

**BRITISH COLUMBIA
MINISTRY OF FORESTS**

Revelstoke Timber Supply Area

Rationale for Allowable Annual Cut (AAC) Determination

Effective January 1, 2000

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Objective of this document

This document is intended to provide an account of the factors I have considered and the rationale I have employed as chief forester of British Columbia in making my determination, under Section 8 of the *Forest Act*, of the allowable annual cut (AAC) for the Revelstoke timber supply area (TSA). This document also identifies where new or better information is needed for incorporation into future determinations.

Description of the Revelstoke timber supply area

The Revelstoke timber supply area is situated in the northwest portion of the Nelson Forest Region and is administered by the B.C. Forest Service (BCFS) Columbia Forest District office in Revelstoke.

The Columbia Forest District comprises a large area including two TSAs (Golden and Revelstoke), Tree Farm Licences (TFL) 55 and 56, portions of Tree Farm Licence #23, Mt. Revelstoke National Park, and Glacier National Park. The Trans-Canada Highway and a major railway pass through the southern portion of the TSA and provide relatively easy access to an area of outstanding mountain scenery.

The Revelstoke TSA is within the traditional lands of the Ktunaxa/Kinbasket Nation, Okanagan and the Shuswap Nations. There are no First Nation reserve communities within the TSA.

As stated in the 1998 Revelstoke timber supply analysis report, the TSA covers 501 471 hectares. The terrain of the TSA is rugged and mountainous, with less than half classified as productive forest land. Because of factors including operability, environmental sensitivity and lower timber quality, the timber harvesting land base currently represents less than one third of the productive forest land base.

Three major biogeoclimatic zones occur within the TSA. They are the Alpine Tundra Zone (29 percent of the total TSA land base); the Interior Cedar-Hemlock Zone (32 percent); and the Englemann Spruce-Subalpine Fir Zone (38 percent). The main commercial tree species include Englemann spruce, subalpine fir (balsam), western hemlock, western redcedar, and Douglas-fir.

The diverse forest environments provide habitat for a wide variety of wildlife species. Some of the more well-known large mammal species include black bear, grizzly bear, moose, elk, mule deer, mountain goat, and mountain caribou.

The economy is relatively well diversified with the predominant employment sectors being forestry, tourism and the public service. The forest industry provides a substantial source of revenue and employment in the TSA. In 1991, the forest sector accounted for 20 percent of the TSA's total employment. Timber processing facilities include three sawmills, two cedar shake and shingle mills, and a pole yard in the city of Revelstoke.

AAC Rationale for Revelstoke TSA

The TSA area is sparsely populated, and approximately 90 percent of its 8640 residents (1996 census) live in the city of Revelstoke.

The major forest licensees in the TSA are Joe Kozek Sawmills Ltd., Bell Pole Company Ltd. and Downie Street Sawmills Ltd. Between 65 and 85 percent of the timber harvested in the TSA is milled locally; the remaining timber is shipped out in the form of pulpwood. Additional timber from outside the TSA is also secured to meet the timber requirements of local mills.

History of the AAC

In 1981, the total land base for the TSA was 248 619 hectares—about half the present figure. At that time an analysis was completed which resulted in the determination of an allowable annual cut (AAC)—for this smaller area—of 130 000 cubic metres. Since that time various factors, including the addition of area to the TSA from Tree Farm Licence (TFL) 23 in 1985 resulted in an increase in AAC of 139 000 cubic metres. From 1985 to 1994, the AAC for the TSA was set at 269 000 cubic metres.

In 1995 the present AAC of 230 000 cubic metres, was determined and is currently apportioned by the Minister of Forests as follows:

Apportionment	cubic metres/year	percent of AAC
Replaceable forest licences (3)	169 603	73.7
Timber sales licences < 10,000 m ³ /yr (4)	12 901	5.6
Small business forest enterprise program (category 1 and 2)	42 841	18.7
Forest Service Reserve	4 655	2.0
Total AAC	230 000	100.0

New AAC determination

Effective January 1, 2000, the new AAC for the Revelstoke TSA will be 230 000 cubic metres, the same as the current AAC. This new AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Information sources used in this AAC determination

- *Revelstoke MAC Strategy. A Spatially Explicit Timber Supply Analysis for TFL 56. ATLAS Modelling Results, Silvitech Consulting Ltd., March 29, 1998.*

AAC Rationale for Revelstoke TSA

- *Revelstoke Timber Supply Area (TSA) Data Package and Information Report*, British Columbia Forest Service (BCFS), November 1997;
- *Revelstoke TSA Analysis Report*, BCFS, December 1998;
- *Revelstoke TSA Public Discussion Paper*, BCFS, December 1998;
- *Revelstoke TSA Summary of Public Input on Data Package and TSA Analysis Report*, BCFS, April 1998 (draft);
- *Revelstoke TSA Inventory Audit*, BCFS Resources Inventory Branch, February 1997;
- *Revelstoke Timber Supply Analysis*, BCFS, June 1993;
- *Revelstoke TSA Rationale for AAC determination*, BCFS, August 26, 1994;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Act Regulations and Amendments*, April 1995;
- *Forest Practices Code of British Columbia Guidebooks*, BCFS and MELP;
- *Forest Practices Code Timber Supply Analysis*, BCFS and MELP, February 1996;
- *Kootenay/Boundary Land Use Plan Implementation Strategy*, Kootenay Inter-Agency Management Committee, June 1997;
- *Working Paper 36/1998, Site Index Adjustments for Old-Growth Stands based on Veteran Trees*, Nigh, G.D., BCFS Research Branch, 1998;
- *Working Paper 37/1998, Site Index Adjustments for Old-Growth Stands Based on Paired Plots*, Nussbaum, A.F., BCFS Research Branch, 1998;
- Letter from the Minister of Forests to the chief forester, dated July 28, 1994, stating the Crown's economic and social objectives for the province;
- Memorandum from the Minister of Forests to the chief forester, dated February 26, 1996, stating the Crown's economic and social objectives for the province regarding visual resources;
- Letter from the Deputy Ministers of Forests and Environment, Lands and Parks, dated August 25, 1997, conveying government's objectives regarding the achievement of acceptable impacts on timber supply from biodiversity management; and,
- Technical review and evaluation of current operating conditions through comprehensive discussions with staff of the BCFS and MELP, including the AAC determination meeting held in Revelstoke, April 14 and 15, 1999.

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires the chief forester to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis, and the inventory and growth and yield data used as inputs to the analysis, typically form the major body of technical information used in AAC determinations. Timber supply analyses and associated inventory information are concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

However, the analytical techniques used to assess timber supply are necessarily simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variations in physical, biological and social conditions, although ongoing science-based improvements in the understanding of ecological dynamics will help reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide complete answers or solutions to forest management problems such as AAC determinations. The information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information required to be considered in AAC determinations.

In making the AAC determination for the Revelstoke TSA, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining AACs for timber supply areas and tree farm licences. Section 8 is reproduced in full as Appendix 1.

Guiding principles for AAC determinations

Rapid changes in social values and in our understanding and management of complex forest ecosystems mean that there is always some uncertainty in the information used in AAC determinations. In making a large number of determinations for many forest management units over extended periods of time, administrative fairness requires a reasonable degree of consistency of approach in incorporating these changes and uncertainty. To make my approach in these matters explicit, I have set out the following body of guiding principles. If in some specific circumstance it may be necessary to deviate from these principles, I will provide a detailed reasoning in the considerations that follow.

Two important ways of dealing with uncertainty are:

- (i) minimizing risk, in respect of which in making AAC determinations, I consider the uncertainty associated with the information before me, and attempt to assess the various potential current and future social, economic and environmental risks associated with a range of possible AACs; and
- (ii) redetermining AACs frequently, to ensure they incorporate current information and knowledge—a principle that has been recognized in the legislated requirement to redetermine AACs every five years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that Section 8 of the *Forest Act* requires me to take into account in determining AACs, I attempt to reflect as closely as possible operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect either to factors that could work to increase the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or to factors that could work to reduce the timber supply, such as integrated resource management objectives beyond those articulated in current planning guidelines or the Forest Practices Code (the Code).

The *Forest Practices Code of British Columbia Regulations* were approved by the Lieutenant Governor in Council on April 12, 1995, and released to the public at that time. The *Forest Practices Code of British Columbia Act* was brought into force on June 15, 1995.

Although the Code is now fully implemented following the end of the transition period on June 15, 1997, the timber supply implications of some of its provisions, such as those for landscape-level biodiversity, still remain uncertain, particularly when considered in combination with other factors. In each AAC determination I take this uncertainty into account to the extent possible in context of the best available information.

As British Columbia progresses toward the completion of strategic land use plans, the eventual timber supply impacts associated with land-use decisions resulting from the various planning processes—including the Commission on Resources and Environment (CORE) process for regional plans, the Protected Areas Strategy, and Land and Resource Management Planning (LRMP) process—are often discussed in relation to current AAC determinations. Since the outcomes of these planning processes are subject to significant uncertainty before formal approval by government, it has been and continues to be my position that in determining AACs it would be inappropriate for me to attempt to speculate on the timber supply impacts that will eventually result from land-use decisions not yet taken by government. Thus I do not account for possible impacts of existing or anticipated recommendations made by such planning processes, nor do I attempt to anticipate any action the government could take in response to such recommendations.

Moreover, even where government has made a formal land-use decision, it may not always be possible to fully analyze and account for the consequent timber supply impacts in a current AAC determination. In many cases, government's land-use decision must be followed by a number of detailed implementation decisions. For example, a land-use decision may require the establishment of resource management zones and resource management objectives and strategies for these zones. Until such implementation decisions are made it would be impossible to fully assess the overall impacts of the land-use decision. Nevertheless, the legislated requirement for five-year AAC reviews will ensure that future determinations address ongoing plan implementation decisions. However, where specific protected areas have been designated by legislation or by order in council, these areas are deducted from the timber harvesting land base and are no longer considered to contribute to the timber supply in AAC determinations.

In the Revelstoke TSA, clarification has been provided on many aspects of land and resource use by government's approval in 1995 of the Kootenay-Boundary Land-Use Plan and a follow-up Implementation Strategy. Government has also made decisions on protected areas.

In addition, in 1995 the Revelstoke and Area Land-Use Planning Minister's Advisory Committee (MAC) was created to make recommendations to government on how the Kootenay-Boundary Land-Use Plan should be implemented locally in the Revelstoke area. The MAC plan has not yet been approved by government and until such time, only practices that have been approved and implemented will be reflected in the timber supply review, along with changes to the land base resulting from government's establishment of new protected areas.

Forest Renewal BC is funding a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. As with all components of my determinations, I require sound evidence before accounting for the effects of intensive silviculture on possible harvest levels. Nonetheless, I will consider information on the types and extent of planned and implemented practices as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of any timber supply effects of intensive silviculture.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data created the extensive delays that resulted in the urgency to redetermine many outdated AACs between 1992 and 1996. In any case, the data and models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, I should immediately reduce some AACs in the interest of caution. However, any AAC determination I make must be the result of applying my judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations' issues, I am aware of the Crown's legal obligations resulting from recent decisions including those in the Supreme Court of Canada. The AAC that I determine should not in any way be construed as limiting the Crown's obligations under these decisions, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the Revelstoke TSA. It is also independent of any decision by the Minister of Forests with respect to subsequent allocation of the wood supply.

Overall, in making AAC determinations, I am mindful of my obligation as steward of the forest land of British Columbia, of the mandate of the Ministry of Forests as set out in Section 4 of the *Ministry of Forests Act*, and of my responsibilities under the *Forest Practices Code of British Columbia Act*.

The role of the base case

In considering the factors required under Section 8 of the *Forest Act* to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review program for TSAs and TFLs.

For each AAC determination for a TSA, a timber supply analysis is carried out using data and information from three categories—land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model (FSSIM), a series of timber supply forecasts is produced, reflecting different decline rates, initial harvest levels, and potential trade-offs between short- and long-term harvest levels.

From this range of forecasts, one is chosen which attempts to avoid excessive changes from decade to decade and significant timber shortages in the future, while ensuring the long-term productivity of forest lands. This is known as the "base case" forecast, and forms the basis for comparison when assessing the effects of uncertainty on timber supply.

Because it represents only one in a number of theoretical forecasts, and because it incorporates information about which there may be some uncertainty, the base case forecast for a TSA is not an AAC recommendation. Rather, it is one possible forecast of timber supply, whose validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer simulation used to generate it.

Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using currently available information about forest management, which may well have changed since the original information package was assembled. Forest management data is particularly subject to change during periods of legislative or regulatory change, such as the enactment of the Forest Practices Code, or during the implementation of new policies, procedures, guidelines or plans.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgement and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. Judgements that may be based in part on uncertain information are essentially qualitative in nature and, as such, are subject to an element of risk. Consequently, once an AAC has been determined, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined.

