predicts many of the polygons will move into the high and very high percent area affected categories (see Figures 26 to 29). The areas around Bonaparte Lake, Lac Le Jeune, and Tranquille Lakes would be in the high to very high category. By 2020 the model predicts that in addition to the three RMZs above, the following areas will move into the high, very high or extremely high percent area affected categories (i.e. >31 percent of the forested areas within these retention polygons will be dead):

- o Ashcroft/Barnes Creek
- o Lac Le Jeune
- o Along the Trans-Canada Highway near the mouths of Campbell and Monty Creeks
- o South West corner of Adams Lake,
- o Caverhill/Akehurst/Birch/Latremouille Lakes and other areas on the plateau
- o Taweel Lake and surroundings

- o Avola and Barrier Lakes.

Caution must be used when interpreting the maps, particularly the retention polygons at lower elevations that may contain grassland habitats. For example one polygon in the Ashcroft/Barnes Creek area is over 600 ha, however only 15 hectares is in forest, of which all the forest is pine. When the pine (ponderosa or lodgepole) is killed off in the model, the entire 600-hectare VQO polygon gets an extremely high rating. The maps are still very useful in defining general geographic areas where it will be difficult, if not impossible to achieve retention objectives within the plan. This is an area where we believe more refined mapping needs to be done.

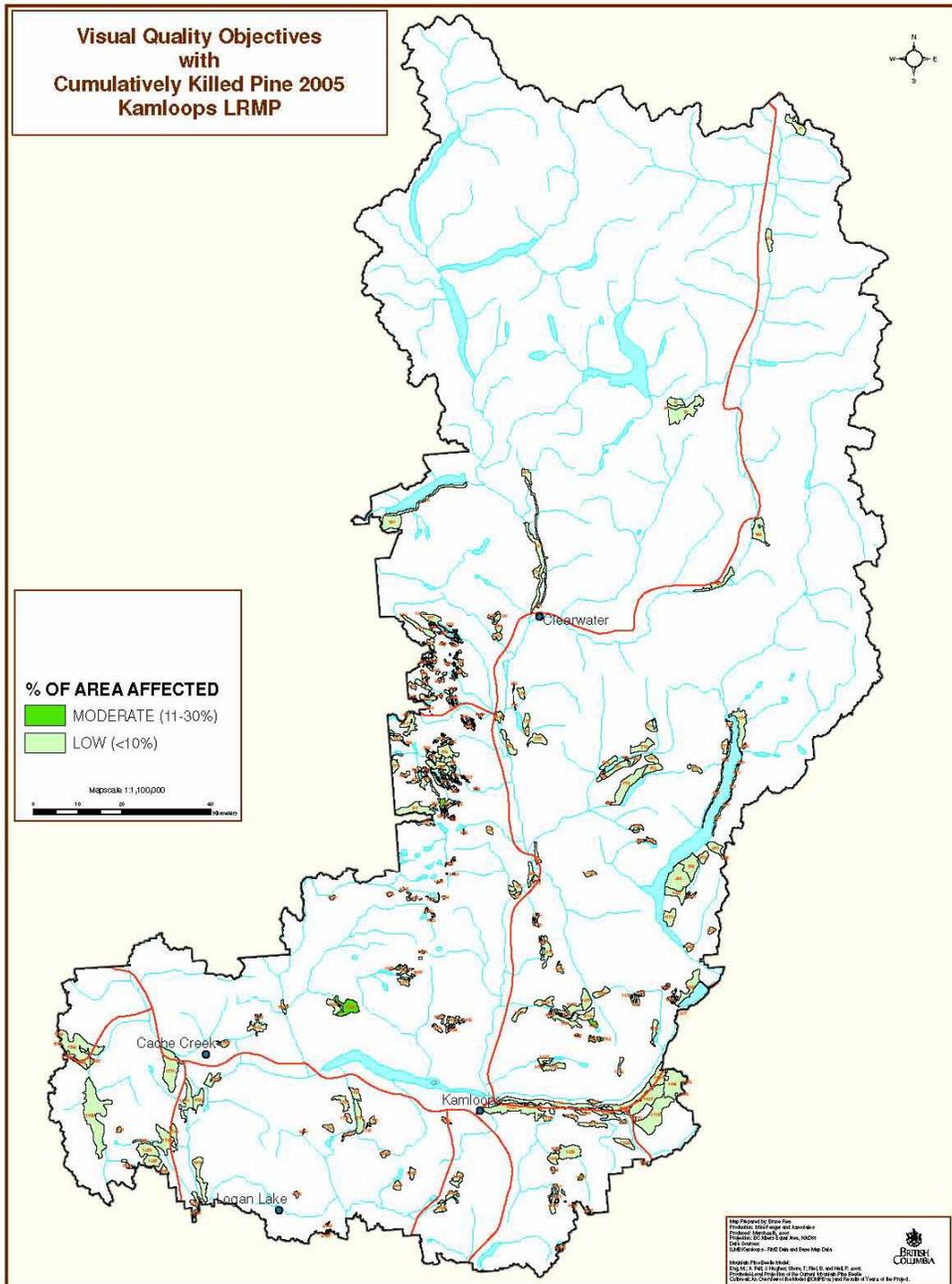


Figure 26: Current (2005) Percent Area Affected in Polygons With Retention Visual Quality Objectives

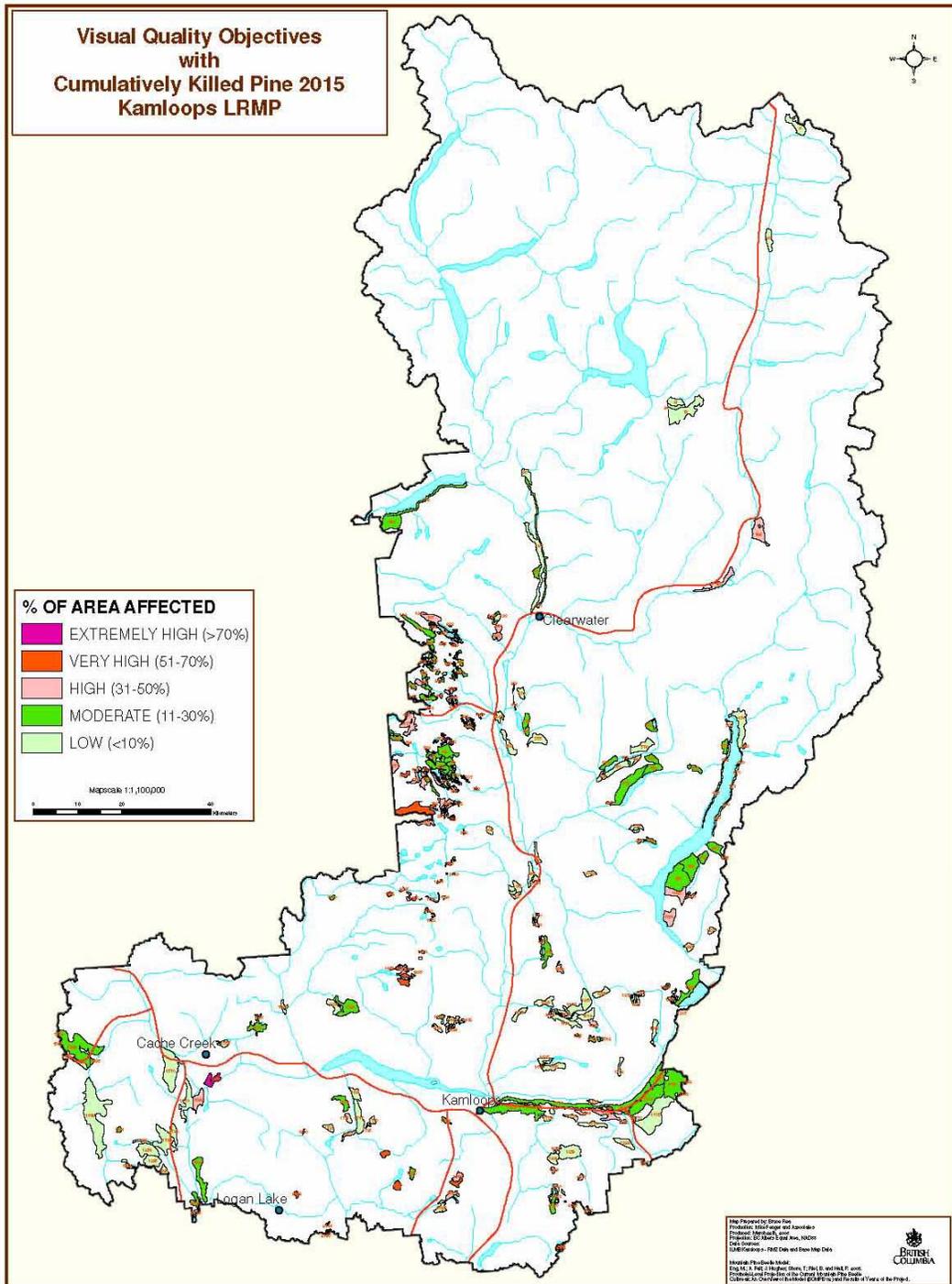


Figure 28: Projected 2015 Percent Area Affected in Polygons With Retention Visual Quality Objectives

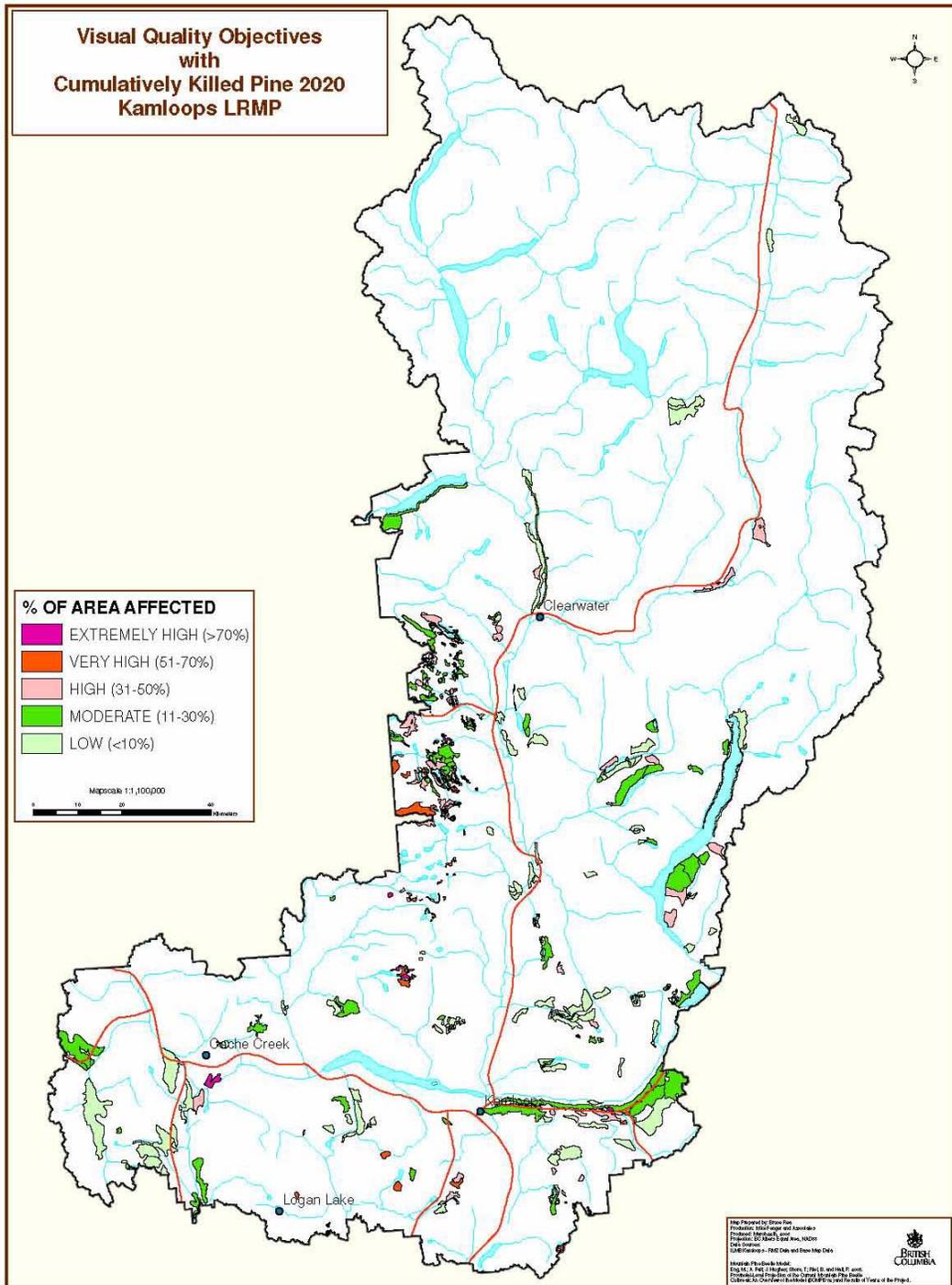


Figure 29: Projected 2020 (post-epidemic) Percent Area Affected in Polygons With Retention Visual Quality Objectives

4.2.9 Results for Class A and B Lakes

The KLRMP recognizes the recreational values associated with lakes. The plan has a number of objectives and strategies that provide direction to manage a 200-meter zone surrounding different lake classes. It is our understanding that two of the strategies will continue as Higher Level Plan for the purposes of FRPA. One strategy speaks to maintaining a mosaic of angling opportunities within the recreational spectrum (i.e. walk-in lakes, drive-to lakes, trophy lakes) and the other speaks to managing lakes in accordance with the Forest Practices Code and the Kamloops and Clearwater District Lakeshore Management Guidelines.

Class A lakes have a 200-meter reserve surrounding them within which no harvesting is permitted. Objectives for Class A lakes are to protect key attributes, and where there are visual concerns, management activities are to meet the Preservation Visual Quality Objectives (VQO). There is an exemption provision for the Ministry of Forests and Range District Manager to allow for harvesting to deal with forest health issues. Both Class A and B lakes have guidance around silviculture, roads, landing and skid roads. Harvesting is permitted within the 200-meter zone surrounding Class B lakes while objectives are to maintain key attributes and where there are visual concerns then management activities should meet the Retention VQO.

There are 23 Class A Lakes (Figure 30) and 103 Class B lakes (Figure 31) in the KLRMP area. The lake classification process did not identify specific lakes that would be managed as walk-in, though the Ministry of Environment has a database with walk-in lakes identified. Walk-in lakes are generally not stocked and rely on natural reproduction from wild fish stocks. There is an objective that speaks to protecting and maintaining the genetic diversity of wild fish stocks. The walk-in lakes did not have specific watershed identifiers therefore we were not able to capture this information.

Providing a mosaic of angling opportunities, particularly for walk-in lakes, will be a challenge in areas that are planned for salvage harvesting. Salvage harvesting may compromise the walk-in management strategy, as harvesting and associated roads will increase access to roads that are now currently walk-in.

We have used the model to determine the total amount of pine in the forested area within 200 meters for each Class A and B lakes. However we have some doubts that the model is accurate at this fine scale. Before reporting out to other agencies and the public we suggest that a sample of lakes be further assessed, or reviewed by those that have local knowledge of these lakes.

Of the Class A lakes, 65 percent of the lakeshore management zones are classified by our analysis as being in the low category (10 percent of the area affected). For Class B lakes, 40 percent are in the low category. The lakes that are of concern will be those in the moderate to extremely high categories, or roughly 35 percent of Class A and 60 percent of Class B lakes. The shorelines of both lake classes can be logged. However it is not known what levels of salvage harvesting will be acceptable to the recreating public,

adjacent property and resort owners. The lakeshore assessments show over 40 of the A and B class lakes have more than 50 percent of the lakeshore management zones in pine, and 15 of which are in the extremely high category with greater than 70 percent of the area affected. When the Lakeshore Guidelines were developed, and the stakeholders were involved in the lake classification process, none of them predicted salvage harvesting/MPB would potentially affect such a large amount of the lakeshores of these high value lakes. The exemption provisions in the guidelines were included to deal with forest health issues related to removing small pockets of MPB infested pine or other species from the lakeshore management zones in a manner that maintained the viewscapes of the area. The current projections of almost complete mortality of mature pine were not contemplated by anyone.

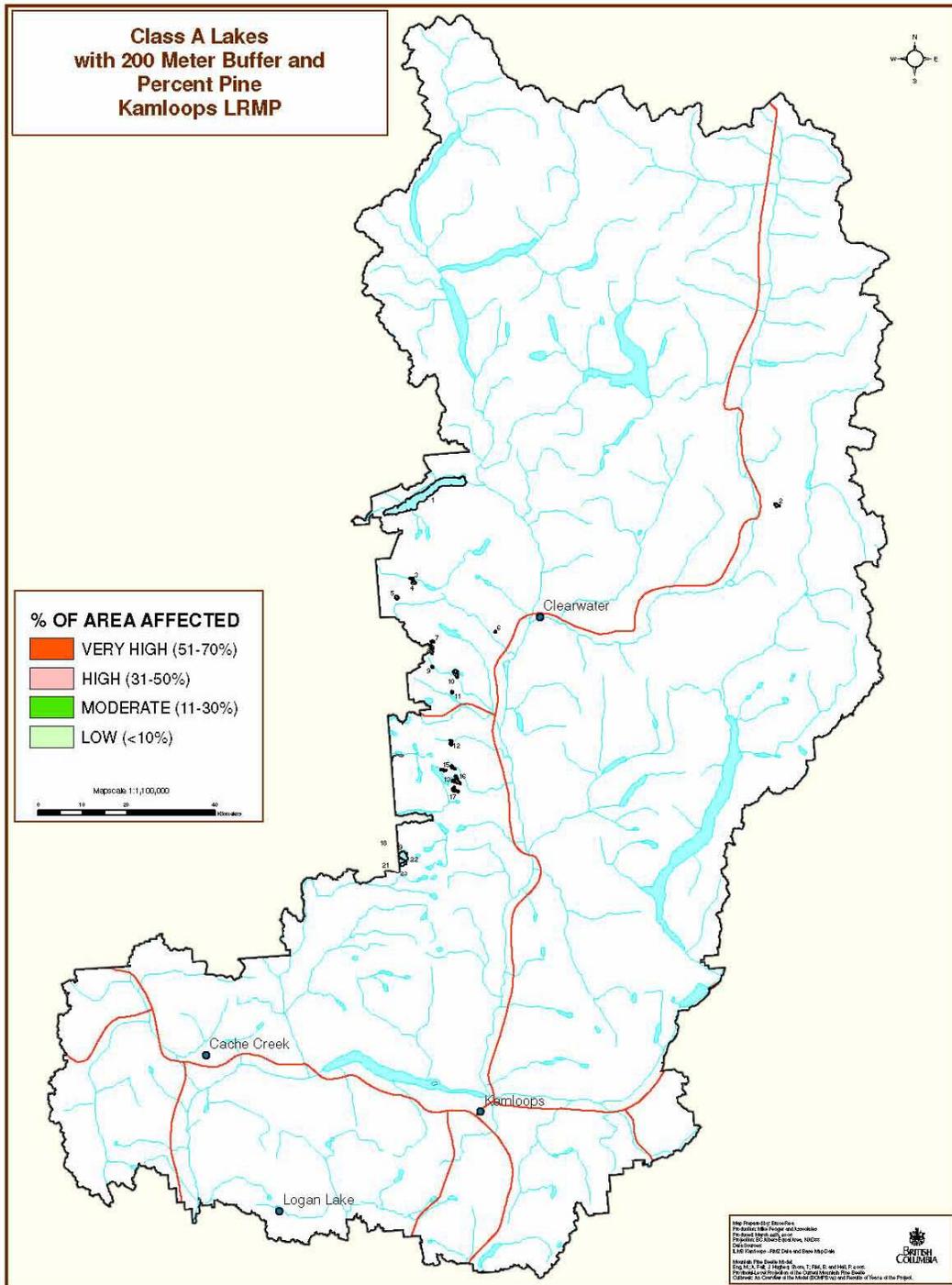


Figure 30: Projected 2020 (post-epidemic) Percent Area Affected in 200 meter buffer zones on Class A Lakes. Due to the scale involved this figure is most useful for depicting locations and numbers of Class A Lakes.

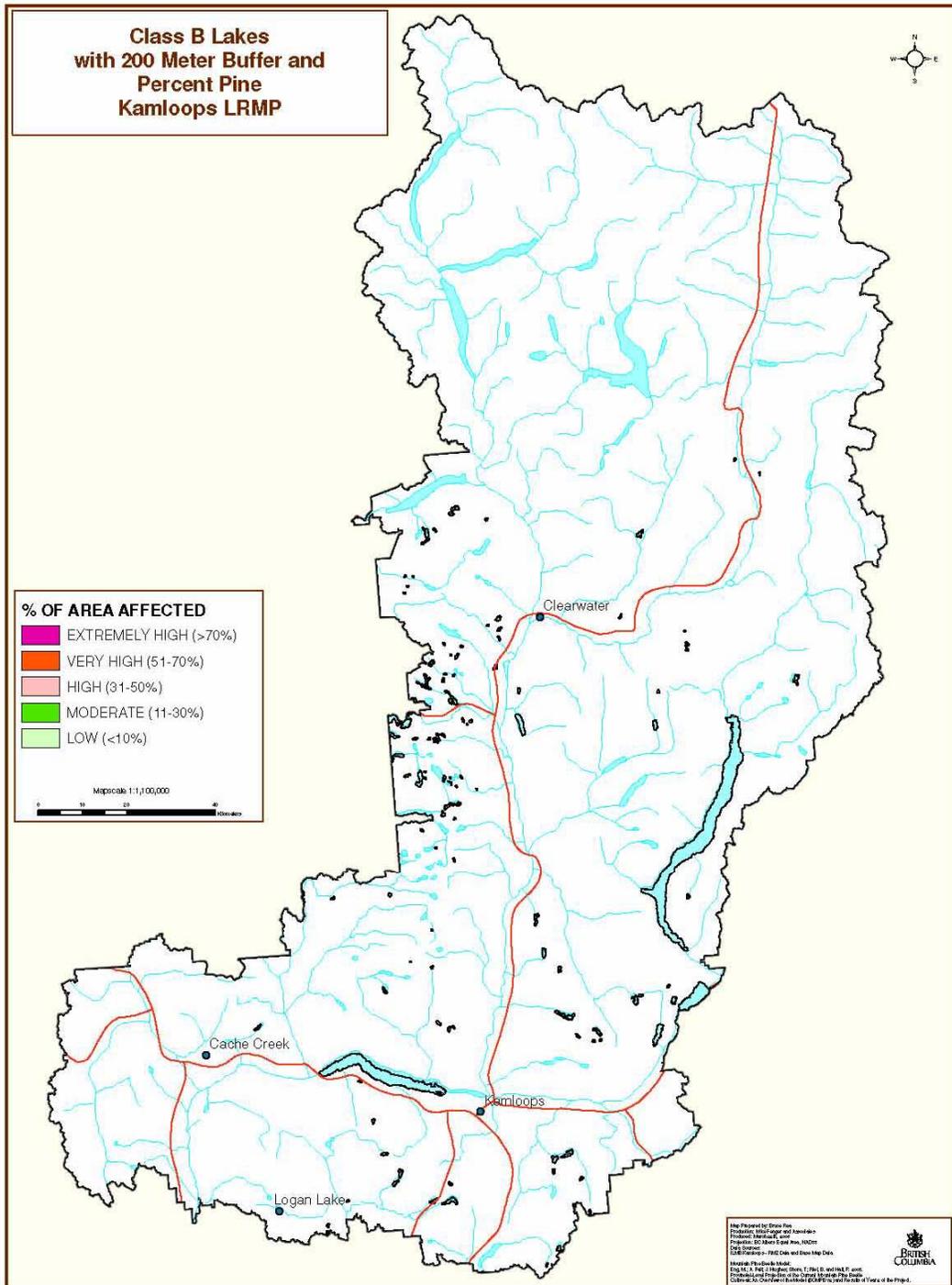


Figure 31: Projected 2020 (post-epidemic) Percent Area Affected in 200 meter buffer zones around Class B Lakes. Due to the scale involved, this figure is most useful in depicting the location and number of Class B Lakes.

