**BRITISH COLUMBIA**
**MINISTRY OF FORESTS**

# Fraser Timber Supply Area

## Rationale for Allowable Annual Cut (AAC) Determination

**Effective April 1, 1999**

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**Chief Forester**

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## Objective of this Document

This document is intended to provide an accounting 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 Fraser timber supply area (TSA). This document also identifies where new or better information is required for incorporation into future determinations.

## Description of the TSA

The Fraser TSA is located in the southern mainland portion of the Vancouver Forest Region, in south-eastern British Columbia. Covering approximately 1.1 million hectares, the TSA corresponds closely to the watershed of the Lower Fraser River Basin, located in the Coast Mountain range, being bordered to the east by the Cascade Mountains, and to the south by the international border with the United States. Administered from the Chilliwack Forest District office in Rosedale, the Fraser TSA is the most densely populated TSA in the province, encompassing the major population centres of the lower mainland and the Fraser Valley. The population of the lower mainland grew by 15 percent to 2.05 million between 1991 and 1996 and is still growing, and that of the Fraser Valley Regional District is predicted to more than double from 220 000 in 1998 to 450 000 in 2021.

The TSA is biologically diverse, extending from sea level to 2400 metres (6000 feet), with representation from five biogeoclimatic zones: Coastal Western Hemlock—the most abundant; Mountain Hemlock; Alpine Tundra; Interior Douglas-fir; and Engelmann Spruce-Subalpine Fir. The TSA contains one of the richest and most diverse arrays of wildlife in Canada, with a number of species being considered by the Wildlife Branch of the Ministry of Environment, Lands and Parks (MOELP) to be “at risk”, including the Northern Spotted Owl.

Forests in the Fraser TSA are dominated by stands of western hemlock and Douglas-fir. Of the total TSA area of 1 107 060 hectares, 507 024 hectares are productive Crown forest managed by the British Columbia Forest Service (BCFS). Of this, 281 480 hectares are currently considered suitable and available for timber harvesting. Thirteen commercial tree species are present, with hemlock, Douglas-fir and balsam being the species most commonly harvested. There is a long history of timber harvesting in the area, and a large proportion of the current forest is comprised of “second-growth” stands established after harvesting.

The forest industry provides a substantial source of revenue and employment in the Fraser TSA, with more than 100 major timber processing facilities. Although a large proportion of the timber processed within the TSA is harvested outside the TSA, timber harvesting is an important part of the local economy, especially in the smaller, more remote communities.

Tourism, recreation, scenic values, biodiversity, and conservation are important in the Fraser TSA. The TSA area encompasses several popular parks including Garibaldi, Manning, and Golden Ears, and since the last timber supply review a number of additional new protected areas totalling 75 299 hectares have been established in the TSA through the Lower Mainland Protected Areas Strategy. The area provides easily accessible forest recreation opportunities to the major population centres, and scenic values are managed carefully, as several major highway corridors cross the TSA.

The geographic area that includes the Fraser TSA overlaps the traditional territories of 34 First Nations Indian Bands and 5 tribal organisations. Eight groups are in treaty negotiations.

## History of the AAC

In 1978, the AAC for the Fraser TSA was 1 643 000 cubic metres. Subsequent redeterminations were as follows: 1979: 1 700 000 cubic metres; 1985: 1 700 000 cubic metres; 1987: 1 765 000 cubic metres (an increase of 65 000 cubic metres reflecting the inclusion of predominantly deciduous forest stands); 1995: 1 550 000 cubic metres (including up to 57 000 cubic metres of deciduous-leading stands.

The AAC of 1 550 000 cubic metres determined in 1995 is currently apportioned by the Minister of Forests under section 10 of the *Forest Act* as follows:

| Apportionment | cubic metres/year | percentage |
|---|---|---|
| Replaceable Forest licences | 1 131 365 | 73.0 |
| Timber sale licences, replaceable, over 10 000 $m^3$ | 16 322 | 1.1 |
| Timber sale licences, replaceable, under 10 000 $m^3$ | 16 368 | 1.1 |
| SBFEP* any category (Section 20) | 207 117 | 13.4 |
| - Category 1 (Section 20) | 0 | 0.0 |
| Category 2 (Section 20) | 0 | 0.0 |
| - Bid proposals (Section 21) | 89 082 | 5.7 |
| Forest Service Reserve | 45 047 | 2.9 |
| Woodlot licences (unallocated) | 19 268 | 1.2 |
| Forest Licences, non replaceable | 25 431 | 1.6 |
| Timber Sale Licences | 0 | 0.0 |
| Pulpwood agreements | 0 | 0.0 |
| **Total** | **1 550 000** | **100.0** |

* Small Business Forest Enterprise Program. These figures exclude SBFEP volumes within Tree Farm Licence (TFL) areas.

## New AAC determination

Effective April 1, 1999, the new AAC for the Fraser TSA will be 1.27 million cubic metres. This volume is a reduction of approximately 18 percent from the current AAC, and includes an allowable harvest of up to a maximum of 32 500 cubic metres of deciduous-leading forest types.

This 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 the AAC determination

Information considered in determining the AAC for the Fraser TSA includes the following:

- *Fraser Timber Supply Area Analysis Report*, (TSAR) British Columbia Forest Service (BCFS) Timber Supply Branch, June 1998;
- *Fraser Timber Supply Area Public Discussion Paper*, BCFS, June 1998;
- *Fraser Timber Supply Area Summary of Public Input on Data Package and TSAR*, BCFS, September 15, 1998;
- Sample Contract to Conduct a VEG Tree Height Assessment, BCFS, March 1998;
- *Spotted Owl Management Plan - Summary Report*, Province of BC, April 1997;

- *Biodiversity Guidebook*, Province of British Columbia, September 1995;
- *Community Watershed Guidebook*, Province of British Columbia; October 1996;
- *Enhanced Forestry Resource Management Plan*, Chilliwack Forest District, 1998;
- *Explanation of Interfor's Fraser Timber Supply Area Wildlife Tree Patch Netdown Analysis*, International Forest Products (Interfor), August 17, 1998;
- *Incorporation of the Inventory Audit in the Fraser TSA Timber Supply Review*, BCFS, 1996;
- *Riparian Management Area Guidebook*, Province of British Columbia, December 1995;
- *Low Site Investigation*, Drake, J.A.; Swenson, D.P., Simons Reid Collins, March 1997;
- *An Evaluation of Deer Winter Range in the Fraser Timber Supply Area*, Hazenboom, Cindy, Interfor, August 10, 1998
- *Working Paper 36/1998, Site Index Adjustments for Old-growth Stands based on Veteran Trees*, Nigh, G.D. BCFS Research Branch, Victoria, B.C., 1998;
- *Working Paper 37/1998, Site Index Adjustments for Old-Growth Stands Based on Paired Plots*, Nussbaum, A.F., BCFS Research Branch, Victoria, B.C.1998;
- *Weyerhaeuser Forestry Paper No. 17, Site Index Tables for Western Hemlock in the Pacific Northwest*, Wiley, K.N., Centralia Wa., 1978;
- Letter dated October 7, 1996 from Interfor to BCFS Resources Inventory Branch, expressing concerns regarding the Fraser TSA volume audit, and reply to Interfor from Keith Tudor, Inventory Branch, dated October 15, 1997;
- *Sustainable Forestry or Timber Mining?*, Gray, B. and Haddock, M, BC Wild, April 1996;
- Letter dated April 8, 1998, from Mark Haddock, West Coast Environmental Law Association, to Chief Forester, regarding the sustainability of logging in the Mountain Hemlock zone and the implications for AAC in the Fraser and Soo TSAs;
- Letter dated June 24, 1998 from Robin Brown, BCFS Forest Practices Branch, to Mark Haddock, West Coast Environmental Law Association, in response to letter re *Sustainable Forestry or Timber Mining?*
- Letter from the Minister of Forests to the chief forester, July 28, 1994, stating the Crown's economic and social objectives for the province;
- Memorandum from the Minister of Forests to the chief forester, 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, August 25, 1997, conveying government's objectives regarding the achievement of acceptable impacts on timber supply from biodiversity management ;
- Letter from the Vancouver Forest Regional Manager to licensees, May 22, 1996, providing direction on landscape-level biodiversity strategies;
- Memo from the Vancouver Forest Regional Manager, to district managers and regional team leaders, dated December 15, 1997, regarding wildlife tree patch implementation;
- Memo and attachment from the Director, Timber Supply Branch, re Incorporating Biodiversity and Landscape Units in the Timber Supply Review, December 1, 1997;
- Technical review and evaluation of current operating conditions through comprehensive discussions with staff of the BCFS and MOELP, including the AAC determination meeting held in Chilliwack, October 7 and 8, 1998;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Act Regulations*, April 1995;
- *Forest Practices Code of British Columbia* Guidebooks, BCFS and MOELP;
- *Forest Practices Code Timber Supply Analysis*, February, 1996, BCFS and MOELP.

## 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 Fraser 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 specific factors in determining AACs for TSAs and tree farm licences (TFLs). 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 for some areas, 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 BC 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 sub-regional plans, the Protected Areas Strategy, and the 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 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 immediately deducted from the timber harvesting land base and are no longer considered to contribute to the timber supply in AAC determinations.

Forest Renewal British Columbia (FRBC) funds 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 persons 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 court decisions, including 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 Fraser 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 (MOF) 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 an information package including 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, starting 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 available, current 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 of British Columbia Act*, 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 Fraser TSA

The base case in this timber supply analysis incorporates a number of significant changes from the base case that was generated in the analysis used in the 1995 AAC determination. The specific assumptions used in this analysis are discussed in detail in the considerations presented below in the appropriate sections. In overview, they include changes incorporated to reflect the following:

- The Forest Practices Code is factored in more fully (only riparian and stand-level biodiversity considerations were included last time).
- A number of new protected areas have been established and are accounted for.
- The provincial government's Spotted Owl Management Plan, approved in May 1997, is being implemented, affecting 17 percent of the timber harvesting land base.
- The results of an inventory audit for the TSA, completed in 1996, have been incorporated.
- A major reassessment of visual quality objectives has been carried out.
- The areas of operability in the TSA have been reviewed.
- The definition of unmerchantable stands has been reassessed.

- A general modelling rule was applied whereby the rate of decline in harvest levels in successive decades was set equal to the size of the initial reduction required.

With these and other appropriate factors incorporated, two successive harvest forecasts, an "initial" forecast and a "base case" forecast were generated and submitted for public review. These are discussed immediately below under (a) and (b). They are also shown graphically below under (c), along with a subsequent, "corrected base case" forecast discussed in that section.

(a) The initial harvest forecast:

The initial harvest forecast—developed in accordance with the assumptions publicized in the May, 1997 data package for the Fraser TSA, before the application of necessary revisions to cutblock adjacency and subsequent production of the "base case" analysis—began with a starting harvest level of 1 395 000 cubic metres—an immediate reduction of 10 percent from the current AAC of 1 550 000 cubic metres. This was followed by further reductions of 10 percent in each of two successive decades, to a mid-term level of 1 021 575 cubic metres. This level represents what the sustainable long-term harvest level would be if it were based on natural (rather than managed) stand yields. A higher, long-term level of 1 201 575 cubic metres, reached in ten decades, reflects the higher productivity of second-growth managed stands when these make a major contribution to the harvest.

As explained in detail in the June 1998 analysis report, a mapping review of the location and rate of the harvest that would result from this initial forecast showed that the forest cover constraints regarding cutblock adjacency, as applied in the initial analysis, could lead to a high concentration of the timber harvest in certain areas of old growth. This concentration did not constitute a reasonable reflection of operational reality. The initial cutblock adjacency assumptions were therefore replaced by constraints applied on a finer geographic scale that produced a more reasonable distribution of harvesting on the landscape, and a second timber supply forecast, referred to in the June 1998 analysis as the "base case", was generated.

(b) The second harvest forecast—the "base case":

This second forecast, using the same forest management assumptions as in the initial forecast, but incorporating revised adjacency constraints, was referred to throughout the analysis report as the "base case" harvest forecast. As also explained in the report, due to the time required to perform the mapping review referred to in the previous paragraph, this revised "base case" was not available in time for use as a reference for sensitivity analyses to be published in the analysis report. Consequently, as noted in the report, all the published sensitivity analyses used in the report were based on the initial harvest forecast rather than the second, "base case" forecast. I have considered the salient differences between the two forecasts. I have concluded that the authors of the analysis report were correct in assessing that sensitivity analyses based on either forecast as a reference would provide information that would be helpful to me in dealing with uncertainty, by identifying those aspects of forest management, practices, or data, or modelling assumptions, in which variations would result in significant changes to the timber supply.

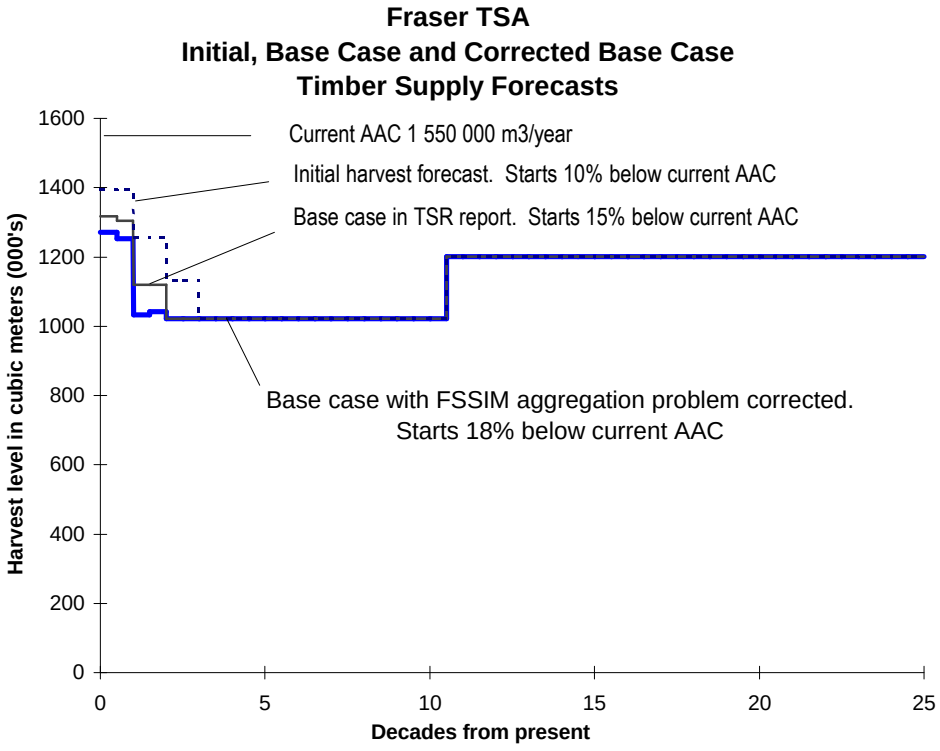
In this second, or "base case" forecast, with improved ability to model cutblock adjacency, the projected starting harvest level was 1.32 million cubic metres—a reduction of about 15 percent from the current AAC (compared to the 10 percent reduction in the initial forecast). This was followed in the next two decades by further declines of 15 percent, and 9 percent, to the same mid-term level as in the initial forecast, 1.02 million cubic metres, now reached after two decades

instead of three. The steady long-term level, reached in about ten decades, was 1.20 million cubic metres, reflecting as before the higher productivity of second-growth managed stands.

After the analysis report detailing both the initial forecast and the "base case" analysis had been published and circulated for public review and comment, BCFS analysts discovered an age-aggregation problem in the FSSIM analysis software that was introducing sufficient error in the regeneration delay values to warrant correction and re-analysis. The error was therefore corrected and a final, "corrected base case" analysis was produced.

(c) Final, corrected base case:

Correction of the FSSIM aggregation problem identified above resulted in the projection of the final "corrected base case" forecast (shown below with the "initial" and "base case" forecasts) which was used as a basis of reference for this determination. As noted in my "Reasons for Decision", correction of the age-aggregation procedure was an unavoidable technical requirement, not subject to debate or opinion, and public comment was not sought on the issue. This "corrected base case" projected a starting harvest level of 1.27 million cubic metres—18 percent lower than the current AAC, followed by a further 18-percent decline in the next decade. The same mid-term level as before, 1.02 million cubic metres, was reached, this time after only one decade, again representing the steady harvest level obtainable from only natural stand yields. The same long-term harvest level as before, 1.2 million cubic metres, was reached about ten decades from now, representing, as before, the higher yields associated with managed, second-growth stands. The final, corrected base case, together with the initial projection and the earlier base case are projected as follows:




At the AAC determination meeting in Chilliwack on October 7 and 8, 1998, in addition to the corrected base case I was provided with revised projections of:

- the volume harvested from natural versus managed stands over time;
- growing stock over time;
- volume harvested from stands less than 100 years old and from alder and maple stands.

In addition, to minimise any error that might be introduced in the assessment of uncertainty in view of the considerable difference between the starting harvest levels in the initial forecast and the corrected base case—a ten-percent reduction in the former versus an 18-percent reduction in the latter—I was also provided with a number of sensitivity analyses carried out using the corrected base case as a reference. All of these analyses have been of assistance to me in considering the factors leading to my determination. As discussed in my considerations set out below, and with the qualifications there expressed, I am satisfied that the corrected base case projection provides a suitable point of reference for my assessment of the timber supply in this AAC 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 Fraser TSA, from a computer file compiled in 1997 by the BCFS Vancouver Forest Region, and reported in the June 1998 timber supply analysis, is 1 107 060 hectares. Of this, 507 024 hectares are productive Crown forest managed by the BCFS.

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 which 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.

