

**BRITISH COLUMBIA
MINISTRY OF FORESTS, LANDS AND
NATURAL RESOURCE OPERATIONS**

Bulkley Timber Supply Area

**Rationale for
Allowable Annual Cut (AAC)
Determination**

Effective January 29, 2014

**Dave Peterson, RPF
Chief Forester**

Table of Contents

Objective of this document.....1

Acknowledgement.....1

Statutory framework.....1

Description of the Bulkley TSA.....1

History of the AAC.....2

New AAC determination.....2

Information sources used in the AAC determination.....3

Role and limitations of the technical information used.....4

Guiding principles for AAC determinations.....5

The role of the base case.....7

Base case for the Bulkley TSA.....8

 - original base case.....8

 - volume estimates for existing natural stands.....9

 - volume estimates for managed stands.....9

 - revised base case.....10

Consideration of factors as required by Section 8 (8) of the *Forest Act*.....11

 Land base contributing to timber harvesting.....12

 - general comments.....12

 - private land.....13

 - non-forest areas.....13

 - unstable terrain and sites with regeneration issues.....14

 - operability.....14

 Forest inventory and growth.....15

 - vegetation resources inventory.....15

 - site productivity estimates.....16

 - minimum harvestable ages.....16

 - volume estimates for existing stands.....16

 - log grades.....17

 - volume estimates for regenerating stands.....17

 - operational adjustment factors.....18

 - genetic worth.....18

 Forest establishment.....20

 - regeneration delay.....20

 - not satisfactorily restocked (NSR).....20

 Integrated resource management objectives.....21

 - general comments.....21

 - cultural heritage resources.....21

 - community watersheds.....22

 - fisheries sensitive watersheds.....22

 - patch size distribution.....23

 - rare and endangered plant communities.....23

 - recreation.....24

 - riparian management.....25

 - landscape level biodiversity.....25

 - core ecosystems and landscape corridors.....26

 - wildlife habitat.....27

 caribou.....27

 mountain goat.....27

 other species.....27

 - wildlife tree retention.....28

 Other information.....29

 - harvest performance.....29

- First Nations consultation	30
- First Nations use of wildlife	31
Alternative rates of harvesting	32
- harvest sequencing	32
Economic and social objectives	33
- Minister’s letters	33
- other public input	33
- employment and community dependence	34
Unsalvaged losses	34
- unsalvaged losses - general	34
- dothistroma needle blight	36
- mountain pine beetle	36
Reasons for Decision	38
Implementation	39
Appendix 1: Section 8 of the <i>Forest Act</i>	41
Appendix 2: Section 4 of the <i>Ministry of Forests and Range Act</i>	44
Appendix 3: Minister’s letter of July 4, 2006	45
Appendix 4: Minister’s letter of October 27, 2010	47

List of Tables

Table 1. Current apportionment of the Bulkley TSA allowable annual cut	2
Table 2. Section 8 of the Forest Act: factors accepted as modelled in the base case	12

Objective of this document

This document provides an accounting of the factors I have considered and the rationale I have employed in making my determination, under Section 8 of the *Forest Act*, of the allowable annual cut (AAC) for the Bulkley Timber Supply Area (TSA). This document also identifies where new or better information is needed for incorporation in future determinations.

Acknowledgement

For preparation of the information I have considered in this determination, I am indebted to staff of the BC Ministry of Forests, Lands and Natural Resource Operations (FLNR) in the Skeena Region, and the Forest Analysis and Inventory Branch (FAIB). I am also grateful to local residents, First Nations, and stakeholders who contributed to this process.

Statutory framework

Section 8 of the *Forest Act* requires the chief forester to consider a number of specified factors in determining AACs for TSAs and TFLs. Section 8 of the *Forest Act* is reproduced in full as Appendix 1 of this document.

Description of the Bulkley TSA

The Bulkley TSA is located in north-western BC and covers 762 734 hectares. It is bounded by the Hazelton Mountains to the west, the Telkwa River watershed to the south, the Babine Mountains to the east, and extends north to the headwaters of the Nilkitkwa River. With its location between interior and coastal climates, the Bulkley TSA includes diverse ecological features.

The diverse ecology of the Bulkley TSA provides habitat for a wide variety of wildlife including: mule and white-tail deer, moose, northern goshawk, coastal tailed-frog, wolverines and little brown myotis. In addition, there are numerous fish species, e.g. coho, sockeye, pink and chinook salmon and rainbow and steelhead trout.

Within the area legally, physically and economically available for timber harvesting – referred to as the timber harvesting land base (THLB) - the dominant tree species are subalpine fir (balsam) (47 percent), spruce (25 percent), and lodgepole pine (23 percent). Hemlock (4 percent) occurs in areas of coastal influence and at high elevations. The stand age class distribution is such that natural stands are mostly older than 100 years with a significant number older than 200 years, and managed stands are less than 45 years. Few stands are between the ages of 45 years and 100 years. After excluding areas due to environmental, economic and operability concerns, 283 510 hectares are available for timber harvesting.

The four main communities in the Bulkley TSA are Smithers, Telkwa, Moricetown, and Fort Babine. Of these communities, Smithers, with a population of about 5350 (2011 BC Stats) is the largest.

First Nations whose traditional territories overlap the Bulkley TSA include: Gitksan Hereditary Chiefs; Kitselas First Nation; Lake Babine Nation; Moricetown Band; Office of Wet'suwet'en (OWET); Skin Tyee Band; and Wet'suwet'en First Nation (formerly the Broman Lake Band).

The Bulkley TSA is administered out of the FLNR, Skeena Stikine Natural Resource District office located in Smithers. This district is part of the FLNR Skeena Region, North Area.

History of the AAC

The AAC for the Bulkley TSA was maintained at 895 000 cubic metres from 1983 until 1995. July 1, 1995 the AAC was set at 895 000 cubic metres, including a 367 000-cubic metre partition for marginal sawlog/pulpwood stands. In January 2002, the AAC was reduced to 882 000 cubic metres, including a 362 000 cubic metre partition for marginal sawlog/pulpwood stands. On August 30, 2005 the AAC determination was postponed until November 26, 2009. On August 9, 2007 a second postponement order replaced the previous order. This order postponed the AAC determination until November 26, 2011, thereby lengthening the postponement period from eight years to 11 years. In 2008, the AAC for the Bulkley TSA was reduced by 30 000 cubic metres due to issuance of the Wetzink'wa Community Forest Agreement (CFA). Consequently, the AAC for the Bulkley TSA in effect at the time of this determination was 852 000 cubic metres.

The AAC in the Bulkley TSA is apportioned by the Minister of Forests, Lands and Natural Resource Operations as shown below in Table 1.

