BRITISH COLUMBIA
MINISTRY OF FORESTS

Tree Farm Licence 45

Issued to International Forest Products Limited

Rationale for
Allowable Annual Cut (AAC) Determination

effective November 1, 1996

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Chief Forester

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Documents attached:

Appendix 3: Minister of Forests' Letter of July 28, 1994, to Chief Forester, re social and economic objectives of the Crown.

Appendix 4: Minister of Forests' memo of February 26, 1996, to Chief Forester, re social and economic objectives of the Crown—visual resources.

Objective of this document

This document is intended to provide an accounting of the factors considered and the rationale employed in making my determination, under Section 7 of the *Forest Act*, of the allowable annual cut (AAC) for Tree Farm Licence (TFL) 45. The document will also identify where new or better information is required for incorporation into future determinations.

Description of the TFL

TFL 45, held by International Forest Products Limited (Interfor), consists of 7 separate areas located north of the community of Campbell River, in the Knight Inlet and Phillips Arm areas. It is located within the Vancouver Forest Region, and is administered from the Port McNeill and Campbell River Forest District offices.

The total land base for TFL 45 is 243 000 hectares, with a productive forest land base of 54 075 hectares. The portion available for timber harvesting is 29 913 hectares (approximately 55 percent of the productive forest land base). The land base available for harvesting (the "timber harvesting land base") is covered with western hemlock, balsam, cedar, and Douglas-fir. Approximately 85 percent of the timber volume on the timber harvesting land base is mature (older than 140 years).

History of the AAC

In 1982, TFLs 17 and 36 were amalgamated to form TFL 45. The TFL, then covering a total land base of 287 410 hectares, was originally granted to British Columbia Forest Products Limited on January 1, 1983. The initial AAC was 305 000 cubic metres. In 1988, TFL 45 was transferred to Fletcher Challenge Canada Limited, and a portion of the AAC (approximately 7.5 percent) was allocated to the Small Business Forest Enterprise Program (SBFEP). An additional 7194 cubic metres (2.5 percent) was allocated to the SBFEP in 1989 under Bill 28. On November 28, 1991, the Chief Forester approved Management Plan (MP) 2 for the TFL with a reduced land base and an AAC of 210 000 cubic metres. The land base was reduced to correspond with the earlier removal of the SBFEP portion of the AAC from the TFL, and therefore the reduced AAC of 210 000 cubic metres was allocated entirely to the licensee. However, with the transfer of the TFL from Fletcher Challenge Canada Limited to International Forest Products Limited in 1991, once again a portion of the TFL AAC was allocated to the SBFEP. The current AAC for TFL 45 is 210 000 cubic metres, which includes the 10 080 cubic-metre allocation for the SBFEP, since this portion of the program is still being administered within the TFL, unlike the other 28 776 cubic meters for which land base was withdrawn from the TFL.

Management Plan	Period	Licensee AAC (m^3)	SBFEP AAC (m^3)	Comments
1	1984-1987	305 000	--	TFL 45 granted to British Columbia Forest Products Ltd. (BCFP).
1	1988	283 418	21 582	Transfer from BCFP to Fletcher Challenge Canada Limited (FCCL) and allocation of volume to the SBFEP.
1	1989-1990	276 224	28 776	Additional allocation to the SBFEP (Bill 28).
2	1991	210 000		MP 2; removal of the SBFEP allocation from the TFL resulted in reduced land base.
2	1992	199 920	10 080	Transfer from FCCL to Interfor and allocation of volume to the SBFEP.

New AAC determination

Effective November 1, 1996 the new AAC for TFL 45 will be 220 000 cubic metres. This represents an increase of 10 000 cubic metres from the current AAC, and 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 TFL 45 includes the following:

- Existing Stand Yields, approved by Resources Inventory Branch;
- Managed Stand Yields/Site Indexes, approved by Research Branch;
- Statement of Management Objectives, Options and Procedures (SMOOP) for draft MP No. 3 of TFL 45, dated April 28, 1995;
- "Procedures for Factoring Recreation Resources into Timber Supply Analyses", British Columbia Forest Service (BCFS), 1993;
- Timber Supply Analysis Information Package (IP), dated December 1995, submitted by Timberline Forest Inventory Consultants on behalf of the licensee;
- Timber Supply Analysis Report for Tree Farm Licence 45, Final Version dated January 1996, submitted by Timberline Forest Inventory Consultants on behalf of the licensee;
- Draft Management Plan 3 (MP No. 3) for TFL 45, dated December 8, 1995;
- Twenty-year Plan for TFL 45, dated January 24, 1996;

- Summary of public involvement for TFL 45 Management Plan No. 3: letter addressed to Ken Collingwood, Regional Manager, Vancouver Forest Region from International Forest Products Limited, April 30, 1996;
- Technical review and evaluation of current operating conditions through comprehensive discussions with BCFS staff, notably at a meeting held in Victoria on May 23, 1996;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Regulations*, April 1995; and
- *Forest Practices Code Timber Supply Analysis*, Ministry of Forests and Ministry of Environment, Land and Parks, February 1996.

Role and limitations of the technical information used

The *Forest Act* requires me as 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 formed the major body of technical information used in my AAC determination for TFL 45. The timber supply analysis is 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 simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variation in physical, biological and social conditions—although ongoing science-based improvements in the understanding of ecological dynamics will help to 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 the complete solution to forest management problems such as AAC determination. 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 I must consider in AAC determinations.

In making the AAC determination for TFL 45, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my considerations in this determination.

Statutory framework

Section 7 of the *Forest Act* requires the Chief Forester to consider various factors in determining AACs for TFLs. Section 7 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 there is always some uncertainty in the information used in AAC determinations. 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 up-to-date information and knowledge—a principle that has been recognized in the legislated requirement to redetermine AACs every 5 years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that Section 7 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 impact of the Forest Practices Code on timber supply is a matter of considerable public concern. In determinations made before the Code was brought into force, no final standards or regulations were available at the time the timber supply analyses were conducted. Accordingly, the analyses were unable to assess the impacts of any new constraints on timber production which might be imposed under the Code. In those determinations I did not consider any more stringent restrictions or additional impacts upon timber supply beyond those anticipated to occur due to the application of guidelines current at the time of determination. However, I assumed that the Code would at least entrench the standards exemplified by those guidelines as statutory requirements.

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. Studies in selected Timber Supply Areas (*Forest Practices Code Timber Supply Analysis*, BCFS, February 1996) indicate that under the Code there will be some impacts on timber supply additional to those expected under previous guidelines. In AAC determinations made since the coming into force of the Code, I have viewed with some caution the timber supply projections in timber supply analyses that pre-date the Code, as is the case in TFL 45. At the same time, I am mindful that the full force of the Code may not be felt during the transition phase of its implementation,

and that the impacts of specific factors on timber supply may not yet have been assessed on a local basis.

The impact on the timber supply of land use decisions resulting from planning processes such as the Commission on Resources and Environment (C.O.R.E.) process or the Land and Resource Management Planning (LRMP) process is a matter often raised in discussions of AAC determinations. In determining AACs it would be inappropriate for me to attempt to speculate on the impacts on timber supply that will result from land-use decisions that have not yet been taken by government. Thus I do not consider the 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 land-use decisions, it may not always be possible to analyze the full timber supply impact in AAC determinations. In most cases, government's land-use decision must be followed by 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 is impossible to properly assess the overall impact of the land-use decision. However, where protected areas have been designated by order in council, these areas are no longer considered to contribute to timber supply. The legislated requirement for five-year AAC reviews will ensure that ongoing plan implementation decisions are addressed.