4.2.10 Results for Settlement Resource Management Zones

The Settlement RMZs are areas proposed for settlement use of Crown lands as outlined in Official Community Plans or other plans. They are generally private land with some Crown land included. The RMZs include specific polygons as identified below:

Ashcroft	Clearwater	Monte Creek
Ashcroft Manor	Duck Range	North of Heffley Creek
Avola	East Clearwater	Paul Lake
Barriere	Heffley Creek	Pinantan
Blackpool	Knustsford	Pritchard
Blue River	Lac Le Jeune	Savona
Boston Flats	Logan Lake	Six Mike
Cache Creek	Louis Creek	Sullivan (Knouff) Lake
Campbell Creek	McLure	Sunshine Valley
Cherry Creek	Martin Prairie	Vinsula/Black Pines
City of Kamloops	Mesa Vista	

These identified sites can be a single settlement polygon, such as Clearwater, or multiple polygons such as Kamloops, which consists of 14 separate polygons. These polygons range in size of a few hectares around Prichard, to a maximum of 12,455 hectares for a polygon in Kamloops.

The key objectives are to meet conditions set out in Official Community Plan (OCP) and to make crown land available where it is identified in the OCP. Resource development is permitted within this zone. Most OCP objectives, where they exist, are somewhat generic and have no specific direction to deal with forest health and management issues on crown land - they default to provincial agencies for action.

A total of 68 individual settlement zone polygons were assessed, and with the exception of four assessment units at Barriere and Louis Creek, all are currently in the low category i.e., less than 10 percent of the forested area impacted by MPB and wildfires (see Figure 32). The high, very and extremely high categories for Barriere and Louis Creek were the result of the McLure Fire. The model predicts that by 2020, approximately 70 percent of the polygons will remain as low, 12 percent progress to moderate, 4 percent to high, 5 percent to very high and 7 percent to extremely high (see Figure 33). With the exception of the high rating at Blue River, the high, very high and extremely high areas are attributed to McLure fire and suspected mortality of ponderosa pine at lower elevations.

The objectives and strategies specific to the Crown land within this zone can still be met even with the levels of impact projected in 2020. However there will be other outstanding issues that will need consideration, such as addressing the risks and benefits of dead ponderosa pine trees in some of the settlement polygons.

4.2.11 Results for Protection Resource Management Zones

Protection RMZs are areas that have been identified for their natural, cultural, heritage and/or recreational values. No logging is permitted within Protection RMZs. The Protection RMZs range in size from 2.6 hectares (Deadman Hoodoos) to 536,095 hectares (Wells Gray park). A total of 69 Protection RMZs were analyzed through the model.

Two of the RMZs show the impacts of the 2003 wildfires, namely Neskonlith (extremely high percent area affected category: >70 percent) and Cornwall Hills (high percent area affected category 31-50 percent) while Savona Hills and McConnel Lake are currently in the moderate category (11-30 percent) of area affected, attributed to MPB. The majority of the RMZs (94 percent) are in the low category (<10 percent of the forested area affected by MPB). The model predicts that by 2010, MPB activity will have increased to the point where the percentage of RMZs in the low category decreases to 71 percent, and by 2020 decreases further to 50 percent. The model predicts that by 2020 approximately 40 percent of the RMZs will be in the moderate to extremely high percent area affected category, summarized as follows: 22 percent moderate (10-30 percent); 10 percent high (31-50 percent); 7 percent very high (51-70 percent); and 1 percent extremely high >70 percent).

The model predicts that the following RMZs will be in the high to extremely high categories by 2020.

Neskonlith Lake	Tunkwa
Lac Le Jeune	Emar Lakes
Cornwall Hills	Arrowstone
Bonaparte	North Thompson Oxbows
Juniper Beach	Tranquille
McConnell Lake	Walloper Lake
Greenstone Mountain	

Cornwall Hills, Bonaparte, McConnell Lake, Emar Lakes and Arrowstone have area specific management strategies, though these strategies are general in nature. MPB will have no significant impact on most of these strategies and objectives, though there may be impacts to individual sites and values in many of the affected parks. Access management is a strategy for Cornwall, Emar Lakes and Bonaparte, which may be difficult to meet with increased access from salvage harvesting surrounding these areas.

In the moderate to high percent area affected categories, mountain pine beetles are expected to increase surface fuel accumulations (i.e. fuels on the ground like fallen needles, branches and trees). Coarse surface fuel accumulations (i.e. larger fuels) will not be significant until after dead trees fall to the ground 10-15 years after their death. This increase in fuels will increase fire risks in some areas, and may require fuel-loading assessments in areas where extensive unsalvaged dead pine intersects with other values, particularly near communities.

Many of the KLRMP biodiversity values were planned to come from Protection RMZs. For example, Old Growth Management Areas (OGMAs – see Section 4.2.3) were located within suitable older ponderosa pine forests in parks. Some Protection RMZs have large areas in ponderosa pine OGMAs. These stands are likely at increased risk from MPB but also from high severity fires resulting from increased surface fuel loading from both lodgepole and ponderosa pine mortality. One can argue that both fires and MPB are natural ecosystem processes; therefore objectives and strategies will be met without taking any specific management action. However these processes are occurring in the context of cumulative impacts including the effects of fire suppression, logging, domestic grazing, and climate change. Therefore, the current objectives and strategies may not be met over the longer term without some type of intervention such as prescribed fire, fuel removal, and management for open forest conditions, in both the Ponderosa pine and Douglas-fir OGMAs within Protection RMZs.

The KLRMP has strategies for all Protection RMZs that provide direction for preparation of Local Level Plans. These plans were the tool to address motorized and non-motorized access, new tenures, use, etc and were to be incorporated into park plans. We did not review any of these Local Level Plans to determine if the strategies identified in the KLRMP were addressed, nor is it clear if any were produced. Therefore it is difficult to determine if the values within the RMZs are addressed. It is clear that MPB killed stands surrounding many protection RMZs will be salvaged and the resulting access will change use patterns within parks and create new access issues that may not have been considered in the original plan.

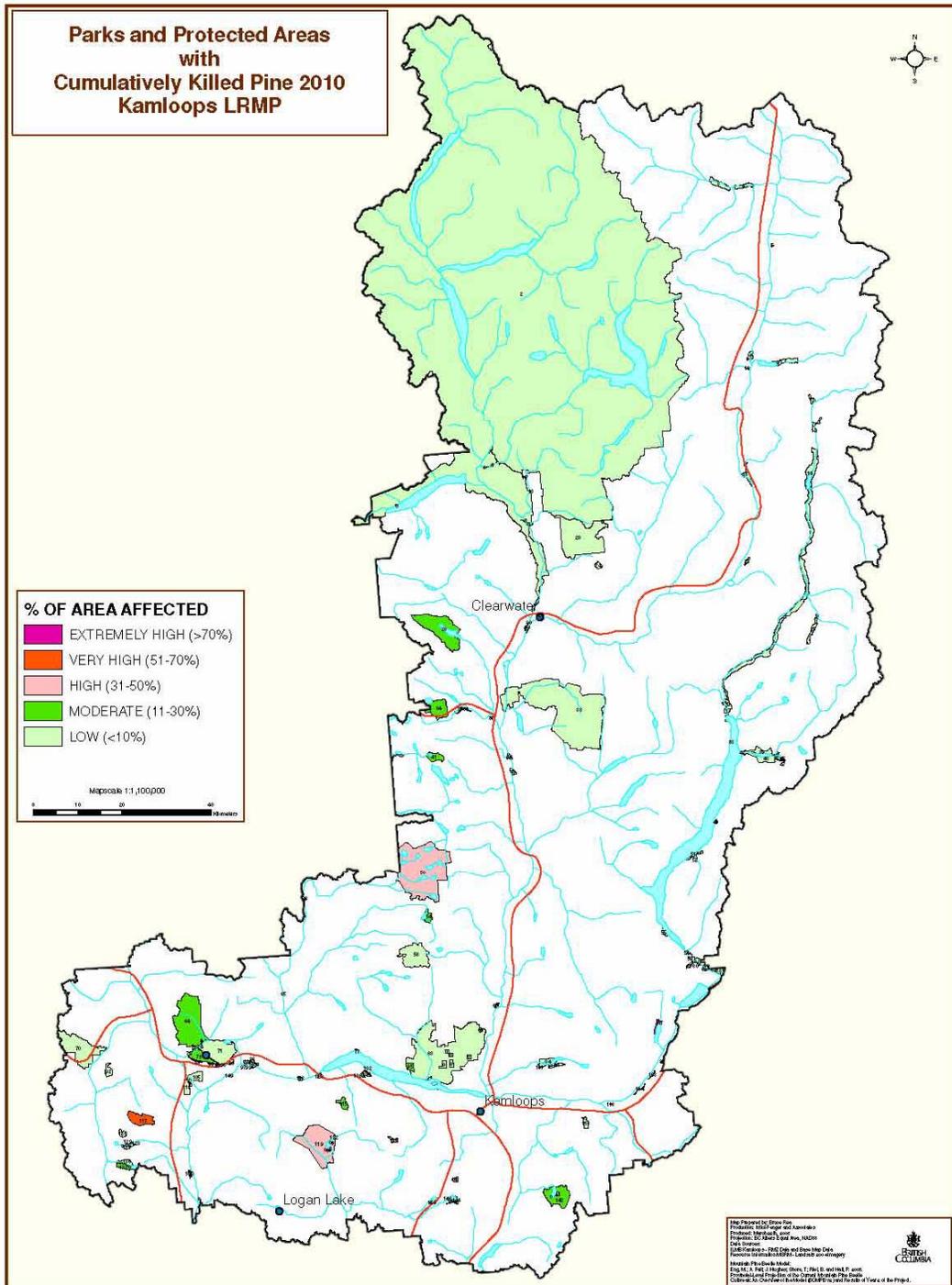


Figure 35: Projected 2010 Percent Area Affected in Protection RMZs

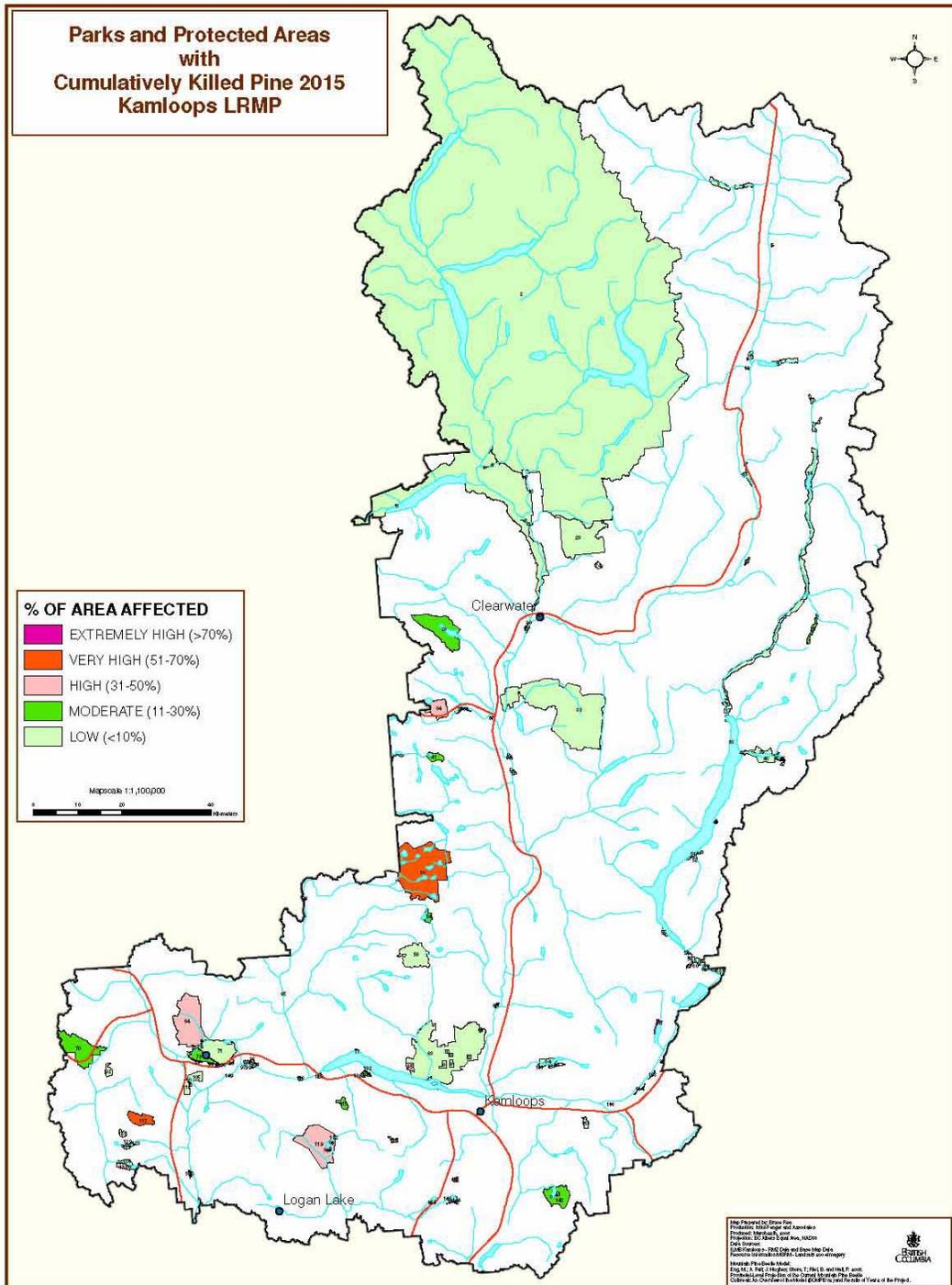


Figure 36: Projected 2015 Percent Area Affected for Protection RMZs

4.2.12 Results for Licensee Operating Areas

Licensee operating areas were used to indicate the proportion of pine in different operating areas, and how this may change over time. The distribution of the chart areas is shown in Figures 38-41, and labels are visible if viewed at a larger scale. This information is included in this report to assist in planning and integrated watershed and local area planning.

Table 9 summarizes all the individual areas shown on the map, and provides a rating based on the overall proportion of mature pine to the total area (including non-forested area and lakes). Therefore, this information cannot be used to compare relative impacts to timber harvest land base in the chart areas.

Table 9: Licensee Areas in KLRMP Affected by Mountain Pine Beetle

Licensee	Forest (ha)	2005	2010	2015	2020
BCTS	224,223	LOW	MODERATE	MODERATE	MODERATE
Bell Pole Company	9,730	LOW	LOW	MODERATE	MODERATE
Canadian Forest Products Ltd.	230,332	LOW	LOW	MODERATE	MODERATE
Gilbert Smith Forest Products Ltd.	59,133	LOW	LOW	LOW	LOW
International Forest Products Ltd.	133,867	LOW	LOW	LOW	LOW
Tolko Industries Ltd.	147,223	MODERATE	MODERATE	MODERATE	MODERATE
Vacant	9,579	MODERATE	HIGH	HIGH	HIGH
West Fraser Mills Ltd.	256,151	LOW	MODERATE	MODERATE	MODERATE
Weyerhaeuser Company Ltd.	591,695	LOW	MODERATE	MODERATE	MODERATE
Grand total	1,661,937	LOW	MODERATE	MODERATE	MODERATE

The distribution of areas and the impact in the units is shown in Figures 38-41.

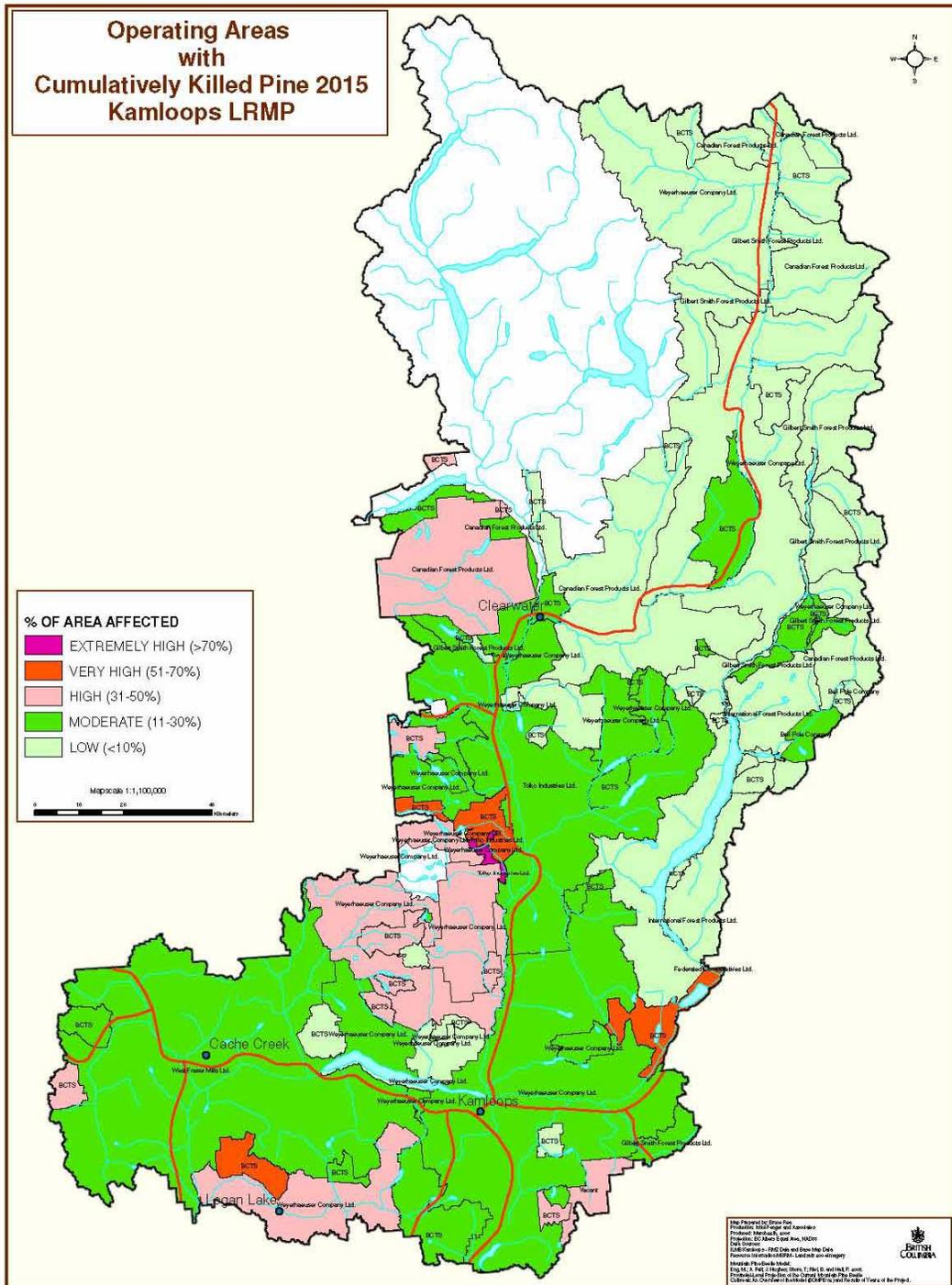


Figure 40: Projected 2015 Percent Area Affected in Licensee Operating Areas

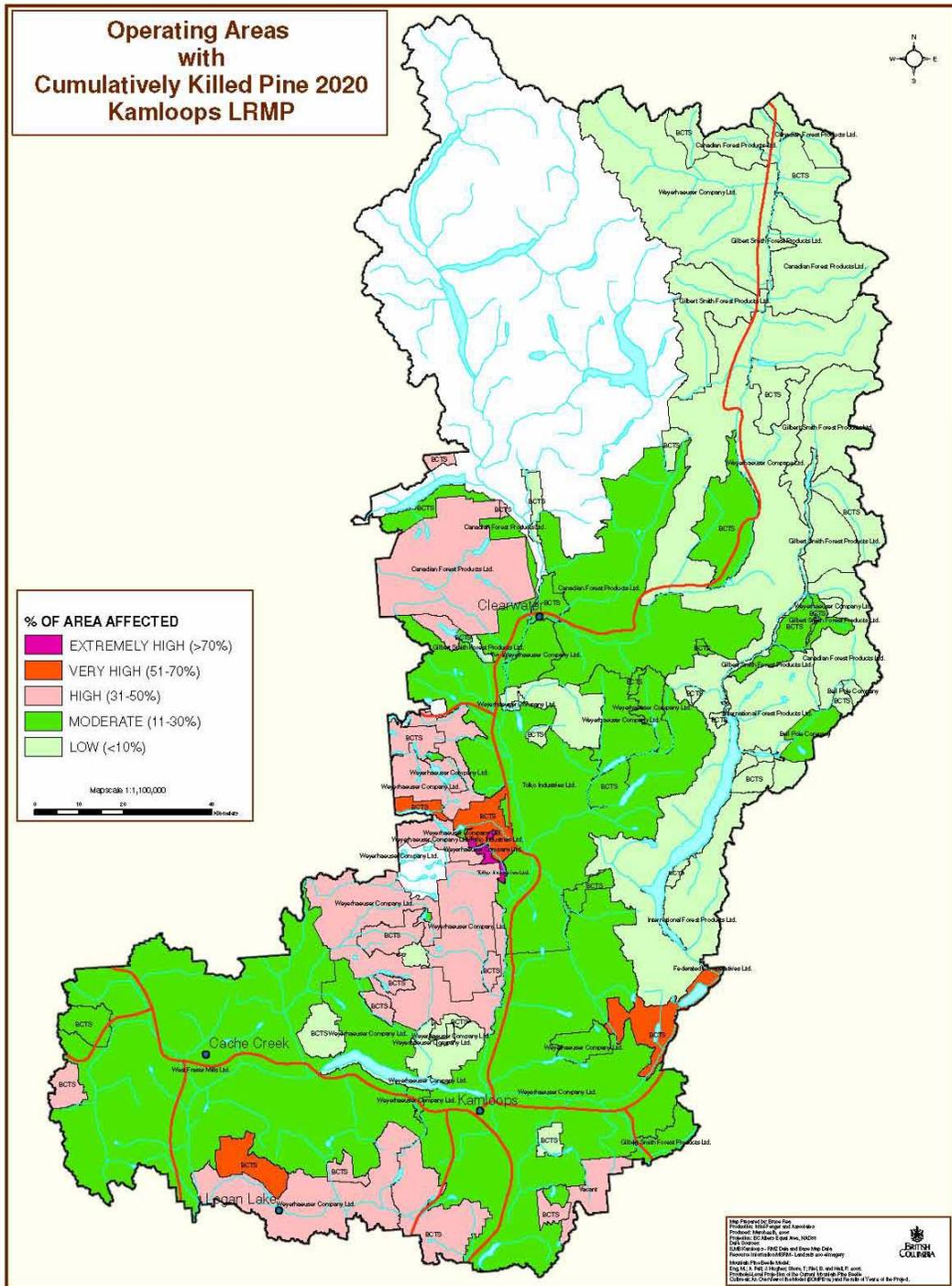


Figure 41: Projected 2020 (post-epidemic) Percent Area Affected in Licensee Operating Areas

5. Discussion

MPB impacts on the KLRMP objectives and strategies were analyzed in Section 4. However this analysis is only part of the picture, as compliance with the wording of the KLRMP objectives and strategies does not necessarily protect the value or goal as envisioned in the plan. Section 4 also attempts to consider risk to the value independent of the objective/strategy (O/S). This report intends to help managers identify and distinguish between the following scenarios that affect the KLRMP goals and objectives/strategies and overall goals.