Base case for the Revelstoke TSA

The base case in the 1998 timber supply analysis incorporates a number of significant changes from the base case that was generated in the 1993 analysis used in the previous 1994 AAC determination. The specific assumptions used in this analysis are discussed in detail in the considerations presented below in the appropriate sections of this document. In overview, they include changes incorporated to reflect the following:

- the Forest Practices Code, including provisions for both stand- and landscape-level biodiversity have been factored into the analysis (in the previous determination, the Code was not in effect);
- the Kootenay-Boundary Land Use Plan Implementation Strategy (June 1997) was approved by the provincial government and now guides current management practices (although some further direction is expected as a result of government's consideration of the MAC recommendations);
- the results of new forest cover inventory, completed in 1997;
- an updated assessment of the operable area (the area considered to be economically and physically feasible to harvest);
- revisions to the estimate of annual unsalvaged losses;
- the results of an inventory audit for the Revelstoke TSA, completed in 1997;

- improved volume estimates for both existing mature and regenerated stands;
- an updated timber supply model (new version of FSSIM) capable of tracking multiple forest management objectives; and
- an updated analytical approach including assessment of how areas outside of the timber harvesting land base contribute to achievement of non-timber resource objectives such as management of biodiversity.

With these changes and other appropriate factors incorporated, a “base case” was generated and submitted for public review, as follows:

The “base case” forecast projected an initial harvest level of 230 000 cubic metres—the same as the current AAC. In the base case this initial harvest level is maintained for 40 years followed by a gradual decline over the subsequent 40 years to a long-term harvest level of 159 000 cubic metres per year.

The removal of two woodlot licences from the TSA was accounted for in the previous AAC determination. As no new woodlot licences have been issued since the last AAC determination, no adjustments were applied to the base case for woodlot licences.

In addition to the base case, I was also provided with a number of sensitivity analyses and projections of alternative harvest flows carried out using the base case as a reference. All of these analyses have been of assistance to me in considering the factors leading to my determination.

Consideration of Factors as Required by Section 8 of the *Forest Act*

Section 8 (8)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvest

- *general comments*

The total area of the Revelstoke TSA is 501 471 hectares, as estimated from a computer file compiled in 1997 by the BCFS. The file was updated to 1994 to account for disturbances and the details were reported in the December 1998 timber supply analysis. Of this, 221 477 hectares (about 44 percent) are considered productive forest.

As part of the process used to define the timber harvesting land base (i.e. the land base estimated to be economically and biologically available for harvesting), a series of deductions were made from the productive forest land base. These deductions account for the factors that effectively reduce the suitability or availability of the productive forest area for economic or ecological reasons. In timber supply analysis, assumptions, and if necessary, projections, must be made about these factors prior to quantifying appropriate areas to be deducted from the productive forest area in order to derive the timber harvesting land base.

A detailed accounting of the areas deducted is summarized in Table 3 of the timber supply analysis report. After the deductions, the current timber harvesting land base for the Revelstoke TSA was estimated to be 67 667 hectares—30.6 percent of the productive area, or about 13.5 percent of the total TSA area.

This represents about 4 942 hectares of more area than was used in the 1993 timber supply analysis to define the timber harvesting land base. This increase is largely due to a recent re-inventory (discussed further below, under *current inventory*) which resulted in additional areas being reclassified as productive forest.

- physical and economic operability

In the Revelstoke TSA, the area available for timber harvesting is limited by steep and unstable terrain, environmental sensitivity, the avalanche areas, non-merchantable forest types, and by demands on operable (as well as inoperable) areas for other forest values. Those portions of the TSA which are not physically accessible for harvesting, or which are not economically feasible to harvest, do not contribute to the timber harvesting land base. In the analysis, a total of 120 376 hectares were classified as inoperable and did not contribute to the timber harvesting land base.

As was noted in the 1994 determination for the Revelstoke TSA, operability was to be re-assessed prior to the next timber supply analysis. District staff examined operability in 1997 (mainly map review with limited ground-checking). The review included an assessment of areas that might be accessible using skyline or helicopter yarding. Although some stands were identified as potentially suitable for skyline systems, the terrain was often found to physically limit any type of harvesting operations and little or no performance has been reported in these areas. Therefore, these potentially accessible areas did not contribute to the timber harvesting land base.

Public input included concerns about the accuracy of the 1989 operability study and a desire for a more comprehensive review of operability. A licensee suggested that some of the areas identified as potentially accessible using skyline or helicopter harvesting systems should be included in the timber harvesting land base.

Although skyline and helicopter systems have been utilized in the TSA, generally they have been used in areas where conventional harvesting systems have been used successfully. Therefore, it is reasonable to assume that the additional areas do not contribute to the timber harvesting land base at this time, although they do represent a future opportunity and could be considered in future timber supply analyses if performance is demonstrated in these areas.

Since the 1997 operability review, district staff have again reviewed operability, specifically in a number of potentially difficult operating areas. During a recent helicopter overview flight of the TSA, I examined many of these areas and concluded that about 3785 hectares (about six percent) of the timber harvesting land base are not likely to be economically feasible to harvest due to extensive and difficult road access combined with lower stand merchantability.

A sensitivity analysis showed that a seven percent reduction to the timber harvesting land base reduces the time to the decline projected in the base case by one decade. Since the sensitivity analysis reduced the land base proportionally across all site productivity classes (good, medium, poor), it is reasonable to conclude that the impact of removing the areas in question—which are predominantly poorer productivity sites—would have even less impact than implied by the sensitivity analysis. I have considered the likely overestimation of the timber harvesting land base as further discussed below, in my “Reasons for Decision”.

Prior to the next timber supply analysis, district staff will continue to monitor the economic and physical operability of stands on the TSA to better update operability on a yearly basis. Given the uncertainty regarding operability, this information will be important for the next determination.

- environmentally sensitive areas

Environmentally sensitive areas (ESAs) in the Revelstoke TSA were updated based on photography taken in 1991 and 1992 as part of the forest cover re-inventory project. Based on high environmental sensitivity and limited harvesting activity occurring in these areas, a reduction factor of 90 percent was applied to ESAs identified with highly sensitive soils and regeneration concerns. This resulted in 12 822 hectares, or 5.8 percent of the productive forest not contributing to timber supply. In the analysis, 10 467 hectares classified as Es1 (unstable terrain), 12 hectares classified as Ea1 (high avalanche hazard) and 2 343 hectares classified as Ep1 (high regeneration difficulty), were excluded from the timber harvesting land base.

ESAs classified with moderate environmental sensitivity were not excluded from the timber harvesting land base. Having reviewed and discussed this approach with District staff, I have concluded that some amount of reduction should apply to the ESA-2 category to reflect the likelihood that some of the area in this category will be unavailable for timber harvesting. Although the appropriate reduction is difficult to estimate with certainty, I note that at least a ten percent reduction is applied to ESA-2 areas in timber

supply analyses of many other areas of the province. I consider it reasonable to do so here as well. The total area classified as moderately sensitive is about 11 315 hectares—7209 hectares for soils and 4106 hectares for areas with potential regeneration problems. After accounting for any potential overlap with other land base reductions and applying a 10-percent reduction factor to these areas, I conclude that approximately 875 hectares of moderately sensitive areas were not accounted for in the analysis.

No areas were directly removed to account for watershed sensitivity, wildlife habitat, avalanche concerns or recreation values due to other factors applied in the timber supply analysis, which are considered to adequately account for the implications of these features or values.

I note that the additional 875 hectares identified as moderately sensitive, represents a small overestimation of the timber harvesting land base compared to the base case harvest forecast. I have considered the associated impacts on timber supply as discussed below in my “Reasons for Decision”.

Prior to the next determination, I recommend that staff examine those areas identified as having high and moderate environmental sensitivity and further refine applicable reduction factors.

- low site productivity

In the timber supply analysis, 1176 hectares were deducted to account for areas incapable of producing sufficient timber to support harvesting. In the analysis low productivity stands were defined as stands having a site index of less than eight metres. These stands are considered to be unmerchantable and were appropriately excluded from the timber harvesting land base.

District staff are satisfied with the criteria used to deduct these areas. Having reviewed the assumptions used in the analysis, I accept that about 1176 hectares is a reasonable assessment of areas with low site productivity for this determination.

- problem forest types

Problem forest types are defined as areas of non-merchantable stands that are physically accessible, exceed the low site productivity criteria, yet are not currently utilized. For this analysis, these areas were defined as hemlock and subalpine fir stands older than 140 years with no component of spruce. These stands were identified based on a review of current forest management practices and recent harvesting performance. Based on this information, 4868 hectares were excluded from the timber harvesting land base.

Licensees submit that some harvesting in these stands has occurred and therefore not all the area should be deducted. District staff agree that some of these stands have been harvested, however, they are usually harvested incidentally in conjunction with higher value stands in adjacent cutblocks and the total area of problem stands harvested is not considered to be significant.

District staff are confident that the current accounting for this factor adequately reflects current performance. Nonetheless, if the district staff find that more harvesting is occurring in these stands prior to the next determination, the reductions will be reviewed in the next analysis. In the meantime, I accept the deductions for problem forest types applied in the base case for use in this determination.

- deciduous stands

In the Revelstoke TSA, deciduous trees—mostly birch, cottonwood and aspen—are currently not considered merchantable. In the timber supply analysis to account for this, all predominately deciduous stands (1597 hectares) and all deciduous volumes in predominately coniferous stands did not contribute to the timber supply.

I note that about 578 hectares of predominately deciduous stands excluded from the timber harvesting land base are actually young stands that are adequately restocked with conifers and which are being actively managed for conifer volumes. BCFS district staff are confident that these stands will become predominately coniferous as the stands age.

I therefore accept that the analysis may have underestimated the timber harvesting land base by about 578 hectares and I have accounted for this as an upward pressure on the long-term timber supply as discussed below in my “Reasons for Decision”.

- roads, trails and landings

In the timber supply analysis, a land base deduction of 2262 hectares was applied to account for approximately 1125 kilometres of existing logging roads which have an estimated average width of 20 metres. The 20 metre average road width is slightly wider than reported for the adjacent Golden TSA (due to generally more difficult terrain found in the Revelstoke TSA). The estimates for road lengths were derived using a recent Geographic Information System data set. BCFS staff consider this approach provides a more accurate estimate of existing road lengths than was used in the previous 1993 timber supply analysis. To account for future roads, a land base reduction of 4703 hectares was applied to account for approximately 2351 kilometres of future roads, with an average width of 20 metres.

In accounting for existing trails and landings, a volume adjustment factor was developed based on a study completed by district staff and the Nelson Forest regional pedologist. Based on the study, volume estimates for existing second-growth stands were reduced by 5.74 percent to reflect existing site productivity losses. For future trails and landings,

volume estimates of regenerated stands were reduced by 3.3 percent to account for future productivity losses.

A number of submissions from licensees stated that the combined area and volume reductions are excessive. They suggested that in some circumstances, winter logging can offset losses and that road rehabilitation can increase site productivity. However, no specific analysis was provided to support or quantify these statements. Another submission suggested that adjustment factors for future roads overlaps with the standard operational adjustments factors (OAFs) of 15 percent applied to volume estimates for regenerating stands. Research staff have examined this concern and confirm that OAFs do not account for reductions due to road construction.

I note that the reductions applied in the base case were derived from a detailed study undertaken by BCFS district staff and the Nelson Forest regional pedologist. I find that the reductions are similar to those applied in the TSAs with comparable operating conditions. For this determination, I am satisfied with the reductions applied to account for existing and future roads, trails and landings. Any new information can be incorporated into future analyses.

- timber licences

Timber licences (TLs) are old tenure arrangements that give a licensee exclusive one-time rights to harvest merchantable timber within the licence area. Once these areas have been harvested, all future harvesting rights revert to the Crown and future harvests from the area will then contribute to the timber supply for the TSA.

For the purposes of the analysis, all the TLs areas were assumed to have been harvested and to contribute immediately to the current timber harvesting land base. However, two of the TLs—comprising a total area of about 1418 hectares—have not yet expired. The two TLs are due to expire by 2025 and therefore should not be considered as contributing to timber supply until they have expired and reverted to the Crown. Nonetheless, in the last five years, some harvesting has occurred on these timber licences. Although the forest inventory does not reflect this recent activity, the harvested areas have been or will be in a regenerated state—an assumption which is sufficiently consistent with the analysis to not cause me concern. If the remainder of the TLs are not developed and regenerated until closer to 25 years from now, this would be inconsistent with the analysis which assumes the total area to currently be in a regenerated state.

However, in discussion with the district, I am advised that it is likely that these TLs will continue to be harvested and regenerated over the next 10 years, thereby reverting to the Crown much sooner than the maximum 25 year term to expiry. The implications to timber supply of the differences between the analysis assumptions and the likely delay in reversion to the Crown are minimal and act entirely in the very long-term as the stands would, for example, be available for harvest 115 years from now rather than 100 years. I note that timber supply is not expected to be constrained during that period of the harvest forecast and I am not placing any weight on these observations for the purposes of this

determination. I ask that BCFS Columbia district staff update the reversion schedule for TLs prior to the next analysis to ensure that the modelling assumptions reflect the actual inventory and reversion schedules for these areas.

