BRITISH COLUMBIA
MINISTRY OF FORESTS

Tree Farm Licence 30

Issued to Northwood Pulp and Timber Ltd.

Rationale
for
Allowable Annual Cut (AAC)
Determination

effective October 1, 1996

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Chief Forester

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Objective of this Document

This document is intended to provide an accounting of the factors 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) 30. The document will also identify where new or better information is required for incorporation into future determinations.

Description of the TFL

TFL 30, held by Northwood Pulp and Timber Ltd., is located just northeast of Prince George in the Prince George Forest District. The TFL stretches from its western boundary near Summit Lake on Highway 97, eastward across the western foothills of the Rocky Mountains to slightly northeast of Sinclair Mills. The most northerly reaches of the Fraser River cut through the south-eastern portion of the TFL.

Located on the McGregor Plateau, the TFL is generally characterized by deep soils, heavy snowfalls and substantial summer rainfall which combine to provide good growing sites with few forest fire disturbances. The area is dominated by the Sub-Boreal Spruce biogeoclimatic zone with small areas of the Interior Cedar-Hemlock in the southeast portion and Engelmann Spruce-Subalpine Fir zones located in the northeast portion.

The total land base for TFL 30 is 182 298 hectares, with a productive forest land base of 159 932 hectares or about 88 percent of the total area. Forests in the area are predominantly spruce, with balsam, lodgepole pine and other species making up the remainder.

The TFL is also designated as the McGregor Model Forest, which is part of an international network of model forests aiming to accelerate the implementation of sustainable development in the practice of forestry by applying new and innovative forest management techniques and utilizing the most advanced technology available. The primary goal of the McGregor Model Forest Association is to develop an information system to help people make ecologically sound, economically viable and socially acceptable decisions about how the forest should be managed.

History of Present AAC

In 1959, TFL 30 was granted to the Sinclair Spruce Lumber Company Ltd. with an original AAC set at 30 384 cubic metres. The amalgamation of TFLs 30, 31 and 34 to become the new TFL 30 took place in 1965 and a new AAC based upon intermediate utilization standards was set at 104 773 cubic metres. In 1967, TFLs 28 and 29 were amalgamated with TFL 30 and a new AAC of 212 378 cubic metres was set for the TFL following the completion of a new land base inventory. As a result of changing to close utilization standards, the AAC was raised in 1969 to 261 932 cubic metres. In 1970 the AAC was raised by 107 504 cubic metres to 369 436 cubic metres for two years. It was then raised a further 52 485 cubic metres to a total of 421 921 cubic metres. In 1976 the AAC was increased to 440 950 cubic metres and Sinclair Spruce Lumber Company Ltd. assigned all its forest tenures to Northwood Pulp and Timber Ltd. With the completion of a new land base inventory in 1979, and in recognition of the need to start reducing

harvest rates towards expected lower mid-term levels, the TFL AAC was reduced by 3550 cubic metres early in 1981. In 1984, the land base classification was updated and with the approval of Management Plan No. 6 in 1986, the AAC was reduced to 428 000 cubic metres. Over the period of 1988 to 1989, 21 312 cubic metres of the AAC were allocated to the Small Business Forest Enterprise Program (SBFEP). In 1991, the trend of declining AACs for this TFL continued with a decrease of 21 000 cubic metres, or about 5 percent, to a level of 407 000 cubic metres. The AAC history for TFL 30 is detailed in the table below:

Management Plan	Period	Total AAC (m^3)	Total Licensee AAC (m^3)	SBFEP AAC (m^3)	Comments
1	1959-1965	30 384	30 384		-Sinclair Spruce Lumber Co. Ltd. -amalgamation of TFLs 30,31,34 in 1965
2	1965-1966 1967-1968 1969	104 773 212 378 261 932	104 773 212 378 261 932		-amalgamation of TFLs 28,29,30 -new land based inventory -conversion to close utilization
3	1970-1972 1973-1975	369 436 421 921	369 436 421 921		Sinclair Spruce Lumber Co. Ltd.
4	1976-1980	440 950	440 950		Northwood Pulp and Timber Ltd. -new land based inventory
5	1981-1985	437 400	437 400		-land base classification update
6	1986 1987 1988 1989-1990	428 000 428 000 428 000 428 000	428 000 428 000 417 344 406 688	 10 656 21 312	
7	1991-1995	407 000	385 688	21 312	includes 10 000 cubic metre partition for marginal types.

New AAC Determination

Effective October 1, 1996, the new AAC for TFL 30 will be 350 000 cubic metres, a reduction of 57 000 cubic metres or about 14 percent from the current AAC. This AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Information Sources Used in the AAC Determination

Information considered in determining the AAC for TFL 30 includes the following:

- *TFL 30: Statement of Management Objectives, Options and Procedures*, Northwood Pulp and Timber Ltd., August 5, 1994;
- *TFL 30: Existing Stand Yields*, Northwood Pulp and Timber Ltd., April 26, 1995;
- *TFL 30: Managed Stand Yields*, Northwood Pulp and Timber Ltd., March 20, 1995;
- *TFL 30: Timber Supply Review Information Package*, Northwood Pulp and Timber Ltd., May 10, 1995;
- *TFL 30: Timber Supply Analysis Report*, Northwood Pulp and Timber Ltd., December 14, 1995;
- *TFL 30: Draft Management Plan 7*, Northwood Pulp and Timber Ltd., December 7, 1995;
- *TFL 30: Twenty-Year Plan*, Northwood Pulp and Timber Ltd., October 17, 1994;
- Technical review and evaluation of current operating conditions through comprehensive discussions with British Columbia Forest Service staff, February 22, 1996,
- *TFL 30 Inventory Audit*, 1996,
- *Forest Practices Code of British Columbia Act*, July 1995; and
- *Forest Practices Code of British Columbia Regulations*, April 1995.

Role and Limitations of the Technical Information Used

The *Forest Act* requires me as Chief Forester to consider biophysical, economic and social 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 30. 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. The analysis also indirectly incorporates some economic information such as an operability classification that defines the types of terrain and timber that can be physically and economically accessed given current technology and markets.

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 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 correct answer or solution to forest management problems such as AAC determinations. The information does, however, provide valuable insight into potential impacts of different resource-

use assumptions and actions, and thus forms an important component of the information I must consider in AAC determinations.

In making the AAC determination for TFL 30, I have considered known limitations of the technical information provided and am satisfied that, with the cautions identified above and at various places in this document, this information provides a sound basis for my 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

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 AACs from a range of possible harvest levels; 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 TSAs (*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 30. 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 or to incorporate their eventual timber supply impact in an AAC determination. 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 impact of the land-use decision. However, the legislated requirement for five-year AAC reviews will ensure such decisions are addressed in future timber supply analyses.

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 far

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)(a)(v) 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.*

Consideration of Factors as Required by Section 7 of the *Forest 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 licensee. For each 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, a series of timber supply forecasts is produced. Each forecast is based on the same set of data and reflects different decline rates, initial harvest levels, and trade-offs between short- and long-term harvest levels.

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

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

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

These adjustments are made on the basis of informed judgement, using 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.