In deriving the timber harvesting land base for the Fraser TSA, deductions were made for non-commercial cover, inoperable areas, low-productivity forest, environmentally sensitive areas, unutilized deciduous stands, high recreation values, existing and future roads, trails and landings, riparian reserves, and newly created parks. A detailed accounting of the areas deducted is given in the analysis report, and is summarized in Table 3 of that report. After the deductions, the long-term timber harvesting land base for the Fraser TSA was estimated to be 280 746 hectares—55.4 percent of the productive area, or 25.3 percent of the total TSA area. In general this represents, in comparison with the timber harvesting land base in the previous analysis: a reduction of roughly 18 000 hectares for new protected areas; an increase of 15 000 hectares for previously excluded low-productivity sites that have been logged in the past; and a net increase of 9500 hectares in the

area considered to be operable. As an overall result, the current timber harvesting land base has been increased by about 6500 hectares.

I have considered provisions for riparian and recreation areas in the "integrated management objectives" section of this document. My consideration of the remaining deductions follows.

- *non-commercial cover*

For the analysis, a total of 943 hectares were deducted from the productive forest land base for non-commercial cover. This is in accordance with the best available information from the inventory files, and as such I accept this deduction as appropriate.

- *physical and economic operability*

Those portions of the TSA which are not physically accessible for harvesting, or which are not feasible to harvest economically, were excluded in deriving the timber harvesting land base, as discussed below.

- *physical operability:*

In the analysis, a total of 133 110 hectares were removed as inoperable areas.

To assess operability in the TSA, a review was conducted in 1996 by licensees, BCFS and a consultant. Some new areas that were previously outside operable lines were included where this was warranted by current performance by licensees or by the creation of new access, or where harvesting was now considered feasible by aerial systems (helicopter, skyline and other overhead systems). Some areas previously included as operable, in Small Business Forest Enterprise Program (SBFEP) areas, were excluded as inoperable.

The review resulted in a net addition of approximately 9500 hectares to the timber harvesting land base that had been derived for the previous analysis, after accounting for economic factors as discussed below. Aerial systems now account for 9141 hectares or about 3 percent of the timber harvesting land base. Currently about 40 percent of the volume in all forest development plans is in this category, and while there were only three helicopter blocks in the TSA ten years ago, today there are thirty, plus skyline systems.

MOELP staff have expressed concern about the shifting of operability lines where this reduces the extent of inoperable areas, since this change affects the amount of forest cover available in unconstrained areas to meet requirements in the biodiversity guidebook. I have considered this below, under *landscape-level biodiversity*, where I have noted the need for planning to determine landscape-unit objectives. In the interim, as also noted in that section, I am satisfied that for the five-year effective period of this determination, the inclusion of the new operable areas will not prevent the attainment of stand-level biodiversity requirements as specified in the *Biodiversity Guidebook*. Nevertheless, it is likely there will be a need to review the operable area again in context of landscape unit objectives when these are established.

The physical operability lines, as defined, are considered by district staff to represent a good approximation to the accessibility of the land base using the current range of operations proposed in forest development plans. Some recent forest development plans have proposed harvesting activities *outside* the newly revised lines, which indicates that the new lines likely do not exceed the range of current operations. However, any such proposals must be evaluated with careful

reference to identified biodiversity concerns and to the need for regular reviews of operability as changes occur in technology, markets, and environmental concerns.

I note that while the operable land base has increased since the last analysis, the newly included areas are primarily in areas of poorer productivity, while those excluded—for example for riparian areas, protected areas, or Spotted Owl habitat—tend to be in the higher productivity range. This will have been accounted for in the analysis with respect to volume implications, but may also influence the economic viability of operations through the quality and value of the timber harvested.

In summary, I have noted the recent date of the review of physical operability and the fact that it resulted both in the inclusion of areas previously considered inoperable, and the exclusion of areas previously considered operable. I have noted that licensees are proposing operations outside the new operability lines and that there is a need to review these lines with respect to landscape-unit objectives, including those for biodiversity, when these become available. I have also noted the trend toward increased use of aerial systems, and I have personally reviewed by aerial reconnaissance the approximate areas of some of the adjustments made to the operability lines. From all this I accept that the extent of physical operability assumed in the corrected base case analysis is a reasonable reflection of current practice and is appropriate for use in this determination.

- *economic operability—low-productivity sites:*

Forest stands that do not currently contain sufficient timber volumes for harvesting to be economically feasible and, based on estimated site productivity, are not likely to achieve a harvestable volume over time, were excluded in deriving the timber harvesting land base. In the analysis, a total of 34 256 hectares of these low-productivity sites were excluded.

To establish the criteria for inclusion or exclusion, a review of economic operability was carried out in March, 1997, in conjunction with the review of physical operability noted above. Cutting permits over the last five years were examined to determine the minimum average net volume per hectare and the area and volume from sites with less than 400 cubic metres of merchantable timber per hectare.

Based on the results of this study and on subsequent interviews with licensees, only those sites that met the following criteria for standing volume and site productivity were included in the timber harvesting land base:

- Standing volume of 350 cubic metres per hectare or more for areas harvestable by conventional systems;
- Standing volume of 400 cubic metres per hectare or more for areas harvestable by aerial systems;
- Standing volume of 150 cubic metres per hectare or more for deciduous stands;
- Stands with a site productivity capable of producing :
  350 cubic metres per hectare or more at age 150 years for conventional systems;
  400 cubic metres per hectare or more at age 150 years for aerial systems.

Questions were raised in the public input as to the economic viability of operations in these lower-productivity stands. Two facts persuade me that their inclusion at this time is appropriate.

First, the review of economic operability showed that 35 percent of the total area in the cutting permits reviewed had volumes less than 400 cubic metres per hectare, while in the timber harvesting land base only 24 percent of the forest stands older than 60 years have less than this volume figure. The fact that licensees are harvesting in areas of lower productivity in a proportion greater than their representation on the landscape, and are harvesting in stands of productivity lower than the cut-off point for inclusion in the timber harvesting land base, confirms that licensees are demonstrating performance in the stands included in the analysis. BCFS staff note that licensees are not necessarily setting out to target lower-volume stands, but when such a stand is discovered adjacent to planned operations in a higher-volume stand, its proximity may render it economic to harvest.

Second, in the last timber supply review, when all sites labelled low-productivity were excluded from the timber harvesting land base, about 15 000 hectares of them were incorrectly labelled, as they had previously been logged and are evidently capable of contributing to the harvest. These areas have now been included for the current determination, although this does not directly affect the short-term timber supply since the areas included are still immature.

A question was also raised in the public input as to the possibility for conflict between the inclusion of additional low-productivity stands and the conservation of biodiversity. I have addressed this concern under *landscape-level biodiversity*, below.

It was also suggested that harvesting in low-productivity stands should be partitioned, to ensure licensees do not "place the cut" in higher-quality stands. I have considered and discussed this with district staff including the district manager. From these discussions and from the methodology of the operability study I am satisfied that the economic operability factors reflect average conditions that will remain valid not just for the present determination but for the longer term. The actual level of performance in these stands therefore can and should be monitored over time, and any significant reduction from the present level can be accounted for, if warranted, by corresponding reductions in the derivation of the timber harvesting land base for future AAC determinations, the first of which will occur in a maximum of five years. Since licensees are aware of, and averse to this consequence of non-performance, I expect this deterrent to be equally effective as establishing a partition, which would ensure the same result but would be more complex and difficult to administer.

In considering this factor I have also reviewed an analysis of the sensitivity of the timber supply to reducing the area of the poorer stands included in the timber harvesting land base by 30 percent, which showed a significant reduction of 4 percent in the initial harvest level.

From all the foregoing considerations, I am satisfied that the assumptions in the analysis regarding economic operability are a reasonable reflection of current performance by licensees, who are in fact exceeding the specified criteria in some cases . District staff do not expect this latter situation to change in the near future, and I note that the criteria used in the review are applicable to longer-term average conditions. As discussed below in *landscape-level biodiversity* I am also assured that the biodiversity requirements of the Forest Practices Code can be met for the duration of this AAC, or until landscape-unit objectives are established, at which point a further operability review may be required. I am also satisfied that excluding an additional portion of the poorer growing sites would result in a substantial negative impact on the timber supply, which would be inappropriate and unwarranted in view of current licensee performance.

I have therefore accepted the assumptions included in the timber supply analysis corrected base case with respect to economic operability.

- *environmentally sensitive areas*

The identification of environmentally sensitive areas in the Fraser TSA is based on inventory work carried out from 1970 to 1974, although more recent, more detailed information exists at the drainage level for parts of the TSA. All harvesting operations on slopes greater than 60 percent require terrain assessment to ensure that operations do not cause environmental damage on unstable slopes.

In deriving the timber harvesting land base for the Fraser TSA, a total of 21 262 hectares, or 4.2 percent of the productive forest, were removed to account for environmentally sensitive areas including soils, avalanche areas, and areas with regeneration problems. Areas sensitive for wildlife habitat are discussed below under “Integrated resource management objectives”.

A concern was expressed by staff of MOELP that the soils information used is not adequate to fully account for the steep and/or unstable terrain of this TSA. I agree that new information from terrain assessments would be preferable to the more dated information used, and while this is not possible at present, this is the intended direction of analyses as resources and information permit. First Nations expressed a concern that the area deducted for environmentally sensitive areas was too small. BCFS staff note that for the current analysis the total environmentally sensitive area actually excluded from the timber harvesting land base is larger than the area specifically attributed to that deduction, since much of the sensitive soil on steep slopes was already deducted in the inoperable category.

For this AAC determination, I acknowledge that some uncertainty exists with regard to steep and unstable terrain and that information is always improving. Nevertheless, the best information available at this time was used, and any new information can be incorporated as appropriate into future analyses. Therefore, and since operations in such areas are subject to mandatory terrain stability assessment, I consider there is little risk in accepting the older inventory information on sensitive areas used in the analysis, taken in context of other land-base deductions, as a reasonable approximation to the extent of sensitive areas in the TSA.

- *protected areas*

The Lower Mainland Protected Areas Strategy as this applies to the Fraser TSA is now complete, except for the protection of approximately 1000 hectares of Fraser Lowlands which is not expected to significantly affect the timber harvesting land base of the TSA.

The following protected areas have been designated by order in council and are thus formally removed from the land base contributing to the timber supply in the Fraser TSA.

| Protected area with OIC | Total area protected (hectares (ha)) | Estimated area in timber harvesting land base (ha) |
|---|---|---|
| Pinecone Burke | 38 025 | 10 876 |
| Indian Arm | 3600 | 3400 |
| Chilliwack Lake | 9040 | 1488 |
| Nahatlatch Watershed | 402 | 88 |
| Mystic Lake | 675 | 105 |
| Mehatl | 23 557 | 2573 |
| **TOTAL** | **75 299** | **18 530** |

The total reduction to the timber harvesting land base from these already designated areas is 18 530 hectares, which was accounted for in the timber supply analysis. Two protected areas, Pinecone Burke and Indian Arm, produce 77 percent of this reduction.

Government has also declared its intention to designate four other areas in the Fraser TSA as protected areas, as part of the Lower Mainland Protected Areas Strategy, but has not yet completed the formal designation process for them all. These areas are the Sumas, Nahatlatch Lakes, Yale-Garry Oak, and Liumchen protected areas. On January 24, 1999, formal protection of the Liumchen and Yale Garry Oak areas was announced. In total all four of these areas represent a further reduction of 2318 hectares to the timber harvesting land base, which was also accounted for in the analysis. Since these areas were not formally designated at the time of the considerations for this determination, I have considered them separately under section 8(8)(a)(v) below.

Since the protected areas identified in the table above are now all formally designated, and since the corresponding areas in the table were deducted from the timber harvesting land base used in the analysis, I conclude that the corrected base case projection accounts appropriately for the reduction in timber supply resulting from the protection of these areas.

- *deciduous forest types*

In the rationale for my 1995 AAC determination for the Fraser TSA I noted that deciduous forest types with a potential for harvesting covered an estimated 14 000 hectares of the TSA, permitting a maximum annual deciduous harvest of 57 000 cubic metres.

In the current timber supply analysis, due to land base changes and higher riparian exclusions and deductions for non-marketable deciduous species, it was assumed that only about 10 000 hectares of predominantly alder and maple stands, with an average volume of 150 cubic metres or more per hectare, could contribute 50 000 cubic metres to the initial harvest level projected in the corrected base case. Of these 10 000 hectares, 7500 hectares were assumed to be converted after harvest to coniferous forest—and to

contribute as such to the medium- and long-term timber supply—and 2500 hectares were assumed to remain perpetually as deciduous forest. A total of 5614 hectares of cottonwood, aspen and birch were excluded from the timber harvesting land base.

BCFS district staff have reviewed the extent and composition of deciduous stands, but this review was not completed until after the current timber supply analysis. From the review it was concluded that even the reduced harvestable deciduous land base of 10 000 hectares used in the analysis was overestimated. District staff now conclude that of the 10 000 hectares that were assumed in the corrected base case to be entirely harvestable, 3500 hectares should have been excluded altogether from the timber harvesting land base, for riparian and other exclusions, and due to the identification of many stands as birch and other species rather than alder and maple. The remaining 6500 hectares included areas suitable for harvesting, and areas suitable for treatment for rehabilitation to conifers. The portion assumed to contribute fully to the short-term timber supply was identified as a maximum of 3000 hectares, with a medium-and-long-term converted coniferous contribution of 3500 hectares.

In reviewing the current and potential use of deciduous stands in the TSA, I note that the 20-year deciduous licence issued in 1988 currently provides for an annual harvest of 11 000 cubic metres. District staff advise that current performance is about 80 hectares per year by the primary licensee and 10 hectares per year by the SBFEP, which confirms this current level is achievable, although finding economically suitable stands is difficult. The remaining deciduous volume in the 1995 AAC is currently allocated to the Forest Service Reserve (FSR) and is intended to be converted to coniferous stands. To date this component has remained largely unharvested due to funding limitations.

I accept that the 3500 hectares that will be excluded as riparian and other land base deductions should not have been included in the corrected base case. The conversion of a further 3500 hectares to conifers, where it is biologically suitable to do so, is currently considered uncertain, depending on funding for rehabilitation programs, which has been unavailable in recent years. From the information presented by district staff, since the licensee is now performing at the licensed level, it appears reasonable to expect that the 3000 hectares of deciduous stands now identified as harvestable are in fact currently viable for harvesting operations.

Sensitivity analysis shows that if all the 10 000 hectares of deciduous stands assumed in the corrected base case analysis to contribute to timber supply were to remain unharvested, the projected mid- and long-term harvest levels would be reduced by about 5 percent, but the short-term supply could still be met by coniferous species. From this it may be inferred that if the 3500 hectares of new deductions are removed, the mid-to-long-term supply would be reduced by about 2 percent. However, since the overall riparian and other exclusions would not change, the larger deciduous deduction would result in a smaller coniferous deduction, with little or no net impact on the mid- and long-term supply. Nevertheless, if no harvesting for conversion occurs on the 3500 additional hectares of deciduous identified as treatable, the mid- and long-term levels would be reduced by up to about 2 percent.

In the public input, concern was expressed that if little deciduous volume is being logged it should not be included in the AAC without a partition, or “faster liquidation” of good

coniferous timber would result. This outcome is uncertain but unlikely, given the currently demonstrated performance in deciduous stands and the unavailability of a deciduous component of the Forest Service Reserve for harvest as coniferous volume.

Others suggested that a strategy should be developed to ensure deciduous stands are logged. In this respect I note that, to the extent that converting deciduous stands to coniferous is biologically suitable and consistent with the management objectives of the district, such treatments would also be beneficial to the timber supply in the mid and long terms. Funding applied to this purpose in this TSA at this time would have the quantifiable result of maintaining the mid- and long-term supply against the approximately 2-percent reduction noted above.

Thus, the extent to which deciduous stands will be harvested is uncertain, but under present conditions it appears the licensee will continue to harvest the licensed volume. Any further *commercial* volume harvested for stand conversion through the SBFEP will also need to come from the commercially suitable 3000 hectares. The extent to which further conversion will take place on the additional 3500 treatable hectares depends on uncertain funding, but the uncertainty affects the mid-to-long term supply.

From these considerations, since the assumed contributing deciduous land base of 10 000 hectares is estimated to be reduced by 3500 hectares—i.e. is now 65 percent as large as assumed in the corrected base case—I have decided to provide in this determination for a deciduous harvest of up to 65 percent of the 50 000 cubic metres assumed in the analysis, i.e. 32 500 cubic metres. This will provide for continued harvesting operations in the commercial deciduous profile, and for development of the non-commercial deciduous profile through rehabilitation and conversion to coniferous stands where biologically appropriate and consistent with other forest management objectives. For the next analysis, with several years' more performance in harvesting deciduous stands, the extent of their ultimate availability should become assessable with less uncertainty.

I have also noted in my "Reasons for decision" that since continued avoidance of harvesting and conversion of deciduous stands could reduce mid-and long-term levels by up to two percent, careful monitoring of this component should continue.

- *roads, trails and landings*

In the timber supply analysis, a deduction of 11 250 hectares was made from the productive forest to account for 7500 kilometres of existing haul and branch roads of average width 15 metres, within immature stands or logged areas. The figure for the length of the roads was derived from a Geographic Information System (GIS)-based program. A further 3400 hectares were deducted for existing trails and landings, an increase of about 300 kilometres over the last analysis. For future roads, trails and landings, a deduction of 734 hectares was applied, from an estimated factor of 1 percent of mature stands. About 125 kilometres of roads (roughly 187 hectares) have been deactivated under FRBC's Watershed Restoration Program, and about 5 percent of the restored roads have been planted with conifer species.

District staff consider these estimates to be reliable, and I note that they are derived in a manner consistent with the methodology validated by the BCFS Data Analysis Working

Group. I therefore accept the deductions for roads, trails and landings, as applied in the corrected base case, as suitable for use in this determination.