1. Objectives and Strategies can be met; MPB does not significantly affect the O/S and the values in question (either due to lack of mature pine in the area in question, or lack of sensitivity to forest conditions. Those O/S that are not sensitive to forest conditions are not included in this report but are noted in Appendix 4).
2. Objectives and Strategies are at risk of not being met, due to the effect of MPB.
3. Objectives and Strategies can be met, but the vision or goal of the plan with respect to the value likely won't be met, due to the effect of MPB. Usually this relates to the wording and interpretation of the objectives/strategies.
4. No Objective or Strategy exists to give direction to meet a goal or vision.
5. The vision of the plan may not be met due to a changing regulatory environment (i.e. government policy and law) that affects the assumptions on which the plan was based. This includes cases where no objective or strategy was developed because the law, policy or government directive at the time precluded the need for an O/S. See Section 6 for a discussion of the Management Context.

It is difficult to separate out the effects of MPB from the effects of salvage harvesting to recover the economic value of the dead and dying pine. Unless retention planning is done or harvesting is limited under KLRMP provisions (e.g. in Protection RMZs or critical deer winter ranges), the consulting team assumed that salvage harvesting would likely proceed in any stands of lodgepole pine significantly affected by MPB. This assumption may not hold if managers decide to do integrated watershed planning as described in Section 7. As described in Section 2.3, salvage harvesting has impacts that are incremental to the effects of MPB itself, and depending on the value and area in question, harvesting decisions can have a major influence on whether KLRMP objectives/strategies are met.

As described above, it is important to note that risk to specific values may remain even without the objectives and strategies being at risk. The maps show that risks to a number of resources will go up significantly. Addressing risk might be best done by renegotiating the plan, something that a majority of interviewees were in support of.

Many of the interviewees were not members of the original KLRMP planning table, but are the government agency person responsible for implementing that part of the plan. As such, many interviewees were not intimately familiar with the specific wording of the

objectives and strategies and were more focused on the KLRMP values. Many interviewees spoke to what they believed was the intent of the plan, and assumed that the plan contents addressed current thinking and needs. In fact there are many gaps in plan objectives and strategies, and the wording of these objectives/strategies may fall short of what some thought was in the plan. The KLRMP was developed at a time when the Forest Practices Code was to deal with many concerns, and the plan defaulted to the former FPC for management direction in many cases. Additionally, the plan did not contemplate forest health issues being so large in scope.

Generally the interviewees' description of problem areas matched well with the GIS analysis done.

In some instances, the model assigned high ratings that upon further examination were not justified, and were more related to the scale of analysis. This occurred as an artefact of small polygon size – e.g. when polygons were less than 10 hectares. This issue is something to address if this methodology is applied in future, potentially by incorporating an algorithm that identifies small polygons, and polygons that have a small forested area relative to the entire polygon. Some of the remaining questions to be addressed regarding risk to plan values are more operational and would require different modelling approaches or assessments, such as risk to specific OGMA's. Also, the complexity of some of the RMZs and their associated categories (including the complexity of the data formats for RMZs) makes a strategic analysis difficult. The actual levels of risk to ponderosa pine forests need to be identified – these areas are affected but it is not known if they are affected to the same degree as lodgepole pine. Also to note is that the estimated equivalent clearcut area for community watersheds may be under-rated, and further examination of the data may be required. This issue is highlighted in Table 4 in Section 4.2.1.

There is uncertainty regarding the rate of spread of MPB. If forest mortality occurs more quickly than forecasted (see Eng *et al.* 2005), then less timber value can be salvaged in the short term (i.e. the next 20 years) than anticipated. If the rate of spread of MPB is slower than forecast, then the accelerated harvest is unnecessarily placing all values at higher risk, including timber values. For this report we assume that the forecasts done by Eng *et al.* are correct.

Lastly, it is important to note that most mapping categories and associated color codes used in the maps in this report are not direct measures of risk. The categories show percent area affected by MPB, which is an indirect measure of risk. The level of risk can vary between values depending on sensitivity to forest condition. A qualitative assessment was done for each value regarding the level of risk as it relates to the percent area affected. For community and 'general' watersheds, and fish and aquatic habitat, the mapping shows percent equivalent clearcut area (ECA), which is a direct measure of risk. Risk related to ECA is described in Section 4.2.1.

6. Management Context

It is important to understand the current regulatory framework to help decide where risk to values may be most effectively quantified and addressed. Information regarding risk and the current planning and regulatory framework is given here to provide context for the management options presented in Section 7.

The Province has developed a MPB action plan (Province of BC 2005), which includes plans to recover the greatest value from dead timber before it burns or decays. The impacts of MPB to timber supply and value are quantified through timber supply reviews in affected areas, which may receive an increase in the annual allowable cut (AAC). In the Kamloops Timber Supply Area, the Chief Forester determined that an AAC uplift of 1,000,000 m³/year and 670,000 m³/year was required to address MPB and the burned over areas, respectively. This uplift has been in effect since January 1st, 2004. The decision to harvest large volumes of pine in a short time period brings unquantified risks to non-timber values, in addition to the risks posed to these values by MPB alone. With a greater understanding of risks posed to non-timber values, it is possible to fairly apportion costs and benefits between timber and non-timber values and interests. Currently there is a high degree of uncertainty regarding the impacts of widespread pine mortality and associated salvage harvesting. Recent major wildfires also bring uncertain impacts to non-timber values.

The Kamloops LRMP was negotiated regionally while the Forest Practices Code was being developed provincially. In some cases, the planning table assumed that the Forest Practices Code (FPC) would provide baseline prescriptive direction for forestry practice. In many cases, in addition to providing strategic goals, objectives and strategies, the KLRMP provided incremental constraints to forest development over and above this FPC baseline. These were some of the major premises on which the Kamloops LRMP was constructed and came into effect as a higher-level plan.

In the context of the new results-based Forest and Range Practices Act (FRPA) that replaces the FPC, the Kamloops LRMP continues as the means to provide incremental direction to forest management, in order to conserve non-timber values. This may be achieved either through legal direction, or overall LRMP direction that needs to be considered by forest planners. Under this new regulatory regime, there is a higher degree of reliance on resource professionals, who in turn rely on direction from the land use plans and the FRPA. The FRPA does not give prescriptive (numeric) direction to the extent done previously under the Forest Practices Code. Agencies no longer review operational forestry plans before approval; rather the emphasis is on approval of strategies to reach stated objectives and evidence provided to support the strategies. Clear social (non-timber) direction comes from objectives and strategies in LRMPs. In some cases, such as where certain of the LRMP objectives and strategies must be addressed in Forest Stewardship Plans (e.g. for the KLRMP), this direction was clarified in January 2006 using the Strategic Planning Regulation (SPR) - see Appendix 5. In the future, if government determines that there is a need to have legally enforceable

direction, this may be done using new Government Actions Regulation (GAR), or the Land Use Objectives Regulation (LUOR). These regulations are pursuant to the Forest and Range Practices Act and the Land Act, respectively. However, the FRPA requires industry to be operating under forest stewardship plans after 2006. Addressing the change in plan risks through GAR or LUOR in order to influence salvage harvesting would therefore need to be completed within months.⁶

The majority of interviewees did not believe that current harvesting practices and plans are sufficient to manage non-timber values. The Chief Forester acknowledges the impacts that result from increased harvesting for MPB, and in response he has issued non-binding policy direction to foresters and forest companies, requesting a higher level of forest retention in harvested stands than that required in regulation.⁷

From our research, it appears that understanding of the FRPA regulatory regime is low, outside of those directly involved in implementing it. We are uncertain to what extent non-timber interests comprehend the new regulatory framework and changes and their new role in providing a social framework and non-legal criteria that forest managers must be accountable to. This is understandable, as regulatory transition is still occurring, and is happening in the midst of the MPB epidemic. Several bulletins on the transition to the new framework have been prepared by the Forest Practices Board (see: <http://www.fpb.gov.bc.ca/bulletin.htm>), that help clarify how risk is addressed and the role of the non-timber interests and Forest Stewardship Plans.

7. Management Options

In this section we present options to manage values identified in the KLRMP, in the context of the current regulatory and natural environment. These options are seen as a starting point to assist managers in charge of land use plans as well as other managers concerned about multiple values. Please refer to Section 4.1 for definitions and examples of major and minor plan changes and initiatives:

1. **Status Quo.** Assumes that the current plan and current legislated forestry requirements are sufficient to manage risk to plan values.
2. **Minor changes to plan.** Assumes minor strategic changes can maintain plan balance and relevance, and manage risk to plan values.
3. **Major change to plan.** Assumes that a major plan revision is the only way to properly address risks presented by MPB and maintain plan relevance.

⁶ Concerns regarding the specificity and enforceability of Forest Stewardship Plans are being expressed by the Forest Practices Board, see <http://www.fpb.gov.bc.ca/special/reports/SR28/SR28.pdf>

⁷ See: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/cf_retention_guidance_dec2005.pdf for Chief Forester guidance

4. **Minor initiatives outside the KLRMP to manage risk to values.** Minor initiatives consistent with LRMP objectives and goals can be taken regardless of what kinds of changes are made to the plan.
5. **Major initiatives outside the KLRMP to manage risk to values.** Major initiatives consistent with LRMP objectives and goals may affect the need or types of change to be made to the plan and may be an effective way to manage risk to plan values.

These options are discussed in more detail below, along with the advantages and disadvantages of each. The options below are not necessarily exclusive – some options may be applied simultaneously.

Option One: Status Quo. Current plan and current legislated forestry requirements sufficient

The context in Section 6 was provided to clarify the status quo option. This option requires less workload for agency staff, and there are already initiatives underway (as part of the GAR) to establish Wildlife Habitat Areas and Ungulate Winter Ranges. However resource objectives delineated in the KLRMP would still be unmet, lessening the relevance and usefulness of the plan and leaving risk to plan values largely unmanaged.

Advantages:

- There is no added workload for government staff or other interests.

Disadvantages:

- Absence of a response to address a majority of values and interests impacted.
- The plan is potentially rendered obsolete when resource objectives are not met.

Option Two: Minor changes to the KLRMP to manage risks

This option makes minor changes to the plan, to strengthen it where most needed and to revise strategies/objectives that can no longer be met, or that need updating. These changes would seek to maintain the balance of the originally negotiated agreement. This option would seek to maintain the relevance and usefulness of the plan through making minor critical changes. However, since objectives are connected, it is possible this option may be difficult to carry out. Minor changes made in one part of the plan may affect other parts of the plan, and necessitate a more substantial plan overhaul that could alter the negotiated balance.

Advantages:

- This option would seek to maintain the relevance and usefulness of the plan.
- Changes would maintain the balance of the originally negotiated agreement.
- Several interviewees support this option.
- Minor revisions may be more expedient than major revisions.
- Social direction could be provided for Forest Stewardship Plans.

Disadvantages:

- The scope of the revisions may be difficult to control.
- This option requires a commitment from all linked interests and clear direction to focus on minor revisions to give clarity in keeping with the negotiated balance
- There would be an increase in workload for government staff and other interests to prepare and assess the minor changes.

Option Three: Major changes to the KLRMP to manage risks

This option is a major overhaul of the KLRMP, to address plan values in a changing natural and regulatory environment. These changes would be substantial enough that they could be considered to alter the balance of the originally negotiated agreement. Given the substantial changes to the forest and the increased harvesting to capture economic value, revision of the plan with the involvement of key interests may be an effective option. Plan revision may be an important way to manage risk to values, particularly if clarity is provided in the form of measurable targets. However this option requires a significant commitment of time and resources, and will require the negotiation of a whole new balance. For the Kamloops LRMP (one of the first LRMPs completed), the willingness to make major changes may reflect the age of the plan.

Advantages:

- Ensures that the plan is relevant in the face of significant changes to natural ecosystems and the regulatory environment.
- Affords an opportunity to provide greater clarity and accountability and express social preferences in light of changed risks.
- Supported by a majority of the interests as an appropriate response.

Disadvantages:

- Requires a significant commitment of time, resources and coordination from the major interests.
- The pace at which the harvesting is proceeding and being approved may render changes ineffective if they cannot be achieved prior to approval of major salvage plans (required before 2007) which will enable harvest until 2012.

Option Four: Minor initiatives outside the KLRMP to manage risk to values.

This option may be implemented in tandem with major or minor plan amendments. There are a number of minor actions that can improve the understanding and management of risks. These include expediting processes under the Government Action Regulation for values at risk i.e., expediting water quality objectives and fisheries sensitivity watershed designations. Another 'minor' initiative would be to significantly increase communications and consultations with sector interests and the public on levels of risk and cost.

Advantages (depending on actions taken):

- Improves understanding of the risks
- Supported by those who would support major plan amendments.
- A higher level of activity (compared to the status quo) can take place to address risks.
- Direction can be provided to salvage harvest planning.

Disadvantages:

- Relatively minor responses to this major event may be difficult to justify, if not done together with more substantive initiatives.
- The process may not be completed before Forest Stewardship Plans (for salvage harvesting) are approved.

Option Five: Major initiatives outside the KLRMP to manage risk to values.

This option is similar to the one above, but if undertaken may preclude a major plan amendment process. Certainly support for two significant and concurrent processes would be a strain on key players. However, a major initiative outside the plan could be constructed to provide the background and information to support a major plan amendment at some future unspecified date.

One potential major initiative would be to have provincial agencies support and lead integrated watershed planning. This planning would likely be focused to areas of higher impact that overlap with domestic and community watersheds and watersheds that contain high fisheries or other ecosystem values, as described in land use plans and agency priorities. Risks to non-timber values could be assessed, and direction and assistance could be given to salvage harvest planning done by the forest industry. A key part of integrated watershed planning in the context of mountain pine beetle attack is strategic planning to locate retention areas, as acknowledged by the Chief Forester. Multi-disciplinary technical teams could develop these integrated watershed-level plans, and this process could be inclusive of the public, or at least inform the public and key interests regarding risks. This process could provide due diligence information in support of Forest Stewardship Plans. Mitigative options could also be recommended by these teams, e.g. for fish habitat and water quality/quantity. This kind of initiative would help manage risk to plan objectives and strategies by sustaining an integrated, landscape-level management focus on non-timber values, giving the forest industry assistance in locating areas appropriate for salvage harvesting relative to KLRMP values as well as directing mitigative actions for areas negatively affected by MPB.

Integrated watershed planning is over and above expectations set in the Forest and Range Practices Act, and thus would require provincial funding. Funding could be provided as a short-term measure in recognition of the special emergency circumstances created by MPB, and directed to selected plan areas that have higher impacts.

Another major initiative referenced in the KLRMP was Local Resource Use Plans (LRUPs) to deal with access, use and other issues, focussing on areas where KLRMP

objectives cannot be met. LRUPs are no longer supported by government, however Sustainable Resource Management Plans (SRMPs) are a tactical level of planning being done for portions of BC (but none in the KLRMP area).

Advantages:

- Undertakes significant action to match the scale of the problem.
- Provides a process for many of the players currently outside of forest planning to understand and potentially give input to how their values are impacted.
- Provides a strategic process and measures to manage non-timber values.
- Can be achieved relatively quickly.
- Gives assistance to the forest industry, in managing the “emergency” nature of the salvage program.
- Provides a venue to develop alternate and innovative solutions

Disadvantages:

- Integrated watershed planning will still be bound by the current objectives and strategies in land use plans, which might have unattainable targets or lack clear direction.
- Requires a significant commitment of resources.
- Uncertainty on the acceptability of directions from outside of the FRPA structure i.e. this process would provide non-binding information into salvage planning.

8. Potential Resource opportunities

Agriculture, range and tourism sectors have potential benefits from the changing landscape linked to this natural disturbance and salvage. In the short term, timber interests also benefit from the increased rate of harvest. More detail on the pros and cons of these potential opportunities is given here.

Agriculture/Range

The BC Cattlemen’s association states that while “salvage operations in Mountain Pine Beetle infected stands will remove natural range barriers, damage range fencing, potentially spread invasive plants, and generally disrupt grazing practices, at the same time the harvesting does create opportunities for an increase in available grazing and access to lands suitable for intensive agriculture development⁸.”

Similar sentiments were reflected in the interviews conducted for this project. Opportunities are certainly apparent, especially in light of Pat Bell’s (the Minister of Agriculture and Lands’) announcement(s) of increases (and a potential doubling) of grazing resources in the province. However, the most obvious limiting factor for increases in agriculture/range is water. The timing and quantities of water are perceived to be too uncertain. Agriculture interests would like to see more storage infrastructure for consistent and dependable supplies throughout the year. Increasing range/agriculture

⁸ see: http://www.cattlemen.bc.ca/releases_2005.htm (viewed March 2006)

opportunities brings a greater demand on limited water resources.

Range interests may also benefit from increased road access. Some concern was expressed over range-utilized roads becoming de-commissioned after salvage. Better communication could alleviate such issues, however additional road maintenance costs would be a consequence.

Increased forage resources will have economic benefits for range interests and the Crown, however these may not be as great as the benefit (to the forest industry and presumably to the public) of reforesting affected areas for future timber supply.

Tourism

Tourism benefits were seen by interviewees to be “what ifs”, as opposed to concrete opportunities, mainly related to greater road access to formerly inaccessible areas.

Timber Supply

In the short-term, timber interests will benefit from the short-term elevation of timber supply. However, industry staff in interviews conveyed that this was also a major responsibility. For example, the promotion of new wood products has been challenging and some products require species other than lodgepole pine. Increasing the percentage of pine that goes into pulp also poses problems for manufacturing. In the mid-term, timber supply will suffer from the loss/salvage of lodgepole pine occurring in the next 10-15 years.

9. Operational Planning for Hydrologic Concerns

As mentioned previously, hydrologic impacts are of critical concern in areas affected by mountain pine beetle. When deciding whether to salvage harvest any given stand affected by MPB, a range of options can be considered including: salvage fully, salvage selectively, or leave it alone (when benefits of salvage are outweighed by damage to another resource). Salvaging as much as possible, and ensuring adequate restocking immediately, may decrease the length of time until the impacted areas are fully hydrologically recovered. However, consideration also has to be given to the initial period of higher risks that may result from that full salvage effort. Increased short-term (10-20 years) hydrologic risk factors from full salvage in a heavily affected watershed would include:

- An increased road system. Road and ditch systems affect peak flows by intercepting groundwater and channelling surface flows to streams.
- An increase in the proportion of the watershed in a clearcut ‘0 percent hydrologically recovered’ state. The choice to salvage all stands which are susceptible pine leading will result in the loss of the significant ongoing positive hydrologic effects of non-pine species and under-story in some of those stands.

To minimize peak flow and water supply risks in highly impacted watersheds, consideration should be given to the length of new roads needed to access a stand, compared to volumes recovered. Extreme short term Equivalent Clearcut Area (ECA) should also be considered, and in the calculation of that potential ECA, a complete estimate of the percent of full hydrologic function provided by non-pine species and under-story should be included. The weight given to these factors in any given watershed will vary according to the water resource values, existing watershed conditions, and the extent of projected MPB impacts.

10. Future related work

This analysis was done at a strategic level, and describes risk to plan values in a mostly qualitative sense, though it is based on quantitative data on pine presence and mortality, and well-known water-related effects of equivalent clearcut area. Amendments or renegotiation of the KLRMP would need to be supported by further information regarding risk to values as well as costs and benefits.

Risk to timber values is fairly well documented, or “real”. It is because of this risk that short-term annual allowable cuts have been elevated, and strategies are under development to try to minimize mid-term shortfalls in timber supply. Risk to non-timber, environmental values is not well documented by any kind of numerical analysis, and thus can be considered “perceived” risk in the eyes of statutory decision makers and the public. The perceived risk to environmental (and social and economic) values is high, and has been greatly increased by the increased rate of harvest. The next steps to be taken will depend on the value in question. Some information gaps and related management actions were identified in this analysis.

For some Community Watersheds, a discrepancy was noted between the equivalent clearcut area (ECA) calculated in previous Interior Watershed Assessment Procedures, and the ECA calculated by the model. It might be useful to investigate this discrepancy, particularly if this methodology is to be applied to other plan areas. In general, a more detailed assessment and monitoring should be carried out on all Community Watersheds with estimated ECAs of 20 percent or higher in 2020 (see Table 4) – using 20 percent as a threshold would take into account the potential underestimates of ECA. Similarly, for fish sensitive streams, assessments and monitoring should be done for any that show a predicted ECA in excess of 25 percent ECA by 2020. These assessments/monitoring can drive management actions, including recommendations for extent and locations of salvage harvesting in sensitive watersheds.

A ground survey is needed to confirm and monitor Old Growth Management Area (OGMA) status. A replacement policy is expected to be implemented if more than 10 percent of the OGMA is salvage harvested. This stand level policy direction requires accurate location of OGMA boundaries and contents beyond what is currently available. An investigation could also better quantify risks to forest biodiversity and devise landscape level approaches to ameliorate this risk. This could be a part of the integrated watershed planning discussed in Section 7.

Our analysis of Class A and B lakes may not be accurate at the fine scale of 200-meter buffer zones. We suggest a sample of lakes be further assessed, and the results reviewed by those who have local knowledge of these lakes.

More refined mapping may be useful in determining impacts to polygons with retention visual quality objectives (VQOs). Current mapping is useful in defining general geographic areas where it will be difficult to meet KLRMP VQOs, but may not be accurate at a finer scale needed to inform management decisions.

Access management is a key issue that arises in any discussion of MPB-related effects on environmental values. Managing roads and other potential effects of salvage harvesting is key to managing effects of MPB on several values described in this report. Integrated watershed planning, and/or integrated access management planning, are two related approaches that address access issues and that could have a significant positive influence on plan values related to the environment.

11. Conclusions

Water-dependant values and objectives in the KLRMP are the most highly affected by the MPB epidemic. Several community watersheds are expected to reach levels of equivalent clearcut area (ECA) by 2020 that are cause for concern – i.e. ECAs approaching or exceeding 30 percent. Three community watersheds have ECAs of high concern. Non-community watersheds (general resource management zones for fish and water) are also affected, particularly on the west side of the North Thompson, from as far north as Mahood Lake to Kamloops, on the north side of the Thompson River below Kamloops Lake (Tranquille, Deadman, Bonaparte), and along the southern edge of the KLRMP area in the Nicola Valley. Fish habitat will be affected by increases in ECA due to changes in channel stability and channel morphology – significant portions of three watersheds are of very high concern, and another four watersheds are also at a high risk of failure in meeting fisheries objectives.

Old Growth Management Areas are a primary vehicle for maintaining biodiversity values in the plan area. This strategic level analysis shows that pine mortality will not affect OGMA objectives. However a ground survey is needed to confirm and monitor OGMA status. By other measures unrelated to the KLRMP, at least six landscape units appear to be at high risk of loss of old forest biodiversity and local extinctions of species that rely on older forests.