The Forest Renewal Plan will fund a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. In general, it is too early for me to assess the consequences of these activities, but wherever feasible I will take their effects into account. The next AAC determination will be better positioned to determine how the Plan may affect timber supply.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues changing. Moreover, in the past, waiting for improved data has created the extensive delays that have resulted in the current urgency to redetermine many outdated AACs. 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 interests 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 the June 1993 Delgamuukw decision of the B.C. Court of Appeal regarding aboriginal rights.

The AAC I determine should not in any way be construed as limiting the Crown's obligation under the Delgamuukw decision, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the TFL. It is also independent of any decision by the Minister of Forests with respect to subsequent allocation of the wood supply. Aboriginal rights will be taken into account as far as possible under Section 7(3) of the *Forest Act* and will be respected in the administration of the AAC determined.

Regarding future treaty decisions, as with other land-use decisions it would be inappropriate for me to attempt to speculate on the impacts on timber supply that will result from decisions that have not yet been taken by government.

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

The Role of the Base Case

In considering the factors required under Section 7 to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review project for TSAs and, for TFLs, by the licensees.

For each AAC determination a timber supply analysis is carried out, using a data package of information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data, and a computer simulation model, timber supply forecasts are produced. These include sensitivity analyses of changes in various assumptions around a baseline option, normally referred to as the "base case" forecast, which forms the basis for comparison when assessing the effects of uncertainty on timber supply.

The base case forecast represents only one in a number of theoretical forecasts, and may incorporate information about which there is some uncertainty. Its 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 current information available about forest management, which—particularly during the period leading up to, and now during, the implementation of the Forest Practices Code—may well have changed since the original data package was assembled.

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. But once an AAC has been determined that reflects appropriate assessment of all the factors required to be considered, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined—it would be impossible for any such analysis to fully incorporate the subtleties of the judgement involved.

Timber supply analysis

The timber supply analysis for TFL 45 that I have considered as part of this determination was undertaken by Timberline Forest Inventory Consultants (Timberline) on behalf of the licensee, Interfor. It has been reviewed by B.C. Forest Service staff. The computer simulation model used by the analyst was the Continuous Area Simulation of Harvesting and Forest Management Projection Model (CASH_FM), which was developed by Timberline. This model is similar to FSSIM, the computer simulation model developed by the BCFS, and provides a reasonable projection of timber supply.

The analysis examined two main management strategies; the first based on current management practices, which served as a base case harvest forecast, and the second based on opportunities for enhanced silviculture. Seven sensitivity analyses were presented around the base case harvest forecast. These sensitivity analyses included changing minimum harvestable ages, existing stand volume estimates, site index estimates, regeneration delay estimates, maximum allowable disturbance percentages, green-up ages, and the amount of area occupied by roads. Additional harvest forecasts were provided which examined the timber supply implications of currently implementable enhanced silvicultural activities, including planting genetically improved planting stock, regenerating stands to species which are expected to have a higher yield, and harvesting stands at earlier ages. I have used these harvest forecasts, and describe some of them in detail, in my considerations below.

For TFL 45, the base case harvest forecast shows that a harvest level of 220 000 cubic metres per year (approximately 5 percent above the current AAC of 210 000 cubic metres per year) could be maintained for one decade before declining by 10 percent per decade for 2 decades, and a further 6 percent after the third decade, to reach 167 000 cubic metres per year. This level, which would be the long-term harvest level for this management unit if all stands regenerated naturally and were left untreated, is then maintained for 7 decades before increasing over 2 decades to the long-term harvest level of 185 100 cubic metres, reached 13 decades from now. For this determination, I have accepted the base case harvest flow projection as a reliable point of reference; henceforth, the term "base case" will refer to that projection.

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Consideration of factors as required by Section 7 of the *Forest Act*

The *Forest Act,* Section 7 (3)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 10, shall 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 harvesting

- *general comments*

The total area of TFL 45 is 243 000 hectares. The land base that is considered available for timber harvesting (the "timber harvesting land base") is limited by inoperability, environmental sensitivity, and unmerchantable forest types. Reasonable assumptions, and if necessary, projections, must be made about these factors and appropriate areas must be deducted from the productive forest area to determine the timber harvesting land base. The timber harvesting land base, as defined in the analysis, is 29 913 hectares.

- *operability*

The principal deduction from the productive forest land base was for inoperability. The operability classification for TFL 45, completed in 1994, identified areas that were harvestable using helicopter, cable and ground harvesting systems. Once these areas were identified, Interfor applied a minimum volume per hectare requirement for each operability class to identify all operable areas in the TFL.

I note that approximately 7 percent of the operable land base is expected to be harvested using helicopter harvesting systems, and 4 percent of the operable land base is occupied by 'marginal' stands—which are accessible, but have a low average volume per hectare and a high incidence of decay. There is a history of harvesting in these stands; accordingly, I do not believe that a partition is needed at this time to ensure performance in them. However, I emphasize that marginal and helicopter-logging stands occupy approximately 11 percent of the timber harvesting land base, and that harvesting must continue in these stands in order to support their continued contribution to the AAC.

District staff have expressed a concern about the areas within Dorothy Creek and the upper Hoodoo Creek drainage that were classified as harvestable using conventional harvesting systems. District staff believe that because these areas are characterized by steep terrain and access is difficult, it would be more appropriate to use helicopter systems for harvesting these areas. Regional staff have also indicated that the classification of some areas in Phillips Arm may be changed from conventional to non-conventional as some roads are permanently deactivated due to slope stability concerns. I acknowledge these concerns, and respond that harvesting practices in these areas, including choice of appropriate technology, will be conducted according to regulations in

the Code. Given the licensee's experience with varied harvesting systems, I do not consider this matter to represent a significant risk to timber supply.

With the exception of the concerns noted above, BCFS staff have approved the operability classification and the minimum volume requirements applied in the timber supply analysis, and I accept the operability deduction as reasonable for use in this determination.

- *roads, trails and landings*

In the timber supply analysis, a deduction of 3.6 percent was applied to the portion of the productive forest land base covered by stands 60 years and younger, to account for existing roads. The projected impact from future roads, trails and landings was accounted for through a 4 percent deduction to the area in stands older than 60 years, applied after the first harvest. District staff believe that the road deductions applied in the analysis are low in comparison with silviculture prescriptions and site degradation assessment results on recently harvested areas. To assess the risks associated with larger road deductions, a sensitivity analysis was provided, with existing road deductions increased to 7 percent and future deductions increased to 5 percent, thereby decreasing the size of the long term timber harvesting land base by 4 percent. This analysis shows that the harvest levels projected in the base case can still be achieved for 5 decades, and that long-term timber supply is reduced slightly. Considering that an underestimation of the area in roads, trails and landings would impact long-term timber supply, I expect these estimates to be further refined for the next determination. I recognize that there is some uncertainty regarding the roads deduction; however, given that any risks are in the long term, I believe the deductions used in the analysis are suitable for this determination.

- *reductions for environmentally sensitive areas*

In the timber supply analysis, after other deductions for non-forested and non-productive areas, non-commercial cover and inoperability, 2910 hectares were considered unavailable for timber harvesting due to high environmental sensitivity, and 828 hectares were excluded from the timber harvesting land base due to moderate environmental sensitivity. Deductions applied to account for environmentally sensitive areas are discussed below under *slope stability*, *recreation*, *wildlife*, and *avalanche*.

- *deciduous forest types*

Stands dominated by deciduous tree species are not considered merchantable in the TFL. Accordingly, the area of the TFL occupied by deciduous stands was excluded from the timber harvesting land base in the analysis, either directly through deductions of the deciduous stands (798 hectares) or indirectly through other deductions, such as those for inoperable areas, environmentally sensitive areas and stream buffers (352 hectares). I am satisfied that the deciduous forest type deductions applied in the analysis appropriately reflect current management.

I note that there is some discussion about converting deciduous stands to coniferous stands. The licensee has indicated that it may be feasible to convert 200 hectares of alder stands to coniferous stands; however, the licensee has not committed to a strategy to convert these stands, the associated yield gains are unknown and other management issues must be examined. I am satisfied that no timber supply adjustments is required on this account at this time.