Table 1. Current apportionment of the Bulkley TSA allowable annual cut

	Total		Partition			
	m ³	%	conventiona l m ³	%	marginal saw/ pulpwood m ³	%
Forest Licences (Replaceable)	409 39 3	46.4 2	332 49 5	63.4 6	76 898	21.5
Forest Licences (Non-Replaceable)	220 93 7	25.0 5	28 750	5.49	192 18 7	53.7
BCTS Timber Sales	208 97 6	23.6 9	126 77 2	24.1 9	82 204	23.0
Wetzink'wa CFA	30 000	3.40	24 300	4.64	5 700	1.60
Woodlots	10 194	1.16	10 194	1.95		
Forest Service Reserve	2 500	0.28	1 450	0.28	1 050	0.29
Total	882 000 ^a	100.0	523 961	100. 0	358 03 9	100. 0

^(a) Effective AAC for the Bulkley TSA is 852 000 cubic metres.

New AAC determination

Effective January 29, 2014 the new AAC for the Bulkley TSA is 852 000 cubic metres of which a maximum of 502 700 cubic metres are attributable to sawlog stands. Sawlog stands are all stands other than marginal sawlog or pulpwood stands.

Marginal sawlog stands are defined as those that meet all of the criteria in one of the following two categories:

1. Balsam-leading stands with greater than 80 percent subalpine fir or balsam-leading stands with second species other than hemlock, western redcedar or yellow cedar that have an average total tree height less than 24 metres and a net type volume comprised of more than 60 percent subalpine fir.
2. Geographically isolated stands at the northern edge of the Bulkley TSA identified as planning cell "C7" in the forest cover inventory.

Pulpwood stands are defined as those that meet all of the criteria in one of the following three categories:

1. Hemlock-leading stands or balsam-leading stands with second species of hemlock, western redcedar or yellow cedar having net type volumes comprised of greater than 50 percent hemlock and less than 20 percent spruce.
2. Balsam-leading stands with greater than 80 percent subalpine fir or balsam-leading stands with second species other than hemlock, western redcedar or yellow cedar having net type volumes comprised of greater than 50 percent amabilis fir and less than 20 percent spruce.
3. All types having net type volumes comprised of more than 50 percent amabilis fir and hemlock combined and less than 20 percent spruce.

This AAC will remain in effect until a new AAC is determined, which must take place within 10 years of this determination.

Information sources used in the AAC determination

- *Forest and Range Practices Act – Regulations and amendments*, current to December 31, 2013;
- *Forest Act*, current to December 31, 2013;
- *Ministry of Forests and Range Act*, current to December 31, 2013;
- *Forest Practices Code of British Columbia Act* and amendments, current to December 31, 2013, and regulations and guidebooks;
- *Heritage Conservation Act* current to December 31, 2013;
- *Provincial Logging Residue and Waste Management Procedures Manual* as specified in the *Forest Act* current to July 15, 2011;
- *Bulkley Land and Resource Management Plan*, April 21, 1998;
- *Bulkley Resource Management Zone Higher-Level Plan Order*, 2000;
- *Bulkley Valley Sustainable Resource Management Plan*, 2005;
- *Bulkley LRMP Land and Resource Management Plan - Objectives Set by Government*, 2006;
- Letter from the Minister of Forests and Range to the Chief Forester stating the economic and social objectives of the Crown, July 4, 2006;
- Letter from the Minister of Forests and Range to the Chief Forester stating the economic and social objectives of the Crown regarding mid-term timber supply in areas affected by the Mountain Pine Beetle, October 27, 2010;
- *Procedures for Factoring Visual Resources into Timber Supply Analysis*, BC Ministry of Forests, 1998;

- Forest Service Bulletin - *Modelling Visuals in Timber Supply Review III*, BC Ministry of Forests and Range, December 2003;
- *Summary of dead potential volume estimates for management units within the Northern and Southern Interior Forest Regions*, BC Ministry of Forests and Range, Forest Analysis and Inventory Branch, 2006;
- *Bulkley Timber Supply Area Timber Supply Review Data Package* (updated), BC Ministry of Forests, Lands and Natural Resource Operations, Forest Analysis and Inventory Branch, 2012;
- *Chief Forester's Standards for Seed Use*, BC Ministry of Forests, Lands and Natural Resource Operations, 2010;
- *Beyond the Beetle: A Mid-Term Timber Supply Action Plan*, BC Ministry of Forests, Lands and Natural Resource Operations, 2012;
- Bulkley TSA – *Documentation of analysis for vegetation resource inventory statistical adjustment*, BC Ministry of Forests and Range, Forest Analysis and Inventory Branch, Churlish, G. and Jahraus, K. 2010 (unpublished report);
- *Bulkley Timber Supply Area OAF1 analysis*, Forest Renewal BC report #720711, Land and McCulloch Forest Management Services Ltd. 2002;
- *OAF1 data acquisition for the Lakes, Morice and Bulkley Timber Supply Areas, Morice-Lakes Innovative Forest Practices Agreement* report No. 322.01, Lang and McCulloch Forest Management Services Ltd., 2003;
- *Multiple-pass harvesting and spatial constraints: an old technique applied to a new problem. For. Sci. 39(1):137-151, Nelson, J.D. and Errico, D., 1993;*
- *Provincial-level projection of the current mountain pine beetle outbreak: update of the infestation projection based on the provincial aerial overview surveys of forest health conducted from 1999 through 2011 and the BCMPB model (year 9)*, BC Ministry of Forests, Lands and Natural Resource Operations, Walton, A. 2012; and
- Technical review and evaluation of current and expected operating conditions and consideration of information received from First Nations and the public at the AAC determination meeting held with BC Ministry of Forests, Lands and Natural Resource Operations staff in Smithers, B.C. on March 12 and 13, 2013.

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires the chief forester, in determining AACs, to consider biophysical, social and economic information. Most of the technical information used in determinations is in the form of a timber supply analysis and its inputs of inventory and growth and yield data. These are concerned primarily with biophysical factors – such as the rate of timber growth and the definition of the land base considered available for timber harvesting – and with management practices.

The analytical techniques used to assess timber supply necessarily are simplifications of the real world. Many of the factors used as inputs to timber supply analysis are uncertain, due in part to variation in physical, biological and social conditions. Ongoing scientific studies of ecological dynamics will help reduce some of this uncertainty.

Furthermore, computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Technical information and analysis; therefore, do not necessarily provide the complete answers or solutions to forest management decisions such as AAC determinations. Such information does 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 determining this AAC for the Bulkley TSA, I have considered known limitations of the technical information provided. I am satisfied that the information provides a suitable basis for my determination.