- woodlot licences

The Revelstoke TSA includes two woodlot licences, totaling approximately 772 hectares. Timber supply on these areas is administered separately from the remaining TSA and in the analysis these areas were appropriately removed from the timber harvesting land base.

- archaeological areas

The TSA is situated within the traditional lands of the Shuswap, the Ktunaxa/Kinbasket and the Okanagan Nations. There are no First Nations community reserves in the TSA. A number of areas have been identified as requiring archaeological impact assessments as a result of reviewing 1998 forest development plans. Currently, no areas of archaeological significance have been identified, however, studies are on-going and may provide more information for future determinations.

- protected areas

For the analysis existing parks were excluded from contributing to the timber harvesting land base. Mt. Revelstoke National Park is encompassed by the TSA and Glacier National Park borders the eastern boundary of the TSA.

I note that while parks do not contribute to the timber harvesting land base, they do contribute to achieving landscape biodiversity objectives as discussed below under *landscape-level biodiversity*. Having review the reductions applied, I am satisfied that parks have been appropriately accounted for in the timber supply analysis.

Existing forest inventory

- current inventory

The forest inventory used for the timber supply analysis was based on a re-inventory completed for the Revelstoke TSA in 1997. Forest cover attributes have been projected to 1998 to account for tree growth. However, disturbances such as harvesting and fires, as well as silvicultural treatments have not been updated since 1994. Therefore the timber supply forecasts do not account for disturbances—including approximately 600 hectares per year of harvesting—which have occurred since 1994.

After the re-inventory, the total productive land base for the Revelstoke TSA increased by about 19 000 hectares. This increase was mainly attributable to two factors:

1. Better estimates of the high-water mark around the three reservoirs (Lake Revelstoke, Kinbasket and Upper Arrow Lakes).
2. Improvement of forest classification, particularly in areas previously classified as non-productive.

In the previous 1994 AAC determination, staff raised concerns about the forest inventory for the Revelstoke TSA. In 1997, BCFS staff completed an inventory audit to test the overall accuracy of the estimate of existing stand volume on the TSA. The 1997 inventory audit originally examined the accuracy of the previous 1977 forest inventory. However, during 1997 inventory audit plots were re-stratified and compared to the 1997 forest re-inventory.

The results of the audit for the operable and inoperable mature component of the inventory show that the volume estimates for mature stands are reasonable. Further analysis of data also shows a similar level of acceptability in only the operable forest land base for the mature volume estimates in the inventory. However, the audit results also suggest that site index assignments for young stands may not accurately reflect actual volume growth. The audit found the non-forest classification in the TSA was within provincial standards. I further discuss aspects of the audit in the sections below, *volume estimates for existing stands* and *site productivity estimates*.

A submission from the forest industry stated that use of the current forest inventory goes well beyond its intended design. I acknowledge this concern but also recognize that better information does not currently exist to support the timber supply analysis. Furthermore, the audit results suggest that the inventory is reasonable for the purposes of this determination.

As mentioned previously above, under *protected areas*, lands not contributing to the timber harvesting land base, including national parks, contribute to resource values such as landscape-level biodiversity. The forest cover inventory in national parks was undertaken in 1956 and projected to 1997 to account for forest growth and aging. However, no updates to account for disturbances such as fire, are available. I encourage staff to obtain any relevant vegetation inventories from Parks Canada so that this information can be used to support future timber supply analyses.

In my determination, I recognize a small downward pressure in the base case forecast since we are now several years into the harvest forecast (which was assumed in the analysis to commence in 1994). However, given the generally stable short-term timber supply, I do not consider this to be significant in terms of the discussion at hand and am confident that given the parameters of modelling, the analyst could have produced a similar forecast to the base case if the update information were taken into consideration.

- *age-class distribution*

The age class of the timber harvesting land base is distributed as follows: about 56 percent of stands are greater than 140 years of age (including 28 percent of stands being greater than 250 years of age) while 23 percent consist of stands 20 years of age or younger. Approximately 62 percent of stands in the timber harvesting land base exceed the minimum harvestable age assumed in the analysis. Although the inventory audit showed that existing forest classifications may underestimate actual stand ages, BCFS staff do not consider stand age as a limiting factor with respect to timber supply and for the purposes of this determination, I accept their conclusion.

- *species profile*

The timber harvesting land base consists of forest stands where the predominant species is western hemlock (33 percent), spruce (24 percent), western redcedar (21 percent), Douglas-fir and larch (13 percent concentrated in the youngest age classes), subalpine fir (5 percent) and a mix of minor species (4 percent).

- *volume estimates for existing stands*

In the timber supply analysis, existing natural stand volumes were estimated and projected using forest inventory attributes and the Variable Density Yield Prediction (VDYP) model (version 6.4a).

As previously discussed above, under *current inventory*, a forest inventory audit was conducted which included an assessment of volume estimates in mature stands. The audit confirmed that estimates used in the current analysis meet provincial standards.

Although the inventory audit did not show a significant difference in volume projections, BCFS Columbia district staff are nonetheless still concerned about the VDYP-projected volume estimates. The analysis reports that in the first decade, harvesting is projected to occur in stands having a volume projection of approximately 510 cubic metres per hectare. However, the audit reported a mean volume of about 350 cubic metres per hectare in the operable land base while actual harvesting records show that stands averaging about 400 cubic metres per hectare are harvested from the TSA.

I have further examined the analysis results and note the analysis reports 510 cubic metres per hectare are harvested in the short term, based on the assumption that harvesting generally occurs first in the oldest forest stands. However, if harvesting is assumed to occur randomly in a mix of mature and old forest stands, then the harvested volumes are reduced to an average of 408 cubic metres per hectare but involve more area than modelled in the base case projection.

To assess the uncertainty in the volume estimates and the associated risk to timber supply, I have been assisted by the results of a sensitivity analysis. The sensitivity analysis showed that when estimates of existing stand volumes were decreased by 10 percent, the duration of the initial harvest level in the base case is lowered from four to two decades. Hence, in any event, a 10 percent overestimation of existing stand volumes does not preclude the achievement of the initial harvest level.

In other words, harvest sequence choices used in modelling can significantly vary the volume per hectare achieved in any given period, and operational reality and model outputs may not always match. However, sensitivity analysis is one of many possible ways of more closely matching model outputs with operational experience and based on my experience it is but one of many possible means of doing so. It does not follow that the sensitivity analysis—with the earlier projected decline—is more realistic than the base case.

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The applicability of inventory audits in timber supply analysis is often complex, as the audit was not designed to support the analysis per se. While, the audit tends to confirm the validity of the inventory, concerns by district staff that mature stand volumes appear to be high in the analysis cannot be validated at this time. However, by studying the volume produced in the “random harvest run”, some insight can be gained into the risk this concern represents to timber supply. The sensitivity analysis shows that short-term timber supply is not impacted on account of this factor. I therefore, accept the volume estimates for existing stands as reasonable for this determination.

Expected rate of growth

- site productivity estimates

Inventory data includes estimates of site productivity for each forest stand, expressed in terms of a site index. For a given stand, the site index is based on the height of the stand as a function of its age. The productivity of a site largely determines how quickly trees grow. This in turn affects the time seedlings will take to reach green-up conditions, the volume of timber that can be produced, and the ages at which a stand will satisfy mature forest cover requirements and reach a merchantable size.

In the Revelstoke TSA, the timber supply analysis used site productivity estimates represented in the forest inventory planning (FIP) file. As previously discussed under *current inventory*, the 1997 audit indicated some uncertainty in the site indices assigned to young stands. Of the twenty stands sampled in the field, one stand was not assessed for site index because it was found to occur in a mature forest. Of the remaining 19 stands, the forest inventory correctly identified site index (within +/- 3 metres of the audit site index) for four stands. The audit results suggest that the forest inventory underestimated site index by more than three metres for eight stands and overestimated site index by more than three metres on seven stands. Therefore, although not statistically significant, the audit suggests that inventory site index assignment are not accurate for younger stands.

In general, forest stands between 30 and 150 years of age provide the most accurate measurement of site productivity. Site indices determined from younger stands (i.e. less than 31 years old), and older stands (i.e. over 150 years old) are the most likely to not accurately reflect potential site productivity. In young stands, growth often depends as much on recent weather, stocking density and competition from other vegetation, as it does on site quality. In older stands, which have not been subject to management of stocking density, the trees used to measure site productivity may have grown under intense competition or may have been damaged, and therefore may not reflect the true growing potential of the site. This has been verified in studies such as the old-growth site index (OGSI) project which indicate that actual site indices may be higher than those indicated by existing data from mature forests.

For the Revelstoke timber supply analysis, preliminary OGSI adjustments for stands older than 140 years were provided by BCFS Research Branch, based on studies completed outside the TSA but which are considered relevant to the TSA area. While the OGSI adjustments were not applied in the base case, their implications to timber supply were examined in a sensitivity analysis. The results of the sensitivity analysis showed that applying the OGSI adjustments to stands older than 140 years did not impact short-term timber supply compared to the base case forecast. However, long-term timber supply increased by about 20 percent from 159 000 cubic metres per year in the base case to 191 000 cubic metres per year; medium-term timber supply was increased as well. The sensitivity analysis also showed that applying OGSI adjustments to only the eligible spruce stands increases medium- and long-term timber supply by 3.4 percent compared to the base case projection.

Concern was expressed through public review that OGSI study results should have been included in the base case. Other public input questioned the applicability of the OGSI study methods.

A consistent conclusion in recent years based on studies such as OGSI is that site productivity has generally been underestimated; managed forests stands tend to grow faster than projected by inventory site index estimates. Notwithstanding the public input expressing concern about OGSI study methods and the lack of field plots in the

Revelstoke TSA, it is not unreasonable to expect higher site productivity than assumed in the base case, provided appropriate silviculture practices (such as brush control) are undertaken. Based on my experience and having reviewed the sensitivity analysis, I accept that medium- and long-term timber supply may be underestimated in the base case. However, I note that short-term timber supply is not impacted and have discussed this further in my “Reasons for Decision”.

Given the potential timber supply consequences of site productivity estimates, I encourage the district staff and licencees in the TSA to monitor performance in regenerated stands with field-based plots to better determine if suggested OGSi increases are being attained.

- volume estimates for regenerated stands

The BCFS uses the Table Interpolation Program for Stand Yields (TIPSY) to estimate regenerated stand volumes for managed stands. Volume predictions using TIPSY are based on management of stocking density, full site occupancy and absence of significant brush competition. In the BCFS analysis, TIPSY was used for all regenerated managed stands less than 20 years old.

In the previous 1993 timber supply analysis for the Revelstoke TSA, the VDYP model was used to estimate volumes of regenerated stands. I note that VDYP is more appropriately used to estimate volumes for existing mature stands (as previously discussed), and TIPSY is now the standard used in timber supply analysis for regenerated stands. Using the TIPSY model resulted in higher projected volumes for regenerated stands in this analysis than in comparison to the previous analysis.

TIPSY projections are initially based on ideal conditions assuming full site occupancy and the absence of pests and diseases in the stand. Therefore, Operational Adjustment Factors (OAFs) are applied to account for losses of timber volume due to unmapped stand openings (OAF1), as well as for age-dependent factors such as pests, disease, decay, waste and breakage (OAF2). The BCFS analysis applied standard reductions of 15 percent for OAF1 and 5 percent for OAF2.

District staff are concerned that root disease may decrease growth and yield of some managed stands in the Revelstoke TSA. Generally this concern applies more to previously planted Douglas-fir and spruce plantations, since current practice is to replant these areas with a mix of tree species less susceptible to root disease. Staff also observed that some of the infected stands are out-growing the impacts of root disease. While they acknowledge that it is difficult to verify if the OAF reductions are correct for the TSA, no better information is currently available.

I accept that the OAFs represent a bona fide attempt to account for a host of factors that can affect stand growth and development. I also note that any negative impact on timber supply from higher OAFs would not be felt until the long term and would not result in a major disruption to the long-term harvest level, but rather would simply work to lower

the long-term harvest level. For the purposes of this determination, I therefore accept the OAFs as modelled in the base case but encourage their further refinement before the next analysis.

The submission from Parks Canada expressed concern that more conservative estimates of future yields are needed and that yield projections developed for unmanaged stands (VDYP) may be a more appropriate model for stands in the Interior Cedar-Hemlock biogeoclimatic zone. The submission also expressed concern that global climatic change was not factored into yield projections. Having reviewed these concerns, I find that it would be inappropriate to estimate future growth based on uncertainty in climatic changes due to the fact that current growth and yield projections take into account proven past tree performances. Uncertainties as to how future climate fluctuations would affect tree growth are presently inconclusive.