Objectives and strategies related to Habitat and Wildlife Special Resource Management Zones (SRMZs) are not significantly affected, in fact MPB activity may be beneficial to the values identified, if road densities and impacts are addressed in salvage operations and if harvest is directed only to dead or susceptible lodgepole pine. Caribou SRMZs were analyzed separately and MPB will have no impact on meeting objectives and strategies in the KLRMP.

Deer Winter Range Assessment Units were rated relative to the percent area affected. Less than 10 percent of the forested area is affected by dead pine. However the percent area affected rises when recent fires are taken into account, and 6 of the 36 assessment units more from low to higher categories of potential impacts. The KLRMP objectives and strategies will be met without plan amendments or other actions as these winter ranges consist mainly of non-pine species, assuming that non-pine species will not be included in salvage harvesting. It is our understanding that the five-hectare size limit for clearcuts will continue in these areas. A requirement for 25 percent snow interception cover needs to be clarified however, or any salvage harvesting that takes place could affect individual units.

Moose are predicted to respond well to the forage found in the increasingly open conditions created by MPB. The limiting factor for Moose Winter Range Assessment Units will be the plan objectives and strategies for visual screening and thermal cover. Early operational planning for salvage harvesting will need to take place to meet these objectives and strategies. Road access related to salvage harvesting will need to be managed in order to maintain moose populations.

Objectives and strategies may not be achievable in the majority of the Recreation and Tourism RMZs. The visual objective for retention appears to be the one most likely to be unmet. For Visually Sensitive Areas, we assessed areas where retention is the visual quality objective (VQO) and assumed that where less than 30 percent of the forested area is affected by MPB, it will be possible to meet the visual quality objectives. Based on this assumption, retention VQOs are currently met but many of the polygons will have greater than 30 percent of the area affected by the year 2020. Objectives and strategies within Blustery and Lac Le Jeune RMZs are likely not achievable.

Class A and B Lakes were investigated for the objectives and strategies relating to recreational values in their 200 meter buffer zones. Two of these strategies are expected to continue under the FRPA: i) maintaining a mosaic of angling opportunities, and ii) managing lakes in accordance with lakeshore management guidelines. Our strategic level analysis may be too coarse to reliably assess impacts to these lakes. However, providing a mosaic of angling opportunities may be a challenge with respect to walk-in lakes in areas where salvage harvesting is occurring. For those lakes that have a significant amount of pine in the 200-meter buffer (according to our analysis, 35 percent of Class A and 60 percent of Class B lakes) the shorelines can be logged. However the extent of MPB was not predicted when the Lakeshore Guidelines were developed and stakeholders may not accept a large amount of harvesting activity surrounding these lakes.

68 Settlement Resource Management Zones were assessed, and of these, all but four are in the low category, i.e. less than 10 percent of the area is affected. Barriere and Louis Creek are in the high, very high, and extremely high categories for area affected, due to the McLure fire. The KLRMP objectives and strategies can still be met even with the levels of impact projected in 2020.

Protection RMZs are ones where no logging is permitted in order to preserve natural, cultural, heritage or recreational values. Two of these show impacts from the 2003 wildfires, while two others are in the moderate category for area affected due to MPB. The majority of the protection RMZs are in the low category currently, but by 2020 40 percent will be in the moderate to extremely high categories for percent area affected. Of the RMZs in the high to extremely high categories, most objectives and strategies are general in nature and will be met. However access management is a strategy for three of these RMZs and this may be difficult to meet with increased access from surrounding areas. Fuel loading assessments may be required in certain areas, for example near communities or in Old Growth Management Areas (OGMAs). In the longer term, the current objectives and strategies may not be met without some type of intervention such as prescribed fire, fuel removal, and management for open forest conditions, in both the Ponderosa pine and Douglas-fir OGMAs within Protection RMZs.

Forest licensees will be affected by MPB to varying degrees depending on the location of their tenure within the plan area. Several licensees have a moderate amount of area affected, particularly by the year 2020.

The harvest of MPB-attacked pine stands will necessitate the building of new roads, which in some areas will significantly increase road access and road densities. Access management and access impacts are addressed in objectives/strategies in most RMZs throughout the KLRMP. In many, strategies recommend tools that can be used to address access risks but do not compel action. If extensive salvage proceeds without the use of tools recommended in the KLRMP, KLRMP objectives and strategies for values like water quality and fish will be placed at greater risk.

The Kamloops LRMP was negotiated in 1995, and plan objectives and strategies were based on assumptions regarding the current regulatory regime, existing and proposed laws and guidelines, and status quo pest management. The extent of the present mountain pine beetle attack was not foreseen in 1995, and significant regulatory changes have also occurred since that time. Different management options are presented to manage the impacts of MPB to the KLRMP and the values it manages. The status quo does not appear to be a viable option, as some level of management action appears required in order to meet the KLRMP strategic vision, goals and broad objectives in the face of changing conditions. A majority of interviewees indicated a lack of satisfaction or confidence in the status quo in protecting and managing the risks to their interest. Major or minor changes to the KLRMP will be most effective in the context of other management initiatives being taken outside of the plan itself. In some instances (i.e. for range interests) MPB presents potential benefits and plan changes are a potential option to help realize these benefits.

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Appendix 1: Interview Process and Participants

The purpose of the interview process was to gather strategic and tactical information on the potential impacts of mountain pine beetle (MPB) and related salvage harvesting on the Objectives/Strategies of the Kamloops LRMPs. Representatives from government were interviewed with respect to their areas of expertise and interest as defined by the LRMP document. Forest industry representatives were also interviewed for their local knowledge of MPB impacts.

- 1. Water**
- 2. Ecosystem**
- 3. Fish and Anadromous Fisheries**
- 4. Tourism and Recreation**
- 5. Agriculture and Range**
- 6. Minerals**
- 7. Wildlife**
- 8. Timber**
- 9. Visually Sensitive Areas, Heritage Trails, Cultural and Heritage Sites**
- 10. Settlement Resource Management Zones**
- 11. Protected Areas**
- 12. Transportation (note not in plan)**

A total of 14 interviews were conducted in Kamloops from January 23rd to 30th, 2006. Interviews averaged 1.5 hours and involved a total of 26 individuals including interviewees interested in each area listed above, with the exception of minerals. Inputs were received in writing from an additional four individuals unable to attend.

Detailed maps of the plan area were developed and presented to participants during each of the interview sessions. Landsat 2005 satellite imagery (1:275,000) was used as a base map to show the current pattern of harvest within each of the plan areas. Resource Management Zones (RMZs), 2003 wildfire boundaries, Old Growth Management Areas, and licensee operating areas were also shown on the landsat base maps. A number of acetate overlays were produced to assist with identifying areas of interest, including distribution of pine (lodgepole and ponderosa) by age, pine volume per ha in several categories, 2005 projected percentage of pine killed (red attack) as well as community watershed and VQO classifications.

Participants were given questions ahead of time and interviews were focused around the LRMP mapped values and areas of key interest outlined in the interview questions below.

A summary document was produced for each interview conducted, and sent to all interview participants for review. All additional considerations and amendments received from respondents were included in the interview summary (see Appendix 2 and 3).

Interview Questions

A. Detailed consideration of impacts

1. Do you have concerns about the current or projected impact of MPB, wildfire or salvage harvesting on the resource values and RMZs for your particular resource management sector and geographic area of interest? YES / NO
2. For your sector, are the existing or predicted impacts of MPB, fire and salvage adequately addressed by the LRMP? (Consider both direct and indirect impacts) YES / NO
 - a. If No, explain what changed results are expected due to MPB and salvage harvesting?
3. Have the land use plan objectives for your sector been compromised or are they at risk of being compromised in future because of beetle, fire or salvage? YES / NO
 - a. If NO. Explain what circumstances give you this confidence (i.e., does the current LRMP support your values and management objectives or does some other factor provide confidence?)
 - b. If YES. What actions would you recommend to address the problem? (be specific)
 - i. Changes to Land Use Plan?
 - ii. Changes to management approaches in the region?
 - iii. Other Higher Level Plan orders?
 - iv. Monitoring or further research required?
4. Based on the maps showing the anticipated pine mortality and where major salvage will take place, which specific RMZs and watersheds could be at highest risk and where should more detailed analysis be focused? Assume up to 70 percent of pine volume will be salvaged.

B. Addressing opportunities

5. Are there opportunities to improve the resource values and RMZs for your sector or geographic area of interest/operations? YES/NO – If NO, go to Q.10
6. What are these opportunities?
7. Who would benefit if these opportunities were realized and how would these benefits be measured?
8. What actions are required before these opportunities would materialize? If there are barriers to taking action, please describe them.
9. Where would this occur? If you can be specific, which RMZs and watersheds do you see supporting these opportunities?

C. Addressing uncertainties

10. Given predicted Mountain Pine beetle impacts, what do you think are the greatest areas of uncertainty for managing resource values, objectives and related RMZs over the next 10-15 years?
11. Who should address these uncertainties (e.g., particular government industry, industry, academia, etc.)?
12. How would you address these uncertainties?
 - If you represent a government agency?
 - If you represent forest industry or other commercial sector?
13. Assuming that 70 percent of the current pine volume may be salvage harvested, what strategic or tactical advice can you provide to help government meet your sector's objectives and interests?

D. Degree of association between interest and MPB/Fire.

14. Based on considerations listed above, how would you rate the potential for influence by the mountain pine beetle outbreak on your key interest(s)? Consider both current and projected future impact. Characterize that influence. Is it a benefit or risk? Is it
 - High,
 - Moderate,
 - Low,
 - nil?
- [High risk means your interest is directly affected, potentially to a high degree and that current measures within the land use plan and elsewhere do not adequately address that risk].
15. Provide a rationale to support the rating.

Interview Participants

The following individuals, listed by LRMP section, participated in the interview process. Many of the individuals listed provided their expertise on both the Kamloops and Okanagan-Shuswap LRMP areas. Interviewees who were included in the interview but who represented only the Okanagan-Shuswap are included here for completeness and noted separately. The four individuals who provided written comment only are also noted. Section interviews are listed in order of occurrence from January 23 to January 30, 2006.

Interview Overview: Terry MacDonald, ILMB; Rachael Pollard, ILMB

Forest Health: Kevin Buxton, MOFR; (with attendance from Richard Specht, MOFR representing Okanagan-Shuswap)

Agriculture and Range: Graham Strachan, MAL; Kevin Murphy, MAL; Phil Youwe, MOFR (with attendance from Alex Mclean, MOFR representing Okanagan-Shuswap)

Timber: Ken Lomas, MOFR; Bill Ashman, MOFR; and a second interview with Dave Dobi, Canfor; and Sean Curry, Weyerhaeuser.

Fish and Aquatic Habitats: Jeff Guerin, DFO (and also comments made by Mike Burwash, MOE; Doug Lewis, MOE and Steve Maricle, MOE from the Ecosystems interview)

Settlement Resource Management Zones: Bob Finley, Thompson-Nicola Regional District; Greg Tomlin, Thompson-Nicola Regional District (with Ken Arcuri, Central Okanagan Regional District Representative from Okanagan-Shuswap)

Old-Growth Management Areas: Sue Omelchuk, MAL; Frank Rowe, MAL.

Tourism, Recreation, VQO and Trails: Drew Frymire, MTSA; Fred Thiessen, MTSA; Peter Rennie, MOFR (written comments from Jennifer Eastwood, MTSA, re: tourism)

Water: Rita Winkler, MOFR; Jephtha Ball, MOE.

Transportation: Tom Freeman, MOT; Dave Schleppe, MOT (with Dan Bella, MOT from the Okanagan-Shuswap)

Protected Areas: Peter Weilandt, MOE; (written comments from Earl Sinclair, MOE)

Ecosystem Management/Wildlife: Mike Burwash, MOE; Doug Lewis, MOE; Phil Belliveau, MOE (written comments from Walt Klenner, MOFR and Steve Miracle)

Appendix 2: Interview Summaries by Value

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
Water	Quantity: Mod. to High risk Quality: Low to Moderate risk	<p>Public safety during high volume run-off events linked to flood forecasting deficiencies</p> <p>Altered snow courses - less accuracy in predicting snow packs, flood occurrences and landslide potential</p> <p>Infrastructure (e.g., bridges, culverts, water delivery systems etc.) may be at risk</p> <p>Floods and water diversions by roads/culverts may lead to increased risk of water quality issues</p> <p>Aquatic habitat through channel changes and changes in flow.</p>	<p>Government commitment to deliver “best water quality” is difficult to ensure, given major, expedited salvage (though not directly linked to O/S)</p> <p>Impacts to water delivery systems</p> <p>Difficulty of delivering on water licenses, storage</p> <p>Shifts in hydrograph (magnitude and timing)</p> <p>Federal Hydrometric Stations are being closed down due to budget deficits. These stations are essential for monitoring water impacts from salvage and MPB.</p>	<p>Consider integrated watershed planning before issuing road permits and cutting permits. Approved road permits do not lead easily to integrated watershed planning</p> <p>Encourage watershed-level management planning</p> <p>Create incentives for licensees to practice innovative silvics and planning in watersheds</p> <p>Integrate watershed monitoring/hydrology impact assessments (WAP) into planning</p> <p>Develop intra-agency coordination for effective watershed planning</p>	<p>Recognize mpb as a natural disaster and thus enable relief funding to support Integrated watershed planning and undertake remediation activities to maintain water values</p> <p>Improve research and monitoring to understand the hydrology cycle at various scales including watershed level.</p> <p>Change silviculture practices to increase timber-type diversity to create increased stability of hydrology cycle and potential future mpb infestations</p>

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
<p>Ecosystem and Wildlife</p>	<p>Parks: Low risk</p> <p>Water: High risk (quality and quantity)</p> <p>Martin & Fisher: High</p> <p>Biodiversity: High risk</p> <p>Riparian values: High risk</p> <p>Wildlife: Moderate</p> <p>Ungulates: Low risk (except caribou)</p> <p>Caribou: Mod – High (indirectly: predators)</p>	<p>Elevated ECAs in salvage operations, especially concerning watershed/aquatic resources</p> <p>Forest Stewardship Plan exemptions of draft results and strategies for everything covered by an HLP objective</p> <p>Salvage work within 200m of lakeshore zone</p> <p>Cattle impacts on riparian areas, esp. if increased AUMs are realized and natural barriers lost</p> <p>Unprotected riparian reserve zones, DM exemption provisions</p>	<p>Walk-in lakes and lakes with wild stocks: increased access jeopardizes the “maintenance and diversity of angling opportunities”</p> <p>Water quality around cattle-impacted waterways</p> <p>Roads and moose issues</p> <p>Critical Deer Winter Range (depending on the amount of PI in the stand)</p>	<p>Develop General Wildlife Measures for regionally identified wildlife species to meet some objectives and strategies</p> <p>Clarify government guidance strategies for priority resources (e.g., water) and, encourage licensee buy-in of Retention Guidelines and, Connectivity Guidance, among others</p> <p>Re-assess the doubling of AUMs in all areas possible</p> <p>Identify and inventory the highest resource values and concentrate on these</p>	<p>Development of water storage on lakes/ small tributaries to buffer changes in peak flows and use storage to augment flows for fish</p> <p>Mitigate air quality impacts by diversifying wood waste markets (e.g., ethanol, pellets, etc., instead of burning)</p> <p>The 311 HLP plan objectives have been reduced to 26 and this Government Action Regulation (see Appendix 5) replaces much of the forestry aspect of the plan. The plan could be reviewed and possible revised to reflect this.</p>

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
<p>Fish and Anadromous Fisheries</p>	<p>KLRMP: Moderate risk</p> <p>Provincially: High risk</p>	<p>Water in all aspects including: altered flows; magnitude and timing; water qualities; loss of thermal protection (shading); decreased insect and litter drop; decreased LWD recruitment; altered nutrient cycling and production; direct impacts on local fish populations)</p> <p>Riparian values (numerous functions identified above)</p> <p>Lower reaches of many streams vulnerable to impacts</p> <p>Soil destabilization: issues with erosion and sedimentation</p> <p>Pressure to harvest conservation areas post salvage.</p>	<p>Fisheries sections below are not adequately addressed by LRMP as written: #3, 4, 7, 10, 11, 12, 28, 30, 31, 32, 68, 69, 70, 72, 74, 75, 76, 78, 81, 82, 83, and 87. (# refer to master list spread sheet used in interviews)</p> <p>LRMP lacks specific/measurable criterion for accountability related to fish habitats</p> <p>Licensee regulatory exemptions are too easy to obtain and allow harvest within riparian areas (including riparian reserves)</p> <p>Several salmon bearing streams contain both Fraser coho (COSEWIC-listed species) and Chinook already have agricultural impacts as well as 2003 fire impacts and now mpb-salvage pressures (i.e., Louis Creek)</p> <p>Hydrology Objectives and</p>	<p>Develop a more comprehensive planning process (e.g., watershed-level)</p> <p>Define high value watersheds and set priorities for mitigation/restoration (e.g., which water channels would benefit most)</p> <p>Increase standards related to riparian protection for high risk (high pine component) watersheds E.g. Increase the reserve zones on S1 large, S4 and direct tributary S5 and S6 streams</p> <p>Inventory and monitoring of post-disturbance riparian habitats</p> <p>Link standards and</p>	<p>Under-planting riparian areas (i.e., below retained dead trees) of conifers and deciduous species</p> <p>Increased potential for research by academic and gov. agencies</p> <p>Undertake improvements in the LRMP such as access planning and improving the hydrology provisions currently lacking.</p>

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
			Strategies: licensees do not perceive any legal obligation	indicators to strategies to create more measurable LRMP objectives and allow for greater accountability	
Tourism and Recreation, Heritage Trails and Visually Sensitive Areas (VQO)	<p>Rec.sites and Trails: Low – Mod. risk</p> <p>Adventure tourism and Resorts: Mod – High risk</p> <p>VQO: High risk</p>	<p>Indirect impacts on water quality</p> <p>Disturbance associated with roads (e.g., direct impacts to trail beds for hauling)</p> <p>Impact to viewscapes</p> <p>Access limitation during and after salvage due to public safety concerns</p> <p>Post-salvage pressure on remaining green stands for AAC allocations</p> <p>Fire hazards</p>	<p>VQOs: Significant overlap of pine volumes with scenic areas; expect some VQOs will not be met whether or not trees are salvaged</p> <p>Many identified resources are not “specifically identified” in the LRMPs</p> <p>LRMP wording “protect” (like park status) would better read, “conserve” or “maintain”</p> <p>Some commercial operators on plateau do not have VQO’s at present</p> <p>Walk-in lakes and lakes with wild stocks: increased access associated with MPB jeopardizes the maintenance and diversity of angling opportunities</p>	<p>Coordinate government communications with interest groups around issues like VQOs and recreation trails; ensure everyone understands what to expect; amend strategies where appropriate/necessary.</p> <p>Increase consultations by MoFR/industry with Tourism Ministry</p> <p>Focus on “Zone 1” VQO corridors associated with highways & classified lakes.</p> <p>Increase priority for coordinated access</p>	<p>Coordination of small-scale salvage operations (e.g., with local clubs) for mitigation of recreation impacts and incorporation of site-specific salvage practices</p> <p>Potential tourism infrastructure upgrades</p> <p>Create LRMP provisions to support access management of motorized vehicles</p>

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
				management planning Review walk-in lakes file: identify realistic compliance and determine where legislated access closures may need to be implemented	

Appendix 2: Interview Summaries by Value					
VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
Agriculture and Range	Moderate to High risk Low benefit; High benefit possible for some tenure holders	Water supplies/yield for irrigation and stock in late summer season when requirements are highest Crown land availability for grazing Grazing opportunities Spread of weeds Removal of range barriers and riparian impacts	Nothing major of concern (i.e., “maintain or enhance industry access to and use of land and water” is written well) Maintaining natural barriers at riparian zones may be problematic, especially when dealing with small-scale salvage	Increase pre-salvage planning to address: range resources (short –term), weeds and barriers (co-ord between forestry and range), and forage supply (long-term) Change forest policy to accommodate greater certainty of grazing opportunities (e.g., amend re-planting regulations)	Increases in summer forage associated with developing early seral forests (at mid & higher elevation) Increases in forage available in more dense Py stands (lower elevations) where mpb impacts are likely to be severe Option to consider agri-forestry concepts in areas where MPB creates lower stocking levels; income from crown land to come from combination of forest and forage harvesting or just forage harvesting Dedicated community pastures (silvo-pastures) Alienation of lands for range Re-direction of appraisal funds to mitigate range

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
					management issues and concerns. Provide range rider instead of fences where barriers removed.
Timber	High risk	<p>AAC levels – mid-term timber supply reduction estimated at 15 percent reduction seemingly unavoidable</p> <p>Accelerated rate of cutting in watersheds</p> <p>Potential and exacerbated impacts on water quality and quantity linked to large-scale disturbance and salvage operations</p> <p>Fragmentation effects on biodiversity habitat values</p> <p>Any values in the MS will likely be severely disrupted (visuals and watershed concerns)</p> <p>Backcountry recreation values</p>	<p>“Maintain or enhance the sustainable supply of timber” not likely possible</p> <p>Community Watersheds</p> <p>Watershed Objectives: “Ensure existence of acceptable levels of water quality and quantity” and, “Maintain the quality and quantity of community water supply” are in jeopardy, especially in light of elevated ECA within the upper catchments</p> <p>VQOs – visuals will be affected - are being met by flexibility in Appendix 8 of the KLRMP; public acceptance uncertain</p> <p>Ecosystem management is at risk of being compromised</p> <p>Forest cover requirements</p>	<p>Amend the plan:</p> <ol style="list-style-type: none"> 1. Create a greater number of measurable objectives 2. Update the terms of reference that are in line with FRPA (clear government objectives to write an FSP), or, cancel the plan <p>Write into the plan more flexibility to allow government and forest licensees to respond to unforeseen circumstances without having to amend the plan again</p> <p>Increase the accuracy of the growing stock</p>	<p>Retention planning in large-scale salvage operations</p> <p>Re-assess appraisal system to address distance b/n dead pine resources and the mill</p> <p>Greater research around what can be done with the volumes of mpb-killed pine</p> <p>Address watershed/ riparian recovery projects</p> <p>Restoration of riparian areas program</p> <p>Tenure reform to allow for long-term leases and innovation incentives</p> <p>Coordinate government</p>

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VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
		Invasive plants Removal of natural range barriers	for furbearers Likely significant riparian deterioration with the removal of range barriers	inventories	approach to manage timber supply issues (e.g., make best use of FFT funding)

Appendix 2: Interview Summaries by Value					
VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
Settlement Resource Management Zones	High risk	<p>Water (quality and quantity)</p> <p>Watershed planning may not be addressed adequately prior to salvage in light of the “emergency” nature of the mpb infestation and lack of designated resources to do so</p> <p>Public health & safety (increased risk of landslides = emergency planning)</p> <p>Drinking Water Act puts more responsibility on the purveyor (local government) to upgrade and restore degraded water systems</p> <p>Uncertain about level of completion of work identified in the KLRMP (1995) and what resulted</p> <p>Regional economic uncertainties</p>	<p>Many of the water strategies need to be re-assessed to strengthen support of achieving objectives</p> <p>Local governments would like to see more information on MPB and results of watershed assessments</p> <p>Monitoring is important to determine whether objectives are being met</p> <p>SRMZs</p> <p>Fish habitats</p> <p>Wildlife habitats</p> <p>Noxious weeds</p>	<p>Take leadership as the provincial government and coordinate with local governments and the private sector around water issues</p> <p>Establish water monitoring baselines (e.g., turbidity levels)</p> <p>Focus research on measuring and managing salvage-related impacts on water</p> <p>Re-address the shifted balance to the KLRMP due to beetle and resource values and highlight other economic/public health drivers (e.g., tourism, backcountry recreation, etc.)</p>	<p>Basic technical research/analysis could determine the main issues/water concerns to address as priorities</p>