Guiding principles for AAC determinations

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining the AACs for timber supply areas and tree farm licences. Section 8 is reproduced in full as Appendix 1. In addition to the chief forester, Section 23 (3) of the *Interpretation Act* expressly authorizes the deputy chief forester to carry out the functions of the chief forester, including those required under Section 8 of the *Forest Act*.

Given the large number of periodic AAC determinations required for British Columbia's many forest management units, administrative fairness requires a reasonable degree of consistency of approach in addressing relevant factors associated with AAC determinations. In order to make our approach in these matters explicit, we, the chief forester and deputy chief foresters, jointly established the following body of guiding principles. However, in any specific circumstance in a determination where we consider it necessary to deviate from these principles, we will explain our reasoning in detail.

When considering the factors required under Section 8, we are also mindful of our obligation as stewards of the forests of British Columbia, of the mandate of the Ministry of Forests, Lands and Natural Resource Operations as set out in Section 4 of the *Ministry of Forests and Range Act*, and of our responsibilities under the *Forest Act* and *Forest and Range Practices Act (FRPA)*.

Integrated Decision Making

One of the key objectives of the Ministry of Forests, Lands and Natural Resource Operations is to take an integrated approach to all resource management decisions that considers all resource values. In considering the factors outlined in Section 8 of the *Forest Act*, we will continue to consider all available information on timber and non-timber resources in the management unit, and all available information on the interactions of the management of those resources on timber supply.

Information Uncertainty

Given the complex and dynamic nature of forest ecosystems, coupled with changes in resource use patterns and social priorities, there is always a degree of uncertainty in the information used in AAC determinations.

Two important ways of dealing with this uncertainty are:

- (i) managing risks by evaluating the significance of specific uncertainties associated with the current information and assessing the various potential current and future, social, economic and environmental risks associated with a range of possible AACs; and
- (ii) re-determining AACs frequently, in cases where projections of short-term timber supply are not stable, to ensure they incorporate current information and knowledge.

In considering the various factors that Section 8 of the *Forest Act* requires the chief forester to take into account in determining AACs, it is important to reflect those factors, as closely as possible, that are a reasonable extrapolation of current practices. It is not appropriate to base decisions on proposed or potential practices that could affect the timber supply but are not substantiated by demonstrated performance or are beyond current legal requirements.

In many areas, the timber supply implications of some legislative provisions remain uncertain, particularly when considered in combination with other factors. In each AAC determination, this uncertainty is taken into account to the extent possible in the context of the best available information.

It is not appropriate to speculate on timber supply impacts that may eventually result from land-use decisions not yet finalized by government. However, where specific protected areas, conservancies, or similar areas have been designated by legislation or by order in council, these areas are deducted from the timber harvesting land base and are not considered to contribute any harvestable volume to the timber supply in AAC determinations, although they may contribute indirectly by providing forest cover to help in meeting resource management objectives such as for biodiversity.

In some cases, even when government has made a formal land-use decision, it is not necessarily possible to fully analyse and account for the consequent timber supply impacts in a current AAC determination. Many government land-use decisions must be followed by detailed implementation decisions requiring, for instance, further detailed planning or legal designations such as those provided for under the *Land Act* and FRPA. In cases where there is a clear intent by government to implement these decisions that have not yet been finalized, we will consider information that is relevant to the decision in a manner that is appropriate to the circumstance. The requirement for regular AAC reviews will ensure that future determinations address ongoing plan implementation decisions.

Where appropriate, information will be considered regarding the types and extent of planned and implemented silviculture practices as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of their timber supply effects.

We acknowledge that alternate strategies for dealing with information uncertainty are to delay AAC determinations or to generally reduce AAC's in the interest of caution.

Given that there will always be uncertainty in information and due to the significant 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 a determination, allowances may need to be made to address risks that arise because of uncertainty by applying judgement to the available information. Where appropriate, the social and economic interests of the Crown, as articulated by the Minister of Forests, Lands and Natural Resource Operations, can assist in evaluating this uncertainty.

Climate Change

One key area of uncertainty relates to climate change. While some controversy appears to remain on the causes of climate change, there is substantial scientific agreement that climate is changing, that the changes will affect forest ecosystems, and that forest management practices will need to be adapted. Nevertheless, the potential rate, amount, and specific characteristics of climate change in different parts of the province are uncertain. As research provides more definitive information on climate change, we will consider the findings in AAC determinations. Where forest practices are implemented to mitigate or adapt to the potential effects of climate change on forest resources, we will consider related information in our determinations.

In addition, vulnerability assessments can provide information on the potential risks associated with climate change, and could be useful in defining how to consider climate change in different AAC determinations. Such assessments could also highlight key topics in need of research that could improve climate change considerations for future determinations.

We note, however, that even with better information on climate change there will be a range of reasonable management responses. Considerations of how to respond in anticipation of uncertain, potential future impacts and risks differ from those related to responding to known or ongoing processes such as the recent mountain pine beetle infestation. For example, it is not clear if either increases or decreases to current harvest levels would be appropriate in addressing potential future increases in natural disturbance due to climate change. Conversely, the present forest conditions resulting from the mountain pine beetle infestation provide a clearer circumstance to which to respond.

To some extent, decisions on the preferred management responses to potential future risks, including potential changes to allowable timber harvests, are appropriately informed by broad discussion among interested parties. We will monitor such discussions and consider them insofar as they are relevant to AAC determinations. In general, the requirement for regular AAC reviews will allow for the incorporation of new information on climate change and its effects on forests and timber supply as it emerges.

First Nations

The Crown has a legal obligation to consult with First Nations regarding their asserted rights and title (aboriginal interests) in a manner proportional to the strength of their aboriginal interests and the degree to which the decision may impact these interests. In this regard, full consideration will be given to:

- (i) the information provided to First Nations to explain the timber supply review (TSR) process;
- (ii) any information brought forward respecting First Nations' aboriginal interests, including how these interests may be impacted; and
- (iii) any operational plans and/or other information that describe how First Nations' interests are addressed through specific actions and forest practices.

Aboriginal interests that may be impacted by AAC decisions will be addressed consistent with the scope of authority granted to the chief forester under Section 8 of the *Forest Act*. When information is brought forward that is outside of the Chief Forester's jurisdiction, this information will be forwarded to the appropriate decision makers for their consideration. Specific considerations identified by First Nations in relation to their aboriginal interests and the AAC determination are addressed in the various sections of this rationale.

AAC determinations should not be construed as limiting the Crown's obligations under court decisions in any way, and in this respect it should be noted that the determinations do not prescribe a particular plan of harvesting activity within the management units. They are also independent of any decisions by the Minister of Forests, Lands and Natural Resource Operations with respect to subsequent allocation of wood supply.