*- timber licence reversion*

Timber licences (TLs) are old tenure arrangements that give a licensee exclusive 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 harvest for the TSA which contains the timber licence area. Accordingly, in the BCFS timber supply analysis corrected base case for the Fraser TSA, a total of 11 such unharvested timber licences containing a total of 3108 net hectares of timber in age classes 7, 8 and 9, were assumed to be included in the timber harvesting land base only after harvesting of the existing stands has taken place. Timber licence areas supporting stands younger than age class 7 were assumed to have already been harvested and thus to have reverted, and so were included in the analysis.

Eight of the 11 licenses are scheduled to expire before the year 2001, and in the analysis it was assumed that through an orderly schedule of reversions through extensions, one-third of the total unharvested timber licence area—i.e. roughly 1000 hectares—would revert in each of three five-year periods: 1997-2001, 2002-2006, and 2007-2011. To any extent that the licences may be harvested earlier than assumed in the analysis, this would not *directly* affect the projected timber supply, but could do so indirectly by reducing the contributions of these areas to forest cover and adjacency requirements. However, considering the relatively small area involved, I find the assumption applied in the analysis to be a reasonable means of incorporating the uncertainty in the reversion schedule and I see no need to adjust the corrected base case on this account.

Existing forest inventory

*- current inventory*

The inventory used for the timber supply analysis is based on forest inventories completed between 1970 and 1974, with most map sheets updated to December 1996 for silviculture and disturbance. The inventory file for the analysis accounts for all disturbances, based on current figures from the Major Licensee Silviculture Information System (MLSIS) and the Integrated Silviculture Information System (ISIS).

Inventory file attributes used in the analysis, including height, age, volume and stocking level were projected to January 1997, and the height and age attributes in the file were adjusted for the results of the inventory audit for the Fraser TSA, completed in 1996. I have discussed the incorporation of the audit results below in *volume estimates for existing stands*.

In response to inaccuracies identified by the TSA inventory audit, a Vegetation Resources Inventory project has been initiated in the Chilliwack Forest District, and in view of the projected declines in supply in this TSA, a priority should be given to completing this project in time for incorporation of the results in the data package for the next timber supply analysis.

The existing forest inventory represent the best available information for use at this time; as such I am content to rely upon it for the purposes of this determination.

*- age-class distribution*

The distribution of age categories in the timber harvesting land base (THLB) is as follows:

| Category | Ages | % of THLB |
|---|---|---|
| mature | >120 years | 28 |
| older immature | 61-120 years | 13 |
| younger immature | <60 years | 59 |

The Chilliwack Forest District has a management strategy of shifting the timber harvest towards second growth, with the objective of attaining a target of 20-percent of the annual harvest from second-growth stands. This will increase the available harvest planning area for licensees, lessen the pressures on the remaining older forests, increase the ability to meet Forest Practices Code requirements such as green-up and biodiversity, and create more opportunities to practice alternative silviculture and harvesting systems due to better uniformity and size in the trees harvested and more favourable terrain on which to operate. Alternative silvicultural systems will enhance the management of Spotted Owl habitat in special resource management zones (SRMZs), in visually sensitive areas, and in urban interface areas where most of the second growth stands are located. The second-growth strategy will also extend the harvesting season for forest workers since many second-growth stands are located at lower elevations.

To reflect this strategy, in the timber supply analysis a target of 20 percent of the area harvested each year was required to come from second-growth stands less than 100 years old.

Sensitivity analysis shows that if no second-growth harvesting takes place in the first 10 years, the total harvest over the ten years must be reduced by about 10 percent, with the harvest level dropping to and remaining at a mid-term level of about 1.0 million cubic metres in 6 years' time. This indicates that the corrected base case harvest level is very dependent on the harvesting of second-growth stands in the short term.

The average level of second-growth harvesting is currently below the 20 percent required to support the corrected-base-case harvest level projection. A review of current forest development plans shows that licensees have planned to harvest 21.5 percent in second growth for 1998, but that the average over the five year period from 1998 to 2002 is just 12.7 percent. From this it is apparent that the second-growth strategy is not only desirable from a management point of view for the reasons shown—it is also essential if the projected harvest levels in the corrected base case are to be achieved. If the average level of second-growth harvesting does not reach the 20-percent level required to support the base case, this could result in a significant AAC reduction in the next determination. I therefore urge both district staff and licensees to afford a high priority to working cooperatively to ensure a rapid and smooth transition to reliance on an appropriately increased contribution from second-growth stands, and I have noted this below, in "Implementation".

*- species profile*

The timber harvesting land base consists mainly of stands comprised primarily of western hemlock/balsam, covering 52 percent of the area, and Douglas-fir, 36 percent. Stands dominated by cedar and spruce each cover about 4 percent, and stands of alder/maple (3 percent) and pine (1 percent) are also present.

It is notable that for Douglas-fir the majority of the more-productive sites are occupied by lower age groups, indicating the historical preference for harvesting higher volumes from the better sites. This has implications for assessing the validity of site-index adjustments for areas occupied by the remaining old growth in the TSA, as discussed below under *site productivity estimates*.

An issue was identified above in *deciduous forest types* regarding the need for conversion of deciduous to coniferous stands to support mid- and long-term harvest levels. No other issues have been identified with respect to appropriate harvesting of species in proportion to their presence on the land base that would indicate a need to question the validity of the corrected base case projection in this regard.

- *volume estimates for existing stands*

As noted above in *current inventory*, the BCFS completed an inventory audit for the Fraser TSA in 1996. The audit showed that the timber volumes in mature stands (older than 60 years) in the timber harvesting land base were overestimated in the 1993 inventory file by a mean value of 23 percent. In order to incorporate the audit results in the timber supply analysis, a team of specialists from the BCFS Resources Inventory Branch, Timber Supply Branch, Vancouver Forest Region, and Chilliwack Forest District identified and proceeded with a set of steps and assumptions to develop and apply factors to adjust the height- and age-attributes on the inventory file, and the volume predicted using the Variable Density Yield Prediction model (VDYP). A 'ratio-of-means' model was used to relate the audit measurements to the inventory file. Details of the process of adjustment of the attributes and volumes are too lengthy for inclusion in this rationale, but may be found in the May 1997 BCFS report *Incorporation of the Inventory Audit in the Fraser Timber Supply Area Timber Supply Review*. Staff of the BCFS Research Branch have subsequently conducted a review of the audit adjustment procedure, and have confirmed that because the estimator that was used to obtain the mean difference between actual and predicted volumes was unbiased, the mean difference estimate of 23 percent is a reliable estimate of the true difference based on the audit data.

Public input identified concern regarding the incorporation of the audit in the analysis. It was suggested that so-called "borderline" plots near the edge of a change between forest cover types should not have been included in the audit results. However, I am advised that even if all the borderline plots were excluded—which would imply that experienced field crews were wrong on the location of all such plots or on the establishment of the forest cover boundaries—there is still a significant statistical difference between the predicted and actual stand volumes.

A question was also raised as to why the 23-percent overestimation in existing volumes did not lead to as large a decline as was implied by the high sensitivity to volume changes referred to in the rationale for the previous AAC determination. There are three reasons for this. First, the large decline shown in the previous analysis resulted from reducing *all* stand volume estimates by 10 percent, which is not directly comparable to the adjustments made to account for the results of the inventory audit; the audit adjustments apply only to stands older than 60 years old, which comprise only about 41 percent of the timber harvesting land base. Second, the remaining stands over 60 years old are on sites of less-than-average productivity. Consequently, adjusting the

stand volume and productivity estimates for these stands had a smaller effect than reducing the volumes for all stands as was done in the analysis for the previous AAC. Third, in the corrected base case, the rate of decline is higher than was assumed in the analysis for the previous AAC, which contributes to a reduced impact on the short-term harvest level in the current analysis.

In assessing the uncertainty in the timber supply associated with the incorporation of existing stand volumes in the corrected base case analysis, and the implications for this AAC determination, I have been assisted by the results of a sensitivity analysis. The volumes used in the corrected base case analysis were adjusted by the *mean* difference (23 percent) found in the audit between actual and predicted volumes. However, as is usual when using sample data, there exists a range of possible outcomes around the average or mean value that is bounded at upper and lower levels by what is called the "confidence interval". To assist me in assessing the risk to the timber supply if the true mean difference in volumes were higher or lower than the mean incorporated in the corrected base case, the results of applying volume adjustments based on each of the two extremes of the confidence level surrounding this mean were investigated. Thus the volumes were first reduced by the *minimum* percentage overestimation that falls within the confidence interval of the audit. In this case the projected short-term harvest level increased by an estimated 5 to 7 percent over that shown in the corrected base case. When the volumes were then reduced by the *maximum* percentage that falls within the audit's confidence interval, the short-term harvest level was lower than in the corrected base case by an estimated 6 to 8 percent.

The fact that these two volume adjustments produced impacts of similar size (in opposing directions) on the initial harvest level projected in the corrected base case is helpful in assessing the risk of accepting this initial level as a true projection of the timber supply. If either one of the adjustments had shown a much greater sensitivity than the other, this may have indicated the need to consider minimising the risk of error by basing the supply projection on a volume adjustment closer to one end or the other of the confidence interval. The relatively equal sensitivity of the timber supply forecast to reducing or increasing the timber yield from mature stands is an indication that relying on a projection that was based on the mean value presents approximately equal risks of over- or underestimation in the supply.

From these considerations I am satisfied that the adjustment to the existing stand volumes in response to the inventory audit has been based on as reasonable a procedure as possible at this time, and provides the best information available for use in this determination. Priority should be set on completing the Vegetation Resources Inventory project in the TSA and on incorporating the results into the next timber supply analysis.

## 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 forest 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 the trees on it will grow, and therefore affects the time seedlings will take to reach green-up conditions, as well as the volumes of timber that will grow, and the ages at which a stand will satisfy mature forest cover requirements and reach a merchantable size or a minimum harvestable age.

In the Fraser TSA, following the 1996 inventory audit, all site indices on the inventory file were re-projected using VDYP after adjusting stand heights and ages as appropriate to account for the

results of the audit. Managed stand yield estimates were produced using the Table Interpolation Program for Stand Yields (TIPSY) and were applied in the analysis to existing managed stands (i.e. current plantations) and to all stands following their projected harvest and regeneration.

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) may 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 old 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 several areas of the province where studies—known as the old-growth site index (OGSI) project—suggest that actual site indices may be higher than those indicated by existing data from mature forests.

Preliminary OGSI adjustments for age-classes 8 and 9 in the Fraser TSA were provided by BCFS Research Branch, based on studies completed in the TSA. If the suggested adjustments were applied, the old growth remaining in the TSA would have the highest average site index on the TSA. This arouses concern about either the validity of this adjustment, or about underestimation in the site indices for younger age classes, since much of the old-growth timber already logged has been from some of the best growing sites, as noted above in *species profile*, and it is certain that the remaining unharvested old growth are not standing on the best growing sites in the TSA.

The OGSI adjustments were not applied in the corrected base case. Instead, their implications for the timber supply were examined in a sensitivity analysis. The results showed no change in the short term, a small increase in the mid term, and a 15-percent increase in the long term. The reason why the substantial increase in assumed productivity produced only a minimal increase in supply in the near-term is that it applies to a relatively small proportion of the timber harvesting land base, i.e. to areas currently occupied by stands in age classes 8 and 9, and the increase in productivity is not realized until the existing stands have been harvested and regenerated and are again available for harvest as second-growth stands.

Concern was expressed in public input that current projections for second-growth stands underestimate their productivity and that the audit has not adequately assessed site index and growth rates for 60-to-100-year-old stands.

In response I agree that while stands older than 60 years were included in the inventory audit and in the subsequent inventory adjustment process for heights and ages, even these adjustments may not have captured the *full productive potential* of these sites, since mature second-growth stands over 60 years old were not managed upon regeneration to the extent that plantations are managed today. I also agree that since the early logging in the TSA was on the better sites, there is a possibility that all site indices for age classes 7 and lower are underestimated. I note that a sensitivity analysis on changes in regenerated volumes found that if the volumes per hectare for all managed stands were increased by 20 percent, this produced a 20-percent increase in the long-term timber supply, but did not affect the short-term supply. Underestimated site indices could also mean a shorter green-up period, with earlier implications for timber supply through a reduced adjacency constraint. This site index increase would apply to all stands up to 140 years of age, and would have a greater effect than the OGSI adjustments for several reasons. First, the adjustment applies to a much greater area than the OGSI and to stands that will be ready for

harvest sooner, because existing 0-to-30-year-old stands may have been underestimated with respect to both site index and volume. Second, these are managed stands, and the older stands aged 40 to 140 years may not have higher volumes since they are not managed in the full sense but do have a higher growth potential (site index) for the future than we currently estimate.

While a review of site productivity for all managed stands could potentially lead to some increase in the projected near-term supply, at the present time I have no firm statistical basis from which to assess the need for any specific adjustment to site indices. Given the further decline in timber supply projected for this TSA, it is critical for more information to be gathered to bring better clarity to these issues for the next determination, and I have noted this below, in "Implementation".

From this I accept that the OGSI sensitivity analysis indicates a high likelihood of higher volumes than projected for the medium and long terms—potentially as much as 15-percent higher in the long term. I also accept the possibility of an underestimation in lower-aged site classes that could, if proven, even further augment the mid- and long-term supplies. However, for the present determination, I accept the site indices on the files as used in the corrected base case analysis as the best statistically reliable information available at this time, and I have made no adjustment to the projected short-term harvest level.

- *mountain hemlock*

Concern was raised by the environmental organization BC Wild in an April 1998 report *Sustainable Forestry or Timber Mining?* that due to a number of factors which they consider to limit the suitability of mountain hemlock as a harvestable species, the entire Mountain Hemlock zone should be removed from the timber harvesting land base in the Fraser TSA until the sustainability of management in this zone can be proved or disproved.

The factors pointed to in the report were: overestimated growth assumptions; slowed growth and physical damage to trees from snow packs; the difficulty of selecting an appropriate silvicultural system; slow and dispersed regeneration due to past slashburning; and a lack of managed yield tables specific to the species. The report stated that 15 percent of the operable forest land base (the timber harvesting land base) in the Fraser TSA is comprised of mountain hemlock forests, that about 60 percent of this had been logged, and that removal of the mountain hemlock forests would result in a downward impact in the order of 15 to 43 percent or more on the short-term harvest level.

BCFS staff have examined these figures and consider that all are overstated to varying extents, mainly because they were based on the entire operable area without taking into account the land base deductions incorporated in deriving the timber harvesting land base. Only about 10 percent of the timber harvesting land base in the Fraser TSA is in the Mountain Hemlock zone (not 15 percent as stated in the report), and this area comprises about 16 percent of all the mountain hemlock in the Fraser TSA (not 28 percent as stated in the report). Thus, about 84 percent of the mountain hemlock in the TSA is unlikely ever to be logged under current management assumptions. About half the area of mountain hemlock in the timber harvesting land base (i.e. about 8 percent of all the mountain hemlock in the TSA) has been logged. A sensitivity analysis in which 30 percent of all the poor productivity sites in the timber harvesting land base were removed—which would be roughly equivalent to excluding all of the Mountain Hemlock zone—produced a 4-percent reduction in the projected initial harvest level.

Many specific concerns in the BC Wild report related to growth and regeneration were responded to in a letter dated June 24, 1998 from Robin Brown, then acting director of the BCFS Forest Practices Branch, to the West Coast Environmental Law Association. I am familiar with the content of the letter, which included a greater review of applicable literature and more technical detail than space permits me to address here. To summarise, the literature cited—particularly Klinka et al (1992), *Silvicultural Analysis of the Subalpine Mountain Hemlock Forest*—concludes that while there are some deficiencies in the existing knowledge of mountain hemlock ecosystems that warrant a conservative approach, sufficient information exists to support rational management decisions in the Mountain Hemlock zone. Other conclusions are that it is reasonable and appropriate to use growth curves for western hemlock as a proxy for mountain hemlock; that partial cutting in order to ensure regeneration is required only for specific problematic sites; and that while snow does build higher in clearcuts, it also disappears faster, so the snowpack disappears at about the same time as, or faster than, it does from the rest of the forest.

BCFS district staff have also responded to statements in the report. Aerial and ground-based surveys in the Fraser TSA have confirmed that blocks in the Mountain Hemlock zone harvested prior to 1987 are able to achieve free-growing status. Comprehensive audits of the extent to which obligations are being met by licensees and the SBFEP for areas harvested after 1987 in the Mountain Hemlock zone also confirm that the majority of these stands are regenerating within allotted specifications.

Accompanied by the District Manager and the Operations Manager for the Chilliwack Forest District, I recently flew over extensive areas of mountain hemlock forests in the Fraser TSA and reviewed to my satisfaction the visible state of the regeneration in the zone. In areas harvested earlier, while broadcast burning was still prescribed as a management option, it was evident that the regeneration was somewhat less vigorous than in areas harvested more recently and not treated with fire, although satisfactory re-growth appeared to be taking place in both cases. The one area that I viewed in which regeneration did appear to be obviously under duress was on an unharvested area burned by wildfire.