The base case in the licensee's analysis was created using IFS Yield (a computer simulation model) which uses 5-year period lengths. The base case indicated an initial harvest level of 386 360 cubic metres per year—about 5 percent below the current AAC of 407 000 cubic metres—for the first five years followed by a 5 percent decline each 5 years for the next 35 years. After this, the base case remains stable at a level of 267 360 cubic metres for 65 years before rising about 28 percent to the long-term harvest level of 373 360 cubic metres. This forecast is dependent on a high level of access to the beetle management zone, as will be discussed below under Spruce bark beetle infestation.

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 description

general comments

The total area of TFL 30 is 182 298 hectares. In the licensee's analysis, 159 932 hectares, or about 88 percent of the total area, are classified as productive forest. The land base considered available for timber harvesting (the "timber harvesting land base") is limited by inoperability, environmental sensitivity, non-merchantable forest types, non-commercial forest cover types and the use of areas for purposes other than timber production. 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. In the licensee's analysis, the initial timber harvesting land base is 126 250 hectares, about 79 percent of the productive forest or approximately 69 percent of the total TFL area.

operability

In the last inventory, which was conducted in 1989, operability was classified as operable for either ground-based or cable and/or overhead harvesting systems based upon their projected viability in the next 20 years. In the licensee's analysis, 4694 hectares of the productive forest were identified as inoperable. Because of the order of reductions in deriving the timber harvesting land base, most of the inoperable sites were excluded under other categories, particularly wildlife habitat and recreational areas. As a result, only 35 hectares were deducted solely for inoperability. BCFS district staff approved the delineation of physical inoperability as identified in the licensee's Total Resource Plan in 1994. Beyond this, I note the licensee's demonstrated commitment to harvesting in difficult areas through the use of helicopter harvesting systems.

Given the approval of district staff and recognizing the correlation between the application of other guidelines and operability, and having had no evidence presented to suggest otherwise, I consider operability to be appropriately accounted for in the licensee's analysis for the purposes of this determination.

environmentally sensitive areas (ESAs)

Some forest areas were identified in the 1989 inventory as environmentally sensitive and these classifications were approved by district staff at that time and are still considered appropriate. In the licensee's analysis, 100 percent of all areas identified as being highly difficult to regenerate, having a high recreation value or having highly unstable soils were removed from the timber harvesting land base. Based upon the licensee's previous harvesting experience, areas identified as having moderate regeneration difficulty or moderately unstable soils were reduced by 25 percent. Altogether, reductions to the timber harvesting land base to account for ESAs totalled 5402 hectares.

Reductions accounting for ESAs were confirmed by BCFS staff as appropriate. Consequently, in the absence of any evidence to suggest that ESAs are not appropriately represented in the licensee's analysis, I am satisfied that, for the purposes of this determination, no adjustments to the base case are required to account for ESAs.

low productivity sites

In determining the timber harvesting land base, sites with low timber growing potential were not considered to contribute to the timber harvesting land base. Areas were deducted if the coniferous volume at age 200 years was projected to be less than 100 cubic metres per hectare. A total of 393 hectares, less than one percent of the total TFL area, was identified as having low productivity. After reductions attributable to other factors were made, 241 hectares were excluded from the timber harvesting land base to account for low-productivity sites.

This TFL is a highly productive unit and I therefore find it reasonable to have a proportionately small reduction to account for low productivity sites in the licensee's analysis. While the low productivity site criterion for the surrounding Prince George TSA is 140 cubic metres per hectare at 140 years, BCFS monitoring of the licensee's performance over the term of Management Plan No. 7 verifies that the licensee is harvesting in stands down to a volume of 100 cubic metres per hectare. In addition, I note that there could be slightly more low site than was represented if, as I discuss below under *volume estimates for existing stands*, existing stand volumes are overestimated since the criteria are volume based. However, any differences would be small, and I do not consider them to be significant in this determination. Overall, I consider low productivity sites to be appropriately accounted for in the licensee's analysis.

deciduous forest types

Sites supporting deciduous (broadleaf species in this area) leading stands were removed from the timber harvesting land base. A total of 4540 hectares, or approximately 3 percent of the total productive area was deducted. As there is currently no utilization of deciduous timber from this unit, I am satisfied that this is an appropriate representation of current practices on TFL 30.

A sensitivity analysis that examined the impact of including the 4540 hectares of deciduous leading stands in the timber harvesting land base did not indicate any short-term influence on timber supply. The analysis does indicate however, that by including these stands in the timber harvesting land base, mid-term supplies could be up to 12 percent higher than in the base case harvest forecast and long-term supplies could be 6 percent higher. I will return to this point below under "Reasons for Decision".

I recognize that the demand for deciduous volumes is increasing and that deciduous stands are being harvested in many other areas in the province. However, until such time as a proposal is put forward to harvest these stands in TFL 30 in conjunction with analysis regarding the interactions of these stands with other resource values such as biodiversity and wildlife habitat, in my judgement it is appropriate to exclude these areas from the timber harvesting land base.

non-commercial brush

Approximately 11 200 hectares that are largely dominated by alder and considered to be non-commercial brush were deducted from the timber harvesting land base. The licensee has assessed this area and scheduled about 6250 hectares for conversion from alder to coniferous plantations. In the analysis, the licensee assumed a treatment rate of 1250 hectares per decade for 5 decades, or approximately 125 hectares per year. I consider this to be reasonable given the licensee's performance over the past 5 years in which they treated an average of 122 hectares per year. The conversion activity is assumed to contribute about 5 percent to the long-term timber harvesting land base. The remaining area not treated, is considered to be either untreatable or to possess riparian or wildlife value in its current state.

estimates for roads, trails and landings

In the licensee's analysis, approximately 3629 hectares, or about 2.3 percent of the total productive forest land base, were deducted to account for the fact that timber production is not expected on roads, trails and landings constructed in the past. In assessing these reductions, the length and width of main roads were derived using maps of the TFL. Each stand in the inventory was reduced by 0.6 percent to account for existing main and secondary roads. For all stands less than 30 years old, a further 3 percent reduction accounting for trails and landings was made. For all stands 30 years old or greater, an additional 0.3 percent reduction was made. These reductions were based upon harvesting activity in the last 6 years.

To account for productive land losses from the future construction of roads, trails and landings, approximately 2620 hectares, about 2.1 percent of the initial timber harvesting land base, were deducted. A reduction factor of 3.2 percent was applied to all stands older than 30 years of age on the timber harvesting land base. This factor is derived by summing a 0.2 percent reduction for future main and secondary roads, and a 3 percent

reduction for trails and landings. This area was designated as a future roads zone in the licensee's analysis and an aggregated yield curve was used to estimate the average volume per hectare these areas contribute to the harvest projection for the first 50 years of the simulation.

A rigorous, quantitative, map-based method was used to derive these reductions and I consider the results to be a reasonable representation of current practice in TFL 30. I have determined that no further adjustments to account for roads, trails and landings are required.

Composition of the forest

forest cover updates / reinventories

The most recent inventory, which was conducted in 1989, was used in the licensee's analysis. The information was updated to the end of October, 1994, to reflect any harvesting and silviculture activities since the inventory data was collected. I accept that this was the best information available for use in the licensee's analysis at the time it was completed.