Appendix 2: Interview Summaries by Value					
VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
Protected Areas (PA)	PA: Low risk	<p>Impacts of increased road densities</p> <p>Increased access into parks with pine salvage</p> <p>Public health and safety issues around parks with high fire fuel loading and greater wildfire risks</p> <p>Invasive weeds following fire/salvage operations</p> <p>Plantations fire risks adjacent to parks</p> <p>Lack of forest health strategic guidelines in LRMP to address PA</p>	<p>Conservation objectives at risk especially if heavily harvested around smaller parks</p> <p>General language of objectives/lack of forest health section reduces concerns about non-compliance with plan</p>	<p>Address potential access issues with access management plans in key areas</p> <p>Promote relationships between tenure holders and government ministries for compliance with harvesting limitations in PA</p>	<p>Increased funding for ecosystem restoration: MPB- related funding</p> <p>Forest encroachment issues may be resolved if MPB causes grassland expansions</p>

Appendix 2: Interview Summaries by Value					
VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
Old-Growth Management Areas (OGMA)	OGMA: Moderate – High risk	Small-scale harvesting trespassing into OGMA Lack of forest health strategic guidelines in LRMP to address OGMA	Numbers of requests to log within OGMA and small scale salvage trespass promoting concerns about risk of non-compliance with plan General language of objectives/lack of forest health section reduces concerns about non-compliance with plan	Promote relationships between tenure holders and government ministries for compliance with harvesting limitations in OGMA Add forest health section to LRMP; add direction related to management of OGMA	Combining NDT4 and OGMA management Utilization of high quality imagery to address MPB; do detailed assessments of species composition and habitat quality effectiveness monitoring exercises in OGMA
Transportation (Note transportation not addressed in Plan)	High risk depending on routing of logging trucks	Erosion risks around new forest roads built quickly/poorly Demands on gravel may require new pockets of gravel to meet those needs Magnitude of water flows and impacts Flooding/dyke system impacts and culvert failures in areas of MOTH responsibility	Concerned that “acceptable limits” may or may not address issues with culverts, etc. (who will pay for mitigation needs?) Current and accurate inventories of roadways need to be maintained and utilized when industry makes use of public right of ways	Create higher level protocol for appropriate management of transportation infrastructure, with a plan for addressing new and increased impacts resulting from salvage LRMP needs a more specific statement to address “transportation resources”	

Appendix 2: Interview Summaries by Value					
VALUE	RANK	KEY VALUE RISKS/CONCERNS	OBJECTIVES/STRATEGIES KEY RISKS/CONCERNS	KEY ACTIONS RECOMMENDED*	OPPORTUNITIES
		<p>Access issues (industrial permit requirements)</p> <p>Staffing of weigh stations to account for night hauling</p> <p>Visibility issues: smoke, dust, fencing</p> <p>Public safety issues with increased traffic on rural roads</p>		<p>Encourage industry mitigation and effective communications to address the concerns of public</p> <p>Assess the needs for night time weigh station staffing; possibility of portable weigh stations</p> <p>Mitigate post-extraction travel corridor restorations</p> <p>Address safety aspects of hauling (e.g., load restrictions, local vs. logging traffic)</p> <p>Danger tree removal/salvage along affected travel corridors</p>	

*Note: Key actions recommended and other information are a summary of interviewees' opinions and are not official recommendations.

Appendix 3: Specific Locations of Concern Identified In Interviews*

VALUE	AREA OF CONCERN	LOCATION(S)	REASONING PROVIDED
Water	<p>Impacts of large-scale salvage and MPB on water quality and quantity</p> <p>Increased erosion and range access around identified high value watersheds with significant pine content</p>	All watersheds	<p>High pine content within and surrounding these watersheds</p> <p>Loss of federal hydrometric stations on any of these streams</p>
Community Watersheds and Domestic Watersheds	<p>Water Quality</p> <p>Drinking Water Act</p> <p>Uncertainty of assessment results (LRMP Appendix 1) for priority watersheds</p>	<p>Fage Creek; Scotty Creek; Barrier River; Bonaparte River; Deadman River</p> <p>Tranquille Creek</p> <p>Peterson Creek</p>	<p>Impacts of large-scale salvage on water qualities and quantities</p> <p>Water monitoring will become increasingly necessary</p>
Sensitive Fisheries	Salmon fisheries and impacts of large-scale salvage within high pine content riparian zones	<p>Louis Creek; Sinimax Creek; Lemieux Creek; Tranquille Creek; Finn Creek</p>	Interior Fraser Coho (a COSEWIC-listed species) and Chinook water course
Fish habitat restoration	<p>Effectiveness of restoration projects intended to improved habitat provisions for Coho and other salmon species</p> <p>Monitoring/assessment of hydrology variables</p>	<p>Lower Paul Creek; Hiuihill Creek; Sinmax Creek</p> <p>Deadman River</p>	<p>High pine content within and surrounding these watersheds</p> <p>Coho, Chinook, Pink salmon, steelhead, and resident fish value</p> <p>Restoration effectiveness to date is unknown</p>
Fish Habitats	Tributary spawning water courses	Bonaparte River;	High pine content

		Louis Creek; Fish Trap Ck, Deadman River; ; Barrier system (e.g., Fennel Creek); Roche Lake Classified Lakes with spawning	within and surrounding these watersheds
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* This is not considered a complete list, only examples of watersheds of concern identified through the interview process.

Appendix 4: Linked KLRMP Objectives and Strategies

KLRMP Assessment of Linked Objectives and Strategies

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
1	2.1.1 Land Management	Minimize soil productivity losses			M	potential site disturbance	R	
2	2.1.1 Land Management	Implement soil disturbance guidelines for all activities			L	potential site disturbance	R	
3	2.1.1 Land Management	Minimize off-site impacts due to soil disturbance			H	erosion and sedimentation concerns	R	
4	2.1.1 Land Management	Use proper road construction and maintenance procedures			L	standard practice		
5	2.1.1 Land Management	Address access issues through a local level plan.			H	access management plans, increased roading	R	
6	2.1.1 Land Management	Monitor use and ensure compliance with regulations to reduce soil erosion and the spread of noxious weeds that can result from the use of trail systems.			H	potential rapid increase in roads and disturbed sites	R	
7	2.1.2 Water Management	Ensure existence of acceptable levels of water quality and quantity			H	high ECAs and increased roading	R	
8	2.1.2 Water Management	Do not allow bulk water exports and large scale interbasin diversions			N	end-user practices		
9	2.1.2 Water Management	Water conservation			N	end-user practices		
10	2.1.2 Water Management	Conduct the appropriate level of watershed assessment on a priority basis, as listed in Appendix 1			H	information to mitigate risks		
11	2.1.2 Water Management	Maintain natural streamflow regime within acceptable limits.			H	potential high ECAs and increased roading	R	

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
			O	S	Rating	Rationale:	R	B
12	2.1.2 Water Management	Upon completion of watershed assessments, carry out appropriate local level planning and implement procedures to rehabilitate negatively impacted watersheds to improve water quality and/or streamflow regimes to a sustainable level			H	watershed already candidate for restoration pre-beetle salvage		
13	2.1.2 Water Management	Recognize and protect instream flows for appropriate non-consumptive uses			H	potential high ECAs and increased roading	R	
14	2.1.2 Water Management	Monitor water quality and provide all sampling data to common GIS data base while identifying and filling gaps			M	need for monitoring may increase		
15	2.1.2 Water Management	Investigate and document repetitive water quality complaints on GIS Base System			M	need for monitoring may increase		
16	2.1.2 Water Management	Verify that all appropriate guidelines and legislation are being followed			L	compliance and enforcement		
17	2.1.2 Water Management	Ensure implementation of a referral process to notify all potentially impacted water licensees when development is proposed			M	potentially increased demand		
18	2.1.2 Water Management	Establish stream flow monitoring and in stream flow requirements on a priority basis			M	potential increase	R	
19	2.1.2 Water Management	Recognize interaction of groundwater with surface water sources			M	impact on springs uncertain	R	
20	2.1.2 Water Management	Establish a groundwater aquifer management program			N	no impact to existing business approach		
21	2.1.2 Water Management	Implement groundwater monitoring sites			N	no impact to existing business approach		
22	2.1.2 Water Management	Minimize risk to lives and property from flooding and erosion			M	potential increased runoff	R	
23	2.1.2 Water Management	Use proper road construction, maintenance and deactivation standards			L	standard practice		
24	2.1.2 Water Management	Consider water licensing tenure where identified opportunity exists			N	no impact to existing business approach		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
25	2.1.2 Water Management	Develop and implement appropriate local level plans for floodplain management.			L	potential for increased flooding	R	
26	2.1.2 Water Management	Recognize and consider existing water tenures			N	no impact to existing business approach		
27	2.1.2 Water Management	Identify and consider water tenure opportunities where unlicensed water is still available for licensing within sustainable levels			N	no impact to existing business approach		
28	2.1.2 Water Management	Protect aquatic ecosystems			H	potential changes in yield and water quality	R	
29	2.1.2 Water Management	Recognize and consider the water requirements of wildlife and plants			H	potential changes in yield and water quality	R	
30	2.1.2 Water Management	Manage work in and about streams to protect aquatic values			L	standard RMA practices		
31	2.1.2.1 Riparian Management Areas	Maintain and/or restore the integrity and function of streamside riparian vegetation to provide for bank and channel stability, long-term supply of large organic debris, suitable stream temperatures and input of nutrients			H	changes in runoff, roads and sediment potential	R	
32	2.1.2.1 Riparian Management Areas	Manage riparian areas, including streams, wetlands and lakes in accordance with the Forest Practices Code and the Kamloops and Clearwater District Lakeshore Management Guidelines, or other applicable management tools or agency agreements			L	standard RMA practices		
33	2.1.3 Ecosystem Management	Maintain and/or enhance ecosystem health as indicated by key species			H	monitoring and adaptive management	R	
34	2.1.3 Ecosystem Management	Implement appropriate local level planning to ensure that key habitat elements are maintained within each landscape unit			M		R	
35	2.1.3 Ecosystem Management	Maintain viable populations of all species across the landscape within their existing geographic range.			H	selected species	R	

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
36	2.1.3 Ecosystem Management	Identify and prepare appropriate local level plans for species and habitats listed "red" by BC Environment Conservation Data Centre			H	selected species		
37	2.1.3 Ecosystem Management	Restore species endangered or threatened by human activities			H	selected species associated with pine	R	
38	2.1.3 Ecosystem Management	Manage key species as indicators of ecosystem health (e.g. caribou - high elevation stands, ESSF).			M	selected species associated with pine	R	
39	2.1.3 Ecosystem Management	Maintain linkages within all landscape units, including forests and grasslands			H	loss of mature pine, emphasis on alternate species	R	
40	2.1.3 Ecosystem Management	Develop ecosystem networks for each landscape unit in the LRMP on a priority basis to be determined by the follow-up committee			H	loss of mature pine, emphasis on alternate species	R	
41	2.1.3 Ecosystem Management	Maintain natural stand attributes in managed forests			H	retain live trees	R	
42	2.1.3 Ecosystem Management	Maintain old growth attributes within landscape units			H	live old trees beneficial	R	
43	2.1.3 Ecosystem Management	Employ stand-level biodiversity practices such as wildlife tree management			H	undisturbed patches with live trees beneficial	R	
44	2.1.3 Ecosystem Management	Maintain and/or enhance a diversity of viable grassland and alpine ecosystems			M	invasive plants and access	R	
45	2.1.3 Ecosystem Management	Encourage disturbance regimes that are similar to natural processes			N	no impact to existing business approach		
46	2.1.3 Ecosystem Management	Manage grasslands to produce a mosaic of grassland habitat			N	no impact to existing business approach		
47	2.1.3 Ecosystem Management	Provide special management resources and/or developments, such as fencing in critical or special habitat areas that may be detrimentally impacted			H	cattle access improved	R	
48	2.1.3.1 Biodiversity Emphasis Options	To conserve the diversity and abundance of native species and their habitats throughout the Kamloops LRMP, following upon direction provided by the Forest Practices Code Biodiversity Guidebook			H	loss of mature forest and large old patches and connectivity	R	

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
49	2.1.3.1 Biodiversity Emphasis Options	Assign preliminary landscape unit biodiversity emphasis options in accordance with the Biodiversity Guidebook as well as the procedures and criteria identified by the Table			N	no impact to existing business approach		
50	2.1.3.1 Biodiversity Emphasis Options	Limit the impact of landscape unit biodiversity emphasis options to no more than 4 percent of the level of timber harvesting in the LRMP over the short and long term			N	no impact to existing business approach		
51	2.1.3.1 Biodiversity Emphasis Options	Develop tools and indicators to measure: progress towards the conservation of biodiversity, impacts of biodiversity emphasis options on timber supply and other resources			H	which LU will not meet objectives		
52	2.1.3.1 Biodiversity Emphasis Options	Undertake analysis with regards to the potential impacts of the Biodiversity Guidebook on resource sectors, and how the Guidebook can be best applied at the local level. This is of particular interest to the agriculture / range sector			N	no impact to existing business approach		
53	2.1.3.1 Biodiversity Emphasis Options	Task the long-term Follow-up Committee with reviewing the preliminary landscape unit biodiversity emphasis options and associated resource impacts. Preliminary biodiversity emphasis options will either be confirmed or revised to meet the objectives and strategies			N	no impact to existing business approach		
54	2.1.4 Grasslands Management	Maintain natural grassland ecosystem processes, including all grassland-dependent species			L	invasive plant species	R	
55	2.1.4 Grasslands Management	Develop Range Use Plans to identify goals and strategies for an area, inventory plant communities, prescribe levels of use, and set a grazing schedule			H	increase in early seral and access (roads and cattle)		
56	2.1.4 Grasslands Management	Manage grazing use to produce a mosaic of grazing levels, including some ungrazed areas, with linkages between them			N			
57	2.1.4 Grasslands Management	Manage grasslands for a diversity of habitat for grassland-dependent species			L	invasive plant species	R	

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					Rating	Rationale:	R	B
		LRMP Text	O	S				
58	2.1.4 Grasslands Management	Maintain and/or enhance range condition so most is in good to excellent natural range condition			N	no impact to existing business approach		
59	2.1.4 Grasslands Management	Provide special management and/or fencing in critical or special habitat areas that may be detrimentally impacted			H	protect critical habitats	R	
60	2.1.4 Grasslands Management	Reduce forest encroachment and density which results from human suppression of natural disturbances			M	fire suppression policy		
61	2.1.4 Grasslands Management	Accept natural disturbances as a tool for grasslands management			N	no impact to existing business approach		
62	2.1.4 Grasslands Management	Develop and implement access plans to reduce motorized access into vulnerable areas and minimize human impact			H	increased new access	R	
63	2.1.4 Grasslands Management	Control noxious weeds by implementing noxious weed control plans			H	increased new access	R	
64	2.1.4 Grasslands Management	Official Community Plans need to recognize the importance of grasslands conservation in their zoning			N	no impact to existing business approach		
65	2.1.5. Inland Fisheries	Maintain a mosaic of angling opportunities within the recreational spectrum (i.e., walk-in lakes, drive-to lakes, trophy lakes)			H	new access, access planning	R	
66	2.1.5. Inland Fisheries	Plan for a mosaic of angling opportunities through appropriate local level planning			H	new access, access planning	R	
67	2.1.5. Inland Fisheries	Continue stocking of lakes as demand, funding and management opportunities dictate			N	no impact to existing business approach		
68	2.1.5. Inland Fisheries	Maintain or increase the natural production of spawning streams through habitat protection measures (i.e. streamside management) and enhancement activities.			H	sedimentation risks, stream temperature changes, water yield changes and timing	R	
69	2.1.5. Inland Fisheries	Monitor forestry practices to ensure that guidelines and management prescriptions are adhered to.			L	compliance and enforcement		
70	2.1.5. Inland Fisheries	Protect and maintain the genetic diversity of wild fish stocks			M	higher risk to fish	R	

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					Rating	Rationale:	R	B
		LRMP Text	O	S				
71	2.1.5. Inland Fisheries	Establish a catalogue of wild fish stocks to be protected			H	higher risk to fish	R	
72	2.1.6 Anadromous Fisheries	Maintain, rebuild or enhance salmon stocks to historic levels			H	higher risk to fish	R	
73	2.1.6 Anadromous Fisheries	Reduce fish exploitation rates to long-term sustainable levels (strategy applies beyond LRMP boundaries)			L	increased access poaching	R	
74	2.1.6 Anadromous Fisheries	Achieve a net gain in productive capacity by habitat management			H	higher risk to fish	R	
75	2.1.6 Anadromous Fisheries	Ensure adequate instream flows to maintain fish stocks			H	changes in temperature, quality and flow	R	
76	2.1.6 Anadromous Fisheries	Maintain and/or enhance steelhead populations			M	standard objective where steelhead occur; but may be more difficult if stream flows or condition are compromised due to increase harvesting, ECAs, runoff, etc.	R	
77	2.1.6 Anadromous Fisheries	Enhance stocks through specific projects			N	no impact to existing business approach		
78	2.1.6 Anadromous Fisheries	Maintain the genetic diversity of wild fish stocks			H	higher risk to fish	R	
79	2.1.6 Anadromous Fisheries	Establish a catalogue of wild fish stocks to be protected			H	greater urgency		
80	2.1.6 Anadromous Fisheries	Avoid irreversible human-made changes to fish-producing habitats			H	potential risk from increased access, erosion	R	
81	2.1.6 Anadromous Fisheries	Maintain watershed integrity and stability through appropriate local level planning, management practices and rehabilitation			L	standard planning practice	R	
82	2.1.6 Anadromous Fisheries	Maintain the physical and biological diversity of fish habitats.			L	standard planning practice	R	
83	2.1.6 Anadromous Fisheries	Protect streamside and riparian areas as per strategies noted in Section 2.1.2.1			H	potential risk from increased access, erosion	R	
84	2.1.6 Anadromous Fisheries	Optimize the value of commercial, sport, and aboriginal fisheries			N	no impact to existing business approach		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
85	2.1.6 Anadromous Fisheries	Restore degraded stream habitat through bank stabilization, revegetation, and other stream improvements			H	may be increased need for restoration due to salvage and roading		
86	2.1.6 Anadromous Fisheries	Optimize the non-consumptive values of fishery resources			N			
87	2.1.6 Anadromous Fisheries	Monitor compliance with and effectiveness of environmental standards and guidelines			H	increased need for C&E due to large increase in industrial activity		
88	2.1.6 Anadromous Fisheries	Distribute fishery net benefits in a fair and equitable manner			N	no impact to existing business approach		
89	2.1.7 Tourism	View tourism as an industry with resource needs			L	standard multiple resource planning objective		
90	2.1.7 Tourism	Identify and provide opportunities for use of Crown land suitable for future development of resort and wilderness tourism operations			L	standard multiple resource planning objective		
91	2.1.7 Tourism	Maintain and enhance the present diverse range of tourism opportunities and experiences that exist within the LRMP area			L	standard multiple resource planning objective	R	
92	2.1.7 Tourism	Manage levels of use to maintain the quality of the experience and the natural environment			L	standard practice		
93	2.1.7 Tourism	Ensure the continued existence of a quality experience in areas used for commercial tourism			H	some areas will have high impact because of salvage and roading	R	
94	2.1.7 Tourism	Use appropriate local level planning to manage access in a way that ensures a marketable tourism experience			L	standard planning practice		
95	2.1.7 Tourism	Use appropriate local level planning to mediate conflict between user groups			N	no impact to existing business approach		
96	2.1.8 Recreation	Maintain or enhance opportunities for a diverse range of recreational values and uses across the biophysical settings of the Kamloops LRMP area			N	no impact to existing business approach		

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					Rating	Rationale:	R	B
LRMP Text			O	S				
97	2.1.8 Recreation	Use appropriate local level planning to identify small, special features such as recreation sites, trails and interpretive forest sites and develop site specific practices which recognize these features			L	standard planning practice		
98	2.1.8 Recreation	Maintain and enhance ecological integrity in areas subject to resource impacts from recreational use			N	no impact to existing business approach		
99	2.1.8 Recreation	Use appropriate local level planning to address the impact of recreational activity on ecological integrity, for example wildlife disruption, damage to plant communities and water quality			L	standard practice		
100	2.1.8 Recreation	Appropriate local level planning must consider the difference between the environmental impact of snowmobiles and wheeled ATV's when zoning for regulation of motorized vehicle use			N	no impact to existing business approach		
101	2.1.9 Agriculture	Provide opportunities for growth and expansion of the agriculture, fisheries and food production industries			M	may be some opportunities for agriculture depending on land use classification and objectives		B
102	2.1.9 Agriculture	Support the purpose and intent of the Agricultural Land Reserve (ALR)			N	no impact to existing business approach		
103	2.1.9 Agriculture	Maintain and/or enhance industry access to and use of Crown resources including land, and water			H	access will likely increase because of salvage		B
104	2.1.9 Agriculture	Consider opportunities for the conversion of high quality crown land to agricultural use through existing referral processes which consider highest and best use.			M	may be some opportunities for agric. Depending on land use classification and objectives		
105	2.1.9 Agriculture	Develop a target level of AUMs for the plan area			N	no impact to existing business approach		
106	2.1.9 Agriculture	Maintain and/or enhance livestock grazing opportunities			H	early seral rangeland can potentially increase due to salvage		B

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			O	S	Rating	Rationale:	R	B
107	2.1.9 Agriculture	Apply intensified integrated resource management and enhanced resource development for grazing			H	likely increase opportunities due to early seral conversion from salvage		B
108	2.1.9 Agriculture	Encourage the adoption of sustainable agricultural practices			L	standard practice		
109	2.1.9 Agriculture	Promote conservation farming techniques to maintain and enhance water quality and soil productivity and to reduce soil erosion			L	standard practice		
110	2.1.9 Agriculture	Promote land and water stewardship programs to manage for other resource values			L	may increase due to increased early seral from salvage		
111	2.1.9 Agriculture	Support the Code of Agricultural Practice for Waste Management			N	no impact to existing business approach		
112	2.1.9 Agriculture	Encourage the agri-food sector to manage for other values such as wildlife habitat, biodiversity and water quality			L	standard IRM strategy		
113	2.1.10 Range	Maintain and/or enhance sustainability, biodiversity and long-term productivity on Crown rangelands			L	standard practice	R	
114	2.1.10 Range	Develop Range Use Plans to identify goals and strategies for an area, inventory plant communities, prescribe levels of use, and set a grazing schedule			M	importance will increase because of new early seral range opportunities		
115	2.1.10 Range	Achieve good to excellent range condition on most areas for livestock and/or wildlife			L	standard practice		
116	2.1.10 Range	Implement research findings on the impacts of grazing on natural ecosystems			N	no impact to existing business approach		
117	2.1.10 Range	Authorize and manage for sustainable levels of livestock grazing on Crown rangelands and encourage intensive management			L	standard practice		
118	2.1.10 Range	Control noxious weeds by implementing Noxious Weed Control Plans			M	importance will increase because of increase access due to salvage		
119	2.1.10 Range	Restore areas detrimentally impacted by grazing			L	standard practice		