In conclusion, I acknowledge there are uncertainties in the management of mountain hemlock forests that warrant a conservative approach to their development and I am satisfied that the current approach by the Chilliwack Forest District is appropriately conservative. Only about 16 percent of all the mountain hemlock in the Fraser TSA is in the timber harvesting land base, and half of these stands have already been logged with a satisfactory history of regeneration. Having considered the technical advice of district staff and the literature reviewed and commented on in Robin Brown's letter, and from my own observations of the successful regeneration in the Mountain Hemlock zone in the Fraser TSA, I see no reason to adjust the extent to which these stands have been included in the timber harvesting land base used in the corrected base case 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 second growth 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 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 timber supply analysis were based on the age at which forest stands meet both a minimum volume criterion and a minimum piece-size criterion. Most minimum harvestable ages were set below the culmination of mean annual increment, or MAI (i.e. the point that the stand is at or very close to the age at which its average annual growth in volume is greatest). For cedar stands, the minimum harvestable ages were based on the MAI for the stand being within 5 percent of this culmination age. Using these criteria, the minimum harvestable ages for coniferous stands ranged from 50 years for Douglas-fir on good sites, to 170 years for hemlock on poor sites, which was applicable also to mountain hemlock stands—and I note that the literature referred to in the mountain hemlock section above supports the use of growth curves for coastal western hemlock as a proxy for mountain hemlock.

In the public input, licensees suggested using a lower minimum harvestable age for good sites, while environmental groups suggested that the low harvestable ages are not attainable and are not reflective of current management. Sensitivity analysis shows that if all minimum harvestable ages are reduced by 10 percent, the short-term harvest level increases by about 1 percent, while increasing minimum harvestable ages by 10 percent produces a 2-percent decrease in the short-term harvest rate. In both cases the long-term harvest rate is unchanged. The low sensitivity of the timber supply to changes in minimum harvestable ages is consistent with the condition in the analysis that the model is not forced to select stands for harvest that are close to the minimum harvestable age.

I consider the criteria applied in defining minimum harvestable ages to be reasonable, and district staff advise me that the minimum harvestable ages used in the analysis are consistent with producing forest stands that are at least as marketable for harvesting as the stands that licensees are currently able to harvest. Since the minimum harvestable ages will be reviewed over the next five years as the district implements its second-growth strategy, I accept the minimum harvestable ages as assumed in the analysis as reasonable and satisfactory for use in this determination.

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

Regeneration delay

Regeneration delay is the period between harvesting and the time at which an area becomes occupied by a specified minimum number of acceptable, well-spaced seedlings.

In the timber supply analysis, average regeneration delays of between 2 and 4 years were assumed, based on limited file reviews, on the experience of district silviculture specialists, and on reviews of compliance and enforcement. I have examined the methodology for deriving these estimates, and while district staff advise that there is a trend towards earlier planting, to allow achievement of legal obligations as soon as possible, which I would encourage, I am satisfied that the estimated regeneration periods used in the analysis reflect current practice, and as such are appropriate for consideration in this determination.

I am aware that, following publication of the timber supply analysis, an age-aggregation problem in the FSSIM software was discovered to be introducing error in the incorporation of regeneration delays in the analysis. I have noted that the error was corrected and that a subsequent corrected base case analysis was produced. As confirmed in "Base case for the Fraser TSA", I have considered this corrected analysis to provide a satisfactory reference point for this determination.

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 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 Fraser TSA, the "current" NSR area totals 6041 hectares—less than two years at the current harvest rate of about 3200 hectares per year, and thus within the acceptable regeneration delay.

The most current data sources, MLSIS and ISIS show backlog NSR areas of 2242 hectares harvested before 1982 and 1832 hectares harvested between 1982 and 1987. All backlog NSR is currently expected to be eliminated by the year 2002.

In the timber supply analysis it was assumed that all backlog NSR will be eliminated in the first decade. Since the actual expected elimination date is several years earlier, there will be a corresponding small addition to the timber supply in the mid-term, which I have noted in my "Reasons for Decision". However, this small discrepancy will have no effect on the volume of timber available for harvest in the short term, and for this determination I have therefore made no adjustment to the initial harvest level projected in the corrected base case analysis.

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

Silvicultural systems

The Chilliwack Forest District Manager's objective for Forest Development Plans is for 50 percent of the areas to be harvested to a retention level of 'clear-cut with reserves' or higher, 10 percent of areas to be harvested with a true partial cutting system, and the remainder to be clearcut. Twenty percent of these harvesting activities by volume are to involve second-growth stands.

Based on a review of Forest Development Plans, current practice in visually sensitive areas shows that 51 percent of the areas proposed for harvesting utilize the 'clear-cut with reserve' system, while 14 percent utilize true partial-cut systems. In other areas, the majority of the area is harvested by the 'clear-cut with reserve' system, and limited commercial thinnings and limited partial cuts have been completed in Special Resource Management Zones (SRMZs) for Spotted Owls and in other constrained operating areas. The average cutblock size is currently 25 hectares.

In the corrected base case analysis, appropriate levels of cover constraint were applied to restrict the rate of cut in visually sensitive areas, SRMZs and deer winter ranges, and wildlife tree reserve patches were accounted for. However, no specific modelling technique was applied to account for partial cutting.

The fact that current practice in the TSA includes some partial cutting while none was modelled is not likely to affect the validity of the corrected base case analysis significantly in the short term. The implications of partial cutting are complex and can work either to increase or decrease the timber supply relative to projected levels. For a given harvested volume, the area affected may be larger than if clearcuts were assumed. Growth and yield may be lower than projected at

certain points in time. Both of these would indicate the true timber supply in the future may be lower than projected. On the other hand, partial cutting could ease adjacency or other cover constraints, which could indicate a greater supply than projected. The net effects of these combined implications are not readily apparent, but at current levels are unlikely to result in a significant impact in either direction. If greater areas are harvested by partial cutting in the future, various modelling techniques can be applied to achieve an approximate representation of some of the implications.

For the present determination, I am satisfied that the silvicultural systems used in the TSA are suitable for achieving the basic requirements of the Forest Practices Code—notably for managing visually sensitive areas and reserving wildlife tree patches—and that these elements have been adequately represented in the corrected base case analysis.

Incremental silviculture

In general, 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. *An Enhanced Forestry Resource Management Plan¾ Interim Approach* has been formulated to guide incremental silviculture activities in the Fraser TSA.

In the Fraser TSA, on average over the past 10 years, juvenile spacing has been carried out on 1250 hectares per year; 450 hectares per year have been pruned and 1400 hectares per year have been fertilized. FRBC did not fund fertilization in the 1997-98 fiscal year, but BCFS and licensees are attempting to re-establish funding. Fertilization and juvenile spacing have been used in the past to decrease the time required to achieve a merchantable piece size. BCFS staff have estimated that fertilization could produce a direct volume gain of up to 0.5 percent in the second decade of the projected timber supply, and up to a 2-percent gain in the mid- term supply, but further analysis is required to verify this. Fertilizing Douglas-fir once, seven to ten years before harvest, is reported to produce a four-percent increase in the volume of harvested fir, but this requires speculation on the location of cutblocks seven to ten years in advance. Pruning and juvenile spacing have been used to improve the *value* of juvenile stands.

In the corrected base case analysis, no incremental silviculture treatments that affect timber volumes were assumed to be undertaken. Since fertilization targeting younger stands has been carried out in the past, and since the results of this are not included on the inventory file, the analysis does underestimate the timber supply, but in this case by an insignificant amount. If funding is restored, and fertilization continues such that significant areas and volumes are affected, this will be assessed and accounted for in future analyses and determinations.

For the purposes of the current determination, I accept that the assumptions made with respect to incremental silviculture in the corrected base case are insignificantly different from recent or current practice and do not introduce measurable error into the projected short-term timber supply.

- *rehabilitation programs*

Historically in the Fraser TSA, when Douglas-fir stands were harvested they were allowed to regenerate naturally into stands comprised predominantly of western hemlock, which are now producing less-than-optimal yields and timber values. Rehabilitation of these areas is

contemplated, to improve the long-term timber supply, but the opportunities for productivity gains have yet to be fully documented. No assumptions were made in the corrected base case with respect to this factor.

Since the stands in question are mapped in the inventory as hemlock-fir, and are included in the timber harvesting land base, their conversion to predominantly Douglas-fir will potentially change the kind and volume of harvestable wood, but will not add to the timber harvesting land base itself. Nevertheless, I am advised that if as many as 5000 hectares, or 1.7 percent of the timber harvesting land base are involved, and if a 30-percent gain in mean annual increment were achieved by this conversion, this could lead to a 0.5-percent gain in timber supply at the TSA level in the long term, but there would be no impact on the short-term timber supply.

The district manager advises that only two such timber sales, totaling 70 hectares, were harvested last year. In special resource management zones, hemlock will be harvested by partial-, rather than clear-cutting, which will likely reduce somewhat the overall potential additional long-term supply. For the present determination I am satisfied that this issue does not warrant any adjustment to the short-term timber supply projected in the corrected base case analysis.

- *commercial thinning*

Commercial thinning is the harvesting, in a maturing stand, of trees large enough to be considered a commercial product. While single-entry commercial thinning regimes do not generally increase total volume yields on a specific site, they can provide opportunities to harvest timber in areas where harvesting is limited, to meet a variety of other resource objectives, and can be used to alter the timing of certain portions of the timber harvest.

In the Fraser TSA, commercial thinning has been used to a limited extent to recover volume that would otherwise be lost to mortality, to improve the quality of forest stands, and to accelerate the attainment of target piece sizes. Commercial thinning is expected to play a key role in accelerating the creation of "A" or "B" types of Spotted Owl habitat in second-growth stands. Creation of "replacement habitat" is an essential step in freeing-up old-growth habitat for harvest.

In the TSA, there are 48 000 hectares of harvestable land base that are potentially suitable for commercial thinning, of which 17 percent are in SRMZs. However, district staff reported that licensees expressed concern about the lack of incentives, especially regarding the appraisal system, as an impediment to commercial thinning. Thinning trials in special resource management zones for Spotted Owls require higher-level direction, clear standards and resolution of appraisal issues. Past incremental silviculture activities have set up areas suitable for commercial thinning, but this information has not been linked to inventory files, so actual commercial thinning opportunities are not readily evident or quantifiable.

At present, I cannot consider commercial thinning in the TSA to be a current practice with a demonstrable program size or significant yield benefits. A proven track record is expected to be established within the next few years. Given the constrained nature of the timber supply in the TSA in the next decade, it would be very beneficial before the next analysis to produce a strategy that will identify the extent of any possible mitigation of the imminent falldown in the Fraser TSA by the use of commercial thinning. For this AAC determination, in the absence of any such strategy, I have accepted as appropriate the assumption in the corrected base case of no contribution to the short-term timber supply from commercial thinning.

**(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 timber supply analysis, the utilization standards assumed were the standard regional utilization standards used for all licences. All timber volume meeting these standards is charged against the AACs of specific licences, and any additional volume that is removed is not charged, since it did not form the basis for the AAC determined for the TSA and is therefore available to be used on an incentive or periodic basis. One licensee in the TSA claimed to practice higher utilization standards than other licensees and therefore requested a less-than-average AAC reduction. However, the AAC that I determine is for the TSA as a whole; the Minister of Forests apportions the harvest to licensees within the TSA. Any representation regarding dispensation from a normal proportional reduction should be made to the Minister, following appropriate consultation with the district manager, although it is not clear that the *Forest Act* provides for the Minister to reduce licences other than proportionally.

If the licensee were indeed practicing higher utilization than the standard, and if this were subsequently to become a new standard in the TSA, I would consider basing the next review of the timber supply in the TSA on that new standard. For the purposes of this determination, I accept the use of the existing regional utilization standards in the analysis as appropriate.

## Decay, waste and breakage

The Variable Density Yield Prediction model (VDYP) used in the timber supply analysis to estimate volumes in existing natural stands more than 30 years old incorporates standard provincial reduction factors to account for losses to decay, waste and breakage. The Table Interpolation Program for Stand Yields (TIPSY) used in the timber supply analysis to estimate volumes for regenerated stands incorporated Operational Adjustment Factors (OAFs): OAF 1 (15 percent) was applied for unmapped stand openings; and OAF 2 (5 percent) was applied to account for pests and diseases, and for decay, waste and breakage. This methodology was approved by BCFS Research Branch for use in the timber supply analysis.

One licensee stated that cruise information suggests the standard factors may be overestimating these losses, by 3 to 4 percent, on a small number of cutblocks. In this instance, staff of BCFS Resources Inventory Branch advise that the information sources are not adequately comparable and the sample size used was not sufficiently large to provide a basis to reject the application of the standard factors to the volumes derived for the Fraser TSA.

I am advised by the Director of Resources Inventory Branch that a study by the Branch shows these standard factors as currently applied are subject to uncertainty in some areas of the province. The nature and extent of this uncertainty are still under study. However, to date this work has not shown a need to revise the factors applied in the current timber supply analysis for the Fraser TSA.

Since the estimates incorporated in the corrected base case analysis for the Fraser TSA constitute the best currently available information with respect to decay, waste and breakage, I have accepted them as such for the present determination.

**(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, among other things, 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.

- *cutblock adjacency and green-up*

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.

In the Fraser TSA, adjacent harvested blocks (in non-visually-sensitive areas) must be greened-up to 3 metres before a new proposed block may be approved. This is assumed to be achieved 12 years after logging plus 2 to 4 years' regeneration delay. This requirement actively constrains the approval of forest development plans in the Fraser TSA due to a long history of progressive harvesting from valley bottom to higher elevations, and to the avoidance of harvesting in extensive "log-around areas", due to Spotted Owls and the provincial Protected Areas Strategy, which has resulted in earlier-than-planned harvesting in some other areas.

The timber supply analysis for the Fraser TSA projected wood flows for each of the 23 draft landscape units in the TSA. To account for cutblock adjacency in the initial analysis, within each draft landscape unit no more than 30 percent of the total area in the timber harvesting land base that is not subject to more restrictive cover constraints for visual quality objectives was allowed to be less than 3 metres in height at any time. That is, trees on a minimum of 70 percent of this area were required to be three metres or more in height. As noted above in "Base case for the Fraser TSA", a mapping review of the location and rate of the harvest that would result from this initial forecast showed that applying this adjacency constraint could lead to a concentration of the timber harvest in certain areas of old growth at higher rates than would constitute a reasonable reflection of acceptable operational practice. The reason for this is that some landscape units—as for example the Pitt drainage—contain large contiguous areas of second growth stands that are over three metres tall but are not yet ready to harvest. The presence of these stands enables 70 percent of the *total* landscape unit area as described to remain at least three metres tall while extensive harvesting proceeds in the remaining old growth stands without adequate regard for adjacency limitations *in that harvested area*. Since this would not be permitted operationally under current practice, the initial adjacency assumption was replaced by more restrictive constraints, applied on a finer geographic scale, that produced a more reasonable distribution of harvesting on the landscape, to generate a second forecast, referred to in the June 1998 analysis as the "base case".

I have reviewed in detail the steps leading to establishing the need for, and to deriving and applying, appropriately revised modelling constraints for adjacency. The steps included (1) a review of operational plans and licensee chart information, (2) a determination of the harvestable rate of mature stands when taking green-up and adjacency into account as intended, and (3) establishment of appropriate new modelling requirements.

These three steps may be summarized briefly as follows.

(1) Although the TSA currently has three years' Standing Timber Inventory (timber which is ready to harvest and for which operational planning is complete), the current AAC and current licensee chart areas would lead to a "gridlock" of cutblocks (i.e. an inability to place blocks adjacent to one another) in five to ten years. A review of plans and chart information showed that cutblock adjacency is the most constraining factor on timber supply in the short term. However, when the adjacency constraint as modelled initially was applied to the whole timber harvesting land base, it was not constraining at all. This is not realistic, and supports the conclusion that, to account reasonably for adjacency, modelling constraints must be applied on a finer geographic scale—specifically to the harvestable mature component, initially.

(2) A review of licensees' forest development and 20-year plans showed that for areas with long harvesting histories, up to 3 green-up periods will be required to completely harvest all the remaining mature stands, and for unlogged drainages, at least 4 green-up periods will be required. Thus between three and four green-up periods will be required to complete the harvesting of all harvestable mature stands in the TSA. The green-up period was assumed to be 12 years' growing time plus a 2-to-4-year regeneration delay.

(3) The use of three or four green-up periods would mean that a maximum of 33 or 25 percent respectively of the remaining area covered by mature trees could be below 3 metres in height. An approximate mid-point of 30 percent was chosen, and this constraint was applied for three decades to mature stands only, and from then on, to both mature and immature stands in the timber harvesting land base in "non-VQO" areas—i.e. in areas not subject to constraints from visual quality objectives (VQOs).

I have considered the reasonableness of the foregoing steps carefully. The small number of unlogged drainages in the TSA means the use of the mid-point between 25 and 33 percent could appear to be over-constraining. However, caution is required in assessing this for several reasons. (i) Analysis shows the timber supply in this TSA to be highly sensitive to changes in forest cover constraints for adjacency—if only 25 percent of the mature cover is permitted to be below 3 metres, the allowable annual harvest is reduced to 1173 hectares, when the current average is 3200 hectares per year. (ii) Future harvesting in second growth stands will be further constrained by the pattern of ages of the stands regenerated on the landscape after past harvesting. (iii) Adjacency constraints are intended to account not only for cutblock proximity but for a number of non-timber resource values. (iv) The criteria used to determine the number of green-up periods needed did not allow for roads or other deductions, which would further constrain the supply.

In view of these considerations, and noting that the mid point between 25 and 33 percent is actually 29 percent, such that the 30 percent as applied is already slightly less constraining, I have concluded that allowing a maximum of 30 percent of the non-VQO harvestable land base to be below green-up height provides a reasonable and adequate but not excessive adjacency constraint,

at least for the next three decades while harvesting continues to rely primarily on mature stands. The adequacy of this 30-percent restriction in accounting for adjacency constraints in future harvesting in second-growth stands, which may be subject to alternative harvesting regimes, will need to be determined on an ongoing basis with reference to emerging information on site indices and silvicultural systems, and the implications of various patch-size distributions on the landscape. In reaching my present conclusion, I have given consideration to the likelihood that shifting 20 percent of the cut to second-growth stands will help to relieve some of the pressures caused by adjacency requirements on the remaining mature forests.