However, an inventory audit was carried out by the BCFS during the summer of 1994. As I discuss in detail below, under *volume estimates for existing stands,* the audit indicates that ground based volume estimates are statistically different from those predicted using stand attributes in the inventory.

age class structure/species profile

Approximately 48 percent of the timber harvesting land base is covered by stands older than 140 years. About 37 percent is covered by stands aged 0 to 20 years, Not Satisfactorily Restocked (NSR) areas, and areas currently covered by non-commercial brush species that are slated for conversion to commercial tree species. The remaining 15 percent of the timber harvesting land base is characterized by a relatively balanced distribution of stands aged 21 to 140.

Stands dominated by spruce cover almost three-quarters of the timber harvesting land base while stands dominated by balsam, pine and other species compose the remaining area.

volume estimates for existing stands

The licensee's analysis used the Variable Density Yield Projection (VDYP) yield model to estimate volumes for all existing stands older than 30 years of age. VDYP is generally accepted as an appropriate model for these types of stands since it is based upon information from many sample plots throughout the province. Based upon the information available at the time, the BCFS Resources Inventory Branch accepted the yield tables as appropriate for use in the licensee's analysis.

A recent statistical inventory audit for the TFL found that, for the TFL taken as a whole, and for the operable land base, the average mature stand timber volume as projected by VDYP from inventory information was approximately 16 percent higher than the mean ground measurements obtained from the plots sampled in the TFL audit. The result indicates a strong possibility that the mature volumes derived through VDYP from the inventory figures used in the licensee's analysis overestimate the actual standing volumes to some extent. The magnitude of the implications for timber supply of this probable overestimation is uncertain, since the audit is intended to provide generalized results which are statistically reliable for the entire TFL, but which do not identify the accuracy of the volume estimates in the inventory data for a particular part or parts of, or for particular groups, species or site classes within, the TFL. Also, the inventory results apply to the current standing inventory essentially providing a snapshot in time that may not apply equally as stands grow and age over time.

Other factors support the likelihood that the mature volumes in existing stands were overestimated in the licensee's analysis. Historical information regarding volumes billed on the TFL from 1982 to 1994 against the area harvested, indicated that average annual volumes per hectare harvested over that period were less than the inventory-based volumes used in the analysis. Further, cruise-based volumes identified in the forest development plan for 1996 indicate lower volumes than predicted by VDYP using the inventory attributes. Finally, the Ek Payandeh yield curves used in the previous analysis were localized for this TFL and projected similar volumes to those found in the audit. Although these factors do not provide conclusive information about the actual volumes, they do support the likelihood that the existing stand volumes are overestimated in the licensee's analysis.

In conclusion, there are indications of a strong likelihood that the inventory volumes used in the licensee's analysis are overestimated. The licensee's analysis shows that this could significantly affect the timber supply in both the short and medium terms.. A sensitivity analysis shows that if existing stand yields are overestimated by 15 percent, the initial harvest level projected in the base case is immediately decreased by a minimum of 10 percent, or as much as 20 percent, depending upon how low the mid-term harvest level is permitted to drop. I have noted this below under Harvest Flow, and have considered this further in "Reasons for Decision".

As noted below under "Implementation of Decision", I expect that the licensee will investigate the source of the indicated discrepancy between the estimates of existing mature volumes used in the analysis and the findings of the inventory audit and other documentation, and that this discrepancy will be resolved and corrected in the timber supply analysis for the next AAC determination.

Expected rate of growth of the forest

site productivity

Inventory data includes estimates of site productivity which is the ability of a particular site to grow trees and is usually expressed in terms of site index. Site index is based on the height of a stand as a function of the stand age. The productivity of a site largely determines how quickly trees will grow, and therefore affects expectations of the time seedlings will take to reach green-up conditions, the volumes of timber that will grow in regenerated stands, and the age at which those stands will reach merchantable size or minimum harvest age. Accurately estimating site productivity in both young and old stands is difficult. In young stands, growth often depends as much on recent weather, stocking density and competition from other vegetation, as it does on site quality. In old stands, which have not been subject to the management of stocking density, the trees used to measure site productivity may have grown under intense competition or may have been damaged, and therefore may not reflect the true growing potential of the site.

In the licensee's analysis, site indexes for existing stands were assigned using BCFS site productivity curves, and estimates of stand height and stand age from the inventory. Site indexes for current managed stands—those less than 31 years old and currently not-satisfactorily restocked—were assigned based upon the mid-point site index of the Special Site Class by species. The site index for future managed stands was based upon the area-weighted natural stand site index. These assignments and any adjustments due to species conversions were reviewed and accepted by the BCFS Research Branch.

The licensee's Management Plan No. 8 notes the possibility that site productivity is underestimated. I note that 60 370 hectares or about 48 percent of the timber harvesting land base exceeds 140 years of age. Based upon studies to date and my experience with northern forests, it is likely, in my view, that the site index of some stands is underestimated. However, the magnitude of the underestimation and the corresponding impacts on volumes, green-up ages and minimum harvest ages are uncertain. Although increased site indexes could mean a potential increase in the mid- to long-term timber supply, a sensitivity analysis showed that even increasing site index by 15 percent would have no effect on the short-term harvest projection because all of the timber harvested in the short term is from existing mature stands.

I am hopeful that the licensee will examine site productivity further to help reduce the uncertainty noted above for the next determination. For now, I consider the likelihood

that site productivity is underestimated to be an upward influence on timber supply in the mid to long-term as I discuss below under "Reasons for Decision".

volume estimates for regenerated stands

Managed stand yield estimates were developed using WinTIPSY and were accepted for use in the licensee's analysis by the BCFS Research Branch. The generated yields were reduced using Operational Adjustment Factors (OAFs). OAF1 (a reduction of 15 percent) was applied to reflect reduced production due to unproductive areas such as swamps and rock outcrops that were too small to be reflected in the inventory. OAF2 (a reduction of 5 percent) reflects natural losses incurred by biotic forces, including disease, as stands mature. As discussed above in *site productivity*, current managed stands were assumed to be those aged less than 31 years. In total, these stands occupy approximately 34 500 hectares.

Regenerated stands were assumed to be planted at a density of 1400 stems per hectare, with the exception of about 2 percent of the timber harvesting land base that is expected to regenerate naturally with pine.

As was mentioned above in s*ite productivity*, if site indexes are underestimated, then it stands to reason that managed stand yields could be higher. However, a sensitivity analysis indicated that timber supply is insensitive to even 20 percent changes in managed stand yields for the first 35 years of this projection. Given this short- to mid-term insensitivity, as well as the lack of conclusive evidence that managed stand yields are in fact underestimated, I am comfortable with the estimates used in the licensee's analysis for the purposes of this determination. Should new evidence become available that suggests otherwise it will be considered in the next determination.

minimum harvestable age

In the licensee's analysis, minimum harvestable ages were defined as the age at which the mean annual increment of a stand culminates—the culmination age—when average growth reaches its maximum . Minimum harvestable ages depended on the species mixture and site productivity. Minimum harvestable ages for existing stands were between 105 and 225 years, and ranged from 75 to 225 years for regenerating stands.