The role of the base case

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

For most AAC determinations, a timber supply analysis is carried out using a data package including data and information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model, a series of timber supply forecasts can be produced to reflect different starting harvest levels, rates of decline or increase, and potential trade-offs between short- and long-term harvest levels.

From a range of possible forecasts, one is chosen in which an attempt is made to avoid both 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. The base case is designed to reflect current management practices.

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 forecast of timber supply, whose validity – as with all the other forecasts provided – depends on the validity of the data and assumptions incorporated into the computer model 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 resulting predictions of timber supply must be adjusted to reflect more appropriately the current and foreseeable situation.

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

Thus, in reviewing the considerations that lead to the AAC determination, it is important to remember that the AAC determination itself is not simply a calculation. Even though the timber supply analysis I am provided is integral to those considerations, the AAC determination is a synthesis of judgment 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. Judgments that in part may be based on uncertain information are essentially qualitative in nature and, as such, are subject to an element of risk. Consequently, once an AAC has been determined, no additional precision or validation would be gained by attempting a computer analysis of the combined considerations.

Base case for the Bulkley TSA

- original base case

The base case proposed in the *Bulkley TSA Timber Supply Analysis Public Discussion Paper* (November 2012), indicates that starting in 2009, an initial harvest level of 802 470 cubic metres per year, which is about six percent lower than the current AAC of 852 000 cubic metres, can be maintained for one decade. Thereafter, the harvest level decreases by six percent to 752 400 cubic metres per year. After 11 decades, the harvest level increases by 17 percent to the long-term level of 881 290 cubic metres per year.

The initial harvest level in the proposed base case, referred to as the *original base case* in this document, is lower than the 2002 AAC because of a 12 percent decrease in the THLB due to the

issuance of the Wetzink'wa Community Forest Agreement and a five percent decrease in the THLB, due primarily to differences in area reductions for sensitive soils and operability.

The 2002 AAC included a 362 000-cubic metre partition for marginal sawlog and pulpwood stands. These stands occupy 41 percent of the THLB. Assuming that the contribution of these stands to the base case harvest levels is proportional, the initial harvest level attributable to marginal sawlog and pulpwood stands is 329 013 cubic metres per year.

During my review of the original base case, I identified three important areas of uncertainty associated with the volume estimates for existing natural, and managed stands. These uncertainties, which are associated with the adjustment of existing natural stand volume estimates using vegetation resources inventory information and the stem densities and operational adjustment factors used to produce managed stand volume estimates, are discussed in greater detail below.

- volume estimates for existing natural stands

The volumes for existing natural stands used in the original base case were generated using the ministry's Variable Density Yield Prediction (VDYP) model version 7 and Vegetation Resources Inventory (VRI) phase I information for the Bulkley TSA. Stand attributes from VRI phase I are estimated using aerial photography. In VRI phase II, ground samples are used to improve the phase I estimates. Due to logistical and cost limitations, only a subset of the forest stands in a TSA are sampled and these samples are used to calculate statistical adjustments to apply to the phase I attributes.

In the Bulkley TSA, VRI phase II adjustments suggest that overall stand volumes are nearly 29 percent higher than inventory volumes and over 50 percent higher for immature and mature stands in the Englemann-spruce/sub-alpine fir (ESSF) biogeoclimatic zone alone. Owing to the magnitude of these adjustments, FAIB staff initiated a review of the methodology used in deriving them. At the time the base case was prepared, the results of the review were not available. Consequently, the original base case used existing stand yield tables based on the unadjusted VRI phase I attributes.

The review identified errors in specific phase I stand attributes in all stands, but particularly in the immature and mature stands in the ESSF biogeoclimatic zone. FAIB staff advised me that application of phase II adjustments is usually appropriate because the phase II ground samples are considered to be reliable. However, due to the large uncertainty associated with the adjustments for the ESSF immature and mature stands, they recommended not applying these particular adjustments. Application of the phase II adjustments to all stands, except the ESSF immature and mature stands, resulted in existing stand volumes that are 12 percent higher than the inventory volume.

During public consultation, a community group asked why the VRI phase II adjustments were not used in the original base case. The response is provided above.

Based on my review of the VRI phase I and phase II adjustments and the advice of ministry experts, I conclude that the existing natural stand yields used in the original base case should have incorporated the phase II adjustments for all stands except the ESSF immature and mature.

- volume estimates for managed stands

The volumes for managed stands (stands less than 45 years of age) used in the original base case were generated using the ministry's Table Interpolation of Planted Stand Yields (TIPSY) model version 4.2. Following initial harvest in the model, all stands were assumed to regenerate to sawlog quality stands. In the original base case, yield tables for the planted components of managed stands were based on the target density of planted stems plus naturally-established stems

(natural ingress). This stand density was then decreased by 20 percent to account for smaller trees that do not compete significantly with the other trees.

Stakeholder input was received regarding how much data is available to support the assumption that all marginal stands will convert to high value sawlog stands following harvest. In response, I note that in the base case, after harvest, openings are categorized as “sawlog” because there is an expectation that reforestation of these openings will be done according to provincial stocking standards. Since second-growth stands will be harvested at younger ages than natural old-growth stands, it is anticipated that second-growth stands will produce sawlog quality timber. This is supported by provincial studies of second-growth stands. On this basis, I accept the stand conversion assumptions used in the base case.

District staff and the regional forest pathologist indicated that the top trees in a managed stand are generally planted trees. As TIPSY yield tables are based primarily on the top 100 stems per hectare, staff recommended that the unreduced target density should be used to generate the TIPSY yield tables. For stands with a target density of 1200 stems per hectare, the regional pathologist further recommended reducing the target density to 1100 stems per hectare to better reflect the results of stand development monitoring that indicate lower than expected free-growing stand densities.

Operational adjustment factors (OAF) are applied to TIPSY generated stand yields in order to account for less than ideal stand conditions. Generally a standard OAF 1 value of 15 percent is used to account for less than ideal tree distribution, small non-productive areas, endemic pests and disease, and random risk factors such as wind throw. For the Bulkley TSA, a study entitled *OAF 1 Sampling in the Bulkley, Lakes and Morice Forest Districts* (2003) recommended reduced OAF 1 values for the Bulkley TSA. Therefore, in the original base case an OAF 1 value of five percent was applied to about 80 percent of stands on the THLB.

In a subsequent review of the OAF study in 2013, FAIB staff concluded that the approach used to assess how much of OAF 1 is due to stocking gaps was acceptable and that a modest reduction to the standard OAF 1 of 15 percent was likely appropriate. However, FAIB staff identified considerable uncertainty around the other OAF 1 components, including: non-commercial competition, endemic forest health losses and random risk factors, and on this basis concluded that the five-percent OAF 1 used in the original base case is likely too low.