I also note that planting of genetically improved stock accounts for about 40 percent of the total seedlings planted in the Revelstoke TSA. Genetically improved seed is selected from the best-growing, most insect and disease resistant trees found in existing natural stands. The genetic diversity of the seedlings meets or exceeds that found in stands within the vicinity and thus provides some assurance that the trees will be adaptive to global change. Therefore, although there may be some uncertainty in the volumes estimates of regenerating stands, it would be inappropriate to disregard the observed trend of productivity and genetic diversity generally found in managed regenerating forests.

A sensitivity analysis assessed the impacts on timber supply of a 10 percent increase and 10 percent decrease in regenerated stand volumes. A 10 percent increase did not affect the short-term forecasts, but did increase long-term timber supply by about nine percent after 80 years. By contrast, a ten percent decrease in regenerated stand volumes decreased the long-term timber supply by about nine percent after 80 years compared to the base case projection but did not impact short-term timber supply.

In summary, I have no evidence to suggest that the TIPSy estimates are not reasonable for use in this determination, and I therefore accept the volume estimates for regenerated stands to be appropriately accounted for in the analysis.

- minimum harvestable ages

A minimum harvestable age is an estimate of the earliest age at which a stand has grown to a harvestable condition. Changing the minimum harvestable age mainly affects when a second growth stand will be available for harvest and how quickly existing stands may be harvested. In practice, many forest stands will be harvested at much older ages than the minimum harvestable age, due to economic considerations and constraints on harvesting which arise from managing for other forest values such as visual quality, wildlife and water quality.

The minimum harvestable ages assumed in the Revelstoke timber supply analysis were based on four factors:

- (1) the age at which stands reach a minimum 25 centimetre diameter at breast height (dbh);
- (2) the age at which forest stands reach a minimum volume of at least 150 cubic metres per hectare;
- (3) generally within 80 percent of culmination age (culmination age is the age at which a stand achieves its maximum average annual rate of volume production); and
- (4) professional judgement by BCFS staff.

Forest industry representatives contend that the 25-centimetre minimum dbh criterion will overestimate the minimum harvestable age on poor sites. However, BCFS staff developed these criteria based on information that shows that little or no harvesting occurs in stands with less than 150 cubic metres per hectare or in stands with an average dbh below 25 centimetres.

A sensitivity analysis indicated that the Revelstoke TSA timber supply is not overly responsive to changes in minimum harvestable age. By decreasing the minimum harvestable age by 20 years, the initial harvest level projected in the base case can be extended from four to five decades, while the long-term harvest level is decreased by three percent. Conversely, a 20-year increase in minimum harvestable ages reduces the duration of initial harvest level from four to two decades and increases the long-term harvest level by 1.2 percent compared to the base case harvest projection.

District staff are satisfied with the assumptions applied in the analysis. Having reviewed the information and the criteria applied in the timber supply analysis, I conclude that the minimum harvestable ages used in the base case are reasonable for the purposes of this determination.

- (ii) the expected time that it will take the forest to become re-established on the area following denudation:

Regeneration delay and impediments to prompt regeneration

Regeneration delay is the period between harvesting and the time at which an area is anticipated to become occupied by a specified minimum number of well-spaced, acceptable seedlings. In the timber supply analysis, on average, a regeneration delay of two years was assumed for all forest stands.

There are no reductions in the analysis to reflect any specific impediments to prompt regeneration. Current practices in the TSA can be reasonably well expected to lead to the successful regeneration of harvested areas and there are no known impediments to regeneration at this time.

Forest industry submissions suggest that the regeneration delay should be reduced by the average age of the planting stock used in the Revelstoke TSA. However, BCFS staff have confirmed that the two-year regeneration delay assumed in the base case is an estimate that accounts for both longer regeneration delays on naturally restocked sites and shorter delays that already reflect the age of the planting stock.

Having reviewed the observed trends, as well as the assumptions used in the analysis, I conclude that a two-year average regeneration delay as assumed in the base case is likely attainable. Therefore, for the purposes of this determination, I am satisfied that regeneration delay has been adequately represented in the analysis.

Not-satisfactorily-restocked areas

Not-satisfactorily-restocked (NSR) areas are those where timber has been removed, either by harvesting or by natural causes, and a stand of suitable forest species and stocking has yet to be established. Areas where the standard regeneration delay has not yet elapsed since harvesting are considered “current” NSR. Where a suitable stand has not been regenerated and the site was harvested prior to 1987, the classification is “backlog” NSR.

In the Revelstoke TSA, the NSR area of the timber harvesting land base was estimated to be about 4918 hectares. Of this amount district staff identified about 1790 hectares, of stands that are 10 years of age or older. In the analysis it was assumed that this area was stocked with lower volume stands and the balance (3128 hectares) was assumed to be current NSR (age zero to ten years).

Subsequent to the analysis, BCFS district staff reviewed current data sources including the Major Licence Silviculture Information System (MLSIS) and the Integrated Silviculture Information System (ISIS). While some discrepancies between the total area of NSR and the distribution between backlog and current NSR were noted, I do not consider the differences to be significant in terms of impact on timber supply. I accept that there has been a reasonable accounting of NSR in the analysis and I accept the assumptions as reasonable for the purpose of this determination.

- (iii) silvicultural treatments to be applied to the area:

Silvicultural systems

During 1991 to 1997, the main silvicultural system used in the TSA was clearcutting; very little of the total volume was harvested using alternative silvicultural systems. BCFS Columbia district staff indicate that the application of alternative silvicultural systems is expected to increase significantly by 2001 to about 22 percent. The alternative systems aim to address non-timber values such as caribou habitat and visual resource management. Also, of the total area to be harvested using clearcutting, over one-half is expected to incorporate wildlife tree reserves.

In the analysis, it was assumed that all harvesting is undertaken using the clearcut system. However, as noted in other sections of this document, requirements of the Forest Practices Code—such as managing visually sensitive areas and reserving wildlife tree patches for stand-level biodiversity—were satisfactorily represented. On this basis, I accept that current practice has been adequately reflected in the base case analysis. As new information becomes available and modelling capabilities improve, a more direct representation of any changes in the mix of silvicultural systems can be analyzed for use in future determinations. In the meantime, I am satisfied that the current means of representation poses negligible risk to my determination.

Incremental silviculture

Incremental silviculture includes activities such as commercial thinning, juvenile spacing, pruning, fertilization, and genetic improvement that are not part of the basic silviculture activities required to establish a free-growing forest stand.

In the Revelstoke TSA, about 400 hectares per year are juvenile spaced or pruned. Commercial thinning is neither current practice, nor planned for in the Revelstoke TSA and appropriately none was assumed in the analysis.

I note that the type and extent of incremental silviculture undertaken in a given management area is very dependent on funding and is difficult to project into the future. If in the future the amount or kind of incremental silviculture actually practiced differs significantly from what was assumed in the analysis, I will consider the associated impacts in future determinations.

- (iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area:

Utilization standards

Utilization standards define the species, dimensions and quality of trees that must be harvested and removed from an area during harvesting operations. In the Revelstoke TSA timber supply analysis, the utilization standards assumed for most species were a minimum 17.5-centimetre diameter at breast height (dbh), a 30-centimetre maximum stump height and a minimum 10-centimetre top diameter inside bark. For lodgepole pine stands, a minimum dbh of 12.5 centimetres was assumed.

BCFS district staff indicate that, with one minor exception, the assumptions used in the analysis reflect current utilization standards and current practice in the TSA. For western redcedar stands older than 140 years, the minimum top diameter inside bark is actually 15 centimetres—not 10 centimetres as was assumed in the analysis. Since this would amount to only an insignificant overestimation in the projected timber supply, I accept the assumptions employed in the base case as a reasonable accounting of utilization standards.

Decay, waste and breakage

Reductions factors are applied to volume estimates of existing natural stands to reflect the volume lost to decay, waste and breakage. Decay losses are built into the (VDYP) volume estimates, while standard waste and breakage factors are applied into the analysis when developing VDYP yield curves. These estimates of losses have been developed for different areas of the province based on field samples.

For regenerated stands, as previously discussed in *volume estimates for regenerated stands*, the TIPSYS model incorporates OAFs that account for anticipated decay, waste and breakage.

In the last AAC determination, the chief forester requested that staff undertake a detailed assessment of the allowances for decay, waste and breakage. Although the volume and decay studies on applicable cedar and hemlock stands are now complete, the information was not available in time for the timber supply analysis.

Preliminary findings indicate that for the timber harvesting land base of the Revelstoke TSA, the accuracy of volume estimates are within one percent. Further examination showed that in older stands (older than 140 years), volumes may be overestimated by up to eight percent. While the results are based on a small sample size they do indicate a trend that some stand volumes may be overestimated. The results of the volume and decay studies will be incorporated into VDYP yield projections for the next timber supply analysis.

I requested that BCFS staff undertake an additional sensitivity analysis to illustrate the impact on timber supply of varying the estimates of volume in existing mature cedar and hemlock stands. The analysis showed that if the volume estimates are overestimated by 10 percent, the initial harvest level could be maintained for three decades but not four. However, given the tentative nature of the study, BCFS Resources Inventory Branch specialists advise that these findings are not sufficiently conclusive to replace the factors used in the analysis and they urge that caution be applied when interpreting the study results.

For the present determination, I consider the estimates incorporated in the analysis to reflect the best available published information with respect to decay, waste and breakage. I have accepted the applicability of the factors as used in the analysis and have made no further adjustments to the base case on account of this factor.

- (v) **the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production:**

Integrated resource management objectives

The Ministry of Forests is required under the Ministry of Forests Act to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

To manage for resources such as water quality and aesthetics, current harvesting practices limit the size and shape of cutblocks and maximum disturbances (areas covered by stands of less than a specified height), and prescribe minimum green-up heights required for regeneration on harvested areas before adjacent areas may be harvested. Green-up requirements provide for a distribution of harvested areas and retention of forest cover in a variety of age classes across the landscape.

- forest cover and cutblock adjacency

The full range of forest values is managed according to the Forest Practices Code and existing plans for the area. Management for non-timber values such as wildlife, water, visual quality and biodiversity involves control of the size and distribution of cutblocks across a landscape, limits on the maximum area of recent harvesting-related disturbance, and retention of minimum amounts of mature and old-growth forest. Such practices and guidelines ensure that harvesting is not concentrated or continuous in a specific area, and that the area of retained forest cover meets objectives for habitat, visual quality and water quality.

The land base for the Revelstoke TSA was divided into overlapping management zones, comprising different proportions of the timber harvesting land base: about 39 percent is located in the integrated resource management (IRM) zone; about 49 percent in the caribou zone; 14.8 percent in the mule deer or moose zone; 6.5 percent in the visual management zone; and 0.6 percent in the community watershed zone. In addition, biodiversity requirements apply across the entire forest land base. Specific forest cover objectives assumed in the analysis for wildlife, visual quality, water quality and biodiversity are discussed in corresponding sections later in this rationale.

In both the IRM and wildlife habitat zones, operations are subject to guidelines on cutblock adjacency, cutblock size, and the maximum area of recent harvesting-related disturbance. The FSSIM timber supply analysis model used for the Revelstoke TSA analysis was not set up to explicitly represent adjacency constraints. Rather, a forest cover requirement was applied in the model to approximate the effects of guidelines on cutblock adjacency and cutblock size. The requirement limited the area covered by

stands below green-up height (two metres) to a maximum of 25 percent. The requirement applied to the timber harvesting land base in the IRM zone, and to the physically operable forest in the wildlife zones. Sensitivity analysis showed that if this requirement were relaxed to 35 percent in these zones, there would be little impact on the timber supply.

BCFS district staff note that guidelines for forest cover and cutblock adjacency have been implemented in the TSA for many years. However, for the purposes of development planning, there is often flexibility in obtaining the maximum 25 percent disturbance limit. Nonetheless, concern has been expressed regarding the use of maximum-permissible-area-below-green-up-age to approximate the timber supply impacts of these guidelines, and the associated uncertainty it introduces into timber supply projections.

A submission from the Revelstoke and Area Land Use Planning Minister's Advisory Committee (MAC) requested that in determining the AAC for the Revelstoke TSA, I consider the results of a timber supply analysis conducted for TFL 56 using the ATLAS timber supply model. This analysis involved explicit modelling of cutblock adjacency (a "spatially explicit" approach). In contrast, the forest cover approximation approach used in FSSIM can be called "spatially implicit." During the past few years, the committee has examined timber supply forecasts, and has observed substantial differences in results generated using spatially implicit and explicit analysis approaches, as demonstrated by the analysis completed for the community's tree farm licence (TFL 56). The committee expressed concern about the accuracy of the spatially implicit modelling approach used in the Revelstoke TSA timber supply analysis.