Timber supply in this unit is sensitive to minimum harvestable ages. A sensitivity analysis indicates that if minimum harvestable ages are increased by 20 years, the initial harvest level must be reduced by about 5 percent compared to the base case projection, followed by decreases of 5 percent in the harvest level every 5 years until year 65 when the minimum harvest level is reached, some 28 percent below the base case. However, in the long-term, timber supply would only be reduced by about 2.5 percent below the base case. Conversely, if minimum harvestable ages are decreased by 20 years, there is no change in the base case harvest projection for the first 35 years. However, timber supply

is projected to be 9 percent higher than the base case in the mid-term and, depending upon harvest flow options chosen, equal or slightly higher in the long-term.

I have no evidence before me that indicates the harvest ages represented in the analysis are not appropriate. BCFS staff have indicated that the ages used are consistent with observations taken in the field. I am satisfied that the licensee's analysis is an appropriate representation of current practice on TFL 30. While I remain mindful of the risks at hand, I have determined that no adjustments to account for minimum harvestable ages are required at this time. I expect this matter to be carefully reviewed by the licensee during the next analysis.

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

Regeneration delay

Regeneration delay is the period between harvesting and the time at which an area is occupied by a specified minimum number of acceptable, well-spaced trees. In the licensee's analysis, 3 years was used for all regenerating stands except for those that were modelled to regenerate naturally to pine, in which case 5 years was used. District staff confirm that the figures used are representative of current practice on the TFL.

Given the licensee's demonstrated achievement of the standards and the absence of any evidence to suggest otherwise, I have determined that regeneration delay has been appropriately represented and that further adjustments to account for regeneration delay are not required.

Impediments to prompt regeneration

The licensee's Management Plan No. 8 indicates that most of the TFL is located on highly productive sites with relatively high levels of vegetative competition. Historically, chemical herbicide treatments were used to control the competition. In more recent years however, manual and mechanical brushing treatments combined with the prompt planting of larger seedlings have proven effective in limiting vegetative competition. This is expected to continue and thus brush competition is not expected to have a significant impact on timber supplies.

One major impediment to prompt regeneration, damage resulting from the spruce terminal weevil, was identified as a concern on TFL 30. The licensee's Management Plan No. 8 indicates that control of the weevil is not taking place due in large measure to a lack of effective control methods. In addition, the licensee indicates that currently there is very little information available on the timber supply impacts of this pest.

District staff estimate that as much as 15 percent of this unit is susceptible to attack from the weevil and note that prolonged leader weevil infestation could lead to an increase in the minimum harvestable age, the green-up age and to some degree a decrease in yield.

As was described above in *minimum harvestable ages*, a sensitivity analysis indicates there will be impacts on timber supply if minimum harvestable ages are increased. Given this, and the fact that portions of the TFL are susceptible to attack, I expect the licensee to identify the scope and intensity of susceptibility to spruce leader weevil on the TFL and to develop a strategy for managing the areas at risk, so that the potential impact can be better assessed at the next determination. I will return to this point below under "Implementation of Decision". I do not have conclusive evidence to indicate the magnitude and impact of spruce weevil damage in this area, but in view of the potential problem, it is appropriate to view the yield curves for these susceptible stands as somewhat of a maximum achievable value rather than a mean. Nonetheless, as I discussed above under *volume estimates for regenerated stands*, sensitivity analysis indicates that up to a 20-percent reduction in regenerated volumes will not have a short-term impact and only a small mid-term impact.

Overall, I note that in this unit there is significant uncertainty regarding the risk and potential impact of spruce weevil damage on timber supply. In my judgement, it is reasonable to wait for clarification surrounding the management of this pest which is expected for the next determination rather than speculating on potential outcomes. I do not consider waiting for better information to impose unacceptable levels of risk to timber supplies in the next 5 years. Accordingly, I am not making any adjustments to the base case at this time to account for impediments to prompt regeneration.

Not-satisfactorily-restocked areas

An area is classified as not-satisfactorily-restocked (NSR) if it is not covered by a sufficient number of tree stems of desirable species as specified in BCFS stocking standards. In the licensee's analysis, if such a condition exists and the area was harvested in 1987 or later, the land is defined as current NSR. If the area was harvested prior to 1987, then the land is classified as backlog NSR. On the timber harvesting land base there are approximately 6672 hectares of NSR, of which about 60 percent (approximately 4000 hectares) is current, and the remaining 40 percent (about 2672 hectares) is backlog. The licensee's analysis represented regeneration of current NSR areas in the first 5 years and backlog areas to be regenerated within the first decade of the harvest projection.

The representation of NSR in the licensee's analysis is consistent with current practice on TFL 30 and with provincial standards. Therefore, I have determined that no adjustments to account for NSR are required at this time.

Residual stands

As a consequence of harvesting to intermediate utilization standards in the 1940s to 1960s, approximately 4 percent of the timber harvesting land base includes residual stands; those with a mixture of mature and younger regenerated trees following partial harvest. Of this, about 1.4 percent is currently above the minimum harvestable age criteria making it available for harvest. The minimum harvestable age for these stands

was set at the culmination age of between 135 and 140 years as projected by VDYP using the appropriately reduced crown closure value.

The licensee has indicated that they intend to harvest these areas and some stands are included in their current forest development plan. I accept that the licensee's analysis appropriately reflects current practice in this unit and make no further adjustments to account for them.

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

Incremental Silviculture

commercial thinning

Currently, there is no commitment from the licensee to undertake commercial thinning on TFL 30. However, a sensitivity analysis was conducted in order to evaluate the timber supply implications of this activity. Good spruce sites in the normal forest and beetle management zones, as described below under Integrated Resource Management (IRM) objectives, were chosen for the analysis as the overall impact on growth was expected to be positive on such sites. Yield projections for the analysis were provided by the BCFS Research Branch and assumed the same stocking levels as those in the base case analysis with a thinning intensity of 70 cubic metres at an approximate stand age of 80 years. However, according to the analysis, commercial thinning results in a reduction in the long-term harvest rate without any reciprocal increase in mid-term timber supplies. The mean annual increment of the thinned stand actually dropped below the corresponding unthinned stand once regeneration delay was accounted for. In addition, rescheduling managed stands modified the harvest queue sufficiently to impact on the projected rise to the long-term harvest level.

Commercial thinning could allow access to stands that would otherwise be constrained by adjacency but, given the results of the sensitivity analysis and the fact that the licensee has not indicated any intention to conduct commercial thinning on TFL 30, I am not making any specific adjustment for it in this determination.

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

Utilization standards and compliance

The standard of timber utilization defines the species, dimensions (stump height and minimum diameter), and quality of trees that must be harvested, and is used to estimate merchantable volume.

A minimum diameter at breast height of 12.5 centimetres for pine species and 17.5 centimetres for all other coniferous species was used in the licensee's analysis. As well, utilization of timber to a 10 centimetre diameter top and a maximum stump height of 30

centimetres were assumed in the analysis for all species. These utilization parameters are the standard limits for interior harvesting operations. In addition, the deciduous component of coniferous dominated stands has been included in the licensee's analysis, which is consistent with current practice on the TFL. BCFS staff confirm that the licensee is meeting these utilization requirements in their operations.