I have also considered public input on this issue. This included: (a) advice to use the top height of the tallest 100 trees in determining green-up periods—this is in fact the standard BCFS procedure; (b) advice to eliminate adjacency restrictions because concentrated harvesting may be acceptable since nature does not create checkerboard disturbances—in this respect I note that, while the *Biodiversity Guidebook* does provide for 20 to 40 percent of the forested area within each landscape unit in natural disturbance types (NDT) 1 and 2 to be in patch sizes of 80 to 250 hectares, which helps to provide interior forest conditions, this does not mean applying adjacency constraints is inappropriate, since their application helps to meet a range of forest management objectives for various forest values and resources; (c) concern that applying adjacency requirements at a finer geographic scale (i.e. to mature stands only in decades 1 to 3) would allow *higher* levels of harvesting—in fact the reverse occurs.

From all the foregoing considerations, I am satisfied that adequate care has been taken to ensure appropriate constraints were applied in the analysis to represent harvesting restrictions that may realistically be expected to result from considerations of cutblock adjacency. In my determination I have therefore made no adjustment to the corrected base case projection on this account.

In view of the number of factors involved in assessing the number of green-up periods required to harvest the remaining harvestable mature stands, and potential changes in the number of periods associated with future harvesting in second-growth stands, district staff should work to provide improved information for the next analysis with respect to the adjacency implications of any site index adjustments, alternative silvicultural systems, and associated patch-distributions, and I have noted this in my implementation instructions below.

- *visual resources*

Careful management of scenic areas visible from communities, public use areas and travel corridors is an important IRM objective and is part of the BCFS mandate—the preamble to the *Forest Practices Code of British Columbia Act* identifies the conservation of scenic diversity as a sustainable use of the forests that British Columbians hold in trust for future generations.

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 this, visual landscape inventories are carried out, to identify, classify and record those areas of the province that are visually sensitive. On completion of such an inventory, a specialist may derive recommended visual quality classes (RVQCs) to identify levels of alteration that would be appropriate for particular areas. The Code requires these areas to be identified, by the district manager or in a higher level plan, and to be made known to licensees. When this has been done and an RVQC has become current, on-the-ground management, it may

be incorporated into a timber supply analysis, preferably as a VQO established by the district manager or contained in a higher level plan. Established VQOs reflect the desired level of visual quality, based on the physical characteristics and social concern for an area, and seek to balance the perceptions and needs of people with the social and economic needs of the Province.

VQOs identify the level of alteration that would be acceptable on a viewscape. In order for VQOs to be achieved, constraints must be placed on timber harvesting, road building and other forest practices in such areas. The constraints applied are based on experience, research findings and public preferences. The constraints are expressed in terms of "forest cover" requirements that relate to the maximum percentage of a "viewshed" that may be harvested at any one time, and to "visually effective green-up" (VEG)—that is, the stage at which a stand of reforested timber is perceived by the public to be satisfactorily "greened-up" from a visual standpoint.

In the Fraser TSA a visual landscape inventory has been completed which meets the current (1997) provincial standard. However, an accompanying visual landscape analysis to develop recommended Visual Quality Classes has not been completed. Consequently, recommended VQOs (RVQOs) that were developed after the previous timber supply analysis were used to approximate current management. To more accurately reflect the level of current management in each zone within the Fraser TSA the classes of "Retention (R)", "Partial Retention (PR)" and "Modification (M)" were expanded. Partial Retention was divided into "Retention/Partial Retention (R/PR)", "Partial Retention (PR)" and "Partial Retention/ Modification (PR/M)". The resulting five classes were reviewed to ensure they are consistent across the district and reflect current management. The corresponding maximum allowable disturbances by class, as a percentage of the total forested area, are: R—3 percent; R/PR—6 percent; PR—10 percent; PR/M—15 percent; M—20 percent. In all classes, visually acceptable green-up height was assumed to be achieved at 5 metres.

In the previous analysis for the Fraser TSA, in the absence of detailed information, reliance on only broad visual sensitivity ratings necessitated assumptions about how each visual zone would be managed. Current management as now defined shows that the assumptions used in the first of the current series of timber supply reviews (TSR 1) were too conservative. BCFS staff estimate that as a result of the more detailed forest cover requirements used in the corrected base case analysis there is a potential gain in timber supply at the TSA level of about 7 percent. This potential gain results from better, more realistic information on the management of visual resources, rather than a change in operational practices on the ground, and is consistent with the social and economic objectives for the management of visually sensitive areas as expressed by the Minister of Forests.

In the corrected base case analysis for the Fraser TSA, the final "percent denudation" value—that is, the volume of timber that may be harvested from the areas without exceeding permissible alteration levels for each RVQO—was corrected using a provincial average for "dispersion", or the interspersion of operable and inoperable areas. This method was consistent with the policy and procedures approved for timber supply analysis in TSR 1. However, the method approved most recently for use in TSR 2 no longer relies on provincial dispersion values, but on local data for Visual Absorption Capability obtained from visual landscape inventories. In view of this difference in procedures, at my request a landscape-unit-level study was carried out (for the East Harrison landscape unit) which showed that the two methods give similar results and that the corrected base case assumptions appear to adequately model management in visually sensitive areas. Since in this case the corrective actions of the two methods would produce approximately

equal results, and since the new policy came into effect only after the data collection for the analysis for this TSA, for this determination I have accepted the use of the previously approved "dispersion" method as a surrogate for visual absorption capability.

Public input included concerns that the RVQOs are not strict enough—i.e. that managing for visual resources needs to be extended further than roadsides and waterways; that visual standards appear to have been reduced without public consultation; that the percentage of retention VQOs should be increased, not decreased; that reducing visual standards will impair other economic activity; and that VQOs are also needed for the Pitt and Nahatlatch areas. In fact the additional timber supply projected to be realized from visually sensitive areas does not result from reducing or relaxing visual standards, but from a change in how the management of these areas is represented in analysis in response to improvements in the quality of the inventory. I am assured by district staff that public input was a component of the newly completed visual landscape inventory for the TSA.

On the other hand, it was suggested by a licensee that VQOs should be revised further after completion of a new survey of public opinion, that VQO zones should be subdivided into areas with slopes of less than, and greater than, 40 percent, with lower green-up height requirements applied on the gentler slopes, and that scenic areas should be designated as primary visual resources of the TSA, with VQOs relaxed in remaining areas (specifically the Nahatlatch and Upper Harrison Lake areas).

In response, in determining AACs, as chief forester my role is to determine the timber supply under current management, which I expect to be consistent with the Forest Practices Code. It is the role of district managers to define current management for their districts in accordance with the Code. Part of defining current management necessitates that the district manager identify and make known those visual resources he wants to manage as scenic areas. For the Fraser TSA, I am informed by the district manager and his staff that current management consists of managing visual values along the principal highway corridors and water bodies. These areas have been made known to licensees. The district has also proposed that the visual resources within the Nahatlatch and Upper Harrison will be managed by the licensee during harvesting operations, but as yet these areas have not been made known as scenic areas under the Code. The district manager's intention to manage these areas for visual values is respected in development plans and I have considered their incorporation in the analysis to reflect a reasonable expectation of management for these areas.

In conclusion, I am satisfied that the management of visually sensitive areas was modelled adequately in the corrected base case analysis, and that BCFS staff are applying appropriate efforts regarding necessary landscape inventories and public involvement to ensure that current management is in accordance with the Forest Practices Code and with the social and economic objectives of the Crown. In the rationale for my previous AAC determination for this TSA, I cautioned that more efforts should be made to harvest the projected volumes of timber from visually sensitive areas. With 5975 hectares proposed for harvest in scenic areas in Forest Development Plans received this year, I am satisfied that adequate effort is being made to realize operationally the timber volumes projected by the corrected base case analysis to be available for harvest in scenic areas in the TSA.

*- declared but undesignated protected areas*

In addition to the protected areas considered above in "Landbase contributing to timber harvest", as noted there government has also declared its intention to designate four other areas in the Fraser TSA as protected areas, as part of the Lower Mainland Protected Areas Strategy, but has not yet completed the formal designation process. These areas are the Sumas, Nahatlatch Lakes, Yale-Garry Oak*, and Liumchen* protected areas. In total they reduce the timber harvesting land base by 2318 hectares:

| **Protected area declared but not yet designated** | **Total area protected (hectares (ha))** | **Estimated area in timber harvesting land base (ha)** |
|---|---|---|
| Sumas | 176 | 176 |
| Nahatlatch Lakes | 2100 | 710 |
| Yale Garry Oak* | 11.65 | 0 |
| Liumchen* | 2187 | 1432 |
| **TOTAL** | **4474** | **2318** |

(*Note: After this table was prepared, on January 24, 1999, Premier Glen Clark announced the official designation of the Liumchen and Yale Garry Oak Ecological reserves.)

A deduction of 2318 hectares to the timber harvesting land base was made in the analysis to account for all of these areas.

Although the Sumas and Nahatlatch areas have not yet been formally designated as protected, in my determination I have considered it reasonable to expect—particularly following the recent designation of the Liumchen and Yale Garry Oak areas—that these areas will be used for purposes other than timber production, and will not continue to contribute to the timber supply, for the following reasons.

All the areas in question have been formally announced by government as components of the Lower Mainland Protected Areas Strategy. Boundaries for the Yale Garry Oak and Liumchen areas have already been signed by the Inter-Agency Management Committee Chair—and in fact these areas have now been announced as officially protected and are no longer in question. The boundaries for the Nahatlatch Lakes area are expected to be finalized soon. Some uncertainty does remain regarding the Sumas protected area, but this affects only 176 hectares of the timber harvesting land base.

Under current management, harvesting is being avoided in these areas in expectation of their imminent formal protection. Assuming these areas will continue to contribute to the harvest could displace some harvesting to other areas where the rate of cut could become difficult to achieve in consistency with integrated management objectives.

Under these circumstances, I consider it reasonable to expect that these areas will be used for purposes other than timber production, namely as protected areas, and I accept their

removal from the timber harvesting land base in the corrected base case as an appropriate assumption for this determination.

The Fraser Lowlands Process will result in the protection of a further approximately 1000 hectares, but due to the very small amount of this area lying in the timber harvesting land base this will have minimal impact on the timber supply.

- *wildlife*

The Fraser TSA contains one of the richest and most diverse arrays of wildlife in Canada. More than 300 species of migratory and resident birds, 45 species of mammals, 11 species of amphibians and 5 species of reptiles range throughout the area. Many wildlife concerns have been accounted for in the timber supply analysis through land base deductions and forest cover requirements representing practices that protect habitat for large mammals and endangered or threatened birds, and that assist in the implementation of biodiversity strategies. Specific provisions for particular species are discussed below, as well as general provision for identified wildlife.

- *Spotted Owls*

The Northern Spotted Owl is found exclusively within the temperate coniferous forests of western North America, with its entire Canadian distribution limited to the southwest portion of British Columbia. In 1986, the Spotted Owl was designated by the Committee on the Status of Endangered Wildlife in Canada as "Endangered", i.e. the owl is "threatened with imminent extirpation throughout all or a significant portion of its Canadian range".

In May, 1997 Cabinet released its approved Spotted Owl Management Plan (SOMP), developed jointly by BCFS and MOELP, which I understand is intended to become a Higher Level Plan declared by government under the Forest Practices Code. The plan includes permanent protection of potentially suitable owl habitat in existing and new protected areas, as well as Special Resource Management Zones (SRMZs) that integrate forestry and owl management, and a strategy to address "matrix birds"—Spotted Owls found outside protected areas and SRMZs.

SRMZs in the Fraser TSA occupy 130 315 hectares, including 47 595 hectares or 17 percent of the timber harvesting land base. In SRMZs, 67 percent of the forest must be maintained older than 100 years over the long term. Limited timber harvesting by partial cutting may take place within this 67 percent, provided this meets objectives defined for the area in an approved Resource Management Plan (RMP). It is currently estimated by BCFS staff that one-third of the volume in one-third of these stands may eventually be removed by partial cutting. In the remaining 33 percent of the forested area in SRMZs, harvesting by clearcutting with reserves may be permitted, consistent with the production of habitat suitable for owls. Government has given direction that the timber supply impacts of implementing the SOMP should not exceed 10 percent per SRMZ.

For matrix birds, the SOMP recognizes the need for short-term protection at ten locations outside SRMZs, which will be phased out over a fifty-year period, as owl populations change.

In the timber supply analysis, the following assumptions were applied with respect to Northern Spotted Owls. As noted above in "Land base contributing to the timber harvest", all protected areas, including the Spotted Owl habitat contained in them, were excluded from the timber harvesting land base. In the analysis, 67 percent of the forested area in SRMZs was retained at

ages greater than 100 years. However, the analysis did not explicitly account for the anticipated partial-cutting harvest of one-third of the volume in one-third of the stands in 67 percent of the forested areas in the SRMZs, since the extent to which partial cutting can be performed successfully in such areas is still undemonstrated. The analysis did not account for the constraint on supply from providing habitat in the short term for matrix birds.

Public input included comments both that too much and too little accommodation has been afforded to the owl. Environmental groups suggested the 67-percent figure should be 80 percent, and that owls will not use stands 100 years of age. However, I note that development of the SOMP included extensive consultation with environmental groups, industry and labour, with a goal of balancing the need for habitat with the socio-economic needs of communities. The establishment of the Spotted Owl Research and Inventory Advisory Committee will ensure that as information specific to owls in B.C. is gathered, any modifications to the SOMP that are deemed essential can be made.

In assessing whether the corrected base case has accounted adequately and appropriately for the timber supply implications of managing Spotted Owl habitat, I have considered as follows. The analysis has recognized the overall intent of most of the SOMP, although the plan has not yet been declared a HLP by government. I consider this to be appropriate in view of the urgency and significance of the issue and the extreme unlikelihood of reversal of a government decision to implement a management plan whose development involved extensive time and consideration from government and non-government agencies.

The analysis did not account for the anticipated partial-cutting harvest of one-third of the volume in one-third of the stands in 67 percent of the forested areas in the SRMZs, which would indicate an underestimation in the supply. The reason given was that little or no performance has been demonstrated with partial cutting. However, the intent of the SOMP is that, with suitable training, employment and timber benefits may be realized in these areas at the same time as owl habitat is being enhanced. While I acknowledge that there is considerable uncertainty in the actual volumes that may be realized, as discussed also above, in “Silvicultural Systems”, I consider it reasonable to expect that some volume will be harvested in this manner.

On the other hand, the analysis also did not account for the additional short-term constraint from matrix birds, which would indicate an overestimation in supply.

In my judgement, the timber volumes associated with both the underestimation from excluded partial-cutting and the overestimation from matrix areas are small and uncertain, and may reasonably be considered to be mutually offsetting, with no significant net error in the projected timber supply.

For the purpose of this determination, I consider the analysis to have adequately reflected the constraints on timber supply arising from government’s announcement and implementation of the Spotted Owl Management Plan—which brings much more clarity to the timber supply constraints associated with managing the owl than was available for the 1995 determination.

*- deer winter range*

Requirements for deer winter range habitat were based on a total of 31 000 hectares of forested land identified on inventory maps as environmentally sensitive for wildlife (i.e. EW1 polygons). A forest cover constraint requiring trees to be older than 100 years was applied directly to 13 000 of these hectares included in the timber harvesting land base, and a further 2000 hectares were

accounted for by land-base exclusions or constraints applied for other purposes. The figure of 13 000 hectares to which this constraint was applied is 5000 less than the corresponding area in the previous timber supply analysis, primarily due to the deletion of lower site productivity Douglas-fir stands from the timber harvesting land base in this analysis, and also to land base exclusions resulting from the Protected Areas Strategy process.

Both BCFS and MOELP recognize that the EW1 polygon information is aging and does not provide an ideal representation of current deer winter range requirements in the TSA. Consequently MOELP staff developed a new, more accurate map series to further refine critical winter range habitat in the timber harvesting land base, but this was not ready for use in the analysis. The series uses GIS to identify areas *capable* of providing deer winter range (i.e. appropriate slope, aspect, and elevation of the terrain) overlaid on maps showing areas that are *suitable* (i.e. leading Douglas-fir stands of age-classes 6 to 9 with appropriate crown closure and winter sun exposure). MOELP staff are confident the updated GIS maps are an accurate representation of suitable critical deer winter range for the TSA, and will use them as a basis for developing a deer winter range management plan.

The new map base identifies a total of 22 000 hectares of forested area for deer winter range, compared to the 31 000 hectares assumed in the corrected base case analysis. Of this, 15 444 hectares are within the operable land base, which compares reasonably with the area accounted for in the current analysis (i.e. 13 000 hectares plus 2000 hectares). The new maps also spatially define and classify the deer winter range.

MOELP staff were initially concerned that the constraint applied for deer winter range in the analysis was underestimated because it was not referenced to criteria for suitability or capability, or the proximity of other areas capable of providing replacement habitat. However, it was subsequently agreed that the method of applying the constraint in the analysis with respect to age, species composition, site productivity and area results in the same constraint on timber volume regardless of the exact location of the constrained area in the timber harvesting land base, (although significant overlap is expected) and that only suitable and capable areas will be determined operationally.

One licensee reported that, based on a review of 10 map sheets, the deer winter range habitat area used in the analysis was overestimated by 31 percent. However, in this assessment the licensee did not differentiate between the operable and inoperable land base, and a review by district staff of the licensee's maps showed that the majority of the overestimated area was in the inoperable land base. Furthermore, since the study also used an older version of the maps that is no longer used for deer management, I cannot rely on this information to adjust the projected timber supply. Another licensee suggested deer winter range should be managed and not excluded from the timber harvesting land base, which is in fact the current analytical method.