Existing forest inventory

-general comments

Complete inventory information for TFL 45 was collected between 1968 and 1971, and additional information was collected from ground sample plots in subsequent years. The inventory was updated to December 31, 1994 to account for depletions resulting from harvesting and fires that occurred since the last inventory was conducted, and any growth that had occurred in the forests to that date. The updated inventory information was used in the timber supply analysis.

- *volume estimates for existing stands*

Volume estimates for existing stands between the ages of 40 and 140 years were developed using the Variable Density Yield Prediction (VDYP) growth and yield model. Volume estimates for stands older than 140 years were taken from average volume lines, which are based on the original inventory information for the TFL.

Sensitivity analysis indicates that the timber supply is very sensitive to changes in existing volume estimates. If the volumes of stands older than 140 years have been overestimated by 10 percent, then the initial harvest level would have to decrease immediately to 165 000 cubic metres per year (a decline of approximately 25 percent from the base case) to avoid future timber supply disruptions. If average volume lines underestimated actual volumes by 10 percent, then the initial harvest level in the base case could be maintained an additional decade, and medium-term timber supply would be increased. Neither change would affect the long-term timber supply.

I am aware of the sensitivity of the timber supply to changes in these volume estimates, and consider it imperative that the inventory estimates be confirmed before the next AAC determination. Interfor has indicated that harvested volumes tend to be higher than volume estimates from the inventory. Although there is some uncertainty about the existing stand volume estimates, at this time there is no conclusive evidence to indicate that these estimates are inaccurate. To help assess the accuracy of the inventory, an inventory audit is being conducted and the results are expected in the winter of 1996. Pending the outcome of that audit, I accept the information presented to me as the best available, and as suitable for this determination.

Expected rate of growth

- *site productivity estimates*

Site indexes, determined from the ages and heights of trees, are used to estimate the productivity (growth potential) of tree-growing sites. The site indexes used in the timber supply analysis base case were accepted by Research Branch staff. However, after comparison of site indexes for cedar with those for other species, Research Branch staff concluded that the site indexes used in the base case for cedar stands, which occupy approximately 10 percent of the timber harvesting land base, are conservative. Staff believed that increasing the site indexes by 6 metres would more likely represent actual site productivity than site indexes used in the base case for areas currently occupied by cedar stands 40 years and younger, and older than 140 years, once they have been harvested and reforested. A sensitivity analysis was conducted to assess the implications of this change. The site index adjustment was not applied to cedar stands between the ages of 41 and 140 years in the sensitivity analysis because more accurate site index estimates are generally obtained for stands of these ages. The sensitivity analysis shows that if cedar site indexes have been underestimated by 6 metres, timber supply is increased slightly in the medium and long term. While the exact magnitude of the site index underestimate is uncertain, I accept, based on assessment by Research Branch staff, that young and old cedar stand site indexes are higher than assumed in the base case. This adjustment places an unquantified upward pressure on timber supply over the medium and long terms.

Further sensitivity analysis examined the timber supply impacts of applying the same 6-metre site index increase to cedar stands as discussed above (that is, only to stands younger than 41 and older than 140 years), and increasing the site index of all other species (excluding stands between the ages of 41 and 140 years) by 3 metres. This sensitivity analysis indicates substantial increases in timber supply over the medium and long terms. Research Branch staff have concurred that site indexes for species other than cedar have most likely been underestimated. However, they caution that there is significant uncertainty about the magnitude of the underestimation, since there is limited evidence specifically for TFL 45 on which to base a site index adjustment. Nevertheless, the 3-metre adjustment used in the sensitivity analysis is conservative compared to some of the preliminary results from paired plot studies in other coastal areas. I believe that site indexes for stands other than those between the ages of 41 and 140 years have likely been underestimated, but the magnitude of any underestimate, and the timber supply implications cannot be quantified at this time. I conclude that this represents an unquantified upward pressure on timber supply in the medium and long term.

A final site index sensitivity analysis examined the impact of increasing the site indexes of *all* cedar stands by 6 metres, and the site indexes of *all* stands of other species by 3 metres. In other words, it was assumed that the site indexes for stands between the ages of 41 and 140 years had also been underestimated. I do not believe it is appropriate to adjust the site indexes for these stands since there is no statistical basis for the adjustment, and since it is more likely that inventory information accurately reflects site productivity for stands in this age group.

To conclude, I accept the Research Branch assessment that young and old cedar stand site indexes are higher than assumed in the base case. Further, I am aware that evidence from other areas of the coast indicates that site indexes have been underestimated. While there is no direct evidence showing that site indexes have been underestimated in TFL 45, I accept that some underestimation is likely for the TFL. The young and old cedar stand adjustment and the likelihood of a more general underestimate of site indexes for other species exert an unquantified upward pressure on timber supply over the medium and long terms. This factor is discussed in "Reasons for Decision." A provincial paired-plot survey is expected to provide further information on site indexes for regenerating stands, which will most likely be useful for future timber supply analyses. In addition, the licensee has indicated an intent to refine site index estimates within the next 5 years. Considering the potential impacts on medium- and long-term timber supply, it is important that improved site index information be available for the next determination.

One final issue related to site productivity, as noted by BCFS staff, is that there is no site index information for approximately 1490 hectares of the timber harvesting land base. For the purposes of the timber supply analysis, this area was assumed to be characterized by medium site productivity. Research Branch considers this assumption acceptable because a large portion of sites in the TFL (65 percent) are of medium productivity, and no other information is available. I also note that most of the stands which lack site index information (1112 hectares) are young, and would have been a result of early logging which occurred mainly on the most productive sites. Therefore, I believe that the assumption used in the analysis is conservative, and until other information becomes available, I am satisfied that it is appropriate for use in this determination.

- *volume estimates for regenerated stands*

Estimates of volumes for existing stands less than 40 years old and future regenerated stands were projected in the timber supply analysis using the Table Interpolation Program for Stand Yields (TIPSY), which was designed for use with managed stands. Research Branch has reviewed and accepted the yield tables used to project regenerated stand volume estimates, and I am satisfied that they are appropriate for use in this determination. However, I am mindful that if site indexes have been underestimated, regenerated stand volume estimates would also be underestimated. The timber supply implications of this have been described above under *site productivity estimates*.

- *operational adjustment factors*

Operational Adjustment Factors (OAFs) are applied to regenerated stand volume estimates used in timber supply analyses in order to account for the loss of timber productivity due to particular operational conditions, such as openings in stands, pests, decay, waste and breakage. The OAFs applied in the licensee's analysis were determined based on the assumption that managed stand volumes would not exceed existing stand volumes by more than 20 to 30 percent. Research Branch has accepted the OAFs used in the analysis as reasonable. I note that these OAFs are much higher than the OAFs applied in other coastal areas, and I consider the volumes projected for managed stands to be a

conservative estimate. Any potential timber supply implications would overlap with those due to site productivity changes, which I have discussed above.

- *minimum harvestable ages*

Minimum harvestable age is an estimate of the average time required for trees to reach a harvestable condition. In the timber supply analysis, the minimum harvestable ages were based on the ages after which further increases in the mean annual increment (MAI, i.e. the average annual volume growth) for each tree species and growing site would be less than 0.5 cubic metres per hectare each year.

Sensitivity analysis provided in the analysis shows that the timber supply is very sensitive to increases in the minimum harvestable age. If the minimum harvestable age is increased by 10 years, then the initial harvest level projected in the BCFS analysis cannot be achieved without causing significant disruptions in timber supply in the future. The initial harvest level would have to decline to 165 000 cubic metres per year (a decrease of approximately 25 percent from the initial harvest level in the base case) in order to avoid timber supply shortages in the medium term. Sensitivity analysis also shows that the harvest forecast is sensitive to decreases in minimum harvestable age. If the minimum harvestable ages are decreased by 10 years, then the initial harvest level projected in the base case can be maintained for an additional decade.