A sensitivity analysis indicates that if a minimum diameter at breast height of 12.5 centimetres for all species is assumed, there would be a small upward influence on timber supplies in the mid- and long-term. While I recognize that there may be opportunities for closer utilization for species other than pine, as I discuss below under "Reasons for Decision", I consider utilization standards and compliance to be appropriately represented in the licensee's analysis as it is consistent with current standards and practice.

Decay, waste and breakage

The Monkman PSYU decay, waste and breakage factors, based on samples for the general area and approved by the BCFS Resources Inventory Branch were used in the generation of existing stand volume tables for the base case harvest projection. 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 consider them to be reasonable 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

As defined in the *Ministry of Forests Act*, the purpose and function of the Ministry of Forests is 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.

In the licensee's analysis, the following 9 resource emphasis zones, in order of decreasing percent of the timber harvesting land base, were identified with specific management objectives: normal forest (60 percent), beetle management (24.6 percent), forest ecosystem network and caribou corridor (5.1 percent), visual quality objective (VQO) modification (3.5 percent), stream and lakeside management (2.9 percent), medium caribou habitat (1.6 percent), VQO partial retention (1.4 percent), Tri-Lakes recreation enhancement (0.6 percent), and VQO maximum modification (0.3 percent). Each of these zones will be discussed under the appropriate considerations below.

cutblock adjacency

In order to protect resources such as wildlife, water quality and aesthetics, current harvesting practices limit the size and shape of cutblocks, and prescribe minimum green-up times (the period following harvesting required for a stand of trees to reach a desired condition such as height). This provides for a distribution of harvested areas and retained forest cover across the landscape, and as such takes into account the impact of several forest management requirements. Cutblock adjacency guidelines are commonly expressed in terms of the number of harvesting entries, or 'passes', required for harvesting operations to cover an area while meeting IRM objectives. A four-pass system was considered most representative of current practice in the normal forest zone and was represented as such in the licensee's analysis.

In order to reflect historical harvest patterns that have been necessitated in part by spruce bark beetle infestations, a beetle management zone was created in the central portion of the TFL for the licensee's analysis. Currently, about 56 percent of the forest cover in this zone is below the minimum green-up height specified. Nevertheless, I recognize that in order to meet forest health objectives for this area, continued salvage harvesting will be necessary. For the purposes of the licensee's analysis, BCFS staff considered the harvest of up to 250 hectares per year in this zone as a reasonable estimate of the amount of disturbance permitted until such time as a four-pass system can be maintained indefinitely. This regime was represented in the licensee's analysis.

While I am satisfied that this is an appropriate representation of current practice in the beetle management zone, sensitivity analysis shows that the projected short-term timber supply is highly dependent upon the continued achievement of this level of harvesting in this zone. If the zone were to be managed instead under a four-pass regime—which is impractical for this zone, given current levels of infestation, but which is the case in the remainder of the timber harvesting land base—the projected initial harvest level would drop to 32 percent below the base case. This poses a potential risk to the short-term timber supply which I have addressed further under Spruce bark beetle infestation and in "Reasons for Decision".

green-up

As discussed above, the green-up ages assumed in the base case harvest forecast are the estimated number of years for the trees growing in a previously harvested area to reach a required height.

In the VQO partial retention and modification zones, the average minimum green-up age assumed in the licensee's analysis was 28 years to grow to a minimum green-up height of 5 metres. Due to slower initial tree growth in the VQO maximum modification zone, a green-up age of 32 years was required to achieve the same required green-up height of 5 metres. Finally, for the caribou habitat, caribou corridors, Tri-Lakes recreation management, the beetle management and the normal forest zones, a minimum height of 3

metres was assumed to be achieved with a green-up age of 22 years. In the stream lakeside management zone, it was assumed that 50 percent of the volume would be retained and therefore no green-up requirements were necessary. I consider green-up to be appropriately represented in the licensee's analysis for the purposes of this determination.

visually sensitive areas

One of the resources required by the *Ministry of Forests Act* to be managed by the Ministry of Forests is outdoor recreation, which is defined under the *Forest Act* to include scenic features. Visual landscape foresters in B.C., in collaboration with specialists from around the world, have developed procedures for identifying and managing visually sensitive areas. Recommended procedures incorporate both biophysical and social factors—including visual sensitivity ratings, numbers of viewers and their perceptions, and others—and provide recommended visual quality objectives for visually sensitive areas.

To meet these objectives, constraints must be placed on timber harvesting, road building and other forest practices in the sensitive areas. These constraints are based on research and experience, and on public preferences and acceptance of degrees of alteration of visual landscape. The constraints are expressed in terms of "forest cover" requirements that relate to the maximum allowable percentage of a landscape that can have visual disturbance at any one time, and to "visually effective green-up", i.e., the stage at which regeneration is perceived by the public to represent a newly established forest.

The licensee's analysis accounted for visual quality management by incorporating specific visual quality objectives in 3 resource emphasis zones as identified above in Integrated Resource Management (IRM) objectives, and g*reen-up*.

Requirements for the maximum modification zone are that a maximum of 25 percent of the zone can have stands less than 5 metres in height at any one time. In the modification zone no more than 24 percent of the area is allowed to have stands less than 5 metres in height at any time. Finally, the partial retention zone, located in areas with moderate visual sensitivity, is the most restrictive VQO zone to harvesting and requires that no more than 15 percent of the area has stands less than 5 metres in height at any time.

Approximately 855 hectares in TFL 30 are identified as VQO retention and are considered unavailable for timber harvesting. However, because this area fully overlaps with the Woodall Creek recreation area and high value caribou habitat which are already removed from the timber harvesting land base as noted above under *operability*, no further reductions to the timber harvesting land base are necessary.

Standard BCFS procedures were followed in the identification of these zones and the definition of their associated forest cover requirements. A sensitivity analysis indicated that timber supplies are not sensitive in the short-and long-term and only slightly in the

mid-term to reductions in visual quality requirements. Given that the delineation of and requirements for these areas comply with BCFS accepted standards and having had no evidence presented to suggest visual quality requirements are not appropriately represented in the licensee's analysis, I am satisfied that no further adjustments are required for this determination.

riparian areas

To protect riparian habitat, buffer or reserve zones are located along watercourses which limits timber harvesting practices. Streamside and lakeside riparian reserves account for approximately 6600 hectares and 250 hectares of productive forest respectively and were considered unavailable for harvest. In total, this represents 4.3 percent of the total productive forest on the TFL. These stream reserves are based upon the Interim Fish and Wildlife Habitat Guidelines for the Prince George Forest District which require a 30 metre reserve width on Class A and B streams and all lakes greater than 1 hectare in size.

In addition, a 20 metre wide buffer adjacent to the above mentioned reserve areas was identified as a riparian management area, and was represented in the licensee's analysis as having a 50 percent volume removal during harvest. As well, the McGregor River riparian area follows the natural riparian flood plain through the centre of the TFL and requirements included a 5-pass harvesting system with a minimum green-up height of 3 metres and the continual maintenance of at least 20 percent of the area in old growth forest which was defined as being at least 120 years old.