I agree with district staff and the regional pathologist that the stand density information used to estimate the managed stand yields for the original base case may be too high.

With regard to the OAF 1 value used in generating managed stand yields, I accept the expert opinion of FAIB staff that the OAF 1 value is likely higher than the five percent used in the original base case. In the absence of information to address the uncertainty associated with non-commercial competition, endemic forest health losses and random risk factor components of OAF 1, I conclude that the provincial standard OAF 1 value of 15 percent should have been used in the original base case. A new program to monitor young stand growth for comparison with TIPSY projections has been initiated in the province, and I look forward to seeing the results incorporated in future timber supply reviews.

- revised base case

In order to reduce the level of uncertainty associated with the original base case (due to the factors discussed above), I requested that a revised base case be prepared in which: VRI phase II adjustments are applied to all existing natural stands with the exception of the ESSF immature and mature stands; managed stand density is reduced and the OAF 1 is increased to the provincial standard of 15 percent.

In the revised base case, which starts in 2009, an initial harvest level of 849 000 cubic metres per year can be maintained for one decade. Thereafter, the harvest level decreases in one step to 813 480 cubic metres per year and this level is maintained for the remainder of the forecast period.

The initial harvest level in the revised base case is almost six percent higher than in the original base case. After the first decade, the revised base case harvest level is eight percent higher than the original base case mid-term harvest level and eight percent lower than the original base case long term harvest level.

I have also reviewed the total growing stock, age class distribution, the harvest contributions from managed and unmanaged stands, the average volume per hectare and average age of harvested stands and the total annual harvest area. Except for the three areas of uncertainty discussed above, the assumptions and information used in the original and revised base case are the same.

Based on my review I am satisfied, subject to the qualifications accounted for in various sections of this document, that the information presented to me provides a suitable basis from which I can assess the timber supply for the Bulkley TSA. For the purposes of this determination, I conclude that the uncertainty associated with the revised base case is lower than in the original base case and provides a better reflection of the best available information. On this basis, for the purposes of this determination, I have decided to use the revised base case as “the base case” or reference forecast. Therefore, for the remainder of this determination and throughout the remainder of this document, I will be referring to the revised base case as the “base case” except in those instances where it is necessary to distinguish between the two forecasts.

In addition to the base case, I was provided with alternative harvest flows, a number of sensitivity analyses carried out using the original base case as a reference, and supplemental analysis work. This and other information noted below have been helpful in the considerations and reasoning leading to my determination.

Consideration of factors as required by Section 8 (8) of the *Forest Act*

I have reviewed the information for all of the factors required for consideration under Section 8 of the *Forest Act*. Where I have concluded that the modelling of a factor in the base case appropriately represents current management or the best available information, and uncertainties about the factor have little influence on the timber supply projected in the base case, no discussion is included in this rationale. These factors are listed in Table 2.

For other factors with uncertainty or where input was received from the public or First Nations, this rationale incorporates an explanation of how I considered the essential issues raised and the reasoning leading to my conclusions.

Table 2. Section 8 of the Forest Act: factors accepted as modelled in the base case

Forest Act section and description	Factors accepted as modelled
8(8)(a)(i) Composition of the forest and expected rate of growth - land base contributing to timber harvesting	<ul style="list-style-type: none"> • Crown ownerships and area-based tenures not contributing to TSA timber supply • low site productivity • non-merchantable forest types • future roads, trails and landings
8(8)(a)(i) Composition of the forest and expected rate of growth – Forest Inventory and growth	-
8(8)(a)(ii) Expected time for the forest to be re-established following denudation	-
8(8)(a)(iii) Silvicultural treatments to be applied	<ul style="list-style-type: none"> • silvicultural systems
8(8)(a)(iv) Standard of timber utilization and allowance for decay, waste, and breakage	<ul style="list-style-type: none"> • utilization standards and compliance • decay, waste and breakage
8(8)(a)(v) Constraints on the amount of timber produced by use of the area for other purposes	<ul style="list-style-type: none"> • scenic resources • special management zones • wildlife habitat – grizzly bear
8(8)(a)(vi) Other information that, in the chief forester’s opinion, relates to the capability of the area to produce timber	<ul style="list-style-type: none"> • marginally economic fibre
8(8)(b) Short and long-term implications of alternative rates of timber harvesting from the area	<ul style="list-style-type: none"> • alternative harvest flows
8(8)(d) Economic and social objectives of the government	<ul style="list-style-type: none"> • economic and social objectives of the government
8(8)(e) Abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area	

Section 8 (8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

- (a) the rate of timber production that may be sustained on the area, taking into account**
 - (i) the composition of the forest and its expected rate of growth on the area**

Land base contributing to timber harvesting

- general comments

The total area of the Bulkley TSA reported in the public discussion paper is 762 734 hectares, of which 500 034 hectares are classified as Crown forest land base.

As part of the process used to define the timber harvesting land base (THLB) – the area that is both legally available and suitable for timber production - a series of deductions was made from the productive Crown forest land base (CFLB). These deductions account for economic or

ecological factors that operate to reduce the forest area available for harvesting. In reviewing these deductions, I am aware that some areas may have more than one classification. To ensure accuracy in defining the THLB, care must be taken to avoid any potential double-counting associated with overlapping objectives. Hence, a specific deduction for a given factor reported in this AAC rationale does not necessarily reflect the total area with that classification: some portion of it may have been deducted earlier under another classification.

For the Bulkley TSA, I acknowledge that the approach used in this timber supply analysis to determine the area available for timber harvesting resulted in a current THLB of 283 510 hectares and a long-term THLB of 274 970 hectares. The current THLB is 17 percent smaller than in the 2001 base case due to a variety of factors. These include the establishment of the Wetzink'wa Community Forest, which accounts for 12 percent of the decrease and the area reductions for sensitive soils and operability, which account for most of the remaining 5 percent decrease.

Based on my review of the information and discussions with staff, I accept that all of the land base assumptions used in the base case appropriately reflect current management and represent the best available information. All of the land base factors considered, with the exception of the three factors discussed below, are listed in Table 2.

- private land

In the base case, 53 308 hectares of private land were excluded from the CFLB.

A member of the public submitted: "...*TSR (or some other process) should show the current contribution of private and non-THLB lands effects on biodiversity in the Bulkley Landscape Unit.*" In response, district staff noted that the Bulkley Valley SRMP states that biodiversity objectives can be legally imposed only on Crown lands, although the SRMP does encourage their application wherever possible.