I requested that staff from the Timber Supply Branch examine the results of the analysis for TFL 56. The FSSIM (spatially implicit) analysis results projected an initial timber supply of approximately 88 000 cubic metres per year, followed by a decline to 50 000 cubic metres per year over a 50-year period. The ATLAS (spatially explicit) analysis, using a different set of data and management assumptions projected an initial harvest level of 27 000 cubic metres per year, which gradually rose to 50 000 cubic metres per year over a 100-year period.

The review by BCFS Timber Supply Branch staff showed that discrepancies in results were not due solely to the different ways of modelling cutblock adjacency. Rather the short- and medium-term differences stemmed from a combination of differences in treatment of forest cover requirements for mature and old-growth forest, effects of explicit modelling of adjacency restrictions, and differences in the base data and management regime being modelled.

In ATLAS, harvesting is completely disallowed in an area if a forest cover requirement for mature or old-growth forest is not met. In FSSIM, if a forest cover requirement is not achieved, a reserve is created that will achieve the requirement as soon as possible, but any additional merchantable timber could be harvested as long as this does not extend the time needed to eventually achieve the requirement. While neither approach is unequivocally better, the most common approach to date has been the reserve approach used in FSSIM – this approach ensures mature and old-growth requirements are achieved

as quickly as possible, while minimizing timber supply impacts. In the absence of proof to the contrary, I accept the approach taken in FSSIM.

The assessment also showed that explicit adjacency restrictions modelled in ATLAS decreased timber supply relative to the forest cover approximation used in FSSIM. While the modelled effect is clear, it is not clear that field implementation of adjacency requirements is as rigid as in a model. For example, flexibility in design of field operations may reduce the effects of adjacency restrictions. The implication of this uncertainty is that the actual timber supply effects of adjacency may be different from those suggested by the model. Some modelling work in the Nelson Forest Region suggests that it may be possible to achieve objectives for the spatial distribution of harvested areas in ways that do not reduce timber supply as much as strict adjacency requirements, for example through management for patch-size distribution.

Finally, it became apparent that the composition of the land base and corresponding management regimes used in the two models were different. There were differences in the areas of caribou and other ungulate habitat, and in areas over which landscape-level biodiversity was being tracked.

Overall, the Timber Supply Branch evaluation showed that given equivalent treatment of forest cover requirements for mature and old-growth forest, and the same data set and management regime, the timber supply projections for spatially implicit and spatially explicit analysis for TFL 56 would have been much closer than initially shown. However, explicit modelling of adjacency requirements decreased projected timber supply relative to a forest cover approximation. Nevertheless, the degree to which adjacency might affect timber supply in practice is uncertain due to the potential for field-level flexibility to lessen restrictions imposed by adjacency.

In summary, I am aware of the indications that spatial analysis and its associated ability to explicitly model adjacency introduces some uncertainty to the timber supply forecasts projected by FSSIM. It is apparent that the two different types of analyses provide different timber supply forecasts, however, it is not apparent which one reflects forest practices better. It is not certain that spatially explicit representation of adjacency requirements more accurately reflects field practices. More work is necessary to better understand and define the links between management objectives, alternative practices that can achieve those objectives, and the implications for timber supply.

In the meantime, for the purposes of this determination, I am satisfied that the FSSIM timber supply base case analysis has adequately addressed forest cover and cutblock adjacency as currently practiced. I have nevertheless remained mindful of the findings of the ATLAS study for TFL 56, and of the potential for future confirmation of some risk to the short-term timber supply projection on this account as further discussed below, under “Reasons for Decision”.

- visually sensitive areas

Careful management of scenic areas along travel corridors and near recreational sites is an important IRM objective. The Code enables the management of visual resources by providing for scenic areas to be identified and made known, and by providing for the establishment of visual quality objectives (VQOs). To achieve these objectives, visual landscape inventories are carried out to identify, classify and record those areas of the province that are visually sensitive.

VQOs limit the amount of visible disturbance that can occur in sensitive areas. Guidelines to meet VQOs include setting a maximum percentage of a viewshed available for harvesting at any time, and setting “visually effective green-up” (VEG) heights for adjacent stands. VEG refers to the height at which a stand of reforested timber is perceived by the public to be satisfactorily “greened-up” from a visual standpoint. Additionally, the degree to which landscape unit principles and higher level plans are implemented, play an important role in the evaluation of a maximum percentage alteration limit for visually sensitive areas.

For the Revelstoke TSA, important scenic areas are generally located along the Trans-Canada Highway and in locations that are visible from the city of Revelstoke. Scenic areas represent about 6.5 percent of the timber harvesting land base with some 2.1 percent classified as retention (very limited harvesting permitted) and the remaining 4.4 percent classified as partial retention (limited harvesting permitted). In the analysis for retention areas, a maximum of five percent of the area was permitted to be below a green-up height (VEG) of six metres. For partial retention areas, a maximum of 15 percent of the area was permitted to be below a green-up height of six metres.

BCFS staff advise that there is some uncertainty about the application of forest cover constraints for visual quality guidelines as applied in the analysis for two reasons:

- (1) The constraints should have been applied to the total forested area, rather than the operable forested area only; and
- (2) The guidelines should have been based on visual landscape units, which are more operationally applicable than the landscape units used in the analysis.

BCFS Columbia staff also indicated that future use of partial cutting silvicultural systems within scenic areas will further decrease the timber supply impacts assumed in the analysis. However, staff also expected more areas to be classified as scenic areas in the future.

A number of public submissions raised concerns about the assumptions for visually sensitive areas in the analysis. The concerns raised were generally directed at the size and location of the areas classified as visually sensitive. These issues are best managed through local planning processes to develop appropriate strategies, which have been part of the MAC process.

A sensitivity analysis was undertaken to examine the potential impact on timber supply of removing the VQO requirements or modelling the requirements to be more restrictive. The results showed no effect on timber supply compared to the base case harvest projection.

Although the impact of applying the guidelines to visual landscape units (rather than the general landscape units defined in the analysis) has not been quantified, BCFS staff conclude this would generally be less constraining on timber supply, but may be offset in the future by the addition of more scenic areas. Notwithstanding the public input, and having evaluated and discussed the potential impacts, I accept the current assumptions for the purposes of this determination. I encourage the Columbia forest district staff to pursue alternative harvesting systems to manage visual sensitivity concerns in the scenic areas in the Revelstoke TSA.

- recreation values

Recreation management objectives were assumed in the analysis to be addressed through forest cover constraints for other resource values, such as visually sensitive areas, wildlife habitat, and riparian areas. BCFS staff indicate that recreation values have been adequately accounted for in the analysis, and I am satisfied that the base case timber supply projection appropriately reflects current management of recreation values.

- identified wildlife

“Identified wildlife” refers to species at risk (blue- and red-listed) and regionally significant species which have not been accounted for by existing non-timber management strategies, such as for biodiversity, riparian management or other wildlife species (like caribou). Specific wildlife habitat areas or management strategies for particular identified wildlife species have not been established in the Revelstoke TSA, although species such as the northern goshawk and bull trout are known to occur in the TSA. The analysis therefore did not account for identified wildlife in the base case.

In February 1999, the provincial government announced its Identified Wildlife Management Strategy (IWMS). Government has set a one-percent limit for the province on the allowable impact on short-term harvest levels from management for identified wildlife. BCFS staff advise that they are uncertain at this time how much habitat area within the timber harvesting land base of the Revelstoke TSA may be required to implement the recently announced IWMS. However, they are aware of the one-percent limit on timber supply impacts and of the existence of blue- and red-listed species within the TSA.

Having reviewed the information, I consider it reasonable to expect that accounting for the likely impact of the IWMS could lead to a reduction of up to one percent in timber supply, as noted in “Reasons for Decision”. On its own merits, this would be primarily a long-term impact.

- ungulate winter range

In the analysis, about 10 035 hectares (14.8 percent) of the timber harvesting land base are included in the ungulate winter range management zone. The ungulate winter range has been identified as important habitat for moose and mule deer. The forest cover and cutblock adjacency guidelines for this zone allow for a maximum of 25 percent of the operable land base in ungulate winter ranges to be in forest stands less than two metres in height. There is also an older-forest requirement whereby a minimum of 40 percent of the operable land base is to be in forests older than 100 years of age in order to provide thermal cover. These guidelines were also applied in the timber supply analysis. Current management practices require a similar regime, however 40 percent of the operable area must be older than 120 years of age, and not 100 years.

The MAC raised concerns that the assumptions in the timber supply analysis do not reflect current practice for ungulate winter range; the MAC strategy has identified more area for ungulate winter range management than was assumed in the analysis. Under the MAC strategy, approximately 32 000 hectares are considered important ungulate winter range. After examining overlapping constraints which apply to approximately 50 percent of the area, the remaining difference in area (between the analysis and the MAC strategy) is about 10 000 hectares.

Subsequent to the completion of the timber supply analysis, I requested an assessment of the risk to timber supply regarding this concern. A sensitivity analysis examined a larger ungulate winter range zone of 20 000 hectares and a higher forest age of 120 years. The results showed no impact, from increasing the size of the zone or using 120 years, to the initial base case forecast. In the long term, timber supply was reduced by 2 000 cubic metres per year compared to the base projection.

In reviewing the information, I find that it is not entirely clear how much larger the ungulate winter range is likely to be after considering all the existing and potentially overlapping constraints already accounted for in the timber supply analysis. Nonetheless, I acknowledge that if the MAC strategy is implemented, the area will be larger than reflected in the base case. However, government has not yet approved the MAC recommendations and I note the very low sensitivity of the timber supply forecast to this issue (i.e., no short-term impact and a possible small long-term impact). In the meantime, I am placing no further weight on this matter beyond having examined the sensitivity analysis and noting the ongoing work, and am satisfied that this is appropriate and does not introduce risk into this determination. I also acknowledge that work is on-going with the MAC technical committee to resolve some of this uncertainty and I expect that it will be resolved prior to the next determination.

- grizzly bear habitat

The direction from the Kootenay-Boundary Land-Use Plan Implementation Strategy (KBLUPIS) indicates that important habitat for grizzly bears will be secured through the application of landscape-level biodiversity guidelines, without additional forest cover requirements. For example, it is assumed that forests adjacent to avalanche chutes that provide important habitat for grizzlies can be identified within biodiversity seral stage guidelines. This direction is reflected in the analysis, with no further allowance for grizzly bear habitat through additional forest cover guidelines.

Current operational practice involves scheduling and managing cut/leave patterns in the operable forest areas adjacent to some avalanche paths. I note that in the Revelstoke TSA, concerns about managing for grizzly bears often relates more to expanding road access than to timber supply. District staff are satisfied with the assumptions for grizzly bears in the timber supply analysis, however, they note that a study is underway to examine and rank grizzly bear habitat in avalanche areas. The results of the study may provide new information for the next determination. For this determination, I accept the analysis as appropriately reflecting current government direction for grizzly bear habitat.

- caribou habitat

The Revelstoke area is home to about 400 mountain caribou, making it one of the three most viable populations in western Canada. Parks Canada and the BC Forest Service have been working on a habitat analysis project for the past seven years.

In the timber supply analysis, the caribou zone comprises 32 979 hectares or 48.7 percent of the timber harvesting land base. The forest cover requirements applied in the analysis for caribou habitat required at least 40 percent of stands in the operable area to be older than 140 years, and 10 percent of the operable area to be in forests older than 250 years. Also, no more than 25 percent of the operable area was allowed to be in stands less than two metres tall. The guidelines used in the analysis are generally consistent with the KBLUPIS.

The area identified in the caribou zone for the analysis was based on 1997 operability maps, while the current caribou management guidelines are based on 1994 operability maps. In reviewing the maps, there is additional operable area (total of 5977 hectares) of which staff estimate that about 1583 hectares require more constraining forest cover requirements than was assumed in the base case. This additional area represents about 2.3 percent of the timber harvesting land base that would be affected with more constraining forest cover requirements, based on 70 percent of the productive forest area maintained in forest stands older than 140 years.

It was noted that a portion of the area (1583 hectares) is located within the 3785 hectares of area with very difficult operating conditions described under *physical and economic operability*. As discussed previously, reducing the timber harvesting land base by seven percent had no impact on short-term timber supply but reduced the time the current AAC could be maintained by one decade.

The forest industry and Parks Canada raised opposing concerns—that guidelines for caribou habitat excessively impact timber supply, and alternatively that the guidelines might not be adequate to protect caribou habitat.

Arboreal lichens are generally thought to occur only in older forests and the forest cover constraints assumed in the base case were intended to simulate conditions required to support their growth. However, arboreal lichens have been found on younger trees in the Revelstoke area. A sensitivity analysis shows that if the old-seral constraints were reduced by 50 years and the mature forest constraints were reduced by 40 years, the current harvest level could be maintained for six decades rather than the four decades projected in the base case. This demonstrates the need for further research to examine how much arboreal lichen, that is suitable for caribou, can be propagated on younger trees.