The Seebach riparian zone includes a high-value salmon stream and experiences significant wildlife use. The area was identified as a timber harvesting land base exclusion removing about 440 hectares of productive forest.

BCFS staff consider the riparian management as represented in the licensee's analysis to meet the Forest Practices Code requirements. I also recognize that the licensee is currently conducting further stream classification to ensure consistency with the Code stream descriptions. Overall, I am satisfied that riparian management requirements are adequately represented in the licensee's analysis for the purpose of this determination and make no further adjustments to account for them.

biodiversity

The Forest Practices Code requires the establishment of both stand and landscape level objectives for biodiversity management. To date these have not been established for this unit and no specific removals were made in the licensee's analysis for biodiversity requirements. Although the magnitude is as yet unknown, I expect there will be some overlaps of biodiversity requirements with visual quality objectives, riparian areas, some deciduous stands and other land base deductions discussed above, and with wildlife requirements as noted below in *wildlife*.

Based upon my understanding of biodiversity requirements gained from experience elsewhere in the province and from the *Forest Practices Code Timber Supply Analysis*, BCFS, February 1996, I find it reasonable to expect that further reductions to the timber supply will be required in this TFL to account for biodiversity. The ongoing LRMP process in the Prince George Forest District will provide some direction regarding

biodiversity objectives and will reduce uncertainty regarding stand and landscape level requirements

I expect the licensee to comply with the Code biodiversity planning requirements so that this information will be available for the next determination. I will return to this point below under "Implementation of Decision."

From my experiences as noted, and particularly with biodiversity considerations in other management units in the Prince George Forest Region, for the purposes of this determination I anticipate that, notwithstanding the potential overlaps referenced above, the additional provisions required in this TFL to ensure that the biodiversity requirements of the Code are met will impose an additional restriction, in the order of magnitude of two percent, on the short-term timber supply projected in the licensee's analysis. I have accounted for the risk associated with this in my determination as noted below under "Reasons for Decision."

wildlife, old growth and forest ecosystem networks

Several proposed forest ecosystem networks have been mapped by the licensee in cooperation with MELP staff. For the most part, these networks are located along riparian corridors.

Specific accounting for the requirements of caribou were included in the licensee's analysis and were received directly from MELP staff. High value caribou habitat, approximately 3.8 percent or 6147 hectares of the total productive forest primarily located within the Engelmann Spruce Subalpine-Fir biogeoclimatic zone, was excluded from the timber harvesting land base. As discussed above under Integrated Resource Management (IRM) objectives, about 5.1 percent of the timber harvesting land base is classified as forest ecosystem network and caribou corridor and about 1.6 percent is medium caribou habitat. Both zones require a 5-pass harvesting system with a minimum green-up height of 3 metres. The management objective for the medium caribou habitat requires that a minimum of 66 percent of the area is covered by old growth forest, defined as 80 years of age or older, while the caribou corridor and forest ecosystem networks require a minimum of 20 percent old growth forest defined as being at least 120 years old.

I consider these regimes modelled in the licensee's analysis to be realistic and representative of current integrated resource management objectives and MELP requirements with respect to wildlife on this unit. Any refinement of objectives for this area, as might arise from the ongoing LRMP process, will be considered in the next determination. At this time, I see no need to make any further adjustments to account for wildlife, old growth and forest ecosystem networks.

recreation

A recreation and landscape analysis was completed by the licensee and approved by the BCFS in 1994. In order to represent the specific operational measures needed to protect recreation management class 1 sites (areas having outstanding recreational, educational, scientific or heritage value), half of these areas were excluded from the timber harvesting land base after other reductions had occurred, resulting in the removal of about 2990 hectares of productive forest.

In addition, three important Recreation Emphasis Areas (REAs), Horseshoe Lake, Woodall Creek and Tri-Lakes, were identified in the recreation inventory. The Horseshoe Lake REA is located between the Fraser and McGregor rivers and is recognized for its valuable moose wintering habitat and high canoeing and wildlife viewing value. Located in inoperable, alpine terrain, the Woodall Creek REA is being protected to preserve high caribou habitat, wilderness hiking and backcountry skiing opportunities on the TFL. Both of these REAs are entirely excluded from the timber harvesting land base. Although the Tri-Lakes REA was not fully excluded, 650 hectares of the area not already covered by other reductions are subject to special management requirements. No more than 10 percent of the 650 hectares is permitted to have forest less than 3 metres in height at any one time which is intended to minimize the visual impact of harvesting activities in the area.

In addition, the Giscome-Portage Historic Trail is flanked by a 200-metre permanent no harvest zone over its entire length through the TFL, as was accounted for in the licensee's analysis. This was done at the request of the BCFS and the Fraser-Fort George and Giscome-Portage Historic Society.

These estimates constitute the best available information and I consider them to represent the recreation requirements identified in TFL 30. I consider the licensee's analysis to reflect these requirements and see no need to make further adjustments to account for them. The completion of the ongoing LRMP is expected to provide further clarification on recreation objectives in this area. Any guidance related to management objectives from this or other processes will be considered in future AAC determinations.

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

Harvest scheduling

In the licensee's analysis, harvesting was assumed to proceed on the basis of prioritization by a combination of species and site class (analysis unit) . In the simulation, a priority list was created for each analysis unit and age class by using the ratio of the difference between the mean annual increment (the average growth) and the current annual increment (current growth) to the current volume per hectare. As a result, in general, the oldest, highest productivity stands are scheduled for harvest first. However, the simulation does contain an adjacency function which defers area from harvest in the short term, thereby preventing the exclusive scheduling of only good sites over the first 20 years of the projection. In the base case projection, spruce and spruce mixture, good sites

represent approximately 38 percent of the timber harvesting land base but contribute about 94 percent of the volume harvested in the first 5-year period and about 85 percent in the second period. I recognize that scheduling higher volume stands earlier significantly reduces the short-term impact of forest cover requirements as less area is required for harvest to meet the base case projection than would be if stands with a lower volume per hectare were scheduled for harvest in this period.

In light of operational requirements such as access and possible timber salvage, as I discuss below in Non-recoverable losses, that may involve more harvesting on lesser quality sites, I consider the harvest schedule rule used in the licensee's analysis as a short-term theoretical maximum in available volume that may not be achieved, which represents an unquantified risk to the short-term timber supply, as discussed below in "Reasons for Decision". By corollary, to the extent that the actual harvest schedule varies from that modelled, reducing the short-term timber supply, the mid-term supply will likely increase due to the availability of the higher volume stands during that period.

(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 management units that have a large mature forest component, such as TFL 30. In the short term, the presence of large volumes of older wood permits harvesting above the long-term harvest level without compromising future timber supplies. In keeping with the objectives of good forest stewardship on areas where a falldown in timber supply is expected, AACs have been and will continue to be determined so as to ensure a smooth and orderly transition toward the long-term harvest level. Thus, timber supplies should remain sufficiently stable to avoid unnecessary adverse impacts on current or future generations. To achieve this, the rate set must not be so high as to cause later disruptive shortfalls in supply, nor so low as to cause undue social and economic impacts now.