MOELP is expected to present the new GIS-based deer winter range suitability maps to BCFS and licensees for use in operational planning and for use in the next timber supply analysis. The map series is also expected to be used for the Ungulate Winter Range Regulation, and eventually to be supported by a Deer Winter Range management plan. I note that the new maps identify an area of deer winter range in the timber harvesting land base similar in size to the area constrained in the corrected base case analysis to be older than 100 years. I also note that sensitivity analysis shows that a 50-percent increase in deer winter range would only reduce the projected short-term harvest level by 2 percent. On the basis of these considerations I am satisfied that the accounting

for deer winter range habitat in the corrected base case corresponds reasonably with current management, and that no adjustment to the timber supply projection is required on this account at this time. From this, I am also confident that any possible refinements evolving from implementation of the Ungulate Winter Range regulation can be incorporated in the next analysis for consideration in the next determination without any significant unanticipated risk to projected supplies.

- *mountain goat winter range*

In the previous AAC determination for this TSA, I noted the potential for unaccounted uncertainties in timber supply with respect to mountain goat winter range habitat. At that time there were limited operational conflicts between goat habitat and the timber harvesting land base, and habitat inventory and mapping were not complete.

Additions to the timber harvesting land base and continued logging at higher elevations have increased the potential for conflict between goat habitat and harvest opportunities. An aerial inventory of mountain goat winter range in the Chilliwack Forest District is ongoing with an anticipated completion date of April 1999. Mapping of winter range polygons at a scale of 1:20 000 is also underway, and has been completed for some areas. Digitization of these polygons will be completed by MOELP over the next few years as part of the Ungulate Winter Range Regulation, and will be available for use in the next timber supply analysis. Because this information was not available for use in the current analysis, no accounting was made for mountain goat winter range.

I am advised that while the mapping will show the majority of winter range polygons to be outside the current operability lines, it is estimated that in the order of 1500 hectares will be within the timber harvesting land base, predominantly in sites of poor productivity at high elevations.

MOELP will present to BCFS and licensees the completed mountain goat winter range habitat requirements for inclusion under the Ungulate Winter Range Regulation, with an understanding that any timber supply impacts will be accounted for in the next timber supply analysis. In the interim, mountain goat winter range will be managed under the existing agreement whereby identified conflicts are addressed at the operational level. Since no accounting was made for goat winter range in the corrected base case analysis, the projected timber supply will be constrained to some additional extent by allowances for this habitat. However, as I have noted in my "Reasons for Decision", the estimated affected area of 1500 hectares represents just 0.5 percent of the timber harvesting land base, and is located in high elevation sites of poor productivity. I am therefore satisfied that any small adjustment to timber supply necessary to provide for this habitat can be accommodated within the short-term timber supply as projected in the corrected base case. When the goat winter range plans are completed, any necessary adjustment to the timber supply, which from current indications is expected to be minor, can be reflected in the next analysis.

- *identified wildlife*

The biodiversity and riparian provisions of the Forest Practices Code are intended to provide for the needs of most wildlife species. However, some wildlife species that are considered by the Wildlife Branch of MOELP to be "at risk" require special management practices. The province's *Identified Wildlife Management Strategy* (the *Strategy*) is in the concluding stages of

development and is expected to be released in the near future. This strategy will provide direction for managing critical habitat for identified wildlife species that are established in the *Forest Practices Code of British Columbia Act*.

The following species, which are identified in Volume 1 of the Strategy and will be included in identified wildlife when designated, occur within the TSA: American Bittern, Bull Trout, Fisher, Grizzly Bear, Keen's Long-eared Myotis, Marbled Murrelet, Mountain Beaver (both subspecies), Mountain Goat, Northern Goshawk, Pacific Water Shrew, Rubber Boa, Sandhill Crane, Tailed Frog, and Turkey Vulture. A list of the Red- and Blue-listed species at risk in the Chilliwack Forest District is given in the *Fraser Timber Supply Area Analysis Report*, Table 2, page 5. Management concerns have been identified for these species.

When the *Strategy* is implemented, Identified Wildlife will be managed through the establishment of Wildlife Habitat Areas or general wildlife measures, or through specific management practices identified in higher level plans. For the present, limited inventory work has been undertaken in the TSA, and there is no current management practice, although MOELP has indicated that a grizzly bear recovery plan for the North Cascades is currently under development. Accordingly, the corrected base case timber supply analysis included no specific accounting for Identified Wildlife.

Public input included specific concern for the management of Grizzly Bear habitat, which is protected not by the Forest Practices Code but by the Grizzly Bear Conservation Strategy. This strategy is currently under development, and it is not clear whether it will further impact timber supply, beyond the considerations noted in this document. Therefore, if further constraints are identified in the future, they will be taken into account in the appropriate timber supply analysis.

The expectation that the *Identified Wildlife Management Strategy* will be implemented in the near future is not speculative since the Strategy is a component of the Forest Practices Code and is in an advanced stage of development. It is reasonable to expect that management for the identified species will follow the guidelines of the Strategy and that this will be in effect before the next AAC determination for this TSA. Government has set an overall provincial limit of one percent on the allowable impact on the short-term timber harvest level from implementing measures for Identified Wildlife. For administrative purposes this impact will be measured in terms of the associated change in net land base area, which will be limited to a one-percent reduction. Since the timber supply in the Fraser TSA is currently constrained by cutblock adjacency rather than by the overall area available to harvest, the timber supply implications of a one-percent net land base reduction would not affect the harvest level projected in the analysis until the mid-to long term.

At this point it is too early to speculate on the extent of habitat area that will be required within the timber harvesting land base to implement the *Strategy*, but since the analysis made no provision for the *Strategy*, the mid- and long-term harvest levels may be up to one-percent lower than projected in the corrected base case, and I have discussed this further in "Reasons for Decision".

In this determination I have therefore made no adjustment to the projected short-term timber supply on this account. As the province clarifies its strategy for the management of species at risk, I expect the implications to be reflected in future timber supply analyses for the TSA and these will be taken into account in future AAC determinations. The identification, inventory and mapping of critical habitats should begin for the identified species, with a view to following

procedures for wildlife habitat areas for known locations, to reduce uncertainty in the management of these species, and in future timber supply analysis.

*- riparian management*

Riparian habitats occur along streams and around lakes and wetlands. The Forest Practices Code requires the establishment of riparian management *reserves* that exclude timber harvesting, and riparian *management* zones that restrict timber harvesting in order to protect riparian and aquatic habitats.

In the corrected base case analysis, 4.8 percent of the timber harvesting land base was excluded from contributing to the timber supply to account for habitat values in riparian *reserve* zones. This figure is based on average figures for stream length for each stream class in coastal areas, as estimated in a 1994 study by Wildstone Resources, and the riparian reserve zone widths specified for each stream class by the Forest Practices Code. The use of average values was necessary because stream lengths specific to the Fraser TSA were not available. To account for the timber volume constrained within the riparian *management* zones, all volume-over-age curves, for both existing natural and regenerated stands, were reduced by 4.2 percent, based on average coastal figures for the number of streams per hectare.

In the absence of information specific to the Fraser TSA, I accept that the coastal average figures provide the best means available for estimating the required allowances for riparian habitat management. On this basis I have accepted the associated timber supply implications incorporated in the corrected base case projection as suitable for use in this determination.

While I consider the coastal average values to provide a satisfactory provisional accounting of riparian requirements for this determination, their use implies a small degree of uncertainty in the timber supply. To reduce this uncertainty, as experience is gained over the next few years in managing riparian areas for the range of stream classifications, data should be compiled on the areas reserved and on the timber volumes harvested in management zones, to provide a more accurate, localized assessment of riparian requirements, to the extent this is possible, for use in the next analysis and determination, and I have noted this below in my implementation instructions.

*- community watersheds*

The Fraser TSA contains 83 of the 450 watersheds in B.C. that are classified as community watersheds as defined by the following criteria: the water source is from a stream where the water is used for human consumption; the stream is licensed under the *Water Act* for a waterworks purpose or a domestic purpose controlled by a water users' community; the drainage area is not more than 500 square kilometres (50 000 hectares). The 83 watersheds cover 5 percent of the timber harvesting land base in the Fraser TSA.

The rate of cut in community watersheds must always be within the limits indicated by a watershed assessment procedure that assesses the past rate of harvest and roadbuilding in a watershed and the associated risks to water quality and quantity. The *Forest Practices Code of British Columbia Community Watershed Guidebook* specifies that maintaining a cut level in the small sub-basins that does not exceed five percent in five years normally ensures that maximum permissible equivalent clearcut areas (i.e. harvest rates) are not exceeded. Accordingly, in the

timber supply analysis, the management of community watersheds was modeled by assuming that 5 percent of the area of the watershed could be harvested in a 5-year period.

Public input included concern that a large, dispersed population relies heavily on surface-fed water sources in the Fraser TSA, that community watersheds have already been heavily logged, and that they should therefore be exempted from future harvesting in view of the long-term impacts of forest management on water run-off and stream environments, especially with the heavy rainfall in this TSA. MOELP staff also expressed concern about rates of harvest in coastal watersheds—particularly given their investments in watershed restoration projects currently underway—and the need for Coastal Watershed Assessment Procedures (CWAPs) to be carried out to help determine appropriate harvest rates.

I agree that proceeding with CWAPS in appropriate watersheds will provide information that will be helpful in reducing uncertainty in the timber supply. However, CWAPs are not intended to be carried out for all watersheds; the Forest Practices Code requires CWAPs to be carried out in community watersheds and other watersheds where the district manager and a designated environment official agree such an assessment is required for streams with significant downstream fisheries values or licenced domestic water users and significant watershed sensitivity, as determined by the district manager and the designated official. The hydrologic focus of CWAPS identifies where issues exist and also identifies appropriate solutions, which could include restoration prescriptions or recommendations on harvesting rates for parts of, or whole watersheds.

For watersheds where the need for a CWAP is not indicated, appropriate planning and the application of the Forest Practices Code with respect to road building, gully assessment, terrain stability assessment, timing windows on harvesting and road construction, logging prescriptions and riparian management will ensure the avoidance of sediment production and direct impacts on streams. Watershed restoration programs are also highly effective in restoring damaged drainages.

I am satisfied that, through CWAPS and Code provisions, district managers have a sufficient range of means at their disposal to ensure that water quality and quantity in both designated and undesignated watersheds are adequately protected from potential impacts associated with timber harvesting activities. I am also satisfied that in the interim before the requisite CWAPS can be completed, the timber supply implications of maintaining water quality in the Fraser TSA have been adequately incorporated into the corrected base case analysis through application of a harvesting constraint consistent with the community watershed guidebook. I also note that a sensitivity analysis showed that reducing the permissible harvested area in the initial harvest forecast from 5 percent to 3 percent of a watershed reduced the projected short-term harvest level by 2 percent—from this it can be seen that this constraint already limits the timber supply in the TSA.

I therefore accept that the representation of community watershed management in the analysis is realistic and adequate and is suitable for use in this determination.

- *recreation*

Recreation resources are an important feature of forest management in the Fraser TSA. The inclusion in the TSA of the Greater Vancouver Regional District, the Lower Mainland area and the communities of the Fraser Valley means forests in the TSA are readily accessible to the

majority of the population of the province. Consequently the TSA has come to provide extensive opportunities for a wide range of popular back-country-, forest-, mountain- and water-related outdoor recreation activities. These include canoeing, kayaking, hiking, climbing, mountain biking, horse-riding, camping, hang-gliding, hunting, fishing, and many more. Public expectations for recreation and eco-tourism have increased greatly in recent years, and will likely continue to increase with the growing population.

To help in accommodating these activities, 4813 hectares identified as Use for Recreation Enjoyment of the Public (UREP) were deducted from the productive forest in deriving the timber harvesting land base. In fact a very limited amount of harvesting is permitted in UREPs provided this does not compromise management of the UREP area. A further 34 hectares, managed exclusively for recreation values, were deducted separately.

The timber harvesting land base includes a total of 7048 hectares of provincial and regional significance, identified as Recreation Class A and B, Management Class 1. Reduced harvesting activities on 3883 hectares of this total area were accounted for in the analysis through forest cover constraints applied to visually sensitive areas. For the balance of 3165 hectares, no specific accounting was made, but it was assumed that some of the affected area would overlap with and be accounted for by forest cover constraints applied for other forest values such as wildlife habitat and winter range.

Public input included the concern that only 34 hectares had been deducted in deriving the timber harvesting land base, given the natural beauty of areas such as Weaver and Chehalis lakes and the Upper Pitt. In fact the much larger areas indicated above were excluded by UREPs, which cover Weaver Lake and portions of Chehalis Lake and Vickers Creek in the Pitt Lake area.

In assessing the appropriateness of the representation in the analysis of the constraint on timber supply that may reasonably be expected by the use of areas for recreation, I note the lack of a *specific* constraint on the 3165 hectares of provincially and regionally significant area (though parts or all of these areas may be constrained by other factors) indicates the possibility of a small overestimation of the timber supply in the corrected base case. However, there was also no accounting in the analysis for the limited harvesting that may take place in UREPs, which would imply a small underestimation. In the overall scale of operations in the TSA, it is unlikely that any net implication resulting from these two small and mutually offsetting factors would be of sufficient significance to warrant any adjustment to the initial harvest level projected in the corrected base case, and I have therefore made no such adjustment.

*- botanical forest products*

Products harvested from the forest in the TSA in addition to timber include pine mushrooms as well as boughs, shrubs, ferns and mosses for floral supplies. Pine mushrooms are not solely dependent on old-growth forest since they do grow in second-growth stands, but in recent years mushroom harvesting has occasionally conflicted with timber harvesting in some parts of the TSA. In general, activities associated with the harvesting of botanical forest products currently can be accommodated within normal management objectives, and do not constrain the timber supply in the TSA.

*- cultural heritage*

Cultural heritage resources are defined in the *Forest Act* and include archaeological sites, traditional use sites and objects such as culturally modified trees (CMTs). Archaeological sites and CMTs that predate 1846 are protected under the *Heritage Conservation Act*. The nature and extent of the required protection of archaeological sites are detailed under this legislation.

The Fraser TSA covers areas of traditional importance to 34 Indian Bands and 5 tribal organizations. Of these, eight groups are engaged in treaty negotiations, and five of these are negotiating Agreements in Principle (AIP). I am advised by district staff that an AIP with the In-SHUCK-ch/N'Quatqua may be reached in the fall. As noted above in my "Guiding Principles", in my determination at this time I cannot anticipate the results of these negotiations or consider associated potential timber supply implications.

With respect to cultural heritage sites in general, knowledge of site locations and their management is a relatively new field that is developing rapidly. Chilliwack Forest District staff will continue to consult with First Nations in working to develop good information on these sites in order to avoid conflicts with timber harvesting, and will focus on operational and strategic planning, and on improving the process where possible. This work is expected to lead to a definition of constraints for the next timber supply analysis.

An extensive inventory exists for recorded archaeological sites along the major waterways in the TSA. Many sites are located outside the timber harvesting land base, in urban areas, parks or within UREPs and riparian zones. Current harvesting operations rarely encounter recorded archaeological sites, but large tracts of the TSA have not yet been inventoried.

For unrecorded archaeological sites, district staff use an archaeological potential model to rate site characteristics within proposed development areas and to identify where further assessment is required. Sites identified by these assessments have been protected in wildlife tree patches, riparian reserves, and by amendments to boundaries. Several recent sites have required substantial block and road modifications, but the overall area set aside from development for archaeological sites in the TSA has not been significant.

Inventories of traditional-use sites have recently been gathered and completed for the Sto:lo and Tsawwassen First Nations. Studies have commenced for the In-SHUCK-ch/N'Quatqua, and further studies are proposed. Specific site management recommendations developed during the consultation process for operational plans have not yet been developed for sites identified in licensees' operating areas, so no adjustments have been made to the timber harvesting land base. Management strategies and their impacts are expected to be known for the next timber supply analysis.

In the corrected base case timber supply analysis for the Fraser TSA, since no net implications for the timber harvesting land base had been identified, and coding was not yet available on the inventory file for archaeological sites, constraints on timber supply from cultural heritage resources were not explicitly accounted for. However, a number of specific sites would have been excluded from the timber harvesting land base as part of deductions made to meet non-timber management objectives in riparian areas, UREPs, parks, and wildlife tree patches.

At this time it is impossible to speculate on the extent to which archaeological and traditional use sites have been accounted for in land base deductions for other forest values and the extent to which this accounting remains outstanding. First Nations have commented that the impacts of

forest practices on their values were not properly identified or considered in the analysis, and that the current archaeological model is insufficient and may jeopardize the sites.

In response, and in summarizing my considerations on these matters, I note the following. District staff currently consult regularly with First Nations during operational planning, to minimize and eliminate conflict between these values and timber harvesting, with a commitment to continually improving the process. While it is certainly true that no explicit accounting for cultural heritage values was made in the analysis, I am assured that many sites would have been excluded from contributing to the timber supply by deductions for forest management objectives other than timber, particularly in riparian areas. In view of these exclusions and of the district's cooperative operational planning and management, I am satisfied that for the effective period of this AAC these resources can be managed through appropriate administration of the harvest level projected in the corrected base case analysis.

In view of the increasing need to manage for archaeological sites in the TSA and to ensure the availability of the best possible information for future determinations, district staff should obtain additional inventories of site locations, update the archaeological model as required, and continue to track the impacts of this management on the timber harvesting land base. For traditional use sites, the proposed inventories should be completed and added to the existing information, and management strategies should be developed and their impacts again tracked. From this, I expect that data will be available for explicit incorporation in the next timber supply analysis and AAC determination.

- *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 by retaining reserves of mature timber, or wildlife tree patches, within cutblocks and in adjacent inoperable and other retained areas, to provide structural diversity and wildlife habitat.