I acknowledge that additional work is required to examine the caribou habitat requirements and the relationship to timber supply to reduce this uncertainty, and I expect that ongoing work will eventually resolve this issue. Nonetheless, I am mindful of the fact that additional operable land base is required to manage caribou beyond that reflected in the analysis—as a result of comparing the 1994 and 1997 operability mapping and the manner in which the caribou constraints forest cover requirements were designed and modelled. I discuss this further below in my “Reasons for Decision”.

- *riparian habitat*

Riparian habitats occur along streams and around lakes and wetlands. The Forest Practices Code requires the establishment of riparian reserve zones that exclude timber harvesting, and riparian management zones that restrict timber harvesting in order to protect riparian and aquatic habitats. To estimate the area needed in riparian reserves and riparian management zones, streams are classified according to the *Riparian Management Area Guidebook*.

In the analysis, stream classes were estimated using the watershed atlas and methods (including a sample design) developed by regional BCFS and MELP staff. Application of the *Guidebook* to these stream classes resulted in a 2048-hectare deduction to the operable area used in the analysis.

BCFS Columbia district staff note that some smaller streams are not shown on the watershed atlas due to the 1:50 000 scale of mapping. Therefore, some of the smaller, seasonal streams and wetlands were not identified nor reflected in the timber supply analysis. Also, staff have estimated that approximately 900 hectares of riparian reserves along larger rivers (S1) were not accounted for in the analysis. However, it is not certain if 900 hectares should be deducted, but something less due to overlaps with inoperable areas and other constraints. Nonetheless, it is apparent that even after accounting for overlaps with other constraints some additional area to account for S1 and some smaller streams should have been excluded from the timber harvesting land base. Having evaluated the deductions applied in the analysis and after reviewing the District concerns, I have concluded the timber harvesting land base is overestimated by up to one percent in the analysis on account of this issue.

I have considered the additional riparian areas not accounted for in the analysis as introducing a small risk that the timber supply may be overestimated and have discussed this below in my “Reasons for Decision”.

Any new information which can be developed to help to better account for riparian habitat should be incorporated into the analysis for the next determination.

- community watersheds

In the timber supply analysis, the community watershed zone accounted for 0.6 percent of the timber harvesting land base. The guideline applied in the analysis to reflect hydrologic recovery of disturbed areas permitted no more than 25 percent of the area in the zone to be covered by forest stands less than nine metres in height at any time.

MELP staff suggested that domestic watersheds be included in the analysis. However, it was found that most of the critical domestic watersheds are located in areas already constrained by parks or private land designations, or modelled with forest cover requirements in the analysis such as visual quality or wildlife habitat.

A licensee submission stated that the forest cover requirements should be applied to the total watershed area rather than to the forested area. The assertion is based on reports indicating that 15 to 35 percent of the total area has to be harvested before a change is noted in a stream's hydrography. While this may be reported in some cases, the forest cover conditions assumed in the timber supply analysis are consistent with the Forest Practices Code. Another submission questioned the use of the nine metre green-up height and suggests that 6.25 metres should be the threshold applied.

BCFS staff are confident that community watersheds were adequately modeled in the analysis, and from my review I am satisfied that this factor presents no risk to the base case timber supply projection.

- *biodiversity*

Biological diversity, or biodiversity, is defined as the full range of living organisms, in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, and the evolutionary and functional processes that link them. Under the Forest Practices Code, biodiversity in a given management unit is assessed and managed at the stand and landscape levels.

- *stand-level biodiversity*

Stand-level biodiversity is managed in part by retaining reserves of mature timber or wildlife tree patches (WTP) within cutblocks to provide structural diversity and wildlife habitat. In considering stand-level biodiversity for this analysis, a weighted average requirement of six percent of stand volume is required to be maintained for WTPs (as derived from the *Biodiversity Guidebook*). Furthermore, it was assumed that 50 percent of WTP requirements would be met by areas outside the timber harvesting land base. Therefore in the analysis, the accounting for WTPs was treated as a three percent reduction to stand volume throughout the planning horizon.

Notwithstanding the requirements outlined in the *Biodiversity Guidebook*, district staff state that it is difficult to determine the exact area or volume in the timber harvesting land base that is being left for WTPs. They suggest that the assumptions in the analysis may in fact represent the maximum volume constraint and therefore, that the three percent reduction may be higher than suggested by current operations. However, they were unable to provide better information to support changing the assumptions.

Another stand-level biodiversity component, coarse woody debris, was not specifically addressed in the analysis. District staff are confident that, due to the age and nature of most stands in the TSA, if coarse woody debris objectives are established in the future, they are likely to be readily achieved through normal utilization practices, and in the absence of any clear evidence to the contrary I consider this to be a reasonable assumption for the purpose of this determination.

In summary, I consider the average volume reductions for wildlife tree patches to be reasonable, and for this determination, I am satisfied that the requirements of stand-level biodiversity are adequately accounted for in the Revelstoke TSA timber supply analysis.

- *landscape-level biodiversity*

Achieving landscape-level biodiversity objectives involves maintaining forests with a variety of patch sizes, seral stages, and forest stand attributes and structures, across a variety of ecosystems and landscapes. Managing for biodiversity is based in part on the principle that maintaining these conditions—together with connectivity of ecosystems and the maintenance of forested areas of sufficient size to maintain forest interior habitat conditions—will provide for the habitat needs of most forest and range organisms.

A major consideration in managing for biodiversity at the landscape level is leaving sufficient and reasonably located patches of old-growth forests for species dependent on, or strongly associated with, old-growth forests.

Although some general forest management practices can broadly accommodate the needs of most ecosystems, more often a variety of practices is needed to represent the different natural disturbance patterns under which ecosystems have evolved. Natural disturbance types (NDTs) vary from frequent wildfires in the dry interior regions to rare stand-initiating events (from wind, fire, and landslides) in the wetter coastal regions.

In accounting for landscape-level biodiversity in the analysis, a number of modelling assumptions were made as discussed below.

(1) biodiversity emphasis options:

The delineation and formal designation of “landscape units” is a key component of a sub-regional biodiversity management strategy. *The Forest Practices Code of B.C. Biodiversity Guidebook* outlines three biodiversity emphasis options—lower, intermediate and higher—which may be employed when establishing biodiversity management objectives (BEOs) for a landscape unit. Each option is designed to provide a different level of natural biodiversity and a different risk to the maintenance of elements of natural biodiversity when finding an appropriate balance between biodiversity and timber supply in setting objectives for a landscape unit.

In the absence of established BEOs, in order to balance social and economic impacts against risk to biodiversity, the provincial policy identified in the *Biodiversity Guidebook* and currently incorporated in timber supply analysis is to model approximately 45 percent of the area in the lower, approximately 45 percent in the intermediate, and approximately 10 percent in the higher BEO.

The KBLUPIS has draft BEO assignments for landscape units that are currently being implemented in forest development plans. The BEOs are identical to the MAC draft strategy, however, they have not yet been formally established under the Code for the Revelstoke TSA. In view of their draft status, and to avoid prejudging the outcome of decisions to be made by authorized statutory decision-makers, in the analysis, consistent with the *Biodiversity Guidebook*, an average forest cover requirement was applied to each landscape unit based on 45 percent lower, 45 percent intermediate, and 10 percent higher biodiversity emphasis.

Public comments, including those from the forest industry, suggested that the analysis should have used the MAC draft strategy for BEO assignments since they are currently being applied to guide forest development. The draft assignments applied to each landscape unit are based on 68 percent lower, 16 percent intermediate, and 16 percent higher biodiversity emphasis.

A sensitivity analysis was undertaken to examine the impact on timber supply of assuming the BEO assignments in the MAC draft strategy. The sensitivity analysis also included changing the base case assumptions to reflect the draft strategy for requiring old forest requirements for lower emphasis areas to be met immediately and for the constraints to be applied proportionately to the operable and inoperable forest areas. The analysis showed that changing the assumptions had no impact on short-term timber supply and only slightly reduced timber supply in the long term. Over the 250-year forecast period, timber supply was reduced by 0.4 percent compared to the base case projection.

I have considered the appropriateness of the “weighted-average” assumption used in the analysis with respect to BEOs very carefully. In my “Guiding Principles” I have noted that in AAC determinations I take direction from land use plans that are approved. Although the KBLUPIS is approved and forest development plans are employing the MACs draft strategy, the identified BEOs are still in draft form, and I am therefore satisfied that the BEOs applied in the analysis were consistent with provincial policy for areas where BEOs are not yet formally established.

The process of establishing landscape units and BEO assignments involves public discussion of their appropriateness, and approval of the district manager. However, I am advised that much public discussion and negotiation regarding the appropriate assignments has already taken place in arriving at the draft BEOs in the KBLUPIS and the MAC draft strategy, and I note that its use was advocated in the public input to this determination, including that from the forest industry. I also note that the derivation of the draft BEOs included considerable socio-economic analysis to strike a balance between environmental protection and economic implications. I understand that government was pleased that a compromise was achieved, and that a general sense of agreement exists that there would be great reluctance to change the BEO assignments. It is also significant that in view of all this, BCFS staff are currently managing to the draft BEOs, believing they are highly likely to become formally established, and have recommended their use in this determination.

From these considerations it is reasonable to conclude that the draft BEOs from the MAC draft strategy are in fact more reflective of government’s land use decision than the weighted average approach taken in the analysis. While the approach taken in the analysis was certainly consistent with the general provincial objective, the draft BEO objectives in the draft strategy were discussed and negotiated specifically for the area in question, and the likelihood of substantial change to these draft objectives appears very limited. Nonetheless, after examining the timber supply impacts from applying the MAC draft strategy BEO assignments, I find no risk to timber supply and have therefore made no further adjustments for BEOs in this determination. Prior to the next determination, I anticipate the BEO assignments will be established and reflected in the timber supply analysis.

(2) seral stage guidelines in the lower biodiversity emphasis option:

In accordance with the *Biodiversity Guidebook* and with the August, 1997 direction from the deputy ministers of the ministries of MELP and MOF, old forest requirements for lower BEOs were designed in the analysis to be met within three 70-year rotations, one-third at a time, and early seral guidelines for low BEOs were not applied.

The MAC draft strategy reports that the old-growth requirements for the lower emphasis areas are to be met immediately. Some public comments supported full (immediate) application of lower BEO seral stage guidelines. As discussed above, a sensitivity analysis showed that changing the BEO assumptions to those identified in the draft MAC strategy had no impact on short-term timber supply.

I note that the assumptions used in the timber supply analysis reflect current government direction and are consistent with the standard approach taken in timber supply analyses for other management units. I am therefore satisfied that there was a proper accounting for this consideration in the analysis, and note the low timber supply sensitivity to varying the assumptions in any event.

(3) proportional old seral requirements in operable and inoperable areas:

Consistent with the recent direction in applying the *Biodiversity Guidebook*, in the analysis the forest cover requirements for old-seral stage biodiversity guidelines were assumed to be met first, and to the extent possible, from inoperable forests and then from operable forests. Prior to this direction, the KBLUPIS had taken more of a proportional approach; for example, if 50 percent of a biogeoclimatic unit was in operable areas, then about 50 percent of the guideline would need to be met in operable forests.

A submission from Parks Canada expressed concern about the assumption that old-seral stage targets are to be met first from inoperable areas, and therefore only reflects a generalized approach. They further state that gains to timber supply from this approach may be minimal while habitat impacts could be severe.

A sensitivity analysis indicates that assuming a proportionate approach to account for old seral forest biodiversity guidelines, does not impact the base case harvest forecast.

In summary, the KBLUP remains unclear on the matter of proportional representation of old-seral forests from operable and inoperable areas. BCFS staff are uncertain what approach will be taken in the future even though current direction under the Forest Practices Code directs that a non-proportional approach be taken. Although the analysis is consistent with this recent provincial direction, whether this will be practiced in the future in the Revelstoke TSA is currently unclear, given the ongoing considerations of the KBLUP and the MAC strategy.

For the purposes of this determination, I accept the assumptions applied in the base case, because they are consistent with recent provincial direction. I am hopeful that by the next determination, government will have given full and due consideration to clarify this matter by considering higher level plan status (under the Code) for certain elements of the KBLUP and MAC strategies.

(4) aging of stands in areas outside the timber harvesting land base:

In the analysis, forest outside the timber harvesting land base, that do not contribute to timber supply (“non-contributing” stands), were assumed to age over time so that, eventually, all non-contributing stands are over 250 years of age. While the forest inventory supporting timber supply analyses is updated regularly to reflect recent disturbances such as those from fire, insects or disease, ongoing natural disturbances were not explicitly modelled in the analysis. As a result over time, an unrealistic proportion of the old seral requirements for landscape-level biodiversity will be met by non-contributing forests.

An alternative approach would be to assume that the existing age-class distribution in non-contributing stands remains the same over time (i.e. that disturbances will offset the aging of the forests). However, this “static” approach would probably lead to an overestimation in the number of natural disturbances, assuming that fire suppression will enable a higher proportion of non-contributing forested areas to age undisturbed over time, than in the past. This in turn would likely lead to an underestimation in the future contribution to old seral requirements made by currently young stands, as these age.