The TFL 30 base case harvest projection indicates that mid-term timber supplies will be below the long-term harvest level. I do not view the mid-term projection as a timber supply disruption; rather, the higher long-term supply is a result of past, current and projected forest management, the benefits of which will be experienced further into the future.

As noted above under *volume estimates for existing stands*, it is likely that mature volumes have been overestimated in the licensee's analysis. Any adjustment to the projected short-term harvest level that must be made in response to this overestimation is interdependent with a simultaneous necessary adjustment to the projected mid-term supply. In essence, the greater the reduction permitted in the mid-term, the smaller the reduction required in the short term. As discussed below under Minister's letter and memo and again under "Reasons for Decision", I have taken this into account in my

determination in context of the other risks and restrictions on supply noted in other sections of this rationale..

20-year plan

The licensee's 20-year plan was accepted by the BCFS in October, 1994, prior to submission of the information package for the licensee's analysis to the BCFS. According to BCFS district staff, the 20-year plan supports the feasibility of the base case projection in the short-term recognizing that the green-up assumptions in the plan are slightly more optimistic than those used in the licensee's analysis. I recognize this variance and note that the licensee is obliged to meet BCFS standards regarding stocking, regeneration delay and free-growing commitments which may somewhat constrain full development of the areas identified in the 20-year plan. However, since a large portion of the timber inventory is mature, I recognize that there is some additional flexibility here to meet operational requirements. While I remain mindful of these minor risks in making my determination, I am satisfied that no adjustments to the base case to account for the findings of the licensee's 20-year plan are required for this determination.

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

Timber processing facilities and community dependence on the forest industry

Timber harvested from TFL 30 represents a significant portion of the raw material requirements of the licensee's manufacturing facilities in Prince George including three sawmills, one stud mill, a plywood plant and a plump. Although not entirely supported by TFL 30, the licensee's operations support about 2400 employees, constituting an important component of the local economy.

(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 and memo

The Minister expressed the economic and social objectives of the Crown for the province in two documents to the Chief Forester: a letter dated July 28, 1994 (attached as Appendix 3), and a memorandum dated February 26, 1996 (attached as Appendix 4). I understand both documents to apply to TFL 30. 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 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 good forest jobs. To this end he stated that the Chief Forester should 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.

To date, the use of alternative harvesting systems and commercial thinning have not been significant in this TFL. However, in areas that are subject to visual quality objectives, the use of these systems may be appropriate. 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. As noted earlier, under v*isually sensitive areas*, the existing visual quality management objectives for this area were assigned according to accepted standards and the base case projection is not overly restricted by them. I consider VQOs to be appropriately represented in the licensee's analysis.

I have thoroughly considered the social and economic objectives of the Crown as expressed by the Minister of Forests and have accounted for them in my determination. In particular, I have taken guidance from the Minister's letter with respect to establishing an appropriate distribution of harvest level reductions between the short and medium terms, in response to the risks to supply identified in this document and noted in the section on Harvest Flow. This is discussed further in "Reasons for Decision".

Local Objectives

As was noted above in several places, the Prince George LRMP process is currently underway. The process commenced in 1994 and is expected to be completed in January, 1997. As the process is not yet complete, it would be inappropriate for me to speculate on any implications this may have for timber supply in TFL 30. However, I recognize the importance of this local planning process and note that completion of the LRMP may influence management objectives for TFL 30. Any guidance related to management objectives from this process will be considered in future AAC determinations.

Existing Partitions

Within the term of Management Plan No. 7, a partition for the harvest of an average of 10 000 cubic metres per year in marginal forest types was put in place to ensure harvesting performance in these stands. Over the Management Plan term the licensee met the requirements of this partition and BCFS district staff are satisfied that the partition is no longer required. I accept their assessment and therefore have determined that this partition is no longer required and will not be continued for the term of Management Plan No. 8.

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

Non-recoverable losses

Based upon data collected by the licensee, the base case analysis included a net deduction of 3640 cubic metres per year to account for non-recoverable losses due to fire (1000 cubic metres), wind damage (1160 cubic metres) and insects (1480 cubic metres). Gross losses are significantly higher but the licensee has taken an aggressive salvage approach thereby minimizing the overall net loss. The licensee has indicated that in the past, approximately one quarter of the volume it has harvested has been damaged timber. At the last AAC determination, a requirement for non-recoverable loss monitoring by the BCFS was put in place by the Chief Forester. This monitoring was conducted and was reflected in the licensee's analysis.

I have carefully reviewed this information and accept that the best information available to assess this factor was used in the licensee's analysis. As such, I do not find it necessary to make further adjustments to the base case analysis in order to account for non-recoverable losses.

Spruce bark beetle infestation

Historical harvesting aimed at salvaging timber damaged by the bark beetle has created some large cutblocks in the central portion of this TFL. As was discussed above under *cutblock adjacency* , in order to best represent the contiguous nature and past management practice in this area, the beetle management zone was created. Approximately 56 percent of this zone, which covers about 25 percent of the timber harvesting land base, has stands aged less than 20 years.

In the licensee's analysis, a harvest of 250 hectares per year in the beetle management zone was modelled to represent the control, salvage and recovery of damaged timber. This management regime was accepted as appropriate by BCFS and MELP staff and is critical to the achievement of the base case harvest projection, as noted above, under *cutblock adjacency*. I agree that spruce bark beetle infestations are a significant risk to the future health of many stands in this area and I consider it reasonable to expect that salvage harvesting in this area will continue. I also note that requirements for the provision of biodiversity in this zone may need to be modified to allow for forest management activities designed to salvage damaged timber, minimize further damage and facilitate reforestation. District staff indicate that, wherever possible, the licensee is retaining trees other than spruce during the harvesting operations which are expected to contribute to biodiversity as wildlife trees or tree patches. Overall, the licensee will be subject to the biodiversity requirements of the Forest Practices Code.

Managing for biodiversity in disturbance-prone ecosystems such as in TFL 30 will be a challenge. Biodiversity objectives and management will need to account for the natural dynamics of the area, as suggested in the Code biodiversity guidebook. Management

objectives for insects and biodiversity clearly need to be considered together followed by monitoring the outcomes.

I expect that a landscape level biodiversity strategy will be prepared for this area following completion of the ongoing LRMP and any results of this strategy should be incorporated into the next analysis for TFL 30.

For the purposes of this decision, I am aware of the very high dependence of the short-term timber supply on the continued harvesting of 250 hectares per year in the beetle management zone as noted above under *cutblock adjacency*. If this harvest level is not fully met, it is reasonable to anticipate that changes in management in the rest of the TSA could compensate to some extent for the associated loss in supply. However, some risk remains, and this risk must be viewed in context of other risks to the projected harvest levels, as I have discussed in "Reasons for decision".

Reasons For Decision

In reaching my decision on an AAC for TFL 30, I have considered all of the factors presented above and have reasoned as follows.