Interfor has stated that stands younger than the minimum harvestable age could be harvested if the stands meet certain merchantability criteria. If this were the case, the timber supply could be more flexible than indicated in the analysis base case. However, I do not anticipate that stands as young as the minimum harvestable age will be harvested at this time; most stands in the short and medium term are projected to be harvested at well beyond the minimum harvestable ages. Timing of availability of regenerating managed stands—that is, the minimum harvestable ages—will be important in defining timber supply, particularly in the medium term. Therefore, definition of these ages should be refined as information on the merchantability of managed stands improves. At this time, I am satisfied that the minimum harvestable ages used in the analysis are suitable for this determination.

- *species profile of harvest*

One of the objectives outlined in MP No. 3 for TFL 45 is to harvest timber in proportion to the existing species profile for the timber harvesting land base. This management objective was not reflected in the analysis, in which harvesting is projected to occur in the oldest stands first, regardless of species. While this approach is acceptable, and commonly used in timber supply analysis, I note that the assumptions used in the timber supply analysis do not fully reflect the harvest profile commitment made in the management plan. Although I consider it important that timber supply analyses should reflect management plan commitments, examination of the current species and age composition of the timber harvesting land base leads me to believe that the failure to

explicitly model harvest of the species profile does not pose a significant risk to short-term timber supply. I have made no adjustments to my determination on this account.

(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 elapsed time after harvesting before an area becomes occupied by a specified minimum number of acceptable, well-spaced trees. For the purposes of the analysis, regeneration delays in TFL 45 were assumed to be 3 years for planted stands and 6 years for naturally regenerated stands. The timber supply in TFL 45 is sensitive to changes in regeneration delay; if regeneration delay has been underestimated by 2 years, the initial harvest level projected in the base case cannot be achieved without causing future timber supply disruptions, and the long-term harvest level is decreased slightly. If regeneration delay has been overestimated by 2 years, then the initial harvest level can be maintained for one more decade than in the base case, and the long-term harvest level is increased slightly. Considering the increase in timber supply associated with a decrease in regeneration delay, I would encourage the licensee to examine opportunities to reduce regeneration delays for the next management plan. At this time, district staff have expressed some concerns about regeneration, as discussed below under Impediments to prompt regeneration. However, until these concerns are verified, I accept the regeneration delay assumptions used in the analysis as reasonable for use in this determination.

Not-satisfactorily-restocked area

Licensee records indicate that TFL 45 contains 496 hectares of not-satisfactorily-restocked areas, of which 479 hectares are within the operable land base. This figure represents current operations only; there are no backlog areas. It was assumed in the analysis that all of these areas would contribute to long-term timber supply. District staff have accepted the assumptions regarding non-satisfactorily restocked areas.

These not-satisfactorily-restocked areas are expected to be regenerated within 2 years. However, in the timber supply analysis, these areas were erroneously assumed to regenerate immediately. The Timberline analyst has confirmed that if this error is corrected in the base case, the resulting timber supply forecast is the same due to the small area involved (about 1.6% of the timber harvesting land base). Furthermore, the sensitivity analyses are not expected to be affected by this correction. Therefore, I am satisfied that this error, involving a very small portion of the timber harvesting land base, does not represent a significant risk to timber supply.

Impediments to prompt regeneration

No impediments to regeneration have been identified in the inventory of environmentally sensitive areas for the TFL. However, Interfor has indicated that regional standards for

the density of trees in regenerating stands ("stocking standards") will not be adhered to on colluvial sites, sites with a high water table, sites with shallow organic soils over rock, and sites where lower stand densities are used to meet wildlife management objectives. Lower stocking standards were not modeled in the analysis. While I do not expect lowered stocking standards to have a significant effect on the amount of timber produced by these stands (except stands with extremely low densities), some of them may more appropriately be classified as environmentally sensitive regeneration sites, which do not fully contribute to the timber harvesting land base. Since this adds some uncertainty to medium- and long-term timber supply, I encourage the licensee to investigate this matter further so that it can be taken into account in future determinations. The total area involved and the projected management regime should be clarified at that time.

In addition, District staff indicate that there are several potential impediments to regeneration, including Sitka spruce weevil, rodent damage, brush competition, root rot, and excessively hot and dry microclimate conditions which were not identified in environmentally sensitive area mapping for potential regeneration problems. Interfor has outlined measures to control brush and deciduous species competition in MP No. 3; however, the management plan does not address other impediments to regeneration. Interfor has stated that difficulties in meeting obligations for establishing stands are not anticipated, although I note that the licensee has been conducting research in some areas which have been difficult to regenerate in the past.

I note the concerns of District staff; however, no substantial impediments to regeneration have been conclusively identified. Nevertheless, I believe the concerns of the district should be investigated. I expect district staff to work with Interfor to validate their concerns. If any problems are identified, they should be addressed in future management plans and timber supply analyses. For this determination, I accept the regeneration assumptions used in the analysis.

(iii) silvicultural treatments to be applied to the area;

Regeneration

In the timber supply analysis, it is assumed that 80 percent of stands harvested will be planted with the species which dominated the site before harvest. The remaining 20 percent of stands is assumed to regenerate naturally, and additional planting or spacing will be used, where required, to meet managed stand objectives. District staff indicate that the assumptions used in the analysis are an acceptable representation of current practice.

Enhanced silviculture

In MP No. 3, Interfor has committed to develop a program of enhanced silviculture. Accordingly, the analysis includes a harvest forecast which shows the timber supply implications of enhanced silviculture activities which the licensee describes as 'currently implementable'. These activities include the use of genetically improved seedlings to

increase yield from regenerated stands, the regeneration of stands to species which are expected to have a higher yield, and the harvesting of existing managed stands at younger ages than the minimum harvestable age. For the sensitivity analysis, it was assumed that: genetic gains would range from a 2 to 5 percent increase in volume, depending on the species group; all Douglas-fir stands would be regenerated to higher-volume hemlock and balsam stands; the minimum harvestable age of all stands regenerated with genetically improved stock on good-productivity sites would be decreased by 10 years, and finally, that site indexes would be adjusted by 6 metres for cedar and 3 metres for other species. The analysis shows that if all of these silvicultural improvements are made, the initial harvest level projected in the base case could be maintained for 6 decades, followed by a 5-decade transition period during which the harvest level would first decrease, then increase to reach a long-term harvest level of 248 100 cubic metres (28 100 cubic metres higher than the initial harvest level). The bulk of the effects can be attributed to the site index adjustment; the remaining adjustments affect only medium- and long-term timber supply. As discussed under *site productivity estimates* above, I do not believe there is firm statistical basis for site index adjustments for all species and all ages. In that section I concluded that site index adjustments exert an unquantified upward pressure on timber supply in the medium to long term. Here I will consider only effects attributable to enhanced silviculture.

The sensitivity analysis is likely conservative in its assessment of potential effects of silvicultural enhancements since the impact on green-up ages resulting from genetic improvements was not modelled. Also, Interfor asserts that it is likely that the minimum harvestable ages could be reduced for medium and poor sites as well, and in this respect, the assumptions modeled in this sensitivity analysis are conservative. Offsetting these effects somewhat is the fact that the site indexes were not adjusted with species conversion from Douglas-fir to hemlock, which would involve a small site index reduction.

This scenario indicates that enhanced silviculture could provide more timber supply in the medium to long term for this TFL than indicated in the base case, which could provide some flexibility to offset downward impacts in the medium term. However, there is no commitment to this management regime in MP No. 3, and no verification that the projected increased yields can be achieved. Therefore, I do not accept this sensitivity analysis as a more appropriate representation of timber supply than the base case. Until commitments are made, and more conclusive evidence is available, I will not adjust my view of timber supply on account of potential actions and effects. In the meantime, I recognize that many of the base case assumptions can reasonably be characterized as conservative and encourage the licensee to pursue silvicultural activities that could very well improve the timber supply projections for this unit.