The risks in assuming that non-contributing stands all continue to age, and that stand disturbances do not occur, were also noted in the public input.

A review of sensitivity analyses indicates that the timber supply is relatively insensitive to changes in assumptions regarding landscape-level biodiversity. In the absence of supporting research, it might have been more realistic in the analysis to apply a disturbance factor based on professional judgement. However, since timber supply is relatively insensitive to uncertainty in these assumptions, there is time to further review and refine the approach to be taken for the next analysis.

(5) parks contribution

The boundaries of some draft landscape units extend into national and provincial parks, where these have the same biogeoclimatic subzone as the adjacent TSA lands. These parks are assumed in the analysis to be part of the land base that does not contribute to timber supply, but which can help to meet seral stage guidelines for biodiversity. This assumption is consistent with provincial policy direction.

As discussed above, non-contributing lands were assumed in the analysis to age continuously over time, and public comments raised concerns about the validity of assuming park lands can continue to meet old seral guidelines particularly since current approaches to vegetation management in parks encourage a natural mosaic of forest stands and ages.

Parks Canada submits that national parks are managed on the basis of natural disturbance regimes and (if disturbed) may result in the area abutting the parks in-effect being managed to lower-emphasis biodiversity.

The assumption in the analysis that parks contribute to meeting seral stage guidelines for landscape-level biodiversity is consistent with provincial policy direction, and I accept this approach. The separate concern about future aging of forests in non-contributing lands, including parks, was discussed above in consideration (4).

In summary, timber supply is not especially sensitive to changes to the assumptions regarding landscape-level biodiversity since the mature and old forest stands in the timber harvesting land base on both the operable and inoperable areas are sufficient to meet most mature- and old-seral stage requirements. I expect that the next analysis will refine the approach used to model landscape-level biodiversity and I urge district staff to continue to address any uncertainty in this factor during ongoing operational planning in the TSA.

- (vi) **any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber;**

Forest development plans and harvest sequencing

Licensees in the TSA annually prepare forest development plans identifying a realistic five-year timber harvesting strategy. Recent experience has shown that licensees are able to locate and plan for a five-year supply of wood; however, this increasingly requires licensees to enter difficult areas and marginal timber types.

In the analysis, it was assumed that the oldest stands are harvested first, with harvesting occurring throughout the TSA. However, forest development plans show that the age of stands planned for harvesting varies considerably and is inconsistent with the sequence assumed in the analysis.

A sensitivity analysis shows the impact on timber supply of a random-age harvest sequence. In this case, the initial harvest level could only be maintained for three decades and not four decades as projected in the base case, with an average volume of 408 cubic metres per hectare. Also, the medium- and long-term harvest projection was about eight percent less than the level depicted in the base case.

In practice the actual ages of harvested stands are not truly random because generally stands are harvested based on a maximum value, and these tend to be the older, higher volume stands. However, I also recognize that they are not likely all the oldest stands but somewhere in between.

I acknowledge that under current operational conditions the modelling assumption of “oldest first” in the base case does not accurately reflect the true current sequence of harvested ages. The sensitivity analysis shows that the assumptions of “random-first” sequencing does not pose a risk to the projected timber supply in the short term. However, the timber supply implications of harvest sequences other than “oldest-first” may increase when analysed in combination with changes in other factors. I have accounted for this risk to timber supply as noted in “Reasons for Decision”.

To avoid the identified potential for timber supply reductions over the longer term, I recommend that staff place priorities on harvesting older stands first wherever possible, and on facilitating access to older stands throughout the TSA.

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area;

Alternative harvest flows

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in many parts of the province. In the short term, the presence of large volumes of older forests often permits harvesting above long-term levels without jeopardizing future timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined to ensure that current and medium-term harvest levels will be compatible with a smooth transition toward the usually (but not always) lower long-term harvest level. Thus, timber supply should remain sufficiently stable so that there will be no inordinately adverse impacts on current or future generations. To achieve this, the AAC determined must not be so high as to cause later disruptive shortfalls in supply nor so low as to cause immediate social and economic impacts that are not required to maintain forest productivity and future harvest stability.

In addition to the base case harvest forecast, BCFS staff assessed a harvest flow alternative. This alternative examined the longest period that the initial harvest level could be maintained without affecting the long-term harvest level. In this case, the forecast resulted in the current harvest of 230 000 cubic metres being maintained for six decades with a rapid decline to about 159 000 cubic metres per year.

In the base case analysis, the analyst applied harvest flow guidelines developed for timber supply reviews, which seek to maintain the current AAC while allowing gradual declines in future harvest levels, and assuring the attainment of long-term harvest levels.

In reviewing a number of sensitivity analysis and noting the stability of the timber supply, I note there is some flexibility to buffer risk introduced by uncertainty in some of the assumptions used in defining the base case.

I have taken this flexibility into account in making my determination, as noted in “Reasons for Decision”.

Community implications

Forestry directly accounts for about 14 percent of the employment in the TSA. Provincially, the current AAC supports an estimated 645 person-years of (direct, indirect and induced) employment and generates an annual employment income of 25 million dollars. Within the TSA, the current AAC supports an estimated 320 person-years of direct employment and an estimated annual employment income of 13.8 million dollars would be earned by residents in the area.

Since the base case forecast projects that the current harvest level can be maintained for four decades, albeit with some uncertainty, potential changes to the harvest level and subsequent impacts on employment and revenue were not examined for this timber supply review.

(c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities;

Timber processing facilities

The timber processing facilities in the Revelstoke TSA include: two lumber mills, a pole yard, a value-added remanufacturing facility, two shake and shingle mills (one currently closed). There are also a number of smaller mills that collectively process less than 10 000 cubic metres per year.

In total, between 75 and 85 percent of the annual harvest is processed in mills within the TSA. Pulp quality logs from the licensees’ operations go to the Celgar pulp mill in Castlegar and Georgia Pacific’s operation in Cache Creek. In addition, mills purchase about 50 percent of their requirements from nearby sources such as adjacent TSAs, TFLs and private lands. This additional wood requirement makes the milling facilities highly dependent on timber supply from other management units.

Selkirk Specialty Wood Products has recently established a value-added mill after being awarded a timber sale licence of 150 000 cubic metres. I note that other similar types of sales may lead to the development of more value-added facilities in the TSA.

- (d) the economic and social objectives of the government, as expressed by the Minister, for the area, for the general region and for British Columbia;

Minister's letter and memorandum

The Minister has expressed the economic and social objectives of the Crown for the province in two documents to the chief forester—a letter dated July 28, 1994, (attached as Appendix 3) and a memorandum dated February 26, 1996, (attached as Appendix 4). I understand both documents to apply to the Revelstoke TSA. They are consistent with the objectives stated in the Forest Renewal Plan and include forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest-level changes in a managed transition from old-growth to second-growth forests, so as to provide for community stability.

The Minister stated in his letter of July 28, 1994, that “any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.” He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end he asked that the chief forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas. To encourage this the Minister suggested consideration of partitioned AACs.

I have reviewed the opportunities for commercial thinning, and, as discussed under *incremental silviculture*, commercial thinning is not currently carried out, or planned for, in the Revelstoke TSA, and none was assumed in the analysis. I have also reviewed opportunities for harvesting in previously uneconomic areas, in respect of which I note that harvesting in marginally economic stands is already assumed in the base case projection.

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that pre-Code constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. I have discussed this above under *visually sensitive areas*, where I noted that for the Revelstoke TSA, analysis guidelines for scenic areas were developed in consideration of other objectives now required under the Forest Practices Code.

Local objectives

The Minister's letter of July 28, 1994, suggests that the chief forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives. The BCFS took a number of steps to provide opportunities for public review through the timber supply review process for the Revelstoke TSA including public opportunities to review the information report and the timber supply analysis, and to respond to a public discussion paper.

The Kootenay-Boundary Land-Use Plan Implementation Strategy (KBLUPIS), which has been accounted for in this determination as well as possible, was approved after years of public dialogue and negotiation. The KBLUPIS has not been declared a higher-level plan under the Code, and as referenced elsewhere in this document, some elements of the plan would benefit from further clarification as the plan continues to be interpreted and implemented. In addition, I have considered and reviewed the MAC draft strategy as discussed above in a number of sections. Key elements of the KBLUPIS are reflected in the assumptions in the analysis, except where otherwise noted, such as in the case of draft biodiversity emphasis option assignments for landscape-level biodiversity, or in the case of “proportional representation” of old-growth on the forested land base.

Wherever possible, I have attempted in this rationale to respond briefly to the views expressed in the public input, and consideration of this input has been an important component of this determination. Public input commonly included expressions of a need to either (a) fully employ both the objectives of KBLUPIS and MAC, or (b) modify these objectives where they were felt to be (i) too constraining on timber supply, or (ii) inadequate for the purposes of environmental protection. I note that the KBLUPIS does provide opportunities for amending approved objectives in the future and that the MAC plan has not yet been approved by government. If and when this is done, the refined or updated objectives can be considered and taken into account in future AAC determinations.

In the meantime, I have taken guidance from the KBLUPIS. As noted in my “Guiding Principles”, I do not consider it appropriate in AAC determinations to attempt to predetermine or prejudice land-use plans, or to anticipate possible changes to existing, or approved land-use plans; rather I will account for such decisions when they have been made by the appropriate statutory decision makers. At this point it is my view that declaring appropriate parts of the KBLUPIS, and possibly parts of the MAC plan, as a higher-level plan under the Code could remove uncertainty and provide clear direction to statutory decision makers responsible for either interpreting or implementing the plan.

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Unsalvaged losses

Timber volume losses due to insects and diseases that normally affect stands (endemic) are generally accounted for during inventory sampling of existing stand volumes. Additional losses such as abnormal (epidemic) infestations are not generally included in the sampling and therefore further accounting is required in estimating the timber supply.

Timber volumes from stands damaged by causes such as fire, insects and disease are often salvaged. However, some of the timber volumes are not recovered through salvage operations due to factors such as limited road access or low timber value.

In regenerated forests, a number of parasites, fungi or plants can kill trees or degrade the quality and value of logs. Losses associated with second-growth stands are addressed by application of operational adjustment factors (OAFs) as noted under *volume estimates for regenerated stands*.

In order to estimate unsalvaged losses in the Revelstoke TSA, actual quantified losses from 1991 to 1996 were assessed from licensees' annual reports, fire reports and other relevant data sources. Total annual losses applied in the analysis were estimated to be 32.5 hectares or about 8586 cubic metres. Nearly all the annual losses (7628 cubic metres) were attributable to fire—either wildfire or broadcast fringe burns. Douglas-fir bark beetle, hemlock looper and blow-down accounted for most of the remaining losses.

However, district staff note that in 1998, over 2000 hectares burned in the TSA. A reassessment of unsalvaged fire losses (based on a 22 year average) to include the 1998 fire season, indicates that the annual losses could be 1282 cubic metres higher than reflected in the base case if these higher losses were to become part of a long term pattern of increased losses.

Input from the forest sector stated that the method for estimating unsalvaged losses for this determination was a significant improvement over the method applied in the 1994 analysis. However, they disagreed that the losses will remain constant over time because road access will increase the opportunity for timber recovery. Also, operational experience within the forest sector suggests that losses should decline over time, as harvesting older stands decreases and increases in younger, healthier stands. Parks Canada expressed concern that the estimate of unsalvaged losses was underestimated, particularly in areas where juvenile spacing and thinning is undertaken.

Having reviewed the approach taken by BCFS staff in accounting for losses in the analysis, I conclude that the base case assumptions represent a reasonable methodology, and I find the estimates appropriate for consideration in this determination. I acknowledge that the estimated losses may decrease in the future, as harvesting shifts from older to younger stands, and this can be accounted for in future determinations. This may, however, be offset by a possible increase in fire losses if the unusually high fire losses experienced in 1998 become part of a long-term trend (although it is uncertain at present if that is the case). In any event, uncertainty about future losses does not affect the projected short-term timber supply. For this determination, I accept the assumptions for unsalvaged losses as applied in the base case, (noting that if the average long term fire loss was increased by 1282 cubic metres—that short term timber supply would be insensitive to or unaffected by this small adjustment).

Reasons for Decision

In reaching my AAC determination for the Revelstoke TSA, I have considered all of the factors presented above, and I have reasoned as follows.

The timber supply analysis base case projected an initial harvest level of 230 000 cubic metres per year. The initial harvest level was projected to be maintained for four decades before beginning a decline over four decades to a long-term harvest level of 159 000 cubic metres per year.

In determining AACs, my considerations typically identify factors which, considered separately, indicate that the timber supply may be either greater or less than that projected in the base case. Some of these factors can be quantified and their impacts assessed with some reliability. Others may influence timber supply by introducing an element of risk or uncertainty to the decision, but cannot be reliably quantified at the time of the determination. These latter factors are accounted for in determinations in more general terms.