The licensee's base case indicated an initial harvest level of 386 360 cubic metres per year for the first five years—about 5 percent below the current AAC of 407 000 cubic metres—followed by a 5-percent decline every 5 years for the next 35 years. After this, the base case remains stable at a level of 267 360 cubic metres for 65 years before rising about 28 percent to the long-term harvest level of 373 360 cubic metres. As noted above in *cutblock adjacency* and Spruce bark beetle infestation, this forecast is very dependent on a high level of access to the beetle management zone.

My considerations have identified information which influences the projected available timber supply either in an upward or downward direction from the licensee's base case harvest projection.

Factors indicating that the timber supply will be more restricted than projected in the base case are:

- indications that the inventory overestimates existing stand volumes;
- expected additional measures to account for biodiversity requirements under the Forest Practices Code;
- optimistic short-term harvest scheduling; and
- the possibility that continued harvesting at 250 hectares per year in the beetle management zone may not be achievable.

A recently completed inventory audit indicates a strong possibility that the mature volumes used in the licensee's analysis are overestimated, given that the findings showed a 16-percent overestimation for the operable area. In addition, historical billing information, the cruise-based

volumes identified in the 1996 forest development plan, and the localized Ek Payendeh curves used in the previous analysis, all indicate lower volumes than the inventory predicts. Although this additional documentation does not provide conclusive information about the actual volumes, it does support the likelihood that the licensee's analysis volumes are overestimated. The licensee's analysis indicated that short-term timber supply is highly sensitive to uncertainty regarding existing stand volumes. A sensitivity analysis shows that if existing stand yields are overestimated by 15 percent, the base case projection is immediately decreased by a minimum of 10 percent or as much as 20 percent depending upon how low the mid-term harvest level is permitted to drop. Given both the results of the audit and the supporting documentation, I consider it likely that the existing stand volumes used in the licensee's analysis are overestimated to some extent, which represents a significant downward risk to the base case harvest projection in the short term, and also has implications for the medium term, as discussed below.

Most of the timber harvesting land base in the licensee's analysis is lacking stand- or landscape-level biodiversity objectives. Based upon Forest Practices Code biodiversity requirements and drawing on experience gained elsewhere in the Prince George Forest Region, I find it reasonable to expect that there will be further reductions to timber supply to account for biodiversity. While the precise extent and magnitude of impacts resulting from the appropriate accounting of these requirements have not been rigourously analysed at this time, and while I expect that there will be overlaps with visual quality objectives, riparian areas, some deciduous forest types, wildlife requirements and other land base exclusions, I consider it reasonable to expect that provisions for meeting biodiversity requirements will restrict the short-term timber supply projected in the licensee's base case analysis by approximately two percent.

The ongoing LRMP process in the Prince George Forest District is expected to provide some direction regarding biodiversity objectives and therefore to reduce uncertainty regarding stand- and landscape-level requirements for the next determination. In the interim, I expect the licensee to meet the Code biodiversity planning requirements.

In the base case projection, spruce and spruce mixture, good sites were scheduled for harvest early in the projection and represent approximately 94 percent of the volume harvested in the first five year period and about 85 percent in the second. In light of operational requirements such as access and aggressive timber salvage activities which may not always be directed at good sites, I consider the harvest schedule rule used in the licensee's analysis leads to a short-term theoretical upper maximum in available volume. This potential short-term volume reduction is a small, unquantified risk to the base case harvest projection.

As noted in *cutblock adjacency*, sensitivity analysis shows that if the harvesting of 250 hectares per year is not achieved in the beetle management zone, the short-term timber supply is substantially restricted, potentially by as much as 32 percent below the base case. Even though it may be possible to partially compensate this potential restriction by changes to the management regime in the remainder of the TFL, the significance of the remaining risk, and its influence on the determination, must be evaluated in context of all the other risks identified above.

Factors that offset some of these restrictions on the base case timber supply projection are:

- the potential for site productivity to be higher than assumed in the licensee's analysis; and
- improved utilization and the possible inclusion of deciduous forest types.

As I discussed above in *site productivity,* the likelihood that managed stands will provide more volume than was estimated in the licensee's analysis and potentially reach green-up and merchantable condition earlier places additional upward pressures on the base case harvest forecast. I expect that empirical studies such as paired-plot analysis may provide better evidence than is currently available. There is a reasonably high probability that site productivity is higher than estimated for the licensee's analysis, but the magnitude of the difference and consequent volume, green-up age and minimum harvestable age effects are unknown and unproven. For now, I consider site productivity to represent an upward pressure on the base case harvest projection in the mid to long-term, although I also acknowledge that a minority of the area subject to potential gains could be counteracted by the effects of spruce weevil damage.

As discussed earlier, there may be opportunities for improved utilization of coniferous species other than pine. A sensitivity analysis indicates that utilization of all coniferous species to a 12.5 centimetre diameter at breast height would increase mid to long-term supplies slightly. In addition, the utilization of deciduous stands could also result in improved timber availability by 12 percent in the mid-term and 6 percent in the long-term. While I recognize that there is no indication that these opportunities may be taken, I recognize their potential to offset future downward risks.

In determining an AAC for TFL 30, I note that there is some flexibility in the short- to mid-term to manage the rate of inter-decadal decline in harvest levels, and the level of the mid-term harvest. This is particularly important in view of the fact that both of these offsetting factors will augment the timber supply in the mid and long terms. I have considered the social and economic objectives of the Crown as expressed by the Minister of Forests which suggest that the AAC should not be decreased more than is necessary to avoid compromising long-run sustainability. However, given the combination of risks associated with the factors discussed above, and particularly considering the sensitivity analysis regarding existing stand volumes, it is my judgement that the licensee's proposed harvest level at just five percent below the current AAC would introduce an unacceptable risk to future timber supplies.

If the full impact of all the risks and factors identified above were applied to the short term harvest level, a large reduction would be required. However, while some of this risk must be accepted immediately, in view of the flexibility in harvest flow, as noted above, it is possible to defer some of the risk to the mid term, where there is also potential for improved utilization and higher site productivity to offset some of the impact.

Taking this flexibility into account, 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, that ensures longer-term integrated resource management objectives can be met, that meets provincial objectives and accounts appropriately

for risks to supply in both the short and medium terms while avoiding disruptive shortfalls in future timber supply, can best be achieved in this TFL at this time by establishing an overall AAC at 350 000 cubic metres per year.

Determination

The new AAC for TFL 30 will be 350 000 cubic metres per year. This AAC comes into effect on October 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 determination and in preparation for the next AAC determination, I expect:

1. the licensee to investigate the source of the indicated discrepancy between the estimates of existing mature volumes used in the analysis and the findings of the inventory audit and other documentation, and to resolve and correct this discrepancy in the timber supply analysis for the next AAC determination;
2. the licensee to identify the scope and intensity of susceptibility to spruce leader weevil on the TFL and to develop a strategy for managing the areas at risk, so that the potential impact of damage due to the spruce terminal weevil can be better assessed at the next determination;
3. the licensee to comply with the Code biodiversity planning requirements so that this information will be available for the next determination.

Larry Pedersen
Chief Forester

September 24, 1996

Appendix 1: Section 7 of the *Forest Act*

Section 7 of the *Forest Act* 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.

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

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

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to

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

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