In addition to the response from the district, I note that the legal objectives set out in the *Forest and Range Practices Act (FRPA)* specify that only Crown land or private land that is subject to a tree farm licence, community forest agreement or a woodlot licence can contribute to meeting forest cover requirements. As to a review of the contribution of private and non-THLB lands effects on biodiversity, I note that such a review is beyond the scope of a timber supply review.

Other members of the public questioned whether I would account for future pipelines or right-of-ways in this AAC determination. In keeping with my guiding principles, I account for all land base conditions as they exist at the time of this determination and do not speculate on future land base changes. Any land base changes that occur following this determination will be accounted for in the next AAC determination.

I conclude that the base case appropriately accounts for private land, pipe lines and right-of-ways.

- non-forest areas

In the base case, any areas of non-forest, including existing roads, are not considered suitable for timber production and are excluded from both the CFLB and the THLB. For this reason, these areas do not contribute to timber supply or wildlife habitat/biodiversity objectives.

A number of comments were received from licensees and a member of the public suggesting that the amount of non-productive area excluded from the THLB to account for existing roads is too high. They maintain that this is due to the decrease in productive forest loss due to roadside harvesting instead of conventional in-block harvesting, winter instead of summer logging and the

burning and replanting of roadside waste piles. One licensee recommended the use of lower buffer widths for some trails.

In response, district staff acknowledged that the loss of productive forest land to road development in the TSA is very low. However, they maintain that the buffers used in the base case are based on actual ortho-photo measurements of visibly non-regenerated road widths. With regard to trail buffers, staff noted that the area associated with trails is very small; therefore, it is unlikely that a reduction in trail width assumptions would result in significant changes in timber supply.

On this basis I accept that the estimates of non-forest areas associated with existing roads used in the base case reflect the best available information and are suitable for use in this determination.

- unstable terrain and sites with regeneration issues

In the base case, 44 661 hectares were identified as either unstable terrain or difficult to regenerate.

Public input was received that indicated that logging on fans should not be permitted because the stability of these landforms may be compromised over time. District staff inform me that logging is not necessarily precluded on fans and the area excluded from the THLB to account for fans that are not suitable for timber harvesting was based on historic logging practices. The stability of these fans over time is unknown.

Licensees maintain that the deductions for non-operable portions of Class IV terrain (steeply sloping; potentially poorly drained), and EP1 (areas expected to be difficult to regenerate after harvest) are too high. District staff responded that the reduction factors used in the base case were calculated using data from a review of 30 years of actual logging practices. Consequently, any area removed in these terrain classes was due to a lack of demonstrated harvest performance.

Based on my review of this information, I conclude that the approach used to account for unstable terrain and sites with regeneration issues in the base case reflects current management and, therefore is appropriate for use in this determination.

- operability

In the base case, 46 746 hectares were excluded from the THLB for reasons of ecological, physical and economic inoperability. Areas excluded for ecological reasons were identified using the recently mapped “woodlands subzone” (within the Engelmann Spruce Sub-alpine Fir (ESSF) and Mountain Hemlock (MH) biogeoclimatic zones). District staff and licensees agree that within this subzone the growing conditions are not suitable for successful reforestation. Physical and economic operability deductions were made to the areas below the woodlands subzone using harvest method mapping (HMM). HMM provides categories of harvest method based on slope criteria and stand quality obtained from the VRI.

A member of the public was concerned that using the lowest elevation of the woodland subzone to define the top of the THLB could have “*potentially negative ecological consequences*”. District staff responded that the woodland subzone was mapped by an ecologist who delineated areas with ecological issues that would prevent successful regeneration within the subzone. Furthermore, they noted that the lower boundary of the woodland subzone is below that defined by either HMM or total chance plans.

For the base case, all HMM types with a harvest method of *inaccessible* (I) were excluded from the THLB because they are physically inoperable. In addition, the HMM stand types of *cable-marginal sawlog* (CM), *cable-pulpwood* (CP), *cable/helicopter -marginal sawlog* (HM)

and *cable/helicopter -pulpwood* (HP) were excluded from the THLB due to economic inoperability because harvesting in these types was less than one percent of the historic harvest (up to 2009). One stakeholder questioned the validity of using a one-percent threshold to exclude stands on the basis of low economic operability. In response, I note that this is already a relatively low threshold. In the event that harvest activity in CM, CP, HM, and HP increases following this determination, this threshold can be reconsidered at the time of the next timber supply review.

Due to concerns that the maximum slope assumption used in the analysis for cable harvest is too low and that CM areas should not be excluded from the THLB, licensees completed an analysis of 2009-2011 harvest data, and pending and approved cutblocks. This analysis confirmed that CP, HM and HP types were appropriately excluded from the THLB, but indicated that a portion of the CM types should be included in the THLB. Based on the ratio of the amount of proposed harvest to the amount previously harvested, district staff support the licensees' conclusion that the CP area included in the THLB is underestimated by 966 hectares or by about 0.3 percent.

I have reviewed the operability information used in the analysis with staff and I have considered the additional information provided by licensees and members of the public. On this basis, I conclude that the assumptions used in the base case to account for ecological, physical and economic operability appropriately reflect current management. With regard to CM, I note that the HMM harvesting classes represent broad definitions of operability and I accept that the THLB may be underestimated by up to 0.3 percent on this account. However, I note that a THLB change of this magnitude has a negligible effect on timber supply and I will make no adjustments to the base case on this account. However, in order to reduce the uncertainty associated with harvesting in CM areas, I encourage district staff and licensees to continue to monitor harvesting in the CM zone so that the confirmed results can be used to inform the next timber supply review, as noted in **'Implementation'**.

Forest inventory and growth

- vegetation resources inventory

For the Bulkley TSA, the inventory information available for use in the timber supply analysis included a VRI Phase I photo interpretation completed in 2008, and a Phase II ground and net volume adjustment factor sampling completed in 2010. Phase II ground measurements are used to correct Phase I photo-interpreted inventory attributes. As discussed above under *'Base case for the Bulkley TSA'*, the revised base case used the phase II adjustments for all stands except those in the ESSF immature and mature strata.

A licensee noted that there were discrepancies in the VRI information, e.g. polygons showing significant volumes but little crown closure, and multi-layered stands with missing secondary species, stocking and volume, used in the timber supply analysis.

Forest Analysis and Inventory Branch staff informed me that a depletion layer was created to update changes to the land base. Staff acknowledged that some VRI information remains uncertain, such as the estimation of basal area and that additional work is required to improve this information.

I have reviewed the inventory information used in the timber supply analysis with staff and conclude that although there appear to be discrepancies in the VRI, the best available information was used in the base case. I encourage staff and licensees to work towards reducing the discrepancies noted in the VRI prior to the next determination.