Two more enhanced silviculture scenarios are described in the timber supply analysis. One is characterized by Interfor as 'feasible pending verification'. In this scenario, in addition to the silviculture enhancements outlined in the 'currently implementable' scenario, stand volumes are increased, future road reductions are decreased, the operable land base is increased, alder stands are converted to coniferous species, high intensity

areas for timber management are established, and commercial thinning is conducted. The final enhanced silviculture scenario examines opportunities which 'require development prior to implementation', including fertilization gains, increased harvesting in environmentally sensitive areas and riparian reserves, and selective harvesting in visually sensitive areas. The timber supply impacts of these two scenarios were not examined in the analysis, and I have assumed no contribution to timber supply from the activities described in these two scenarios in my determination. However, I accept that these scenarios suggest that some timber supply flexibility may be gained in the future if additional enhanced silviculture activities are implemented.

Commercial thinning

Interfor has stated that there is some opportunity to use commercial thinning to increase medium-term timber supply by allowing some volume to be harvested from stands that would not otherwise be harvestable prior to decade 12. Interfor expects alternative silvicultural systems and commercial thinning to provide as much as 1 percent of the total volume harvested in the TFL. The licensee has also committed in MP No. 3 to increasing this portion to 10 percent over the next 5 years. Alternative silviculture and commercial thinning may particularly be used in visually sensitive areas where conventional harvesting is limited by visual quality objectives. No allowance for commercial thinning was made in the analysis.

To the extent that commercial thinning and alternative silvicultural systems are used successfully in otherwise constrained areas, it will be accounted for in the future. However, no commercial thinning has been undertaken in TFL 45 to date, and I am satisfied that the analysis appropriately reflects the current situation.

(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 and compliance

The standard and level of timber utilization define the species, dimensions and quality of trees that must be cut and removed from the site during harvesting operations. For stands younger than 140 years, all trees must be utilized to a minimum of 12.5 centimetres in diameter at breast height and to a minimum top diameter of 10 centimetres. For stands older than 140 years, trees must be utilized to a minimum of 17.5 centimetres in diameter at breast height and to a minimum top diameter of 15 centimetres. Stump height must not exceed 30 centimetres in either category. These standards reflect current practice and have been accounted for in the analysis.

Decay, waste and breakage

The estimates of the volume of wood within a stand lost to decay, waste or breakage that were used in the analysis for existing stands were accepted by BCFS Resource Inventory Branch staff. As was discussed above under *volume estimates for regenerated stands*, OAFs were applied to regenerated stand volume estimates in order to account for the loss of timber productivity due to decay, waste, and breakage. These estimates constitute the best available information and I accept their applicability for use in this 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 (IRM) objectives

The Ministry of Forests is required by the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources to ensure production and harvesting of timber and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which IRM objectives constrain the timber supply must be considered in AAC determinations.

- *soils*

A total of 2524 hectares characterized by highly sensitive soils has been identified in TFL 45. Of the 1142 hectares of these highly sensitive areas located within the operable land base, 95 percent was considered unavailable for timber harvesting in the analysis, leaving 54 hectares of areas with highly sensitive soils in the timber harvesting land base. An additional 4686 hectares are characterized by moderately sensitive soils, and of this area, 2786 hectares are within the operable land base. In the analysis, to reflect management actions needed to protect soils, 20 percent of these areas located within the Phillips Arm portion of the TFL and 5 percent of these areas located within Knight Inlet were considered unavailable for timber harvesting, leaving 2413 hectares of areas with moderately sensitive soils in the timber harvesting land base. This approach was approved by staff of the Vancouver Forest Region as representative of current management, and I am satisfied that the sensitive soils areas are modelled using reasonable assumptions.

- *avalanche*

A total of 2420 hectares in TFL 45 are characterized by unstable soils with an avalanche risk. Of the 411 hectares of these avalanche-prone areas within the operable land base, 85 percent were assumed to be unavailable for timber harvesting in the analysis, leaving 61 hectares of area prone to avalanche within the timber harvesting land base. This assumption has been approved by Vancouver Forest Region staff, and I am satisfied that the analysis accounts adequately for these areas and that no further adjustment is required on this account in this determination.

- *recreation*

A recreation inventory, which included biophysical, cultural, and historical features and their current and potential recreational use, was completed by the licensee and approved in 1995 by Vancouver Forest Region staff. Of the 386 hectares of highly sensitive recreation areas identified in the TFL, 212 hectares are within the operable land base. To represent management actions needed to maintain highly sensitive recreation areas, it was assumed in the analysis that on average 95 percent of these areas are unavailable for

harvesting, leaving 7 hectares of highly sensitive recreation areas within the timber harvesting land base of TFL 45. In addition, 3141 hectares of moderately sensitive recreation areas have been identified in the TFL, of which 1343 hectares are within the operable land base. In the analysis, a 40-percent reduction was applied to the majority of these areas. Some moderately sensitive recreation areas were reduced by specific amounts, ranging from 10 to 50 percent. In total, 723 hectares of moderately sensitive recreation areas are assumed to be within the timber harvesting land base of TFL 45. I believe that the assumptions used in the analysis reasonably reflect management of recreation resources, and I am satisfied that the timber supply impact of recreation has been adequately represented.

- *wildlife habitat*

Mapping of sensitive habitat was provided to Interfor by the Ministry of Environment, Lands and Parks in January, 1995. The information from these draft maps was incorporated into Interfor's mapping system and into the timber supply analysis. A total of 2354 hectares of highly sensitive wildlife area was identified in TFL 45, of which 1395 hectares are within the operable land base. Of these operable areas, 95 percent are considered unavailable for timber harvesting, leaving 57 hectares of highly sensitive wildlife area within the timber harvesting land base. In addition, 1217 hectares of moderately sensitive wildlife area was identified, of which 550 hectares are considered to be within the operable land base. Of these operable wildlife habitat areas, 40 percent are assumed to be unavailable for timber harvesting in the analysis, leaving 304 hectares of moderately sensitive wildlife habitat areas within the timber harvesting land base of TFL 45. I am satisfied that the reductions applied to the operable wildlife habitat areas reflect integrated management for timber and wildlife habitat and are appropriate for use in this determination. However, Ministry of Environment, Lands and Parks staff have indicated that some of the wildlife habitat areas on the Interfor maps have been shifted by approximately 50 to 100 metres from the valley bottoms to uphill sites. This mapping error was incorporated into the timber supply analysis. Although the amount of area managed as wildlife habitat is modeled correctly, some of these areas have been shifted from high-productivity valley sites to uphill sites characterized by lower productivity. If these areas were shifted back to the correct location, the timber supply would be decreased slightly, since fewer high-productivity sites—but more lower-productivity sites—would be available for harvesting. Since there is only a small amount of area affected by this error, I consider it to represent a small, unquantified downward pressure that does not pose a risk to short-term timber supply. I expect the licensee to correct this error so that the corrected assumptions can be incorporated into the next analysis.

It has come to my attention recently that the Ministry of Environment, Lands and Parks has expressed concerns regarding mountain goat habitat in high elevation areas, and particularly in avalanche areas, in the Knight Inlet portion of the TFL. Mountain goat habitat was not considered in the timber supply analysis, and as a result, the impact that this habitat has on timber supply has not been assessed at this time. The amount of the timber harvesting land base affected by mountain goat habitat has not yet been quantified. I expect that this matter will be clarified for the next determination. In the meantime, I

am satisfied that any operational concerns regarding mountain goat habitat will be accounted for through the application of the Forest Practices Code. Moreover, I do not expect this issue to represent a significant risk to short-term timber supply because most mountain goat habitat areas are located in higher elevations where there is a relatively small proportion of harvesting activity planned for the short term. Accordingly, I have made no adjustment to account for mountain goat habitat in my determination.