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					Rating	Rationale:	R	B
		LRMP Text	O	S				
120	2.1.10 Range	Minimize tree/grass/cattle conflicts through integrated management practices			L	standard practice		
121	2.1.11 Minerals	Encourage new mining industry* opportunities and development which provides for local employment and investment			N	no impact to existing business approach		
122	2.1.11 Minerals	Implement the Provincial Mineral Strategy in the Kamloops LRMP			N	no impact to existing business approach		
123	2.1.11 Minerals	Ensure that land use designations support mineral investment confidence			N	no impact to existing business approach		
124	2.1.11 Minerals	Strive for diversified and enhanced industrial mineral industries, including value-added opportunities			N	no impact to existing business approach		
125	2.1.11 Minerals	Provide input to municipal planning (OCPs, bylaw referrals) to maintain sand and gravel mining opportunities			N	no impact to existing business approach		
126	2.1.11 Minerals	Maintain or enhance access to land for mineral** exploration and development			M	access will likely increase due to salvage		B
127	2.1.11 Minerals	Use appropriate local level planning to encourage long-term access to subsurface resources and compatibility of surface uses			L	standard IRM planning strategy		
128	2.1.11 Minerals	Maintain or enhance access to Crown land for public mineral collecting and recreational placer activity			M	access will likely increase due to salvage		B
129	2.1.11 Minerals	Monitor and review lands closed to mineral and placer exploration (e.g. no-staking-reserves) and recommend amendments			L	standard practice		
130	2.1.11 Minerals	Encourage geoscience inventories for mineral investment and land use decisions			N	no impact to existing business approach		
131	2.1.11 Minerals	Visual quality and biodiversity objectives do not preclude mine development activities. However, every effort should be made to meet visual quality and biodiversity objectives			L	standard IRM strategy		

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					Rating	Rationale:	R	B
132	2.1.11 Minerals	Conduct government-sponsored geological surveys, mineral deposit research, and exploration incentive programs			N	no impact to existing business approach		
133	2.1.11 Minerals	Ensure rehabilitation of mineral exploration and site access disturbances			N			
134	2.1.12 Wildlife	Ensure habitat needs of all naturally occurring wildlife species are provided for. Special attention will be paid to those red- and blue-listed species, as defined by BC Environment, and species designated as regionally important (e.g. Mule Deer)			H	increased importance due to increase access issues and conversion to early seral due to salvage	R	
135	2.1.12 Wildlife	Manage forests for a diversity of age classes and forest stand structures across landscape units			H	extensive conversion to early seral in some areas due to salvage	R	
136	2.1.12 Wildlife	Ensure that critical wildlife habitat is identified and managed appropriately through local level planning			L	standard IRM planning		
137	2.1.12 Wildlife	Conduct habitat improvement projects			H	likely required due to impacts of salvage and fire		
138	2.1.12 Wildlife	Manage wildlife populations to meet both consumptive and non-consumptive demands within IRM goals and land capability			L	standard IRM planning		
139	2.1.12 Wildlife	Ensure linkage between critical habitat areas, preferably incorporating them within an ecosystem network			H	landscape connectivity objectives and patterns will likely be affected because of increase salvage and access	R	
140	2.1.12 Wildlife	Maintain hunting opportunities			L	standard IRM objective		
141	2.1.12 Wildlife	Accommodate a mosaic of hunting opportunities through appropriate local level planning			L	standard IRM objective		
142	2.1.12.1 Critical Deer Winter Range	Maintain or enhance forage production and habitat requirements in critical deer winter range			L	most deer winter range is found below pine leading stands		
143	2.1.12.1 Critical Deer Winter Range	Disperse the timber harvest throughout the winter range and spread it out evenly over the rotation			L	standard planning strategy		

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					Rating	Rationale:	R	B
144	2.1.12.1 Critical Deer Winter Range	Maintain at least 25 percent of forested area in thermal cover. Link thermal cover units together with suitable travel corridors, especially mature Douglas fir vets on ridges			M	forest cover and linkages may be impacted if these areas have pine which is salvaged	R	
145	2.1.12.1 Critical Deer Winter Range	Practice uneven aged management wherever possible			L	most deer winter range is NOT pine leading, therefore should not be affected by salvage and non-even aged management		
146	2.1.12.1 Critical Deer Winter Range	Apply clear cuts smaller than 5 hectares where uneven aged management cannot be practiced			L	same as above		
147	2.1.12.1 Critical Deer Winter Range	Ensure maintenance of browse species such as Ceonothus, wild rose and saskatoon through range management practices			M	importance may increase if new forage opportunities increase due to salvage, however, most winter range is not in pine leading stands		
148	2.1.12.1 Critical Deer Winter Range	Pursue mixed forest management, with similar species distribution to natural stands (including deciduous)			M	may not be possible in where composition of pine is higher, requiring salvage	R	
149	2.1.12.1 Critical Deer Winter Range	Establish access management guidelines			M	increased access for salvage may require roading through or near deer winter range		
150	2.1.12.1 Critical Deer Winter Range	Incorporate management objectives for Critical Deer Habitat into local level planning for the area			L	standard IRM planning strategy		
151	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	In burned portions of critical deer winter range: Ensure that salvage logging balances economic opportunities with conservation of winter habitat for deer.			H	important to maintain winter range structural characteristics (security, shelter, forage) where possible		
152	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	In burned portions of critical deer winter range: Focus the harvesting strategy on the removal of dead and dying timber, while allowing incidental removal of green trees for access and safety.			H	same as above		

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			O	S	Rating	Rationale:	R	B
153	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	Maintain a target of at least 25 percent of the area as dispersed, unharvested patches with attributes that best serve the needs of snow interception cover and security cover, including (in order of priority): 1. green, mature or older Douglas-fir-dominated stands with relative high crown closure; 2. partially killed, mature or older Douglas-fir-dominated stands; 3. younger green Douglas-fir-dominated stands; 4. other green conifer stands and green standing timber; and, 5. green stands immediately adjacent to the critical deer winter range, but within the burn perimeter.			H	same as above		
154	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	Retain patches, clumps or groups of trees that provide security cover for deer. (Note: These patches need not meet the attribute requirements of wildlife tree patches.) Locate patches approximately 250 metres apart or from another unharvested area.			H	maintain patches where possible, but 250 distance criteria may not be achievable depending on condition of surrounding landscape (i.e., if salvage of pine has occurred)		
155	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	In charred, dead or dying stands the 5 hectare cutblock limit does not apply.			N	strategy achievable		
156	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	Access management in burned portions of critical deer winter range: Minimize new permanent access. Where practicable, use temporary access structures to minimize permanent access.			H	may be increased access due to pine salvage in adjacent areas	R	
157	2.1.12.1 Fire Salvage Harvesting in Critical Deer Winter Range	Access management in burned portions of critical deer winter range: Ensure levels of access meet LRMP objectives and strategies.			H	may be increased access due to pine salvage in adjacent areas	R	
158	2.1.12.2 Critical Moose Winter Range	Maintain thermal and visual cover for moose, and enhance browse production			H	extent of mature forest cover will be impacted due to increased salvage harvest	R	
159	2.1.12.2 Critical Moose Winter Range	Maintain suitable forest cover attributes with respect to thermal cover and forage production			H	same as above	R	

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					Rating	Rationale:	R	B
160	2.1.12.2 Critical Moose Winter Range	Ensure adequate forage is maintained during silvicultural activities (brushing and weeding, stand tending)			H	likely increased opportunities due to early seral conversion from salvage		B
161	2.1.12.2 Critical Moose Winter Range	Provide visual screening of swamps and openings along highways, secondary roads, and main forestry roads			H	increase pine salvage may compromise this strategy, but important to implement regardless to reduce poaching and other security pressures on moose		
162	2.1.12.2 Critical Moose Winter Range	Pursue mixed forest management with similar species distribution to natural stands (including deciduous)			H	increased pine salvage, and conversion of large areas to early seral may compromise this objective. Retain non-pine species wherever possible	R	
163	2.1.12.2 Critical Moose Winter Range	Ensure grazing management practices that maintain browse species such as red osier dogwood and willow			H	potential new grazing opportunities and pressure from early seral conversion		
164	2.1.12.2 Critical Moose Winter Range	Establish access management guidelines			H	increased roading due to salvage		
165	2.1.12.2 Critical Moose Winter Range	Incorporate management objectives for critical moose habitat into local level planning for the area			L	standard IRM planning		
166	2.1.13 Timber	Maintain and/or enhance the sustainable supply of timber			H	rate of cut greatly accelerated	R	
167	2.1.13 Timber	Reforest all backlog Not Sufficiently Restocked sites by the year 2000			H	increased demand and workload for reforestation	R	
168	2.1.13 Timber	Rehabilitate previously disturbed forest land (e.g. old landings and roads)			L	standard practice but some old roads may require reuse due to increase access demands for salvage		
169	2.1.13 Timber	Enhance timber production through prompt reforestation and management practices to increase stand yields			M	increased demand and workload for reforestation	R	
170	2.1.13 Timber	Encourage utilization of pulp components of stands that are currently being harvested			L	standard practice		

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					Rating	Rationale:	R	B
171	2.1.13 Timber	Convert current pulp quality stands to new forests that will produce merchantable timber			N	no impact to existing business approach		
172	2.1.14.1 Visually Sensitive Areas: Resource Management Objectives	Primary objective in Visually sensitive areas is to ensure that the levels of visual quality expected by society are achieved on crown land in keeping with the concepts and principles of integrated resource management			H	VQO objectives may be compromised because of increased levels of salvage and large cutblock sizes	R	
173	2.1.14.1 Visually Sensitive Areas Resource Management Objectives	Areas outside the identified visually sensitive areas in the Kamloops LRMP are managed for landscape objectives as follows: alterations may dominate the characteristic landscape but must borrow from natural line and form to such an extent and on such a scale that they are compatible to natural occurrences			M	VQO objectives may be compromised because of increased levels of salvage and large cutblock sizes	R	
174	2.1.14.2 Visually Sensitive Areas: Visual Resource Management Strategies	Resource development is permitted and encouraged within visually sensitive areas consistent with achieving Visual Quality Objectives			M	same as above	R	
175	2.1.14.2 Visual Resource Management Strategies	Timber harvesting within visually sensitive areas will be managed in accordance with the Forest Practices Code and the Kamloops LRMP <i>Visual Quality Guidelines</i> (Appendix 8). VQO's will be integrated into planning for forest resource development through local level plans			L	standard IRM planning		
176	2.1.14.2 Visual Resource Management Strategies	A public review process will be set in place to establish, monitor and review Visual Quality Objectives and resources within the Clearwater and Kamloops Forest Districts			N	no impact to existing business approach		
177	2.1.14.2 Visual Resource Management Strategies	Management of visual quality by non-timber uses will be managed in accordance with the Forest Practices Code and various other provincial guidelines for visual quality, such as those found in the Ministry of Energy, Mines and Petroleum Resource's <i>Guidelines for Mineral Exploration</i> and the Ministry of Transportation and Highways <i>Manual of Aesthetic Design</i>			M	VQO objectives may be compromised because of increased levels of salvage and large cutblock sizes	R	

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					Rating	Rationale:	R	B
		LRMP Text	O	S				
178	2.1.15 Heritage Trails	Identify, restore, and manage provincially significant Heritage Trails			L	should be able to meet this objective since salvage or fire in these areas may require trail restoration		
179	2.1.15 Heritage Trails	Locate and map trail locations, and seek appropriate designation. (e.g. the Hudson's Bay Company Brigade Trail)			N	no impact to existing business approach		
180	2.1.15 Heritage Trails	Protect heritage values through application of a heritage management plan or appropriate local level plan			L	standard IRM planning		
181	2.1.16 Cultural and Heritage Sites	To protect archaeological sites in the LRMP			L	standard IRM planning		
182	2.1.16 Cultural and Heritage Sites	Undertake archaeological assessments in all High and Medium Potential areas identified in the Archaeological Overview Assessment			N	no impact to existing business approach		
183	2.1.16 Cultural and Heritage Sites	As part of the archaeological impact assessments, undertake selective impact assessments of Low Potential areas to verify the accuracy of the Overview			N	no impact to existing business approach		
184	2.1.16 Cultural and Heritage Sites	Present the Overview to the public and local First Nations and seek feedback			N	no impact to existing business approach		
185	2.1.17 Traditional Native Land Use	(no Objectives or Strategies)			M	some areas of traditional use may be impacted by salvage harvesting or access	R	
186								
187	2.2 Settlement Resource Management Zones	Manage land within community growth boundary to meet the objectives set out in approved community land use plans			N	no impact to existing business approach		
188	2.2 Settlement Resource Management Zones	Provide Crown land where it is identified in Official Community Plans for community and industrial development			N	no impact to existing business approach		
189	2.2 Settlement Resource Management Zones	Agencies will encourage community expansion to occur within designated community growth boundaries			N	no impact to existing business approach		

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					Rating	Rationale:	R	B
190	2.2 Settlement Resource Management Zones	Local government will be encouraged to develop Official Community Plans where they do not already exist			N	no impact to existing business approach		
191	2.2 Settlement Resource Management Zones	Resource development within community and industrial growth boundaries should be designed to accommodate future development potential			N	no impact to existing business approach		
192	2.2 Settlement Resource Management Zones	Preference should be given to partial cutting systems for forest harvesting			M	may not be achievable in areas with high pine composition and associated salvage harvest	R	
193	2.2 Settlement Resource Management Zones	Appropriate agencies will consult with local government. Crown resource management will be consistent with approved settlement plan zoning. Local government approval is not required for the renewal of existing tenures			N	no impact to existing business approach		
194	2.3.1 Protection Resource Management Zones: Resource Management Objectives and Strategies	Protect viable, representative examples of British Columbia's natural diversity and recreational opportunities and to protect special natural, cultural heritage and recreational features			L	standard IRM and HLP planning		
195	2.3.1 Protection Resource Management Zones: Resource Management Objectives and Strategies	Logging, mining and energy exploration and development are prohibited in all Protection RMZs			H	this strategy may not be achievable if extensive pine salvage is required	R	
196	2.3.1 Protection Resource Management Zones: Resource Management Objectives and Strategies	Respect existing uses where these meet the objectives of Protection RMZs			N	no impact to existing business approach		
197	2.3.1 Protection Resource Management Zones: Resource Management Objectives and Strategies	To prevent recreational overuse, a local level plan may give direction to the use and access to an RMZ to preserve both the environmental and the experience of using the area. Both public independent and commercial recreation use may be managed for this reason.			L	may be greater importance for local planning due to increased road access for salvage		

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					Rating	Rationale:	R	B
198	2.3.2 Protection Resource Management Zones: Area Specific Objectives and Strategies	P7. Dunn - Timber harvesting, other than that required for subsurface exploration and development is prohibited in that portion of the McCarthy 4 mineral claim that lies within the Dunn Peak RMZ, until such time as the mineral claims expire and the decision is made whether or not to make the area part of the Protection RMZ	O	S	M	may not be achievable in areas with high pine composition and associated salvage harvest	R	
199	2.3.3 Protection Resource Management Zones: Special Feature Protection Resource Management Zones	P51 North Thompson Oxbows - East - comment Existing Timber Licence to be saved and excepted (60ha)			N	no impact to existing business approach		
200	2.3.3 Protection Resource Management Zones: Special Feature Protection Resource Management Zones	P52 North Thompson Oxbows - West - comment Existing Timber Licence to be saved and excepted (10ha)			N	no impact to existing business approach		
201	2.3.3 Protection Resource Management Zones: Special Feature Protection Resource Management Zones	P53 Oregana Creek Old Growth - comment Area between the road and Goal 1 PA just north of Tum Tum Lake to be managed for caribou habitat values			H	confirm composition of pine and whether salvage would be required?	R	
202	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Ensure existence of acceptable levels of water quality and quantity			H	increased roading, harvest and potential erosion	R	
203	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Maintain the quality and quantity of community water supply			L	standard IRM objective	R	

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					Rating	Rationale:	R	B
		LRMP Text	O	S				
204	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Resource development activities are permitted and encouraged so long as Community Watershed Zone objectives are achieved. Minimum standards for the management of Community Watersheds are governed by the Forest Practices Code and Provincial Community Watershed Guidelines. Objectives and strategies outlined in the General Management Zone apply as base management for this zone.			H	increased roading, harvest and potential erosion	R	
205	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Conduct the appropriate level of watershed assessment for each community watershed on a priority basis to be determined and implement remedial strategies on a priority basis			M	standard IRM strategy, but may have increased importance because of increased levels of harvest		
206	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Water conservation			N	no impact to existing business approach		
207	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Ensure drinking water systems meet or exceed Canadian Drinking Water Quality Standards within maximum acceptable element concentrations			N	no impact to existing business approach		
208	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Ensure compliance with relevant legislation, regulations, guidelines and plans			N	no impact to existing business approach		
209	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Ensure existing water quality sampling in Community Watersheds on a priority basis			N	no impact to existing business approach		

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					Rating	Rationale:	R	B
210	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Investigate all complaints dealing with water quality in a timely fashion			N	no impact to existing business approach		
211	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Maintain natural stream flow regime within acceptable limits			H	potential high ECAs and increased roading	R	
212	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Refine existing sampling program to more fully assess those streams where yearly analysis or complaints show unacceptable water quality and promptly implement all recommendations arising from this detailed assessment			N	no impact to existing business approach		
213	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Upon review of applicable watersheds, implement procedures to rehabilitate negatively impacted watersheds to improve water quality and/or streamflow regimes to a sustainable level			M	may be increase importance due to increased roading, harvest and potential erosion		
214	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Establish instream flow requirements for appropriate non-consumptive uses			N	no impact to existing business approach		
215	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Minimize risk to lives and property from flooding and erosion			M	potential increased runoff	R	
216	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Ensure road construction, maintenance and deactivation complies with appropriate legislation and regulation while maintaining adequate drainage throughout resource development activities			L	standard practice but likely more demand because of increased roading for salvage		

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					Rating	Rationale:	R	B
217	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Recognize interaction of groundwater with surface water sources			M	impact on springs uncertain?	R	
218	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Develop and implement comprehensive Floodplain Management Plans in selected areas on a priority basis to be determined			L	potential for increased runoff with great ECAs		
219	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Encourage inter-agency/public co-operation to achieve harmony within each community			N	no impact to existing business approach		
220	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Establish a groundwater aquifer management program			N	no impact to existing business approach		
221	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Implement groundwater monitoring sites			N	no impact to existing business approach		
222	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Implement a notification procedure within the referral system to protect affected water licensees when development is proposed			L	standard practice/strategy		
223	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Encourage the creation of water user groups for each watershed			N	no impact to existing business approach		