- site productivity estimates

For natural stands, the base case used the existing site index – a measure of site productivity - in the VRI. For managed stands, the base case aggregated stands into broad moisture classes for each biogeoclimatic variant using Predictive Ecosystem Mapping (PEM) completed in 2010 and the associated site index from the Site Index by Biogeoclimatic Ecosystem Classification (SIBEC) database. SIBEC provides an estimate of site index for each leading species in a PEM moisture class. In the base case, managed stand yields were based on the mean site index, area-weighted by leading species, for each moisture class aggregate.

During consultation, the Office of the Wet'suwet'en (OWET) questioned the definition of analysis units and PEM to assist in their own work on rare ecosystems, medicinal plants and related resources. District staff provided all of the technical information requested.

One stakeholder group questioned the magnitude of the increases in managed stand yields used in this timber supply analysis compared to those used in previous timber supply reviews and asked whether the site productivity information used in this analysis is valid. In response, staff indicated that the increase in managed stand yields is due to the site index adjustments applied to managed stands in this analysis. These adjustments are consistent with the site productivity estimates from the *Old Growth Site Index and Bulkley Operational Adjustment to Site Index Study*, the results of sensitivity analyses prepared in 2001 and local SIBEC data.

For this determination, I accept that the approach used in generating site productivity estimates is appropriate and I will make no adjustments to the base case on this account.

- minimum harvestable ages

For the base case minimum harvestable ages were defined using height, diameter and volume criteria. While the height and diameter minima varied according to stand quality and species, all stands had to exceed a minimum stand volume of 150 cubic metres per hectare in order to be eligible for harvesting in the model

A member of the public questioned whether the minimum harvest volume of 150 cubic metres per hectare was speculative. District staff informed me that the minimum harvest criteria assumed in the base case are supported by demonstrated harvest performance since 2001.

One forest licensee commented that the base case seems to defer harvest in managed stands until well beyond the achievement of maximum mean annual increment (MAI). I note that the minimum harvestable age is only an indication of when the stand first becomes eligible for harvest in the model and is not a target age for actual harvest. Additionally, harvest may be deferred beyond maximum MAI to meet requirements for seral stage targets and other resource values.

I accept that the criteria used to define minimum harvestable ages in the base case appropriately reflect demonstrated harvest performance. Therefore, I will make no adjustments to the base case on this account.

- volume estimates for existing stands

In the base case all existing stand yields, with the exception of ESSF mature and immature stand yields, were adjusted based on VRI phase II information. For further detail, refer to the section entitled '*Base case for the Bulkley TSA*' earlier in this rationale.

Based on a comparison of cruise to inventory volumes, a licensee submitted that VRI phase II adjusted stand yields overestimate the volumes of existing stands and that this could result in an

“*upward pressure*” on the AAC. In addition, it noted that the VRI underestimates the pine composition of stands, which is significant as pine salvage will continue to be a priority.

FAIB staff advised me that comparison of inventory and cruise volumes is not recommended because the latter do not represent a random sample and thus cannot be used to identify statistical bias in the inventory. Nevertheless, work is ongoing to examine the cause of the high adjustment factors, including assessment of potential errors in photo interpretation, analysis of VDYP7 output, and exploration of the addition of ground samples to reduce sampling error in some strata, such as the ESSF mature and immature.

On this basis, I accept that application of VRI Phase II adjusted yield tables for all stands except those in the ESSF mature and immature stands is appropriate

- log grades

In April 2006 new log grades were implemented for the BC Interior. Previously, a log was assessed according to whether the tree it came from was alive or dead at the time of harvest. Prior to April 2006, Grade 3 endemic (the ‘normal’ mortality observed in a mature stand) and Grade 5 (dead tree with less than 50 percent firmwood and/or less than 50 percent of lumber produced is merchantable) were not charged to the AAC if harvested. Under the new system, grades are based on log size and quality at the time it is scaled, not simply whether it was alive or dead at harvest. To better account for all harvested volume in the AAC cut control, logs that were previously considered Grade 3 endemic or Grade 5, which are also referred to as “dead potential”, are now charged to the AAC. Therefore, this volume now needs to be taken into account in the AAC determination.

Estimates of timber volume in the base case did not include dead potential volume. Possible sources of data about dead potential volume include inventory audit plots, VRI phase II ground samples, permanent sample plots, and temporary sample plots. At this time, the inventory audit is considered the best of the above-mentioned sources of data regarding dead potential timber in the Bulkley TSA because the sample plot design includes a large number of trees and tree classes are recorded directly. The 1996 inventory audit for this TSA indicated that dead potential volume is about 7.6 percent of the total volume (equal to 8.2 percent of the live volume) of stands older than 60 years on the forested land base.

I acknowledge a recommendation from the forest industry that any increase in the AAC should be proportionately allocated to licensees and that species correction factors (SPFs) should be accounted for in the AAC. However, it is not within the scope of my authority as chief forester to apportion the AAC that I determine. Apportionment of the AAC is the responsibility of the Minister of Forests, Lands and Natural Resource Operations.

Having considered the available information, I concur with staff that the inventory audit data provides the best estimate of dead potential timber in the Bulkley TSA. Given that the inventory information used in the base case did not account for about 8.2 percent of dead potential volume for stands older than 60 years, I conclude that the short-term harvest levels projected in the base case were underestimated by about eight percent and I will account for this in my determination as discussed under ‘**Reasons for Decision**’.

- volume estimates for regenerating stands

In the base case, regenerating stand yields were created using the ministry’s Table Interpolation of Stand Yield model (TIPSY 4.1d), the assumptions specified in the data package, and the changes described in this document under “*base case*”.

I am aware of industry input that regeneration for some treatment units should be modelled as “100 percent plant” and that recognition should be given for thinning projects in problem forest types. District staff advised me that the assumption of ideal stem distribution associated with 100 percent planting is not appropriate given conditions of ingress and advanced natural regeneration, and that stand thinning is not standard practice in the Bulkley TSA.

During the review process, a member of the public asked whether higher stocking will result in trees at culmination age having shorter heights and smaller diameters and whether some site series have higher than reported planting of pine. As noted above, the stand densities used in the original base case are higher than those used in the base case. FAIB staff indicate that the model used for this timber supply analysis will not harvest stands until the minimum harvest age criteria are reached. These criteria are independent of culmination age. With respect to pine planting, the species information applied in the base case is consistent with the information in the ministry’s Reporting Silviculture Updates and Land Status Tracking System (RESULTS) database.

During consultation the OWET indicated that some stands should be managed to a lower stocking density for the purpose of berry production. District staff inform me that opportunities to promote berry production are provided for under the Wetzink’wa Community Forest Agreement Management Plan.