- *riparian/fisheries habitat*

Based on meetings and conversations with BCFS staff in November 1995, it was decided that a 30-metre reserve along class A and B streams and a 20-metre reserve around class A and B lakes would meet anticipated Forest Practices Code requirements for protection of riparian habitat. These specifications were applied in the analysis, with 90 percent of the area within these reserves excluded from the timber harvesting land base. In addition, there are approximately 257 kilometres of class C streams in the TFL. Interfor estimates that 95 percent of these streams are minor, and require no reserves. The remaining class C streams, and the 30-metre riparian reserve applied to them, cover approximately 77.1 hectares of the productive forest land base. This area was removed proportionately from all analysis units in the analysis. In total, 253 hectares have been excluded from the timber harvesting land base (after other reductions) to account for riparian reserve areas—a deduction of approximately 1 percent. However, the analysis did not account for harvesting restrictions in riparian management zones, which are required in addition to reserves under the Forest Practices Code.

I believe that the technique used to determine the amount of class A, B and C streams is reasonable. Furthermore, I note that in November 1993, Interfor was advised by the Department of Fisheries and Oceans (DFO) to use a 20-metre reserve for class A streams and major class B and C streams, and a 30-metre reserve for class A lakes. The DFO also suggested adding an additional 5 metres for class A streams to account for sensitive fisheries habitat. BCFS staff indicate that the reserves applied in the timber supply analysis likely limit timber supply more than those suggested by the DFO since a wider reserve zone was applied to both class A and B streams in the analysis than was recommended by the DFO. However, the fact that the reserves are larger than recommended does not necessarily offset the lack of accounting for riparian management zones. Furthermore, I am concerned that the amount of area excluded from the timber harvesting land base for riparian management is significantly smaller than the reductions applied in other management units comparable to TFL 45. Based on experience with comparable management units such as the Strathcona TSA (as detailed in the *Forest Practices Code Timber Supply Analysis*), the impact of riparian management represents an additional downward pressure of 2 to 3 percent in the short, medium and long term. I have accounted for this downward influence under "Reasons for Decision", below.

- *biodiversity*

Biological diversity, or biodiversity, is 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. The Code acknowledges the need to conserve biodiversity, and a supporting guidebook has been released that addresses stand- and landscape-level biodiversity needs for a variety of ecological units found within the province. A major consideration in managing for biodiversity at the landscape level is leaving sufficient and appropriately located mature forests for species dependent on, or strongly associated with, old-growth forests. At the stand level, retention of wildlife tree patches and coarse woody debris are the major biodiversity concerns.

Currently in TFL 45, stand-level biodiversity is partially accounted for through the use of the clearcut-with-reserves silviculture system, which involves the permanent or temporary retention of groups of standing trees within cutblock boundaries. The licensee indicates that mapping of forest ecosystem networks (FENs), which contribute to the achievement of landscape-level biodiversity, is underway and is currently being reviewed by Ministry of Environment, Lands and Parks staff.

The impact of stand-level biodiversity was not accounted for in the analysis. Analysis work conducted in the Strathcona and Sunshine Coast Timber Supply Areas, which incorporated Code requirements for riparian areas, indicates that stand-level biodiversity, in the absence of specific landscape-level biodiversity provisions, decreases the volume of available timber by approximately 2 percent. I consider this to be a reasonable estimate of the timber supply impacts of stand-level biodiversity in TFL 45. Accordingly, I have considered stand-level biodiversity requirements as an additional 2 percent downward pressure on timber supply.

With respect to landscape-level biodiversity, the licensee indicates that approximately 46 percent of the productive forest land base is excluded from the timber harvesting land base, and it is probable that there is more than enough area covered by representative species to account for landscape-level biodiversity. It may be possible to develop a plan that accommodates landscape-level biodiversity requirements without further exclusions from the timber harvesting land base. Nevertheless, the *distribution* of representative area, not just the *amount* of area, is critical to the achievement of landscape-level biodiversity. Until landscape-level planning is undertaken, the possible timber supply implications cannot be assessed with any certainty; therefore, I will make no adjustments to account for landscape-level biodiversity at this time. However, it is important that a plan be available for examination at the next determination.

- *cutblock adjacency*

In order to protect non-timber resources such as wildlife, water quality and aesthetics, current harvesting practices limit the size and shape of cutblocks and prescribe a minimum "green-up" height for regenerating stands before adjacent cutblocks can be harvested. This provides for a distribution of harvested areas and retained forest cover across the landscape, which helps to meet several forest management objectives. Cutblock adjacency guidelines are commonly expressed in terms of the number of

harvesting entries, or "passes," required to harvest the entire area of the timber harvesting land base.

In the analysis, it was assumed that no more than 25 percent of the timber harvesting land base in the integrated resource management zone can be younger than 12 years of age at any time. This forest cover requirement approximates a four-pass harvesting system. I note that this requirement is more constraining than those used in some other coastal management units; however, I note that this is the licensee's best approximation of current management in the TFL. Furthermore, BCFS staff indicate that the adjacency assumption used in the analysis does not restrict timber supply in the base case. I accept that the assumption made in the analysis regarding adjacency is reasonable for use in this determination.

- *visually sensitive areas*

Forest resources managed by the BCFS include recreation resources. "Recreation resource" is defined in the *Forest Practices Code of British Columbia Act* to include "scenic or wilderness features or settings that have recreational significance or value". In order to manage such scenic features, visual landscape foresters in B.C., in collaboration with specialists in other parts of the world, have developed procedures for identifying and managing "visually sensitive areas". These procedures incorporate both biophysical and social factors—including visual sensitivity ratings based on topography, slope and other biophysical factors, and social factors such as numbers of viewers and their perceptions—and provide recommended visual quality objectives (VQOs) for visually sensitive areas. These objectives limit the amount of visible disturbance that is acceptable in such areas.

Three zones with different visual quality objectives, covering approximately 33 percent of the timber harvesting land base, were identified for the analysis. For the retention visual quality zone, a maximum of 2 percent of the timber harvesting land base could be covered by stands younger than 16 years of age (the green-up age) at any time. For the partial retention visual quality zone, a maximum of 10 percent of the timber harvesting land base could be covered by stands younger than the green-up age. For the modification visual quality zone, a maximum of 25 percent of the land base could be covered by stands younger than the green-up age. The maximum allowable percentages were determined using "Procedures for Factoring Recreation Resources into Timber Supply Analyses". The green-up ages have been estimated using the results of a 34-cutblock survey for green-up height and site index tables. These forest cover requirements have been accepted by BCFS regional and district staff.

Sensitivity analysis was provided, showing the timber supply impacts of adjusting green-up ages by two years for all management zones. This analysis showed that if green-up ages are increased by 2 years, there is no change from the base case in the short and medium term; however, the harvest level rises 2 decades later to a lower long-term harvest level than in the base case. If green-up ages are decreased by 2 years, the short-term harvest level can be maintained for an additional decade and long-term timber supply is increased slightly.

Another sensitivity analysis shows the impact on timber supply of increasing and decreasing the maximum allowable disturbance percentages for all visual quality management zones to the highest and lowest percent disturbance allowed for each visual quality objective. In addition, when allowable disturbance percentages were increased for the sensitivity analysis, it was assumed that areas in the integrated resource management zone would be harvested under a 3-pass harvesting system, allowing 33 percent of the timber harvesting land base to be younger than green-up age. If the allowable disturbance is increased in all management zones, the initial harvest level projected in the base case can be maintained for 4 decades before declining to a long-term harvest level 10 000 cubic metres higher than in the base case. The Timberline analyst indicates that even though the forest cover requirements in the IRM zone have also been made less restrictive in this sensitivity analysis, most of the timber supply impacts illustrated in these sensitivity analyses result from changes to the requirements applied to the visual quality management zones. If the allowable disturbance level is decreased in all management zones, the initial harvest level must be reduced immediately to 159 400 cubic metres per year—a decrease of almost 28 percent from the base case initial harvest level—to avoid severe disruptions in timber supply in the future, and the long-term harvest level is decreased by 14 000 cubic metres per year from that of the base case.