For areas where landscape units with defined objectives are not yet formally designated, as is currently the case in the Fraser TSA, the area of wildlife tree retention needed is determined from Table 20(b) of the *Forest Practices Code of B.C. Biodiversity Guidebook*. In the Fraser TSA, it is estimated from inventory file summaries that about 50 percent of the forested area is harvestable, and about 70 percent of the harvestable area has already been harvested without the recommended retention of wildlife trees. For these conditions, Table 20(b) recommends the retention of 12 percent of the area of each cutblock in wildlife tree patches. For coastal areas, it is estimated that up to 75 percent of the required area of wildlife tree patches can be met in riparian or other areas outside the timber harvesting land base (*FPC Analysis*, 1995). On this basis it was assumed that for the Fraser TSA the average proportion of the harvestable area of each cutblock required to be retained in wildlife tree patches is 3 percent and in the corrected base case analysis all volume-over-age growth curves were reduced by that figure.

The district manager and MOELP staff agree that in practice, although there is variation between areas and elevations in the TSA, on average more than 12 percent of harvestable areas in the TSA are constrained for riparian management and other reasons, with most silviculture prescriptions showing 14 to 18 percent of the total area being constrained, and in their judgement the figure of 3 percent as an additional requirement specifically for wildlife tree patches is a reasonable estimate.

In public input, licensees submitted that the areas left unharvested around each block should suffice for wildlife tree purposes, with no further deduction necessary. One licensee submitted a GIS-based report of wildlife tree requirements, concluding that not all elements of biodiversity can be, need to be or will be maintained on every hectare of the timber harvesting land base, that areas already removed from the operable land base for other values are more than twice the figure identified as needed for wildlife tree patches, and that since these areas are well distributed on the landscape, no further netdown is needed.

In response, while I accept that the conditions described by the licensees *may* satisfy the recommendations of the *Biodiversity Guidebook* in some cases and for specific periods of time, the maximum allowed distance of 500 metres between patches may not be met in this way for all areas, and in any case the eventual harvest of adjacent stands will remove much of the assumed wildlife tree contributions from those areas. Unfortunately I was not able to use the GIS-based study as a reliable assessment of wildlife tree provisions and requirements since the study examined the potential requirements in the remaining mature stands only, and did not consider the existing immature stands which make up the majority of the timber harvesting land base.

In conclusion, I acknowledge that uncertainties exists in the degree to which the timber harvesting land base is already constrained in ways that will satisfy wildlife tree requirements, and in the additional area that must by corollary be retained from each cutblock specifically for this purpose. However, the assumptions applied in the corrected base case analysis are consistent with the recommendations of the *Biodiversity Guidebook*, with the 1996 *Forest Practices Code Timber Supply Analysis Report*, and with the operational experience and judgement of BCFS and MOELP staff. Therefore, in the absence of conflicting, reliable information, I consider the risk of an over- or underestimation of the timber supply in the base case projection on this account to be low, and I accept the assumption used in the analysis to represent wildlife tree requirements in the TSA as suitable for use in this determination.

- *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. The *Forest Practices Code of BC Biodiversity Guidebook* is based in part on the principle that this—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 (wind, fire, landslides) in the wetter coastal regions.

The delineation and formal designation of "landscape units" is a key component of a sub-regional biodiversity management strategy. Any of a range of biodiversity emphasis options may be employed when establishing biodiversity management objectives for a landscape unit. The *Biodiversity Guidebook* outlines three biodiversity emphasis options—lower, intermediate and higher. 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.

For areas where landscape units have not yet been formally established, or an emphasis option has not been assigned for a landscape unit, the *Biodiversity Guidebook* recommends the lower biodiversity emphasis option be used as a default to guide operations. In addition, in the absence of a plan, the policy currently incorporated into timber supply analysis—with the intention of balancing social and economic impacts against risk to biodiversity, is as follows: model approximately 45 percent of the area in the lower biodiversity emphasis option, approximately 45 percent in the intermediate emphasis option, and approximately 10 percent in the higher emphasis option, consistent with the 1996 *Forest Practices Code Timber Supply Analysis* report.

Since the landscape units in the Fraser TSA are in a draft stage and biodiversity emphases have not yet been formally assigned, an area-weighted '45-45-10'representation was applied in the corrected base case analysis. The requirements for old seral forests were applied independently to each biogeoclimatic variant within each draft landscape unit, and were determined by the natural disturbance type into which each variant falls. In the portion of the TSA that will be assigned low-biodiversity emphasis, only one third of the eventual old seral requirement was assumed to be required in the first 70-year rotation, with the remainder being phased in over the following two rotations. Forest cover constraints for the old seral stage only were applied; those for the early seral and mature-plus-old seral stages were not applied. This is consistent with operational practice in the TSA, since analysis has shown significant timber supply impacts in the first and second decades when these were applied. These assumptions as applied are consistent with the recommendations of the *Biodiversity Guidebook* and with the 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.

A number of comments received in the public input were critical of the biodiversity assumptions in the analysis, particularly with respect to the adequacy of representing identified wildlife, the protection of biodiversity values in general, the restricted application of seral stage requirements to avoid impacts on timber supply, and the risk to species of fish and wildlife from habitat destruction.

In response, having reviewed the procedures used in modelling the landscape-level biodiversity requirements in the Fraser TSA, I have concluded that they were based on, and consistent with, provincial policy as conveyed in the above documents. The intent of this policy is clearly stated in the deputies' letter, which identifies the need to achieve a reasonable balance between economic and environmental values and provide an acceptable level of risk to the biological diversity of the province, by applying the recommendations of the *Biodiversity Guidebook* in

consistency with the assumptions in the 1996 report *Forest Practices Code Timber Supply Analysis*. Many of the criticisms received do not in fact reflect shortcomings in the analytical method; rather they express differences with the underlying provincial policy on which the analysis is based. However, my assessment of the timber supply must be consistent with this policy, and for the purposes of the present AAC determination I confirm that I am satisfied the policy expressed in the deputies' letter has been appropriately incorporated in the analysis.

MOELP staff also expressed concern, as noted above in the sections on *physical operability* and *economic operability*, about changes in operability lines and in the availability of inoperable areas to contribute to biodiversity planning requirements, considering that cutblocks continue to be proposed outside the operable land base. Inoperable areas are assumed—both in timber supply modelling and in the operational practice on which the modelling assumptions are based—to make contributions to meeting biodiversity requirements. If increasing numbers of cutblocks are placed in inoperable areas without planned regard for landscape-level biodiversity cover constraints and objectives, it would appear reasonable to conclude that the ability to met these requirements could eventually become compromised in some areas. However, in the timber supply analysis, precaution was taken to ensure that, for each biogeoclimatic variant in each (draft) landscape unit, sufficient forest cover is in place at all times throughout the 250-year forecast period to meet biodiversity requirements as currently formulated in provincial policy. These requirements are met at projected harvest levels whether harvesting takes place inside or outside the currently identified timber harvesting land base. For this reason, and taking into account the age-class distribution in the TSA which shows extensive areas of timber in older age classes outside the timber harvesting land base, I am satisfied that there is no conflict between maintaining the harvest level projected in the corrected base case analysis and maintaining the identified landscape-level biodiversity requirements, at least for the five-year effective period of the AAC currently under determination.

Nevertheless, it is important to ensure that operations in the TSA proceed in ways that will maintain levels of forest cover consistent with those assumed for each (draft) landscape unit in the analysis, to avoid incurring future risk to the supply from each unit and thus to the overall projected harvest levels. To accomplish this, it is important that landscape-unit plans and objectives for the TSA be completed as early as possible. When the objectives for the landscape units are formally established, the operable area should be redefined to ensure ongoing consistency with these objectives.

MOELP staff also expressed a concern that in the analysis it is assumed that areas of non-contributing forest continue to age uninterruptedly, allowing the model over time to assume that old seral forest biodiversity requirements can be satisfied from outside the timber harvesting land base, when in fact natural disturbances such as fire and pests will occur to various extents in inoperable areas, introducing uncertainty into the ability of such areas to provide adequately for biodiversity requirements. I agree that this accurately describes the current operation of the FSSIM model, but this does not introduce uncertainty in the projected timber supply until the longer term. Meanwhile analysts are currently working to adapt the FSSIM model to incorporate a representation of these stand disturbances, and any necessary adjustments to future projections will be made long before any risk would be incurred to the actual timber supply. Furthermore, frequent re-determinations every five years allow for reconsideration based on actual changes in forest cover which might have taken place subsequent to the last analysis.

From all of these considerations, acknowledging both the need to formally establish landscape-unit objectives to ensure continued compatibility between landscape-level biodiversity requirements and the integrity of projected future timber supplies, and the need to adapt the FSSIM model to incorporate natural disturbances in non-contributing areas, I accept the landscape-level biodiversity assumptions applied in the corrected base case analysis as consistent with provincial policy as well as local management practice and therefore suitable for use in this determination.

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

All considerations related to this determination are listed under the appropriate subsections of the Forest Act in this rationale document. I have made no additional considerations under this subsection.

**(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, including the Fraser TSA. In the short term, the presence of large volumes of timber in 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, the timber supply should remain sufficiently stable 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.

Recent findings related to the productivity of managed, second-growth stands have resulted in many cases in the projection of harvest levels that are higher in the long term—due to the recent and current planting and tending of good quality, well spaced seedlings—than in the medium term when supplies continue to depend mainly on the natural productivity of unmanaged stands. In this situation analysis shows that in some cases even a very large AAC reduction today would not permit a mid-term level at or above the elevated long-term level.

The corrected base case for the Fraser TSA shows such a projection, and analysis of harvest flows alternative to the published base case (using the assumptions applied in the published base case) showed that establishing a non-declining forecast (i.e. in which no future reductions are permitted) would require an immediate harvest level reduction of about 30 percent. Scheduling has prevented performing this particular analysis with the corrected aggregation assumptions, but their more restrictive nature would necessitate a comparable or greater immediate reduction. Although this alternative projection resulted in a slightly higher mid-term level than in the initial forecast and published base case, it still required a step up to the same long-term level as in those forecasts, but one decade earlier. Analysis also showed that under the assumptions in the published base case the AAC could not be set immediately as high as the long-term harvest level without significant shortfalls over the first 100 years. Analysis of the volumes harvested from

natural and managed stands shows that the same would be true under the assumptions used in the corrected base case.

Under the assumptions used in the corrected base case, the initial harvest level could not be maintained for ten years—a small reduction was required after five years. This shows there is simply not sufficient timber ready for harvest in the TSA to permit an alternative forecast with an initial harvest level higher than that projected in the corrected base case.

Under the published assumptions for the base case, attempting to reduce by 25 years the period before the step up from the mid-term to the long-term level (i.e. setting the step at 80 years from now instead of 105) caused a significant rupture in the projected long-term supply at about decade 15 of the projection. I am advised that this would be equally likely to occur with the corrected base case.

Regardless of the harvest flow policy applied, the steady long-term level would remain unchanged, as it is a function only of the size and estimated productivity of the land base and the management practices applied.

Public input suggested that since the base case initial harvest level is far above the long-term sustainable rate, future jobs and community stability are at risk. However, the corrected base case is the only projection considered that conforms to all the corrected assumptions and is consistent with the socio-economic objectives of the Crown expressed by the Minister of Forests as discussed below. A higher initial harvest level is not attainable. Lower initial levels, which entail greater reductions immediately in order to avoid, or apply smaller, reductions in the future, are possible, but are not consistent with the socio-economic objectives of the Crown, and do not provide a steady, equitable distribution over time of the socio-economic implications of the falldown in timber supply associated with the transition from harvesting in old-growth to harvesting in second-growth forests.

Community dependence on the forest industry

In 1996 the population of the Fraser TSA was 2,052,672, having grown by 14.8 percent since 1991, with the largest increases being in the central TSA and the largest decrease in the Fraser Canyon. The population is expected to grow by a further 13 to 16 percent between 1996 and 2001. In 1991, logging and forestry services accounted for 0.4 percent of the total workforce in the TSA, and primary forest products manufacturing accounted for a further approximately one percent. Logging and primary products manufacturing accounted for 5.8 percent of the region's employment related income. Overall in the TSA, from 1991 to 1996, employment in logging and forestry services declined by 27.1 percent. From 1990 to 1997, employment in forest products manufacturing declined by 12.5 percent. In 1996, 18 percent of all manufacturing in the TSA was related to wood and paper products.

Currently the AAC for the Fraser TSA supports 1,953 person-years of direct employment, plus 2,300 person years of indirect and induced employment, for a total of 4,253 person-years, worth $166.4 million annually. Residents of the TSA account for 85 percent of the direct employment. However, dependence on the forest sector is not uniform throughout the TSA. Of the direct workforce resident in the TSA, 85 to 95 percent reside in the eastern portion of the TSA. The Ministry of Finance and Corporate Relations (Ministry of Finance) estimates that this portion of the TSA relies on the forest industry for at least 15 percent of its total income.

The corrected base case forecast for the Fraser TSA indicates a reduction in the first decade of approximately 280 000 cubic metres from the current AAC. This implies reductions of about 300 person-years of direct employment within the TSA, and another 50 person years in the rest of the province, plus a total reduction of 420 person-years in indirect and induced employment. It also implies a reduction of approximately $9.5 million annually in government revenues. Further reductions are implied in the second decade.

An AAC reduction at this time is more likely to present a need for socio-economic adjustment in some communities in the eastern Fraser Valley and the Hope-Fraser Canyon areas than in many other parts of the TSA that are located within the highly economically diversified Lower Mainland area.

Public input on the published socio-economic analysis included concern that revenues from uses of the forest other than timber harvesting should be considered and accounted for. While I agree in principle, at present this is very difficult to monitor, and I am assured by district staff that, judging from current levels of activity, anticipated reductions in revenues from a reduced timber harvest would outweigh the benefits from any associated increase in harvesting botanical products. Concern was also expressed that impacts in the TSA—particularly in the eastern areas—were understated, which may be valid to some extent where combined regional harvest level reductions may incur threshold effects on production facilities. However, the figures from the Ministry of Finance are the best information available to me at this time.

Forest Renewal British Columbia (FRBC) Mitigation Strategy

In response to the declines in timber supply and associated potential AAC reductions projected for the Fraser TSA, a draft strategy has been developed by a team from the Chilliwack Forest District, New Forest Opportunities Limited, FRBC, Human Resources Development Canada, and the B.C. Ministry of Advanced Education, Training and Technology. The objectives of the strategy are: to provide services and resources to displaced workers; to assist communities with impacts of reductions in the forest sector workforce; to encourage community and private sector leadership in addressing the changing circumstances of local employment; and to continue to integrate support for the transition in forest employment with ongoing community and regional economic diversification activities.

I have reviewed a draft outline of this strategy, and in considering the short and long term implications to the province of alternative rates of timber harvesting in the Fraser TSA, I have been mindful of the existence of the potential role of this strategy in mitigating the effects of a reduction in harvest level.

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

Timber processing facilities and requirements

In 1997 a total of 94 mills were operating in the Fraser TSA, compared to 133 mills in 1990. District staff note that a definite downward trend has become evident in the normal fluctuation in the number of operating mills. The volume of timber processed in the TSA has declined steadily during the 1990s, from 13.2 million cubic metres in 1990 to 10.5 million cubic metres in 1997. Harvesting in the Fraser TSA itself accounts for only 8 to 10 percent of the total volume processed in the TSA, but some individual mills, such as the J.S. Jones mill in Boston Bar, rely on

the TSA for up to 50 percent of their supply. Thus while a reduction in the TSA harvest level of the size indicated in the corrected base case (18 percent) may represent a reduction of only up to 1.8 percent in the total volume of timber processed throughout the TSA, particular mills may experience more directly a greater proportional reduction in supply.

**(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).

This letter and memorandum are consistent with the objectives stated in the April 1994 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." The Minister 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.

As noted above in " Alternative harvest flows", the initial harvest level projected in the corrected base case is the highest level—the smallest reduction—achievable without later projected disruptions.

As noted under commercial thinning, while 48 000 hectares of the harvestable land base in the Fraser TSA are potentially suitable for commercial thinning and a proven track record is expected to be established within the next few years, at present I cannot consider this to be a current practice in the TSA with a demonstrable program size or significant yield benefits, and I have accepted as appropriate the assumption in the corrected base case of no contribution to the short-term timber supply from commercial thinning. However, I have noted below in "Implementation" that it would be very beneficial before the next analysis to produce a strategy that will identify the extent of any possible mitigation of the imminent falldown in the Fraser TSA by the use of commercial thinning.

I have also reviewed opportunities for harvesting in previously uneconomic areas, noting (see above, physical and economic operability) that the operability review conducted in 1996 resulted in a net addition of approximately 9500 hectares to the timber harvesting land base, which has already been accounted for in the corrected base case analysis. I have noted the need for landscape-unit planning to ensure compatibility between biodiversity objectives and the extent of operable areas. I have also considered the extent of harvesting in low-productivity stands, and recommended that harvesting performance be controlled by monitoring rather than by partition. I am satisfied that for this determination the timber supply analysis adequately reflects economic opportunities for harvesting.

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that the constraints applied to timber supply in order to meet VQOs before the Forest Practices Code came into force, 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 due to more detailed visual landscape inventory mapping and associated forest cover requirements, the current analysis shows that an estimated 7-percent increase in the TSA timber supply will be gained operationally over that represented in the previous analysis.

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 Chilliwack Forest District actively solicited public input through direct mail-out to over 200 individuals, organizations and businesses, a briefing for area MLAs, a stakeholders' information meeting in Chilliwack, and media interviews. Despite unavoidable short notice for the informational open house, many written responses were received and are summarized in the *Fraser Timber Supply Area Timber Supply Review: Summary of Public Input, BCFS 1998* which I have reviewed and which is attached to this document as Appendix 5.