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			O	S	Rating	Rationale:	R	B
224	2.4.1 Special Resource Management - Community Watersheds: Resource Management Objectives and Strategies	Development of guidelines for grazing will involve any grazing tenure holders in the Community Watershed			L	standard IRM strategy, but may have increased importance because of increased levels of harvest		
225	2.5.1 Special Resource Management - Habitat/Wildlife Management Areas: Resource Management Objectives and Strategies	Overall objective of special resource management zones for habitat and wildlife management areas is to: maintain or enhance identified wildlife habitat areas			H	salvage or fire could compromise characteristics of WHAs	R	
226	2.5.1 Special Resource Management - Habitat/Wildlife Management Areas: Resource Management Objectives and Strategies	An important strategy for achieving this objective is to undertake long-term planning for each of the habitat zones and wildlife management areas, which include some or all of the following: a/ an inventory of opportunities and features; b/ mapping of wildlife and biodiversity values; c/ defined and mapped long term operational areas for other resource uses; and, d/ access management			M	increased importance of planning (or reviewing impacts to existing plans) due to possible impact from increased harvesting and access		
227	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Maintain a viable population of caribou within defined ranges, while maintaining ecosystem health			H	confirm composition of pine and whether salvage will impact caribou habitat?	R	
228	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Implement operational timber harvesting guidelines for both late and early winter habitat areas, to ensure forest attributes needed by caribou are maintained, refer to Kamloops LRMP Timber Harvesting Guidelines for Caribou Habitat (appendix 10)			H	confirm composition of pine and whether salvage may be required: implement retention strategies to protect forest attributes for caribou		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
229	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Strategies for Transitional / Early Winter Habitat are to provide snow interception cover, early winter foraging, calving areas and movement corridors to adjacent areas			H	confirm composition of pine and whether salvage may be required: implement retention strategies to protect forest structural attributes for caribou, including integrity of forested movement corridors	R	
230	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Strategies for Late Winter Habitat are to provide sustained lichen production and movement corridors. A rotation age of 150 years will be used in late winter habitat areas. Second entry will only take place if it can be shown that adequate habitat containing "caribou attributes" would be left after logging of second pass			H	same as above	R	
231	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Current logging guidelines will be reviewed in 5 years, with possible modifications based on the findings of the interim report of the 10-year research program			L	standard IRM planning		
232	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Migratory corridors linking high capability caribou habitat in the LRMP to surrounding areas will be identified and mapped. Forest management guidelines for maintaining these areas as travel corridors are included in Kamloops LRMP Timber Harvesting Guidelines for Caribou Habitat (Appendix 10)			H	confirm composition of pine and whether salvage may be required: implement retention strategies to protect forest structural attributes for caribou, including integrity of forested movement corridors		
233	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Improve understanding of the behaviour and biology of caribou populations, and the effect of resource development on caribou habitat			H	impacts of large scale salvage on or adjacent to caribou habitat are poorly understood		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
234	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	A 10 year research project will be jointly developed and presented to the Forest Renewal Plan of BC. The intent of this research project would be:						
235	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	a/ to evaluate the impact of current guidelines for timber harvesting in caribou habitat.			H	relate to pine beetle or wildfire salvage		
236	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	b/ to identify habitats used by caribou and to characterize key attributes of those habitats.			L			
237	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	c/ to review attributes required in movement corridors			M	relate to beetle or fire salvage		
238	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Within the RMZ, there will be a mapped "Research Area". This area will be used as the key research area in the proposed research program. There are a number of cutblocks in the research area that will be logged over the next three years (specifically, FLA18694 CP133, 136; 142; 118; 143; and 154). An agreement is in place that no further logging will be proposed within this area until the interim report of the research project has been reviewed			L	evaluate implementation of this strategy if pine salvage is required		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
239	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	The concept of very limited tree cutting for exploration purposes is not prohibited during the moratorium period			L	depending on stand composition, pine salvage may be required		
240	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	A review is to be completed by Dec 31, 1999 to assess the need for continuation of the research area			N	no impact to existing business approach		
241	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Timber harvesting in the research area will be undertaken using current guidelines for logging in winter and transitional caribou habitat. Winter roading will be minimized and not kept open beyond each winter's logging requirements			H	strategy only impacted if high pine composition and salvage harvest is considered	R	
242	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Local level plans will address access concerns related to caribou management. In order to minimize predator access to caribou habitat, winter logging will be concentrated in order to minimize the length of ploughed road			L	standard IRM planning		
243	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Encourage separation of caribou and other ungulates within caribou habitat to reduce risk of predation. Pursue moose enhancement programs outside of the Caribou Management Zone			L	standard IRM planning and wildlife habitat management objective		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
244	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Caribou use the high elevation meadows within Late Winter habitat for summer forage. New opportunities for grazing or expansion of existing tenures would have to avoid the use of high elevation meadows and riparian areas within Late Winter habitat through the use of full time range riders or other appropriate methods			L	same as above; elevation above most pine stands		
245	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Where grazing is used as a silviculture tool for vegetation management, range herders or other appropriate methods must be utilized to avoid predator interactions			M	potential increased range opportunities due to early seral conversion from salvage	R	
246	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	remainder of caribou objectives and strategies in H1 are not applicable						
247	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H2 - H9 North Thompson Caribou Habitat/Recreation and Tourism	See H1 and 2.6 to 2.6.1.4 direction for details						
248	H10. Battle Bluffs Wildlife Habitat (Forest harvesting not typical in this area)	Maintain the natural diversity of plant and animal life			L	IDF and PP -- generally below areas with high pine composition; salvage restricted		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
249	H10. Battle Bluffs Wildlife Habitat	Prescribed fire and/or prescribed domestic livestock grazing may be used to maintain natural diversity of grasslands and the PP and IDF zones			L	same as above		
250	H10. Battle Bluffs Wildlife Habitat	Maintain natural stand attributes in managed forests			L	same as above		
251	H10. Battle Bluffs Wildlife Habitat	Prevent encroachment of conifers onto grasslands			L	same as above		
252	H10. Battle Bluffs Wildlife Habitat	Manage for mixed age classes of PP and IDF, minimum 20 percent old growth			L	same as above		
253	H10. Battle Bluffs Wildlife Habitat	Allow natural spacing of conifers in PP and IDF zones			L	same as above		
254	H10. Battle Bluffs Wildlife Habitat	Maintain habitat for flammulated owls, for primary cavity nesters e.g. Flickers and Blue Grouse			H	presence of wildfire and danger tree removal (fire operations) may impact habitat for wildlife tree dependent species. Use wildlife/danger tree assessment procedures for individual tree situations	R	
255	H10. Battle Bluffs Wildlife Habitat	Maintain forage and thermal cover for Mule Deer			L	IDF (presence of large Fd which provide winter range characteristic); limited pine composition should restrict salvage in these areas		
256	H10. Battle Bluffs Wildlife Habitat	Selection timber harvesting will be allowed only to enhance wildlife habitats			M	potential pine salvage may compromise this objective	R	
257	H10. Battle Bluffs Wildlife Habitat	Maintain snags and maturing grassland stage of succession			L	limited pine		
258	H10. Battle Bluffs Wildlife Habitat	Maintain and enhance the condition of identified riparian sites			H	if increase salvage, potential for increased runoff, erosion or siltation	R	
259	H10. Battle Bluffs Wildlife Habitat	Identify all important riparian sites and establish management objectives for their use			L	standard IRM strategy		
260	H 11 Skull Wildlife Habitat	Maintain the natural diversity of plant and animal life			L	standard IRM strategy		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
261	H 11 Skull Wildlife Habitat	Maintain or enhance forage production and habitat requirements in critical deer winter range.			M	deer winter range generally in IDF with low composition of pine. Some pine salvage could impact winter range characteristics	R	
262	H 11 Skull Wildlife Habitat	Manage as per Critical deer winter range. Section 2.1.12.1						
263	H 12 Skwilatin Wildlife Habitat	Maintain the natural diversity of plant and animal life			H	potential impacts of increased harvesting/salvage	R	
264	H 12 Skwilatin Wildlife Habitat	Maintain or enhance forage production and habitat requirements in critical moose winter range			H	salvage and increased conversion to early seral should benefit forage production for moose		B
265	H 12 Skwilatin Wildlife Habitat	Manage as per Critical Moose winter range section 2.1.12.2						
266	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Maintain or enhance opportunities for a diverse range of tourism and/or recreational values and uses across the biophysical settings of these zones			N	no impact to existing business approach		
267	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Undertake local level planning which will include some or all of the following: a/ an inventory of opportunities and features; b/ detailed Visual Quality Objectives; c/ mapping of wildlife and biodiversity values; d/ defined and mapped long term operational areas for tourism and/or recreation; e/ defined and mapped long term operational areas for other resource uses; and, f/ access management.			L	standard IRM and HLP planning; increased access management		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
268	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Where deemed necessary and subject to the development and annual review of the area management plan, both independent public and commercial public use may be managed to preserve both the environment and experience in a RMZ.			N			
269	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Facilitate tourism development if appropriate to the objectives of each RMZ			N	standard IRM and HLP planning		
270	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Match tourism facilities and development with intended recreational experience of the RMZ.			N	no impact to existing business approach		
271	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Maintain viewsapes in recreation and tourism areas to a standard that does not detract from the recreational enjoyment of users			H	increase salvage harvesting and roading may impact viewscape objectives	R	
272	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Visual quality objectives will apply to all users			N	no impact to existing business approach		
273	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Visual Quality Objectives will be established in accordance with Ministry of Forests Visual Landscape Management and directives for Visually Sensitive Areas (Section 2.1.14)			N	no impact to existing business approach		
274	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Visual Quality Objectives will be reviewed and approved through local level plans.			N	no impact to existing business approach		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
275	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Maintain a level of access that meets the objectives of each Recreation and Tourism RMZ.			M	may be increased access for salvage harvesting		
276	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Maintain a level of motorized recreation opportunity if appropriate for each RMZ			N	standard IRM planning		
277	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Road and trail construction, maintenance and deactivation and other surface disturbances and construction will be undertaken in a manner that meets the management objectives of each recreation and tourism zone, in accordance with direction from an approved plan, local process, or enhanced referral.			L	standard practices, but may be increased demand due to increased road construction		
278	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Identify type and quantity of motorized recreation use allowed in each RMZ.			N	no impact to existing business approach		
279	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Local level plans will address motorized and non-motorized recreation use.			N	no impact to existing business approach		
280	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	The difference between the environmental impact of snowmobiles and wheeled vehicles must be considered when zoning for regulation of motorized vehicle use during local level planning.			N	no impact to existing business approach		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
			O	S	Rating	Rationale:	R	B
281	2.6.1.1 Special Resource Management - Recreation and Tourism: Higher Use Recreation and Tourism Zones	Provide easily accessible tourism and recreation opportunities			N	no impact to existing business approach		
282	2.6.1.1 Special Resource Management - Recreation and Tourism: Higher Use Recreation and Tourism Zones	Maintain a diverse forest stand structure, species and age class distribution			H	species and age class distribution will be impacted if pine composition necessitates salvage and conversion to early seral	R	
283	2.6.1.1 Special Resource Management - Recreation and Tourism: Higher Use Recreation and Tourism Zones	Maintain motorized recreation opportunities where appropriate			N	no impact to existing business approach		
284	2.6.1.1 Special Resource Management - Recreation and Tourism: Higher Use Recreation and Tourism Zones	Local level plans will address motorized and non-motorized recreation use			N	no impact to existing business approach		
285	2.6.1.2 Special Resource Management - Recreation and Tourism: Natural Environment Recreation and Tourism Zones	Provide recreation and tourism opportunities in a natural environment.			M	rec. and tourism opportunities may be negatively impacted (i.e., viewscales, trails conditions, etc.) in areas with increased salvage and roading	R	
286	2.6.1.2 Special Resource Management - Recreation and Tourism: Natural Environment Recreation and Tourism Zones	Maintain diverse forest stand structure, species and age class distribution			H	species and age class distribution will be impacted if pine composition necessitates salvage and conversion to early seral	R	
287	2.6.1.2 Special Resource Management - Recreation and Tourism: Natural Environment Recreation and Tourism Zones	Promote natural forest conditions through application of the appropriate silviculture system			H	dependent on stand composition, salvage harvesting may necessitate clearcutting only		

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
		LRMP Text	O	S				
288	2.6.1.2 Special Resource Management - Recreation and Tourism: Natural Environment Recreation and Tourism Zones	Low to moderate use trails and facilities may be developed.			N	no impact to existing business approach		
289	2.6.1.2 Special Resource Management - Recreation and Tourism: Natural Environment Recreation and Tourism Zones	Develop an access management plan to maintain the appropriate access.			H	increased roading for salvage must be incorporated into AMP		
290	2.6.1.3 Special Resource Management - Recreation and Tourism: Backcountry Recreation and Tourism Zones	Maintain the natural character of the area, and provide opportunities for recreation / tourism in a backcountry / wilderness setting			H	backcountry and wilderness opportunities may be negatively impacted (i.e., viewscapes, trails conditions, forest structure, etc.) in areas with increased salvage and roading	R	
291	2.6.1.3 Special Resource Management - Recreation and Tourism: Backcountry Recreation and Tourism Zones	Provide opportunities for development of backcountry facilities.			N	no impact to existing business approach		
292	2.6.1.3 Special Resource Management - Recreation and Tourism: Backcountry Recreation and Tourism Zones	All roads will be built using best management practices which minimize road clearing widths. Wherever possible, roads will be closed and reclaimed following completion of activities			L	standard practice, but increased demand due to possible salvage access		
293	2.6.1.3 Special Resource Management - Recreation and Tourism: Backcountry Recreation and Tourism Zones	Maintain a diverse forest stand structure, species, and age class distribution			H	species and age class distribution will be impacted if pine composition necessitates salvage and conversion to early seral	R	

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
294	2.6.1.3 Special Resource Management - Recreation and Tourism: Backcountry Recreation and Tourism Zones	Promote natural forest conditions through application of the appropriate silviculture system			H	dependent on stand composition, salvage harvesting may necessitate clearcutting only	R	
295	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Maintain predominantly primitive conditions across the landscape to provide recreation and/or tourism opportunities.			H	backcountry and wilderness opportunities may be negatively impacted (i.e., views, trails conditions, forest structure, etc.) in areas with increased salvage and roading	R	
296	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Extractive uses are permitted providing they are consistent with the objectives of the RMZ.			L	standard IRM and HLP planning strategy		
297	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Access management plans will be consistent with the objectives of the RMZ.			M	standard HLP planning strategy, but may be more pressure due to increased access for salvage harvest	R	
298	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Emphasis on locating facilities outside of this area			N	no impact to existing business approach		
299	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Encourage natural ecosystems and disturbance regimes to function where possible.			M	increased salvage and ECAs shifts landscape seral stage distribution to early seral, even though beetle is a natural disturbance agent, attempt to mimic natural patterns by retaining unsalvaged areas	R	

Index	LRMP Section	Kamloops LRMP direction (objectives and strategies)	Objective	Strategy	Degree of Association of O/S with MPB/Fire/Salvage (H)igh, (M)oderate, (L)ow, (N)il		(R)isks / (B)enefits	
					Rating	Rationale:	R	B
300	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Assess the impacts of use and facility development for each area.	O	S	N	no impact to existing business approach		

Appendix 5: Kamloops LRMP Land Use Objectives Supporting FSPs Under FRPA

HLP #	Master Spreads heet #	LRMP section	Kamloops LRMP objective or strategy continued as Higher Level Plan for purposes of FRPA
A		General Management RMZ	All resource management zones and specified areas associated with the objectives in this Order will continue
1	17	2.1.2 Water Management	Ensure implementation of a referral process to notify all potentially impacted water licensees when development is proposed
2	32	2.1.2.1 Riparian Management Areas	Manage riparian areas, including streams, wetlands and lakes in accordance with the FRPA and the Kamloops and Clearwater District Lakeshore Management Guidelines, or other applicable management tools or agency agreements
3	42	2.1.3 Ecosystem Management	Maintain old growth attributes within landscape units
4	48	2.1.3.1 Biodiversity Emphasis Options	To conserve the diversity and abundance of native species and their habitats throughout the Kamloops LRMP
5	65	2.1.5. Inland Fisheries	Maintain a mosaic of angling opportunities within the recreational spectrum (i.e., walk-in lakes, drive-to lakes, trophy lakes)
6	120	2.1.10 Range	Minimize tree/grass/cattle conflicts through integrated management practices
7	134	2.1.12 Wildlife	Ensure habitat needs of all naturally occurring wildlife species are provided for. Special attention will be paid to those red- and blue- listed species, as defined by BC Environment, and species designated as regionally important (e.g. Mule Deer)
		Zone specific	
8	142	2.1.12.1 Critical Deer Winter Range	Maintain or enhance forage production and habitat requirements in critical deer winter range
9	143	2.1.12.1 Critical Deer Winter Range	Disperse the timber harvest throughout the winter range and spread it out evenly over the rotation
10	144	2.1.12.1 Critical Deer Winter Range	Maintain at least 25 percent of forested area in thermal cover. Link thermal cover units together with suitable travel corridors, especially mature Douglas fir vets on ridges
11	158	2.1.12.2 Critical Moose Winter Range	Maintain thermal and visual cover for moose, and enhance browse production.
12	159	2.1.12.2 Critical Moose Winter Range	Maintain suitable forest cover attributes with respect to thermal cover and forage production
13	172	2.1.14.1 Visually Sensitive Areas: Resource Management Objectives	Primary objective in Visually sensitive areas is to ensure that the levels of visual quality expected by society are achieved on crown land in keeping with the concepts and principles of integrated resource management

14	173	2.1.14.1 Visually Sensitive Areas Resource Management Objectives	Areas outside the identified visually sensitive areas in the Kamloops LRMP are managed for landscape objectives as follows: alterations may dominate the characteristic landscape but must borrow from natural line and form to such an extent and on such a scale that they are compatible to natural occurrences
15	182	2.1.16 Cultural and Heritage Sites	Undertake archaeological assessments in all High and Medium Potential areas identified in the Archaeological Overview Assessment
16	187	2.2 Settlement Resource Management Zones	Manage land within community growth boundary to meet the objectives set out in approved community land use plans
17	225	2.5.1 Special Resource Management - Habitat/Wildlife Management Areas: Resource Management Objectives and Strategies	Overall objective of special resource management zones for habitat and wildlife management areas is to: maintain or enhance identified wildlife habitat areas
18	227	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Maintain a viable population of caribou within defined ranges, while maintaining ecosystem health
19	228	2.5.2 Special Resource Management - Habitat/Wildlife Management Areas: Area-Specific Objectives and Strategies H1. North Thompson Caribou Habitat (General)	Implement operational timber harvesting guidelines for both late and early winter habitat areas, to ensure forest attributes needed by caribou are maintained, refer to Kamloops LRMP Timber Harvesting Guidelines for Caribou Habitat (appendix 10)
20	250	H10. Battle Bluffs Wildlife Habitat (Forest harvesting not typical in this area)	Maintain natural stand attributes in managed forests
21	254	H10. Battle Bluffs Wildlife Habitat (Forest harvesting not typical in this area)	Maintain habitat for flammulated owls, for primary cavity nesters, e.g. Flickers and Blue grouse.
22	261	H 11 Skull Wildlife Habitat	Maintain or enhance forage production and habitat requirements in critical deer winter range.
23	264	H 12 Skwilatin Wildlife Habitat	Maintain or enhance forage production and habitat requirements in critical moose winter range
24	271	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Maintain viewsapes in recreation and tourism areas to a standard that does not detract from the recreational enjoyment of users
25	277	2.6.1 Special Resource Management - Recreation and Tourism: Resource Management Objectives and Strategies	Road and trail construction, maintenance and deactivation and other surface disturbances and construction will be undertaken in a manner that meets the management objectives of each recreation and tourism zone, in accordance with

			direction from an approved plan, local process, or enhanced referral.
26	296	2.6.1.4 Special Resource Management - Recreation and Tourism: Remote Recreation and Tourism Zones	Extractive uses are permitted providing they are consistent with the objectives of the RMZ.

Appendix 6: Detailed Assessment Methodology

This method is based on the 2005 Integrated Land Management Bureau assessment of the Vanderhoof Land and Resource Management Plan (LRMP) and the terms of reference for assessment of the Kamloops and Okanagan LRMPs. A generic approach is laid out here, which could potentially be applied to other LRMPs affected by mountain pine beetle (MPB), wildfire and where major salvage is planned. This method was applied to the Kamloops and Okanagan-Shuswap LRMPs.

Generic Approach

Assessment of impacts to plan values is based on two sources of information:

The two sources were:

1. Interviews of government agency representatives and others, to identify LRMP-related issues, impacts, mitigative recommendations, or opportunities as a result of the Mountain Pine Beetle epidemic (and to some extent, recent fires). Government agency representatives familiar with the plan area were interviewed using standard questions on perceived impacts/risks and benefits associated with changes expected from mountain pine beetle. Forest licensee representatives were interviewed because of their specific geographic knowledge pine forests distribution and operational salvage planning responsibilities.
- 3) A GIS analysis and interpretation was done subsequent to and guided by the interviews. Available information on pine location and mortality was used to assess plan RMZs and watersheds sensitive to forest condition. Outputs include an assessment of which objectives/strategies are currently at risk of non-compliance, and which RMZs and watersheds are affected.

Before the interviews the LRMP is reviewed and each objective and strategy is evaluated for **Degree of Association between the O/S and natural disturbance by MPB/Fire/Salvage**. This qualitative assessment ranks the association as (H)igh, (M)oderate, (L)ow, (N)il and whether the link is a risk or a benefit. The High and Moderate associations then became the focus. The spreadsheet was available for reference during the interviews.

Interview process.

Representatives from government were interviewed with respect to their areas of expertise and interest as defined by the KLRMP document. Some representatives from the forest industry were also interviewed, to capture their local knowledge regarding the effects of mountain pine beetle. Maps were produced for the interviews that showed the distribution of (lodgepole and ponderosa), age, volume, and mortality as well as the current pattern of harvest, in relation to plan values and zones. To show the distribution of past harvesting the LRMP and the RMZs were mapped on a 2005 Landsat base. Pine

distribution was shown using a clear acetate overlay. These maps were produced to help the interviewees define the threats/opportunities to their interests. A standard set of questions was used, and provided to the interviewees in advance (Appendix 1), and after the interview, a summary was produced and sent to the interviewees for confirmation and amendment. The interview results were then summarized by value and presented in a table format (see Appendix 2). Since the interviews preceded the GIS assessment no analysis was provide of the degree and extent of potential impacts. The summary of results is therefore referred to as perceived risk. Where interviewees made specific reference to an area this was noted (see Appendix 3). The individual interviews are part of the project files but not included in the report. When the interviewee information is summarized it is important to assess whether there was support for: no revisions, minor revisions or major revisions. Major and minor revisions were defined as per the plan.

Geographic Information System Assessment

Impacts to non-timber resource values were assessed using a Geographic Information System (GIS). Relative risk was based on the proportions (percent) of areas disturbed (burned and pine forest distribution) within each Resource Management Zones (RMZ) polygon. In addition to plan RMZs and to address general resource management zones objectives, groups of watersheds were also used as assessment units based on watershed atlas drainage groups. In the watershed assessment units, and for community watersheds and fish RMZ watersheds, cumulative effects on hydrology were taken into account by including all recent disturbance including recent harvesting, together with beetle and fire killed areas). An estimated equivalent clearcut area (ECA) was calculated and young forests and hydrologic recovery were factored into the calculated percent ECA.

Risk to plan objectives and strategies was qualitatively assessed based on the percent area affected or percent ECA for water-related values. More difficult to assess was the impact to value overall and not simply whether administratively the objectives were in failure. A series of report-sized maps show the current percent area affected or percent ECA (2005) and the forecasted area affected and ECA for 2010, 2015 and 2020. Forecasts were based provincial model projections of pine mortality from Eng *et al.* (2005).

Operating areas and TFLs were used to clarify the distribution of pine relative to forest companies operating areas. This was considered helpful to understand the where the dead wood was located and which companies would be doing the bulk of the salvage planning and harvesting.

The following describes the procedure in more detail:

STEP 1. Select units of assessment for each value/interest in the LRMP.

The data used to assess pine mortality in each RMZ comes from Eng *et al.* (2005), and the condition of the polygons (i.e. if they are in age class 1 and 2) comes from the provincial Vegetation Resources Inventory (VRI). The Eng *et al.* 2005 data are in raster

form, and are suitably accurate for strategic assessment for the majority of RMZs, because when the raster information is overlain on the vector defined polygons, errors are masked along the edges of the larger RMZs. However, the resolution of the data is 16 hectares, in a 400 m by 400 m square (raster format). Since all LRMP RMZs are in digitized lines (vector form) there is a greater degree of uncertainty on smaller RMZs. A generic approach was used with changes in the analysis based on best reflections of the RMZ and values. Forest Biodiversity, water related values (fish and Community Watersheds), Scenic areas and Visual Quality Objectives were all treated slightly differently. Because Old Growth Management Areas (OGMAs) are small and suffer inaccuracies when subject to the provincial raster data from Eng, the pine content of OGMAs was determined using the VRI and any OGMAs over a 30 percent pine threshold noted and included in the analysis. It is then assumed that 90 percent of the pine over age class 3 will be dead by 2020. This provides a crude assessment regarding the pine content of OGMAs. Individual OGMAs are not shown on maps, rather, a tally is kept for Landscape Units/BEC zones, and impacts are calculated and assessed per LU/BEC zone using total OGMA area and total pine, assuming 90 percent mortality of mature pine. In areas where there was a significant amount of non-forest within RMZ the ratios were considered for forest only. For example changes in VQO were based on forested area only so that area with grassland and rock were removed and then changes to forest component forecast. Changes to water related objectives (fish habitat and water for human use) were also isolated to the forested components within the assessment unit. In addition current condition of the forest (past harvesting) and future condition and regeneration were modeled.

STEP 2. Assess pine presence in the units and assess extent (area) of mortality in the context of past harvesting and disturbance. Rate the risk/ impact on objective/strategy.

All selected polygons (map units) are assessed for presence of pine or recent fires and assessment units. Areas without pine or recent fires are rated show no change and are rated low risk.

For those polygons with pine, the extent of pine and pine mortality are calculated using the 6 mortality classes from Eng *et al.* (2005). The six mortality classes are:

- 1) <1 percent
- 2) 1-10 percent,
- 3) 11-30 percent,
- 4) 31-50 percent
- 5) 51-70 percent
- 6) 71-100 percent

For an RMZ/polygon the total area of pine is multiplied by the percentage of dead pine within the RMZ (as per the mortality classes above) to find the percentage of the land area covered by dead pine. For Wildlife, Settlement, and Community Interface RMZs, this percentage was calculated using the entire RMZ area. For other values linked most

directly to forests, the percentage of land area affected is calculated relative to the total forested area within the RMZ. This is done for community watershed RMZs, fish RMZs, 3rd order watersheds, Visual Quality Objectives (VQOs) and Old Growth Management Areas (OGMAs) to ensure that risk to the value was not masked.

For community watershed RMZs, fisheries RMZs, and 3rd order watersheds (based on the watershed atlas watershed groupings), the total area within the RMZ in age class 1 (0-20 years) and age class 2 (21-40 years) that has not yet recovered hydrologically is added to the area covered by dead pine. The area of young forest in the polygon is important, as visual quality, wildlife habitat, and watershed hydrology all recover as stands age. Forest stands greater than age class 2 (more than 40 years old) are assumed to be hydrologically recovered. As mountain pine beetle or fire kills a forest stand, it will be set back to age class 1 (zero years of age). MOF (1999) describe recovery in terms of average canopy height and indicate that 90 percent recovery occurs when the average tree canopy has achieved 9 metres in height. For age class 1 (0 to 20 years) the mid point of the age class was used (10 years) and assigned 0 percent hydrologic recovery, age class 2 (21 to 40 years) assumed the mid point (30 years) and is assigned 75 percent hydrologic recovery. Once the area in the various age classes is identified, a rating is assigned to the entire unit. The maps for this analysis show early seral forest (<40 years of age, pro-rated for hydrologic recovery) resulting from past harvesting, as well as recent fires and dead pine within the forested area. This step was taken because it provides important insights regarding the watershed-level effects of mountain pine beetle. Some larger community watersheds are composed of several smaller watersheds, and the 3rd order watershed ratings show which portions of community watersheds and larger fish RMZs are most affected.