The following factors have been identified in my considerations as reasons why the timber supply projected in the base case may have been overestimated to a degree that can be quantified:

- *operability*: the 1997 operability review indicated that timber harvesting on about 3785 hectares (about six percent) of the timber harvesting land base is not economically feasible due to extensive and difficult road access combined with low stand merchantability.
- *environmentally sensitive areas*: none of the 11 315 hectares of moderately sensitive areas was excluded from the timber harvesting land base in the analysis. After applying a 10 percent reduction factor to these areas and accounting for potential overlaps with other land base deductions, I concluded that approximately 875 hectares of moderately sensitive areas should have been excluded from the timber harvesting land base.

The following factors have been identified as indicative of potential overestimation of the timber supply to degrees that currently cannot be quantified with accuracy:

- *caribou habitat*: there is uncertainty about accounting for caribou habitat in the timber supply analysis, however, it is not clear to what degree the forest cover requirements for caribou have been underestimated.
- *identified wildlife*: to account for implementation of the provincial Identified Wildlife Management Strategy in this TSA, consistent with provincial guidance, I have accepted an overestimation of up to one percent in the timber supply throughout the forecast period. I am mindful of the risk of the uncertainty associated with this factor but feel it is necessary to consider the risk associated with this uncertainty given that

some species at risk are known to exist in this TSA and government has put in place policy tools that will lead to management objectives being set for them.

- *riparian habitat*: riparian management areas adjacent to S1 and some smaller streams were not fully accounted for in the timber supply analysis. I concluded that timber supply was overestimated in the base case. While the precise amount of the underestimate is unquantified, further evaluation by forest district staff and the timber supply analyst led to the conclusion that the likely order of magnitude is less than one percent of the timber harvesting land base.
- *harvest sequencing*: the modelling assumption of “oldest first” in the base case does not reflect the current age profile of harvested stands. This does not represent a risk to the short-term timber supply, but may introduce a risk to the long-term timber supply if operations do not generally harvest the oldest stands first.
- *spatially explicit analysis*: the two different types of analyses, ATLAS and FSSIM (spatially explicit and spatially implicit, respectively), provided different timber supply forecasts. While this is a provincial concern, the modelling approach applied in FSSIM is intended to be flexible, as are current operations. There are two points of view: either the modelling is not reflective of rigid constraints, or the constraints are being applied too rigidly in the field. More work is necessary to better understand and define operational goals. Although I do not believe that the current approach introduces significant risk to the timber supply, I acknowledge that spatially explicit analysis and its associated ability to explicitly model adjacency indicates some uncertainty when interpreting the timber supply forecasts produced using FSSIM.

The following factors have been identified as reasons why the timber supply projected in the base case may have been underestimated to degrees that may be quantified:

- *deciduous stands*: about 578 hectares of predominately deciduous stands excluded from the timber harvesting land base are actually very young stands (less than 40 years of age). Over the course of the rotation these stands will become predominately coniferous and therefore should be considered as contributing to the timber supply. The majority of these stands are adequately stocked with an understory of coniferous species and district staff have confirmed their intention to manage these stands for coniferous production.
- *site productivity estimates*: in the analysis application of OGSi adjustments to site indices for mature stands older than 140 years of age showed the potential for an increase of about 20 percent in available timber supply over the long term. Medium-term timber supply is also improved as the decade six and seven reductions shown in the base case are fully offset by the increase in timber supply arising from the OGSi adjustments.

I find that in examining the upward and downward pressures on timber supply, I can draw reasonable conclusions about the timber supply at this time, and have reasoned as follows:

Firstly, having consulted district staff on the matter of the increased area required for managing caribou habitat (1583 hectares), I am advised that this area is almost fully overlapped by the additional area of inoperability (3785 hectares) described above under *physical and economic operability*. Furthermore while most, but not all, of this area is already accounted for by the additional operability reduction, I further note that that the additional caribou area is not a netdown per se but rather an area that requires additional forest cover constraints to be applied beyond those already applied in the base case.

This being the case, it is therefore unlikely that any small residual area not covered by the operability reduction would have a further impact on timber supply. I base this conclusion on the sensitivity analysis which shows that if forest cover constraints, or age to green-up were made more constraining across the entire wildlife and IRM zones, short-term timber supply can still be maintained for four decades (rather than five as shown in the base case) and meet the criteria of a managed transition to a slightly lower long-term harvest level.

The further downward influences when considered either on their own merits or in conjunction with the other downward influences do not provide sufficient cause to reduce the AAC at this time. Again I am guided by sensitivity analysis in drawing this conclusion. The known downward influences total to about 6.9 percent of the timber harvesting land base. A sensitivity analysis which tested the impact of a seven percent reduction to the timber harvesting land base showed that the current harvest level could still be maintained for four decades (rather than five as shown in the base case) then undergoing a reasonable series of declines similar to the base case, and ultimately declining to a level about seven percent below the base case long-term harvest level.

Having considered the reasonably quantifiable factors, I will now turn to those factors which are not as readily quantified but are known to have a downward influence on timber supply to the extent that they introduce uncertainty (and hence risk) into my decision.

Generally short-term timber supply is considered to be quite stable in the analysis, as shown by the numerous sensitivity analyses conducted and documented during the review. The downward pressures from identified wildlife and the additional riparian adjustment, while somewhat uncertain, are known by order of magnitude to likely be less than two percent combined. Given the stable short-term timber supply, in my judgement these factors—even when considered in conjunction with the ESA and operability reductions—are unlikely to result in a reduction to short-term timber supply or to disrupt a managed transition to a steady, albeit lower, long-term harvest level.

Having established that the current harvest can be maintained for several decades—after accounting for the above noted reductions—I will now consider the remaining downward influences in conjunction with the upward influences on timber supply.

The upward influence of about a 0.8 percent increase in the timber harvesting land base due to the inclusion of the deciduous areas, combined with the likelihood of higher site productivity has an extremely favourable influence on timber supply. While there is some uncertainty about the full attainment of the 20 percent timber supply increase due to OGSI, I am in general agreement that timber supply is much more favourable in this unit than shown in the base case and note the impact on timber supply works primarily in the medium to long term.

Given that the concern that has been raised about harvest sequencing acts primarily in the long-term (about an eight percent reduction according to the sensitivity analysis), I am confident that this is more than offset by the above-noted upward influences, and this factor therefore does not introduce any further cumulative risk to the attainability of short-term timber supply. In fact, to this point, it is my conclusion that the timber supply in this unit is likely more stable than shown by the base case.

Finally there is one outstanding concern. Questions have been raised about the uncertainty associated with the spatially implicit model (FSSIM) that was used in this analysis. While I have discussed this matter thoroughly earlier in this document, I do acknowledge that there is still uncertainty associated with this factor. However, given my earlier conclusions about the stability of timber supply in the analysis, and the likelihood of an overall more stable timber supply after considering all other factors, uncertainties and influences on timber supply—I do not feel it would be appropriate to change the AAC in this unit because of the uncertainty associated with different modelling approaches at this time. I do however feel it is important to resolve this concern and am aware that there is work ongoing at a provincial level to do so. This and other matters will obviously have to be carefully reviewed again at the time of the next AAC determination.

In summary, I am satisfied on balance that after accounting for the factors influencing this decision, that the harvest level projected in the base case can be readily maintained for the next five years without introducing a risk of disrupting the smooth transition to a stable long-term harvest level.

Determination

I have considered and reviewed all the factors as documented above, including the risks and uncertainties of the information provided. It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that reflects current management practices as well as the socio-economic objectives of the Crown, can be best achieved in the TSA by establishing an AAC of 230 000 cubic metres.

This determination is effective January 1, 2000, and will remain in effect until a new AAC is determined, which must take place within five years of the effective date of this determination.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage BCFS staff to undertake the tasks and studies noted below and earlier in the appropriate sections of this document. I recognize that the ability of staff to undertake these projects is dependent on available staff resource time and funding. These projects are, however, important to help reduce the risk and uncertainty associated with key factors that affect the timber supply in the TSA.

- *operability*: in preparation for the next timber supply analysis, the district should annually monitor operability to reduce uncertainty regarding the size of the timber harvesting land base;
- *harvest profile*: while monitoring operability, district staff should review the age profile of harvested stands;
- *environmentally sensitive areas*: BCFS and MELP staff should re-examine areas classified as moderately sensitive to ensure they are appropriately accounted for in the next analysis;
- *problem forest types*: the district should continue to review the utilization of problem forest types to realistically assess their contribution to timber supply;
- *site productivity estimates*: performance in regenerated stands should be monitored with field-based plots to determine if the increases in site productivity suggested by the old growth site index studies are fully warranted;
- *not-satisfactorily-restocked areas*: prior to the next determination, staff should reassess the areas classified as current and backlog NSR;
- *riparian management areas*: the accounting of riparian habitat should be improved;
- *aging of stands in inoperable areas*: this is a provincial issue that requires an assessment of how to best model disturbance patterns and succession in areas outside the timber harvesting land base.

In addition, this determination has underscored the need for clarification of the KBLUPIS particularly with regard to factors that affect timber supply as well as non-timber objectives. In addition, I note that the MAC draft strategy has not yet been approved by government.

There is a particular need for direction on the application of landscape-level biodiversity guidelines in operable and inoperable forests, and the resultant implications for grizzly bear habitat management. Many public comments received in the timber supply review for this TSA raised concerns about the MAC draft strategy and the existing KBLUPIS guidelines. Confirmation and clarification of management guidelines either in the form of a higher level plan or policy direction are therefore needed to address these concerns.

A handwritten signature in dark ink, appearing to read 'L. Pedersen', followed by a horizontal line extending to the right.

Larry Pedersen
Chief Forester

August 5, 1999

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the Forest Act, Revised Statutes of British Columbia 1996, reads as follows:

8. Allowable annual cut

8. (1) The chief forester must determine an allowable annual cut at least once every 5 years after the date of the last determination, for
- (a) the Crown land in each timber supply area, excluding tree farm licence areas, community forest agreement areas and woodlot licence areas, and
 - (b) each tree farm licence area.
- (2) If the minister
- (a) makes an order under section 7 (b) respecting a timber supply area, or
 - (b) amends or enters into a tree farm licence to accomplish a result set out under section 39 (1) (a) to (d),

the chief forester must make an allowable annual cut determination under subsection (1) for the timber supply area or tree farm licence area

- (c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and
 - (d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.
- (3) If
- (a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and
 - (b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).

- (4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).
- (5) In determining an allowable annual cut under subsection (1) the chief forester may specify portions of the allowable annual cut attributable to
- (a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area,
 - (b) different types of timber and terrain in different parts of private land within a tree farm licence area, and

AAC Rationale for Revelstoke TSA

- (c) gains in timber production on Crown land that are attributable to silviculture treatments funded by the government of British Columbia, the federal government, or both.
- (6) The regional manager or district manager must determine a volume of timber to be harvested from each woodlot licence area during each year or other period of the term of the woodlot licence, according to the licence.
- (7) The regional manager or the regional manager's designate must determine a volume of timber to be harvested from each community forest agreement area during each year or other period, in accordance with
 - (a) the community forest agreement, and
 - (b) any directions of the chief forester.
- (8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider
 - (a) the rate of timber production that may be sustained on the area, taking into account
 - (i) the composition of the forest and its expected rate of growth on the area,
 - (ii) the expected time that it will take the forest to become re-established on the area following denudation,
 - (iii) silviculture treatments to be applied to the area,
 - (iv) the stand of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area,
 - (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production, and
 - (vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber,
 - (b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,
 - (c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities,
 - (d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and
 - (e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

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Appendix 2: Section 4 of the *Ministry of Forests Act*

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to
 - (a) encourage maximum productivity of the forest and range resources in the Province;
 - (b) manage, protect and conserve the forest and range resources of the Crown, having regard to the immediate and long term economic and social benefits they may confer on the Province;
 - (c) plan the use of the forest and range resources of the Crown, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the Crown and with the private sector;
 - (d) encourage a vigorous, efficient and world competitive timber processing industry in the Province; and
 - (e) assert the financial interest of the Crown in its forest and range resources in a systematic and equitable manner.

Documents attached:

Appendix 3: Minister of Forests' letter of July 28, 1994

Appendix 4: Minister of Forests' memo of February 26, 1996

Appendix 5: Summary of Public Input



File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

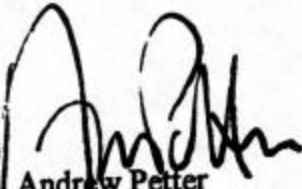
Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

.../2

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,



Andrew Petter
Minister



File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: The Crown's Economic And Social Objectives Regarding Visual Resources

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

.../2

Larry Pedersen
Page 2

In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis*.

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.



Andrew Petter
Minister of Forests