In particular, concerns were expressed that the AAC reduction should not jeopardize the Boston Bar Mill, in which considerable investment has been made, or other Fraser Canyon communities; that the harvest level in First Nations' traditional territory be sustainable and First Nations' values be maintained, protected or enhanced; that the highest short- and long-term harvest rates be achieved to "maximize sustainability"; that timber harvesting has environmental impacts such as declining fish stocks, and the forest sector must start to "put far more back into the resource"; that job loss can be mitigated by industry restoring past damages; that forest cover requirements are not imperatives but choices; and that more tenures should go to small operators for environmental responsibility and more jobs.

Consideration of this input, where appropriate, has been an important component of this determination, and where possible I have attempted in this rationale to respond briefly to the views expressed.

Some of the views expressed are beyond my jurisdiction to address under section 8 of the *Forest Act*, and I make the following general comments in response. The AAC I determine must be the product of considering all factors under section 8, including the Crown's objective that AAC reductions be only as large as necessary to avoid future disruptions in supply. AACs are determined for entire TSAs, not for discrete portions (although particular harvest levels may be specified in the case of established partitions) and the apportionment of the harvest among licensees is the statutory responsibility of the Minister of Forests, not the Chief Forester. Administering the AAC to ensure consistency with managing appropriately for archaeological and cultural heritage values is the responsibility of the District Manager. Harvesting practices are specifically regulated by the forest Practices Code to avoid damage to streams, and recent audits show high levels of compliance with the Code. Watershed restoration projects (with attendant job creation) are already current practice in the TSA.

Although some of the concerns expressed do not bear directly on my considerations in determining this AAC, I appreciate the high level of public interest shown in forest management issues in this TSA, and I note the ongoing divergence in some of the expressed opinions and the confirmation of the need to maintain an appropriate relationship between socio-economic and environmental values.

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

Unsalvaged losses

Unsalvaged losses are timber volumes that are destroyed or damaged by natural causes such as fire and disease but are not recovered through salvage operations. In regenerated forests, a number of parasites, fungi or plants can kill trees or degrade the quality and value of logs. Estimates for unsalvaged losses account for epidemic (abnormal) infestations and for factors that result in losses that are not recovered through salvage harvest programs but which are not recognized in yield estimates. Timber volume losses due to insects and diseases that normally affect stands (endemic losses) are accounted for in inventory sampling for existing timber yield estimation or through other methods. Losses associated with second-growth stands are addressed by application of the operational adjustment factors (OAFs) as referred to below and under *decay, waste and breakage*.

Losses to wildfire: In the Fraser TSA, from 1987 to 1997 an average of 135 hectares per year have been burned by wildfire. Of this area, an average of 75 hectares per year have been assumed to lie in the timber harvesting land base, resulting in an estimated average annually damaged volume of 17 000 cubic metres. Approximately 1075 cubic metres per year of this volume were salvaged, and 15 925 cubic metres per year were unsalvageable. These assumptions were included in the corrected base case analysis.

In 1998, fires consumed the atypically large area of 2100 hectares in the TSA, about 85 percent of which was in operable areas. This will lead to the salvage of 196 000 cubic metres and an unsalvageable loss of 404 000 cubic metres. Much of this loss was associated with the Nahatlatch fire. Since the loss to this fire alone was much larger than the annual average, a separate analysis was performed specifically to examine the potential implications of the Nahatlach fire for the timber supply in the TSA. The results showed no change for the first five years in the initial harvest level projected in the corrected base, followed by a small reduction in the second five years, and no further change. This result is consistent with the fact that the timber supply in the TSA is limited in the short term by cutblock adjacency considerations rather than by the number of harvestable trees. Since the change in the projected timber supply resulting from this recent fire is minor and confined to the second five years of the forecast, I consider that the ten-year-average assumptions used in the analysis for unsalvaged losses to fire are appropriate for use in this determination.

Losses to wind: On average, about 90 hectares per year are lost in the Fraser TSA to wind-throw. The 1992 Insect and Disease Report estimated the resultant damaged volume at 31 500 cubic metres, of which 29 000 cubic metres were salvaged, and 2500 cubic metres were unsalvaged. These values were included in the corrected base case analysis, and I have no conflicting evidence to invalidate this as the best currently available information.

Losses to insects and disease at endemic levels were accounted for in the corrected base case analysis by applying the standard OAFs of 15 percent (OAF1) and 5 percent (OAF2). These two factors account for a number of conditions contributing to yield reductions, including stocking gaps in regenerating stands, and decay, waste and breakage. Studies are underway in some areas of the province to reduce uncertainty in the applicability of the adjustment factors by isolating and quantifying some of the specific components they account for. However, no such study is yet underway in the Fraser TSA, and I accept that the adjustment factors as applied are the best, currently available means for accounting for these losses and conditions.

In summary, I am satisfied that all known unsalvageable losses in the TSA have been incorporated in the corrected base case timber supply projection to the highest standard of accuracy possible at this time.

## Reasons for Decision

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

The declines projected by the corrected base case forecast for the timber supply in the Fraser TSA reflect the TSA's primary dependence today on the harvest of old-growth timber on sites of lower productivity than were harvested in the past, and the growing dependence of future harvests on the second-growth forests that have regenerated on the already harvested sites, but only relatively small amounts of which have yet reached harvestable age. In that context, five years ago the base case analysis used in my 1995 determination forecast a series of reductions of approximately 10 percent per decade over 30 years to a steady level of about 1.18 million cubic metres per year. Since that time a number of factors have further constrained the supply. These include more complete accounting for the Forest Practices Code, decisions on protected areas, the Spotted Owl management plan, and revised volume estimates following an inventory audit. The supply has also become increasingly constrained by past patterns of contiguous harvesting that now present difficulties in locating cutblocks that allow for the retention of the requisite forest cover to meet biodiversity objectives.

These factors have been offset to some degree by a reassessment of visual quality objectives and their modelling, a modest increase in operable area, and a redefinition of unmerchantable stands.

The net result, following the corrections to the representation of adjacency and aggregation procedures discussed in detail in sections (a), (b) and (c) of "Base case for the Fraser TSA", above, is the currently projected need for an immediate 18-percent reduction in harvest level, followed by a further 18 percent reduction in ten years' time. The projected subsequent steady level of 1.02 million cubic metres is lower than the 1.18 million previously forecast, but increases after ten decades (primarily due to higher estimated volumes in managed stands) to a steady, long-term level of 1.2 million cubic metres. As I noted above, in "Alternative harvest flows", the harvest level today could not be set at a "non-declining" level without an immediate 30-percent reduction. Attempts to set the initial level at the long-term level and "fill-in" the lower mid-term level were unsuccessful because the inventory of mature wood in the TSA is insufficient to "bridge the gap" to the long-term level. All indications are that the Fraser TSA is well into the "fall-down" stage of the transition from historic levels of harvest, that have been based on the accumulated inventory of old growth, to longer-term levels that must now increasingly be based on the rate of growth of the regenerated forest. The rate of decline of this fall-down has been

increased by the factors noted above—implementation of the Code, new protected areas, Spotted Owl management, and revised estimates for existing volumes.

The 18-percent reduction projected in the corrected base case is a significant departure from the 10-percent reduction projected in the originally published "initial" analysis, and 3 percent greater than the 15-percent reduction projected in the published "base case". For the reasons discussed in *cutblock adjacency and green-up* I am satisfied that the revised adjacency modelling procedures incorporated in the published "base case" projecting a 15-percent reduction represent current practice more accurately than the procedure in the "initial" analysis. The corrected age-aggregation procedure used in the "corrected base case" projecting an 18-percent reduction is necessary to avoid introducing error into assumptions about regeneration delay, and is now standard procedure in FSSIM timber supply analyses for all TSAs in the province. In view of the unavoidable technical requirement for this adjustment, public comment on the issue was not sought, in order to maintain a schedule of determinations that will meet the provincial statutory requirement.

Questions have been asked as to why, given the 23-percent overestimation in existing volumes identified in the volume audit and the high sensitivity to volume changes referred to in the rationale for the previous AAC determination, the analysis did not project at least a 23-percent immediate reduction, and I have answered this question in *volume estimates for existing stands*.

Having carefully reviewed the considerations which led to the need for the series of analyses—the published "initial" and "base case" analyses, and the previously unpublished "corrected base case"—for the reasons outlined in the referenced sections of this document I am satisfied that, of the three analyses, the "corrected base case" provides the most reliable projection of the timber supply for consideration in this determination. In my considerations set out in the main body of this document, I have therefore reviewed in detail the validity and currency of the assumptions about forest management, practices and policy that were incorporated in the corrected base case projection.

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—in this case the corrected base case. Usually 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 determination. These latter factors are accounted for in determinations in more general terms.

In the present determination for the Fraser TSA, my considerations have identified no reasons why the timber supply projected in the base case may have been *over*estimated in the short term to a degree that may be quantified. The following factors—management of deciduous species, identified wildlife, and mountain goat habitat—have been identified as indicative of potential overestimations of the timber supply to degrees that currently cannot be quantified with accuracy, but for the reasons given none of these will affect the timber supply in a way that requires adjustment to the initial harvest level projected in the corrected base case:

- With reference to my considerations under *deciduous forest types*, the extent to which deciduous stands will be harvested remains uncertain. As noted there, the continued avoidance of harvesting and conversion of deciduous stands could affect mid-and long-term levels by up to four percent. Careful monitoring of this component should therefore continue.

- I have noted that no accounting was made for goat winter range in the corrected base case analysis, that any known conflicts with harvesting are addressed at the operational level, and that the projected timber supply may be constrained to some additional extent by allowances for this habitat. However, I have also noted that the estimated affected area of 1500 hectares represents just 0.5 percent of the timber harvesting land base and is located in high elevation sites of poor productivity, such that any small adjustment to timber supply necessary to provide for this habitat can be accommodated within the short-term level projected in the corrected base case. MOELP will present to BCFS and licensees the completed mountain goat winter range habitat requirements for inclusion under the Ungulate Winter Range Regulation, with an understanding that any timber supply impacts will be accounted for in the next timber supply analysis.
- Government has set an overall provincial limit of one percent on the allowable impact on the short-term timber harvest level from implementing measures for Identified Wildlife. For administrative purposes this impact will be measured in terms of the associated change in net land base area, which will be limited to a one-percent reduction. Since the timber supply in the Fraser TSA is currently constrained by cutblock adjacency rather than by the overall area available to harvest, the timber supply implications of a one-percent net land base reduction would not affect the harvest level projected in the analysis until the mid-to long term. At this point it is too early to speculate on the extent of habitat area that will be required within the timber harvesting land base to implement the Identified Wildlife Management Strategy, but since the corrected base case analysis made no provision for the Strategy, the mid- and long-term harvest levels may be up to one percent lower than projected in the corrected base case.

The foregoing factors have the potential to constrain the timber supply in the period beyond the duration of the AAC currently under determination.

The following factors have been identified as possible indications of underestimation in the projected supply, although none are certain and quantified for the short term.

- As noted in *site productivity estimates*, sensitivity analysis has shown that preliminary old-growth site index adjustments for age-classes 8 and 9 in the Fraser TSA would produce a small increase in the mid term and a 15-percent increase in the long term, but no change in the short term. Thus the mid- and long-term supplies may be somewhat higher than projected in the corrected base case.
- I have also accepted the *possibility* of an underestimation in site classes for younger stands that could, if proven, add to the mid- and long-term supplies beyond the potential increase indicated by OGSI adjustments. In addition to the later implications for volumes in regenerated stands, in view of the high adjacency constraint in this TSA, the possibility of underestimated site indices in younger age classes could mean shorter green-up periods, with earlier implications for timber supply through reduced adjacency problems. However, in the absence of statistically valid data on which to base any such site index adjustment, I have not assumed any contribution on this account in the short term. It is critical for more information to be gathered to bring better clarity to these issues for the next determination.
- Since the actual expected elimination date for all backlog NSR is several years earlier than assumed in the timber supply analysis, there will be a corresponding small addition to the timber supply in the mid-term, but this will have no effect on immediate harvest levels.

- As discussed in *rehabilitation programs*, if 5000 hectares, or 1.7 percent of the timber harvesting land base are involved in the rehabilitation of western hemlock sites back to Douglas-fir, and if a 30-percent gain in mean annual increment is achieved by this conversion, this could lead to a 0.5-percent gain in timber supply at the TSA level in the long term, but there would be no impact on the short-term timber supply.

The foregoing four factors all have the potential to increase the projected timber supply at later dates, but current information indicates that they will not have any effect during the effective period of this determination.

Since the timber supply impacts of the three constraining and four augmenting factors listed above are all uncertain and are not likely to occur until after the period of this AAC, in this determination I have made no adjustments on their account. Nevertheless I have considered their possible later impacts singly and in combination and have concluded that at this time, considering that these factors work both to increase and constrain the supply beyond this determination period, in aggregate they do not appear to present any risk to the supply that cannot be managed in the mid and long terms within the approximate values projected in the corrected base case forecast.

I have noted in the *cultural heritage* section that the Fraser TSA covers areas of traditional importance to 34 Indian Bands and 5 tribal organizations, of which eight groups are engaged in treaty negotiations, and four of these are negotiating Agreements in Principle. I have also noted there and in my "Guiding Principles" that in my determination at this time I cannot anticipate the results of these negotiations or consider associated potential timber supply implications. I am aware that knowledge of cultural heritage site locations and their management is a relatively new, rapidly developing field, and I expect Chilliwack Forest District staff will continue to consult with First Nations in working to develop good information on these sites in order to avoid conflicts with timber harvesting, and will focus on operational and strategic planning, improving the process where possible. This work is expected to lead to a definition of constraints for the next timber supply analysis. I acknowledge that no explicit accounting for cultural heritage values was made in the corrected base case analysis, but I am assured that many sites would have been excluded from contributing to the timber supply by deductions for forest management objectives other than timber, particularly in riparian areas. In view of these exclusions and of the district's cooperative operational planning and management, I am satisfied that for the effective period of this AAC these resources can be managed through appropriate administration of the harvest level projected in the corrected base case analysis.

I have noted earlier that proposed inventories of archaeological and traditional use sites should be completed and added to existing information, and management strategies should be developed and their impacts tracked. From this, I expect that data will be available for explicit incorporation in the next timber supply analysis and AAC determination.

Notwithstanding the foregoing, since the timber supply analysis made no explicit accounting for cultural heritage values, and since extensive cultural heritage inventories are underway, if these are found to have an impact on timber supply sufficient to indicate the need for re-analysis, I am prepared to consider reviewing such an analysis, with a view to the possibility, if indicated, of revisiting this determination at an earlier date than the five-year review required by the *Forest Act*.

As noted in *deciduous forest types*, I have decided to provide in this determination for a deciduous harvest of up to 65 percent of the 50 000 cubic metres assumed in the analysis, i.e. 32 500 cubic metres. This will provide for continued harvesting operations in the commercial deciduous profile, and for development of the non-commercial deciduous profile through rehabilitation and conversion to coniferous stands where biologically appropriate and consistent with other forest management objectives. Since continued avoidance of harvesting and conversion of deciduous stands could reduce mid-and long-term levels by up to two percent, careful monitoring of this component should continue.

From all the considerations and reasoning set out above in this document, I have found no cause or basis from which to conclude that the initial harvest level projected in the corrected base case timber supply forecast should be varied in any way to more accurately represent forest management, practices or policy as currently applied in the Fraser TSA.

Therefore, having taken into account the known risks and uncertainty in 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 the socio-economic objectives of the Crown for the area, that provides for longer-term integrated resource management objectives, and that reflects current forest management, practices, and policy, can be best achieved in the Fraser TSA at this time by establishing an AAC of 1 270 000 cubic metres, effective April 1, 1999.

## Determination

Effective April 1, 1999, the AAC for the Fraser TSA will be 1.27 million cubic metres. This volume is a reduction of approximately 18 percent from the current AAC, and includes an allowable harvest of up to a maximum of 32 500 cubic metres of deciduous-leading forest types. This AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

## Implementation

This determination is effective April 1, 1999, and will remain in effect until a new AAC is determined, which must take place within five years of this determination. In the period following this determination and leading to the subsequent determination, I expect the following to be carried out:

- The second-growth strategy is essential to support the projected harvest levels in the corrected base case. I urge district staff and licensees to work cooperatively to ensure a rapid and smooth transition to reliance on an appropriately increased contribution from second-growth stands.
- Before the next analysis a strategy should be produced that will identify the extent of any possible mitigation of the projected imminent falldown in the Fraser TSA by the use of commercial thinning or other means.
- District staff should work to provide improved information for the next analysis with respect to site index adjustments, alternative silvicultural systems, and associated patch-distributions.
- As experience is gained over the next few years in managing riparian areas for the range of stream classifications, data should be compiled on the areas reserved and on the timber

volumes harvested in management zones for a more accurate, localized assessment of riparian requirements for use in the next analysis and determination.

- Operations in the TSA should proceed in ways that will maintain levels of forest cover consistent with those assumed for each (draft) landscape unit in the analysis, to avoid incurring risk to the supply from each unit and thus to the overall projected harvest levels. To accomplish this, landscape-unit plans and objectives for the TSA should be completed as early as possible.
- A priority should be placed on completing the Vegetation Resources Inventory in time to incorporate the results in the data package for the next timber supply analysis.
- Since continued avoidance of harvesting and conversion of deciduous stands could reduce mid-and long-term levels by up to two percent, careful monitoring of this component should continue.

Larry Pedersen

Chief Forester

February 2, 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

(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

Province of British Columbia
Ministry of Forests
OFFICE OF THE MINISTER

# MEMORANDUM

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

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