I note that the licensee has committed to greater use of partial cutting harvesting systems in the TFL. The use of these silviculture systems in visually sensitive areas would likely allow for harvesting of more volume in these areas than might otherwise be expected. In addition, it is evident that small changes in the forest cover requirements applied to visually sensitive areas have a significant impact on timber availability, and that large increases in timber supply can be gained in the medium term if requirements for visual quality are moderately reduced. I have taken guidance from the Minister's memorandum (see Appendix 4) expressing the provincial socio-economic objective of ensuring an appropriate balance between protecting visual resources and minimizing the impact of such measures on timber supply, particularly given the environmental protection measures included in the Forest Practices Code. Considering the above, I conclude that the opportunity to decrease visual management constraints on timber supply represents an unquantified upward pressure, and have taken this into account in my determination, as discussed below under "Reasons for Decision".

- *areas of cultural or archaeological significance*

First Nations involvement was solicited for MP No. 3; however, there were no respondents. In MP No. 3, Interfor has committed to respecting First Nations interests in those resource use activities undertaken in traditional territory, seeking First Nations involvement in economic development opportunities, and ensuring the protection of culturally or archaeologically significant sites. No evidence was presented to suggest the presence of culturally or archaeologically significant sites in the TFL. However, the licensee submits that the impacts of any such sites will have been accounted for in the timber supply analysis through reductions for sensitive recreation sites. I cannot be certain that recreation sites will overlap completely with possible cultural or archaeological values, but I am satisfied that reasonable efforts have been taken to solicit

information, and will be taken in future planning and operations to account for such values.

(vi) any other information that, in his opinion, relates to the capability of the area to produce timber;

Twenty-year plan

In the past, the amount of harvesting conducted in the Phillips Arm area has been considerably higher than the contribution of this area to the timber harvesting land base. In response to district staff concerns, Interfor has planned to shift much of the harvesting in the TFL to Knight Inlet. Over the term of the current 20-year plan, covering the years 1995 to 2014, 85 percent of the harvest is planned to occur in Knight Inlet. The analysis suggests that 85 percent of the total harvest can be supported by the timber supply in Knight Inlet for the next 20 years. However, there are concerns about the operational feasibility of this considerable increase in harvesting in the Knight Inlet area which must be resolved before the 20-year plan can be approved. This issue should be monitored in the period leading up to the next determination.

Planning Issues

In MP No. 3, Interfor states an intention to establish Resource Management Zones and objectives for TFL 45, and to work toward the designation of MP No. 3 as a higher level plan. Interfor also intends to enhance the timber-producing capability of the timber harvesting land base by designation and management of part of the TFL as a 'high intensity area'. If these plans come to fruition, they will be accounted for in future determinations. However, as discussed above, under "Guiding principles for AAC determinations", I will not speculate on decisions, such as the designation of higher level plans, that have not yet been taken by government. Furthermore, until plans and decisions have been implemented, it is impossible to properly assess their timber supply impacts. I have made no adjustment on this account in my determination.

I am aware that the Kwalate area and portions of the Knight Inlet area have been identified as areas of interest under the Protected Areas Strategy. These areas may come under review for designation as protected areas. A Land and Resource Management Planning (LRMP) process has been initiated for the central coast area which encompasses the TFL. The Central Coast LRMP process will examine land use and resource management in this area, and clarify the status of these areas of interest for incorporation into future determinations.

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

Harvest flow

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in TFLs that have an old-growth component, such as TFL 45. In the short term, the presence of older forests permits harvests that are above the long-term harvest level without jeopardizing the future timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined so as to ensure that current and mid-term harvest rates will be compatible with a smooth and orderly transition toward the usually (but not always) lower long-term harvest rates. Thus, timber supplies should remain sufficiently stable to ensure 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 undue immediate social and economic impacts.

In the timber supply analysis, one alternative harvest forecast was provided which used the base case management assumptions. This forecast projects an initial harvest level of 210 000 cubic metres per year (the current AAC, and 10 000 cubic metres less than in the base case) followed by declines of 10 percent per decade for 2 decades, and a further 2 percent after the third decade, to reach 167 000 cubic metres per year. The harvest would remain at this level for 6 decades before rising to the long-term harvest level one decade earlier than in the base case. Since this alternative is very similar to the base case, I am not provided with substantial additional information on potential harvest flow. However, the base case meets the general criteria described in the above paragraph and I accept it as a suitable reference on which to base my considerations.

Community dependence on forest industry

Most of the people employed in harvesting of TFL 45 timber live in Campbell River. The employees of mills that process timber from the TFL live primarily in Vancouver and Squamish. I am aware of the contribution that harvesting and processing of timber makes to the economy of these communities.

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

Mill requirements

Most of the timber harvested in TFL 45 is transported to Vancouver and used by various sawmills in the lower mainland area of the province.

Interfor has 7 sawmills on the coast which consume a total of approximately 3.129 million cubic metres of timber annually. Their total supply of sawlog timber volume is approximately 2.666 million cubic metres. The remainder of the sawmills' wood supply is purchased.

(d) the economic and social objectives of the Crown, as expressed by the minister, for the area, for the general region and for the Province; and

Minister's letter

The Minister has expressed the social and economic objectives of the Crown for the province in two documents to the chief forester: a letter dated July 28, 1994, (attached as Appendix 3) and a memorandum dated February 26, 1996, (attached as Appendix 4). I understand both documents to apply to TFL 45. They are consistent with the objectives stated in the Forest Renewal Plan and include forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest level changes in a managed transition from old-growth to second-growth forests, so as to provide for continuity of employment.

The Minister also stated in his letter that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability." He placed particular emphasis on the importance of long-term community stability and the continued availability of 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. The latter would likely require the use of alternative harvesting systems, and to encourage this the Minister suggested consideration of partitioned AACs.

As discussed above, under Commercial thinning, no commercial thinning has yet been undertaken in TFL 45, and none is planned. With regard to operability, I note that the licensee plans to harvest in marginal stands and in areas suitable for helicopter harvesting systems, as discussed under *operability*. Current opportunities for harvesting in

previously uneconomical areas have been accounted for in the analysis, and I am satisfied that the assumptions used in the analysis appropriately reflect the objectives expressed by the Minister.

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that pre-Code constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply when considered in conjunction with other Code requirements. As noted above, under *visually sensitive areas*, VQOs place significant limitations on timber supply in TFL 45, and I have addressed that impact in light of the memorandum under "Reasons for Decision."

Local objectives

The Minister's letter and memorandum both encouraged the chief forester to consider important local social and economic objectives that may be derived from the public input. No public comment was received during the review of MP No. 3, and there was little attendance at open houses held during the public review of the statement of management objectives, options and procedures. I am satisfied the licensee made reasonable efforts to solicit input. However, no specific, expressed local issues, beyond the general ones expressed by the Minister, have been brought forward for me to address at this time.

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

Non-recoverable losses

Non-recoverable losses are timber volumes destroyed or damaged by natural causes, such as fire and disease, that are not recovered through salvage operations. In the analysis, annual non-recoverable losses resulting from fire and windthrow damage were estimated to be 2900 cubic metres. This figure is based on an estimate of 0.1 cubic metres per hectare per year loss, and while there is no statistical information to confirm this estimate, BCFS staff indicate that the estimate is reasonable. As I have no better information to rely upon, I accept it at this time, but I would like to see unsalvaged loss estimates identified with better data and greater methodological rigour in future determinations, both here and elsewhere in the province.