Watersheds are then categorized in a simple fashion based on a quasi-equivalent clear-cut area estimated solely from age class. It is recognized that slope, snow pack, roads and values at risk also inform on the sensitivity of watersheds, however at this strategic level these could not be assessed.

This estimate of ECA has some potential inaccuracies. Forest inventory in the database used may be inaccurate. As well, giving all age class 1 a 0 percent hydrologic recovery, and all age class 2 a 25 percent recovery is a simplification. To check how accurate this simplified calculation of ECA was, checks were made against detailed IWAPs in the government e-library of Watershed and Channel Assessments. A cursory check indicates that the results from the GIS analysis were within +/- 6 percent ECA around 80 percent of the time, which is reasonable for a strategic overview. Examples of potential data inaccuracies are found in IWAP comparison outliers such as Kamloops' Cornwall CWS, where the GIS analysis gives a 2005 ECA of 4 percent, while the 1997 IWAP gives the ECA as 36 percent, and the OSLRMP's Pennask Creek above the lake, which the GIS analysis shows as 7.5 percent ECA, while the 1997 IWAP shows a 24 to 27 percent ECA. An example of error from simplification of age class 2 recovery may be found in the Raft River results, where 2005 ECAs from the GIS analysis are around 10 percent lower than the IWAP results. One explanation for this outlier is that the main access road into the Raft basin was built in 1972, so much of the age class 2 is in the younger half of 21-40

years, and we gave it all a 30 yr average age. Equivalent Clearcut Areas in Community watersheds in the Kamloops LRMP appear to be underestimated by the GIS analysis for the 2005 base case more than the other categories of watersheds assessed

The spreadsheet used for this analysis is depicted below. Pine mortality is calculated for the present (2005) and for 2010, 2015 and 2020, and put into the categories described in Table 2 in this appendix. Whether the plan objectives are at risk of non-compliance is a qualitative judgement, and is discussed for each value/group of RMZs based on the current condition and the final predicted (worst case) condition.

Pine Volume has not been used directly in this analysis; however the model developed by Eng *et al.* (2005) links mortality to age class 4 and above, so areas that are shown as dead have pine volume and may be salvaged. It is assumed that provincially, 70 percent of the volume of dead pine that was planned for harvest over the next several decades will be salvaged in the short term (in the next 10 to 15 years). It is also assumed that higher volume stands, in general will be favoured for salvage over lower volume stands. The assessment described here therefore presumes salvage will occur, and indicates the degree to which other values are most likely affected by this salvage.

Ratings for Visual Quality Objectives (VQOs) depend on the total area in age class 1, as visual ‘green-up’ is assumed to occur once regenerated areas reach 20 years of age.

Table 1. Simplified Generic Interest/value Excel Spreadsheet (broken into two sections)

One spreadsheet was produced per value e.g. caribou, community watersheds

RMZ Map Label (name if possible)	Total area (ha)	Total Area of Forest (ha)	Total Area pine (ha)*	Area in age class 1 < 20 yrs** (ha)	25 percent of Area in age class 2 20-40 yrs***(ha)	Fire (ha)

* this follows MOFR Eng and means pine PI or Py in forest cover label.. Except for smaller RMZ (OGMAs) where VRI data is used.

** early seral stages (age class 1 and 2 are based on VRI data)

*** This column relates to hydrologic recovery where it is assumed there is 75 percent recovery of age class 2. The recovery is based on the height of regeneration at the mid point of the age class.

Table continued....

RMZ Map Label Name where possible	Cumulative ECA in 2005 (hectares, percent and ECA rating category (L,M,H,VH))	Sum of hectares affected			Rating: percent Area Affected or % ECA (L, M, H, VH, EH)			
		2010	2015	2020	2005	2010	2015	2020

Step 3 Map condition of affected units for 4 time periods: 2005, 2010, 2015, 2020.

A map is generated for each value or groups of values, and for each of the time periods (2005, 2010, 2015, 2020). Similar to the maps found in the LRMPs, the maps fit into a standard page size. Each RMZ is color coded according to the legend below. The risk rating depends on the value in question, which is why percent area affected is used as opposed to risk levels. The relative risk to the values is discussed in the section preceding the maps in the report.

Table 2. Map legend / ratings for Percent Area Affected

% of Area Affected or % ECA	Class definition	Map legend colors
Low	< 10%	
Moderate	11- 30%	
High	31-50%	
Very High	51 – 70%	
Extremely High	71%	

With respect to mountain pine beetle impacts, management options were summarized in five scenarios or options for next steps, some of which can be applied simultaneously. These scenarios are: 1) maintain the current situation as is (no change to the land use plan); 2) make minor changes to the plan to maintain plan relevance; 3) make significant changes to the plan to address risk and changes posed by MPB; 4) undertake minor initiatives outside the plan to sustain plan objectives; and, 5) undertake major initiatives outside the plan to sustain plan objectives

KRLMP Resource Management Zones and Watersheds Assessed

1. Water, Fish and Anadromous Fisheries
2. Ecosystems (Old Growth Management Areas)
3. Wildlife
4. Recreation and Tourism
5. Visually Sensitive Areas
6. Heritage Trails, Walk in Lakes

- 7. Settlement Resource Management Zones
- 8. Protection RMZs

STEP 1. List all areas and then remove those without pine.

1. Water, Fish and Anadromous Fisheries Assessed for Pine Presence

A. Community Watersheds

W1	Avola Creek	W8a,b	Lac Le Jeune	W15	Rosen Creek
W2	Cornwall Creek	W9	Leonie Creek	W16	Resort Creek
W3	Currie Brook	W10*, P1b	Lopez Creek	W17	Russell Creek
W4	Gill Creek	W11	McDougall Creek	W18	Skowootum Creek
W5*	Guichon Creek	W12	Nelson Creek	W19	Toops Creek
W6	Hascheak Creek	W13, P15,P25	Paul Lake	W20, P11b	Tranquille Creek
W7	Jimmies Creek	W14	Peterson Creek	W21	White River

*Removed CWS, included in the analysis.

B. Significant Watershed Sensitivity Appendix 1 Watersheds

Watershed	Issues
Fage Creek	Domestic water
Finn Creek	Salmon
Gold Creek	Fisheries
Huihill Creek	Fisheries
Scotty Creek	Domestic water
Raft River	Fisheries
Upper Adams	Fisheries
Barriere River	Fisheries, domestic water
Otter Creek	Fisheries
Bonaparte River	Fisheries, domestic and irrigation water
Deadman River	Fisheries, domestic and irrigation water

C. The District Manager Policy letter of 2003 had the following additions to Community Watersheds and Appendix 1:

- Spapilem
- Cahillity
- Demers
- Heffley

TFL 35 various
Lemieux Cr
Martin Mtn
Louis Cr

D. The following is a list of anadromous fish streams identified by Fisheries and Oceans.

These watersheds were assessed:

Adams River
 Hiuihill Cr
 Nikwikwaia Cr lower
Albreda River
Barrier
 Harper
 Haggard
 Fennell Cr
Blue River
Clearwater River
Deadman
 Cris Cr
Dunn Cr
 McTaggart Cr
 Joseph Cr
Lemieux Cr
Louis Cr
 MacGillivray Cr
 Christian Cr
Mahood River
Mann Cr
Momich Cr
 Cayenne Cr
North Thompson River
Medium tributaries
Raft River
Sinmax Cr
South Thompson River
 Medium tribs
Thompson River
 Tranquille River
Upper Adams River
Burton Cr

2. Ecosystems (Old Growth Management Areas)

Units of assessment: LU/BEC

Using OGMA polygons and VRI data, identify pine within OGMA greater age class 3.

Sum total area in OGMA and total area in pine age class 3 + and assign percentages.

Show LU/BEC maps ranked to amount of area affected as per Table 2.

OGMAs greater than 30 percent bring into matrix step 2.

3. Wildlife

Units of assessment (Caribou has 33 assessment units while other wildlife habitat areas have one each)

H1	North Thompson Caribou (General)	H8	North Blue Caribou
H2	Alan Creek Caribou	H9	Thunder Caribou
H3	Bischoff Caribou	H10	Battle Bluffs Wildlife Habitat
H4	Bone Caribou	H11	Skull Wildlife Habitat
H5	Clemina Caribou	H12	Skwilatin Wildlife Habitat
H6	North Thompson Glacier Caribou	H13	Dewdrop-Rousseau Wildlife Management Area
H7	Smoke Caribou	H14	Skull Wildlife Management Area

Critical Mule deer winter range RMZ

Critical Moose winter range RMZ

4. Recreation and Tourism RMZ

Units of Assessment Are:

- R1. Alan Creek
- R2. Bischoff
- R3. Blustery
- R4. Bone
- R5. Clemina
- R6. Lac le Jeune
- R7. North Thompson Glacier (including McAndrew Lake)
- R8. Smoke
- R9. Taweel
- R10. Thompson and South Thompson Rivers
- R11. Tod Mountain - outside the Controlled Recreation Area
- R12. Tod Mountain - Controlled Recreation Area
- R13. Lakes Areas

5. Visually Sensitive Areas,

Units of Assessment are:

- VQOs
- Retention

6. Class A and B Lakes (Includes walk-in lakes)

A list of Class A and B Lakes was developed, then a 200 meter radius was applied and pine content was ranked from highest to lowest.

7. Settlement Resource Management Zones

Ashcroft	Clearwater	Monte Creek
Ashcroft Manor	Duck Range	North of Heffley Creek
Avola	East Clearwater	Paul Lake
Barriere	Heffley Creek	Pinantan
Blackpool	Knustsford	Pritchard
Blue River	Lac Le Jeune	Savona
Boston Flats	Logan Lake	Six Mike
Cache Creek	Louis Creek	Sullivan (Knouff) Lake
Campbell Creek	McLure	Sunshine Valley
Cherry Creek	Martin Prarie	Vinsula/Black Pines
City of Kamloops	Mesa Vista	

9. Protection RMZs

P1. Arrowstone
P2. Blue Earth
P3. Bonaparte
P4. Caverhill High Basin
P5. Clearwater River Corridor
P6. Cornwall
P7. Dunn Peak
P8. Elephant-Rattlesnake
P9. Emar
P10. Guichon
P11. Lac du Bois
P12. McConnell Lake
P13. Momich
P14. Oregon Jack
P15. Paul Lake Extension
P16. Porcupine
P17. Roche Lake
P18. Taweel
P19. Trophy Mountain
P20 Two Spring
P21. Upper Adams
P22 LacLeJeune
P23 Niskonlith
P24 North Thompson
P25 Paul Lake
P26 Roderick Haig Brown
P27 Spahts Cr

Appendix 7: Fully Documented GIS Analysis Package

By Bruce Rea, GIS Analyst, March 29, 2006

Background

The assessment is strategic and shows quantitatively and qualitatively how plan values and their related objectives and strategies are affected by changes in forest age classes and composition resulting from the death of forest stands from recent forest fires and from mountain pine beetle attack on lodgepole and ponderosa pine. The results provide insight on where and to what extent interests and values in an LRMP are affected.

The strategic overview uses data from Eng et al. (2005) to describe the extent of pine mortality within RMZs over four time periods: current (2005), 2010, 2015 and 2020. The mountain pine beetle epidemic is expected to be over before 2020 and thus the final map will show the final extent of pine mortality –pine (age class two and younger) is assumed to survive.

Purpose/Goal of Analysis

This information is shown on a map time series for each value or set of values. We will Create maps illustrating areas of concern and the level of potential impact from the Mountain Pine Beetle. Four time periods will be mapped: 2005, 2010, 2015 and 2020. The maps will be used to identify where efforts may best be focused to mitigate the damage from this infestation. Spreadsheets will accompany the maps and will indicate in detail how much land is impacted by the MPB, and the status (RMZs, tenures etc) of the land in the area of interest.

Products to be Delivered

Arc/Info coverages in Export format including: Resultant datasets and final datasets holding statistics.

8 ½ x 11 inch maps of LRMP objectives and associated data.

Analytical results in Spreadsheets for each RMZ, etc. analysis.

Workplan

Identify spatial data from LRMP processes; merge them with necessary spatial data, including Marvin Eng's Mountain Pine Beetle Cumulative Kill Models and recent fire datasets. Run these through a formulated analysis and tabulate results.

Project Initiation

- Discussions with client to clarify what the project should deal with
- Identify opportunities for provincial coordination
- Identify what data requirements are.
- Review proposed methodologies with client.

Data Preparation

1. Vegetation Resource Inventory

- Extract the VRI from the LRDW. Extract Polylyayer table

2. Marvin Eng's Data Models

- Contact Marvin Eng, identify datasets necessary for completion of project
- Acquire associated metadata to understand and manipulate correctly the data received from Marvin Eng

3. Acquire LRMP Data

- Determine and acquire all necessary LRMP associated datasets

Project Diary / Log

This project is split between two LRMP areas, Kamloops and the Okanagan-Shuswap. Techniques will be similar between the two analyses.

Example:

Project Initiation

Data Acquisition

- Completed data acquisition for all LRMP objectives represented with spatial datasets

Data preparation

Vegetation Resource Inventory (VRI)

Used the AML main_1.aml to extract the VRI data from the LRDW, joined Polylyayer tables to polygon attribute table. Appended Kamloops and Clearwater FDs for Kamloops LRMP and Salmon Arm, Vernon and Penticton FDs for Okanagan-Shuswap LRMP.

Marvin Eng Data

Converted ASCII files received from Marvin Eng to GRID, then to polygon topology.

Altering Grid Codes

All of Eng's datasets required their Grid-Code altered so not to be lost in merging of datasets

Assemble Resultant

Aml was written called ENG_UNION.AML to complete the data preparation. It will output the resultant coverages ready for further calculations. The aml takes all the

coverages topologically combines them and adds items for statistical calculations. A mirrored coverage consisting of just RMZ linework holds the items of which subtotals are calculated to from the mast resultant coverage. This creates a “flat” file of which is converted to a dbase file and submitted in Excel format. The following describes the steps taken to develop the results in the final spreadsheets:

After the conversion of Eng’s data and subsequent ITEM unique naming of Grid Codes, we assigned ‘Severity Midpoints’ to Cumulative2005, 2010, 2015 and 2020 datasets for values falling within these classes:

```

grid-code = 0 calc cu percentnum percent-ptcat = '0 percent'
grid-code < 10 and grid-code > 0      calc cu percentnum percent-ptcat = '<1
percent'
grid-code >= 10 and grid-code <= 100  calc cu percentnum percent-ptcat = '1-10
percent'
grid-code > 100 and grid-code <= 300  calc cu percentnum percent-ptcat = '11-30
percent'
grid-code > 300 and grid-code <= 500  calc cu percentnum percent-ptcat = '31-50
percent'
grid-code > 500 and grid-code <= 700  calc cu percentnum percent-ptcat = '51-70
percent'
grid-code > 700 and grid-code <= 1000 calc cu percentnum percent-ptcat = '71-100
percent'

```

Merged all of Marvin Eng’s datasets into one dataset, including volume of forest, volume of pine, age of forest, inventory groups, and habitat.

Merged this dataset with Fire Polygons current to October 2003.

Forest Age Classes were classified according to MOF standards and polygons with Fire records were classes as Age Class 1.

```

age-code >= 1 and age-code <= 20      calc age_class = 1
age-code > 20 and age-code <= 40      calc age_class = 2
age-code > 40 and age-code <= 60      calc age_class = 3
age-code > 60 and age-code <= 80      calc age_class = 4
age-code > 80 and age-code <= 100     calc age_class = 5
age-code > 100 and age-code <= 120    calc age_class = 6
age-code > 120 and age-code <= 140    calc age_class = 7
age-code > 140 and age-code <= 250    calc age_class = 8
age-code > 250                        calc age_class = 9

```

Here we set the New Age Class to 1 where fires occurred in forested areas and set the volume of forest to zero where fires occurred. If the original Age Class was zero where a fire occurred we set the New Age Class back to zero.

```

calc newage_cls = age_class
resel fire_number <> ''
resel vol-code > 0
calc vol-code = 0
calc volp-code = 0
calc newage_cls = 1
resel age_class = 0
calc newage_cls = 0

```

We then used these midpoints to calculate the area of pine projected to be killed by the model based upon the volume of pine divided by the Total Forest volume within each polygon. We first selected polygons that fell within climates suitable to pine (hab-code = 1)

```

    cu percentnum percent-ptcat = '<1 percent'      calc cu percentnum
percent-sv1mp = 0.005
    cu percentnum percent-ptcat = '1-10 percent'    calc cu percentnum
percent-sv2mp = 0.05
    cu percentnum percent-ptcat = '11-30 percent'   calc cu percentnum
percent-sv3mp = 0.20
    cu percentnum percent-ptcat = '31-50 percent'   calc cu percentnum
percent-sv4mp = 0.40
    cu percentnum percent-ptcat = '51-70 percent'   calc cu percentnum
percent-sv5mp = 0.60
    cu percentnum percent-ptcat = '71-100 percent'  calc cu percentnum
percent-sv6mp = 0.85

```

```

hab-code = 1, volp-code > 0
calc pine_mult = ( volp-code / vol-code )
calc pine_ha = ( area * pine_mult ) / 10000

```

```

    cu percentnum percent-ptcat = '<1 percent'
    calc cu percentnum percent-sv1ha = cu percentnum percent-sv1mp *
pine_ha
    cu percentnum percent-ptcat = '1-10 percent'
    calc cu percentnum percent-sv2ha = cu percentnum percent-sv2mp *
pine_ha
    cu percentnum percent-ptcat = '11-30 percent'
    calc cu percentnum percent-sv3ha = cu percentnum percent-sv3mp *
pine_ha
    cu percentnum percent-ptcat = '31-50 percent'
    calc cu percentnum percent-sv4ha = cu percentnum percent-sv4mp *
pine_ha
    cu percentnum percent-ptcat = '51-70 percent'
    calc cu percentnum percent-sv5ha = cu percentnum percent-sv5mp *
pine_ha
    cu percentnum percent-ptcat = '71-100 percent'
    calc cu percentnum percent-sv6ha = cu percentnum percent-sv6mp *
pine_ha

```

After calculating and summing item values, we then calculated the Equivalent Clearcut Area using either the following for Watersheds:

```

calc cls2_25per = 0
calc cls2_25per = ( cls_1_2_ha - cls_1_ha ) * .25
calc cu05eca_ha = cu05-sumha + cls_1_ha + cls2_25per
calc cu10eca_ha = cu10-sumha + cls_1_ha + cls2_25per
calc cu15eca_ha = cu15-sumha + cls_1_ha + cls2_25per
calc cu20eca_ha = cu20-sumha + cls_1_ha + cls2_25per

```

```

calc cu05ecaper = ( cu05eca_ha / totfor_ha ) * 100
calc cu10ecaper = ( cu10eca_ha / totfor_ha ) * 100
calc cu15ecaper = ( cu15eca_ha / totfor_ha ) * 100
calc cu20ecaper = ( cu20eca_ha / totfor_ha ) * 100

```

Or, used the following for remaining RMZ values:

```

calc cls2_25per = 0
calc cls2_25per = ( cls_1_2_ha - cls_1_ha ) * .25
calc cu05eca_ha = cu05-sumha + fire_ha
calc cu10eca_ha = cu10-sumha + fire_ha
calc cu15eca_ha = cu15-sumha + fire_ha
calc cu20eca_ha = cu20-sumha + fire_ha
calc cu05ecaper = ( cu05eca_ha / totfor_ha ) * 100
calc cu10ecaper = ( cu10eca_ha / totfor_ha ) * 100
calc cu15ecaper = ( cu15eca_ha / totfor_ha ) * 100
calc cu20ecaper = ( cu20eca_ha / totfor_ha ) * 100

cu05ecaper <= 10          calc cu05ecacat = 'LOW'
cu05ecaper > 10 and cu05ecaper <= 30  calc cu05ecacat = 'MODERATE'
cu05ecaper > 30 and cu05ecaper <= 50  calc cu05ecacat = 'HIGH'
cu05ecaper > 50 and cu05ecaper <= 70  calc cu05ecacat = 'VERY HIGH'
cu05ecaper > 70          calc cu05ecacat = 'EXTREMELY
HIGH'
cu10ecaper <= 10          calc cu10ecacat = 'LOW'
cu10ecaper > 10 and cu10ecaper <= 30  calc cu10ecacat = 'MODERATE'
cu10ecaper > 30 and cu10ecaper <= 50  calc cu10ecacat = 'HIGH'
cu10ecaper > 50 and cu10ecaper <= 70  calc cu10ecacat = 'VERY HIGH'
cu10ecaper > 70          calc cu10ecacat = 'EXTREMELY
HIGH'
cu15ecaper <= 10          calc cu15ecacat = 'LOW'
cu15ecaper > 10 and cu15ecaper <= 30  calc cu15ecacat = 'MODERATE'
cu15ecaper > 30 and cu15ecaper <= 50  calc cu15ecacat = 'HIGH'
cu15ecaper > 50 and cu15ecaper <= 70  calc cu15ecacat = 'VERY HIGH'
cu15ecaper > 70          calc cu15ecacat = 'EXTREMELY
HIGH'
cu20ecaper <= 10          calc cu20ecacat = 'LOW'
cu20ecaper > 10 and cu20ecaper <= 30  calc cu20ecacat = 'MODERATE'
cu20ecaper > 30 and cu20ecaper <= 50  calc cu20ecacat = 'HIGH'
cu20ecaper > 50 and cu20ecaper <= 70  calc cu20ecacat = 'VERY HIGH'
cu20ecaper > 70          calc cu20ecacat = 'EXTREMELY
HIGH'

```

OGMAs and Class 'A' and 'B' Lakes Resultants

OGMAs and Class A and B Lakes (buffered 200m) were merged with VRI and calculated as to how much susceptible pine exists within each polygon by percentage of area of polygon. Only the Buffer area of the Class A and B lakes was used for accurate pine percentage. Ratings were developed similar to the standard divisions established for all other datasets.

Susceptible Pine was considered as: PL (Lodgepole Pine) or PY (Ponderosa Pine) Species 1 >= 30 percent and Projected Age >= 40 years.

OGMAs were totalled for each Landscape Unit within the LRMP areas and percentage susceptible pine per OGMA total area per Landscape Unit was mapped.

Create Derived Coverage

Derived Coverages include all of the output subtotals from the resultant merged datasets. These derived coverages are clean linework datasets, RMZ polygon linework only, containing item values used for the reports. The following are the final datasets used in tabulations:

A_STATS, B_STATS, CANC_STATS, CWS_STATS, DEER_STATS,
HAB_STATS, LU_STATS, MOOSE_STATS, NEWCAR_STATS,
OGMA_PINE, OGMA_STATS, OGPINE_LU, OP_STATS, PARKS2_STATS
RETO_STATS, SET_STATS, SHEDS_STATS, VQO_LU, VQO_STATS
X_WSA_STATS

Produce Statistical Report

Spreadsheets produced using Frequency commands to pull the necessary Items and values from each dataset in a standardized order. Except for OGMAs and Class A and B Lakes, which were run through a separate analysis using VRI alone.