Reasons for decision

In reaching my decision on an AAC for TFL 45, I have considered all the factors presented above and have reasoned as follows:

The base case harvest forecast shows that a harvest level of 220 000 cubic metres per year (approximately 5 percent above the current AAC of 210 000 cubic metres per year) could be maintained for one decade before declining by 10 percent per decade for 2 decades, and a further 6 percent after the third decade, to reach 167 000 cubic metres per year. This level is maintained for 7 decades before increasing over 2 decades to the long-term harvest level of 185 100 cubic metres per year. This forecast conforms to the principles discussed in 7(3)(b) above, regarding the transition from old- to second-growth harvesting, and based on my review of implications to the province of alternative harvest rates, lies within an acceptable range of harvest forecasts for TFL 45 at this time.

My considerations have identified a number of factors that exert either upward or downward influences on the timber supply projected in the base case and that were not accounted for in the base case forecast, due to changes in practice or information since completion of the analysis in January 1996.

Factors exerting a downward influence on timber supply and reducing the length of time the initial harvest level can be maintained include:

- On the Interfor maps, some of the wildlife habitat areas have been shifted by approximately 50 to 100 metres from their actual locations in the high-productivity valley bottoms to lower-productivity uphill sites. This mapping error was incorporated into the timber supply analysis and represents a small, unquantified downward pressure in the medium to long term;

- The analysis did not account for riparian management zones now required under the Forest Practices Code. This represents a 2 to 3 percent downward pressure on timber supply over all time frames; and

- Provisions under the Code for stand-level biodiversity decrease the volume of available timber by approximately 2 percent over all time frames.

Factors suggesting the timber supply may be greater than projected in the base case are:

- The site index of cedar stands (other than those between the ages of 41 and 140 years) have been underestimated, and as a result, medium- and long-term timber supply is higher than indicated in the base case. It is also likely that the site indexes of all other species (excluding stands between the ages of 41 and 140 years) have been underestimated; however, the amount of underestimation has not been quantified with any certainty at this time. This represents an additional unquantified, but potentially substantial upward influence on medium- and long-term timber supply beyond the impact of increased cedar site indexes.

- Small changes in the forest cover requirements applied to visually sensitive areas have a significant impact on timber availability, and large increases in timber supply can be gained in the medium term if requirements for visual quality are moderately reduced. In addition, the use of partial cutting harvesting systems in visually sensitive areas may allow for harvesting of greater volume in these areas than might otherwise be expected. Considering the Minister's memorandum discussed above, I conclude that allowing for less restrictive forest cover requirements in visually sensitive areas represents an unquantified upward pressure.

The downward factors represent an immediate decrease in timber supply of approximately 5 percent. BCFS staff indicate that even if timber supply were decreased by this amount, the initial harvest level projected in the base case could still be maintained if a more rapid rate of decline, such as 15 percent per decade, were acceptable. Sensitivity analysis verifies that the short-term harvest levels projected in the base case can still be attained with a 4-percent decrease in the size of the timber harvesting land base, which I consider to be a reasonable approximation of the impact of overlapping riparian and biodiversity requirements. From this, I conclude that even without taking into account the upward influences on timber supply, a harvest level of 220 000 cubic metres per year can be maintained in the short term while allowing for a reasonable transition to long-term timber supply levels.

If the information described above indicated that the projected initial harvest level, which represents an increase of 10 000 cubic metres over the current AAC, could only be maintained for one decade, I would not provide an AAC increase. However, adjustments in the management of visually sensitive areas could provide significant flexibility in the timber supply of TFL 45. Sensitivity analysis shows that if the allowable disturbance is increased in all management zones, the initial harvest level projected in the base case can be maintained for 4 decades before declining to a long-term harvest level higher than in the base case. On this basis alone, I am satisfied that the projected initial harvest level can be achieved for longer than the one decade forecast in the base case. However, site index adjustment represents an additional, and significant, upward influence on timber supply. The analysis shows that if site indexes for young and old cedar stands have been underestimated, medium-term timber supply is increased over that of the base case. Furthermore, if site indexes for other species (excluding stands between the ages of 41 and 140 years) are increased by 3 metres, then the initial harvest level projected in the base case can be maintained for 6 decades. As discussed above, there is no conclusive statistical basis for the 3-metre increase; however, I cannot ignore evidence presented to me from other coastal areas of the province which indicate that the estimate used in the analysis is reasonable and likely conservative for this management unit. While I would hesitate to apply site index increases on their own, I believe they add extra support and flexibility to the upper pressures afforded by other factors.

Considering the upward and downward influences discussed above, I believe it is likely that a harvest level of 220 000 cubic metres can be maintained for at least several decades. As discussed in the considerations, there is also potential to provide additional flexibility in future timber supply through enhanced silviculture and related reductions in minimum harvestable ages and regeneration delays. From the foregoing reasoning, it is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that

provides for requirements of the Forest Practices Code as they are currently implemented, that ensures longer-term integrated resource management objectives can be met, that meets provincial objectives and that avoids disruptive shortfalls in future timber supply, can best be achieved in this TFL at this time by establishing the AAC at 220 000 cubic metres.

Determination

From a careful evaluation of the assumptions incorporated in the timber supply analysis, and from all the foregoing considerations and reasoning, it is my determination that a suitable AAC for TFL 45 at this time is 220 000 cubic metres.

This determination comes into effect on November 1, 1996 and will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Implementation of Decision

During the term of this current management plan, the following must be provided or undertaken by the licensee:

- Improvement of site index information for the next determination;
- Examination of opportunities to reduce regeneration delays;
- Determination of the total area with lowered stocking standards and the management regime proposed for these areas; and
- Correction of the wildlife habitat mapping error.

In addition, I expect BCFS staff to:

- Validate their concerns about impediments to regeneration, and if any problems are identified, ensure they are addressed in future management plans; and
- Resolve the operational concerns about the feasibility of achieving 85 percent of the harvest in the Knight Inlet area.

Other requirements have been noted in my Management Plan approval letter.

Larry Pedersen
Chief Forester
October 31, 1996

Appendix 1: Section 7 of the *Forest Act*

The B.C *Forest Act* Section 7 reads as follows:

Allowable annual cut

7. (1) The chief forester must determine an allowable annual cut before December 31, 1996, and after that determination 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 and woodlot licence areas, and

(b) each tree farm licence area.

(1.1) If, after the coming into force of this subsection, the minister

(a) makes an order under section 6 (b) respecting a timber supply area, or

(b) amends or enters into a tree farm licence to accomplish the result set out under section 33.1 (1) (a) to (d),

then, with respect to that timber supply area or tree farm licence area, as the case may be, the chief forester is not required to make the determination under subsection (1) of this section before December 31, 1996, or within 5 years after the last determination, but is required to make the determination

(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.

(1.11) If

(a) the allowable annual cut for the tree farm licence is reduced under section 7.1 (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 7.1 (6).

(1.12) If the allowable annual cut for the tree farm licence area is reduced under section 7.1 (3), the chief forester is not required to make the determination under subsection (1) or (1.1) of this section at the times set out in subsection (1) or (1.1) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 7.1 (2).

(1.2) [Repealed 1994-39-2.]

(1.3) In determining an allowable annual cut under this section 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 Province, the federal government, or both.

(2) The regional manager or district manager shall determine a volume of timber to be harvested under a woodlot licence during each year or other period of its term, according to the licence.

(3) In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 10, shall 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) silvicultural treatments to be applied to the area;
(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;
(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 his opinion, relates to the capability of the area to produce timber;

(b) the short and long term implications to the Province 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 Crown, as expressed by the minister, for the area, for the general region and for the Province; and
(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

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.

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