I conclude that use of TIPSY to model managed stand yields and the regeneration assumptions used in the base case are appropriate for this determination. With regard to the input received from the OWET and based on my discussions with district staff, I am satisfied that their interests in berry production are being accommodated at an operational level and are provided for under the Wetzink’wa Community Forest Agreement Management Plan.

- operational adjustment factors

The provincial OAF 1 of 15 percent was applied to the TIPSY yield curves for managed stands used in the base case. This was to account for conditions which impact stand yield but are not expected to increase over time. Further detail is provided in the “*revised base case*” section of this document.

I am aware of input from interest groups and the public regarding OAF 1 and OAF 2, questioning if these adjustment factors should be increased to reflect forest health problems in young stands and the apparent increasing temperatures and changes in precipitation patterns. Ministry staff indicate that the provincial OAF 1 of 15 percent is based on the most current information available and that FAIB is implementing a young stand monitoring program to determine how well second growth stands are performing relative to TIPSY projections. This information will help to calibrate the TIPSY model and can be used in future TSRs.

I conclude that the revised base case appropriately applied the provincial OAF 1 of 15 percent. I expect that for the next timber supply review, the results of the young stand monitoring program will help to reduce the uncertainty associated with the OAFs.

- genetic worth

In BC, licensees must use genetically improved Class A seed where available, as per the *Chief Forester’s Standards for Seed Use*. The objective is to improve the productivity of second-growth stands. Class ‘A’ seed is obtained through the collection of cones from trees that display genetically superior traits such as height growth and disease resistance. Seedlings grown from the collected seed are then used to reforest areas with growing conditions similar to those of the genetically superior trees. Class ‘A’ seed therefore has “genetic worth” (GW) *versus* Class ‘B’ seed.

The Seed Planning and Registry (SPAR) system is used to monitor seed used for reforestation in the province. In the Bulkley TSA, Class ‘A’ seed is only available for interior lodgepole pine and spruce. For the base case, data from SPAR (2002 – 2009; pre-2002 is not available) was used to calculate the eight-year average genetic gain for these two species. These averages were used in TIPSYS to generate yield curves for stands harvested since 2001 that were planted with pine or spruce, and to all future stands.

The base case assumptions are supported by the Forest Genetics Council, which anticipates that for much of the Bulkley TSA, the full requirement for seed orchard production of Class ‘A’ pine and spruce will be met by 2014. Future gains for these two species are expected to be 10 percent and 23 percent respectively. Tree Improvement Branch advises that estimates of GW such as those recorded in the SPAR database are supported by extensive global research spanning more than 80 years, and by field trials and progeny testing carried out for more than 15 years in BC.

District staff have expressed concern that with climate change these gains might not be realized and thus the gains modelled in the base case may be inappropriate. Significant public and special interest group input was also received on this topic; and can be summarized in four key points:

- Seedlings from natural stand (Class ‘B’) seed sources are naturally more resistant to disease and climate change than those from Class ‘A’ seed.
- Resilience of genetically-improved stock to forest health concerns has not been adequately tested.
- Increased volume production is more likely through the use of non-local species (e.g. western larch and interior Douglas-fir) *versus* the gains expected from the use of Class ‘A’ seed.
- “*In light of climate change*”, it is uncertain that GW estimates will be materialized. The end result could be the creation of plantations of poorly adapted trees that ultimately reduce future volumes.

In response to these concerns I note that the Tree Improvement Branch indicates that “resilience” – a measure of growth performance and genetic suitability, of a seedlot relates primarily to how well matched the climate-of-origin and the climate of the planting site are as the climate changes. Testing of resilience is being done through DNA analyses and field trials and results to date show that Class ‘A’ and ‘B’ seed sources are equally diverse genetically. There is no evidence to support that Class ‘A’ seed sources are less resilient than Class ‘B’ seed sources.

Assisted migration studies, in which seeds from native species growing in different climatic conditions (e.g. drier, warmer etc.) are tested for potential use in BC, are in progress but no definitive results are available yet to indicate that the use of non-local species is superior to the use of Class ‘A’ seed. Other related work to address these types of uncertainties is underway through goals of the 2012 FLNR Forest Stewardship Action Plan for Climate Change Adaption and through application of climate change models such as Wang et al. (2006a, 2012a). Finally, I note that decreasing the managed stand yield curves did not significantly affect the first decade or mid-term harvest levels in the base case.

In conclusion, based on my review of the information regarding the use of genetically improved seed I accept that the assumptions used in the base case reflect current management and are; therefore, appropriate for use in this determination. I acknowledge the concerns expressed by district staff and the public regarding the uncertainty surrounding the actual growth of genetically improved trees in view of climate change. Consequently, I encourage the ongoing monitoring of stands established using genetically improved seed for both growth and pest resistance during young stand monitoring. The confirmed results can then be used to inform the next timber supply review, as noted in ‘**Implementation**’.

Section 8 (8) (a) (ii) the expected time that it will take the forest to become re-established on the area following denudation

Forest establishment

- regeneration delay

Regeneration delay is the time period between the completion of harvest and successful reforestation of the denuded site. In the Bulkley TSA, harvested areas are reforested by planting as soon as possible resulting in a regeneration delay of one to two years. In the base case, a one-year regeneration delay was applied to stands following harvest in the model.

During consultation, a member of the public expressed concern that BC Timber Sales was not re-establishing stands within the one-year period assumed in the base case. Ministry staff reviewed stand re-establishment information and confirmed that BCTS is re-planting harvested areas within one year, often with older seedlings such that many BCTS blocks have regeneration delays of less than one year.

I conclude that the regeneration delay estimates used in the base case appropriately reflect current practice and are suitable for use in this determination.

- not satisfactorily restocked (NSR)

Areas harvested after October 31, 1987 that have not been adequately restocked are referred to as 'current NSR'. Areas harvested prior to this date are referred to as 'backlog NSR'.

Both types of NSR are assumed to be reforested promptly in the base case, with the exception of about 700 hectares of additional NSR that has been added from the Small Scale Salvage Program that does not currently have a dedicated funding source for treatment.

The base case accounted for 1743 hectares of current NSR and 570 hectares of backlog NSR. A recent RESULTS query showed that the NSR backlog has been reduced to 60 hectares.

A licensee commented that 'backlog NSR' and 'unknown' status polygons should be reviewed to determine the stocking levels and treatments required. I am advised by district staff that treatments for these areas are being planned, and that improvements to RESULTS data are ongoing.

I accept that the assumptions used in the base case to account for current and backlog NSR areas reasonably reflect current management and will make no adjustments to the base case on this account.

Section 8 (8) (a) (iii) silvicultural treatments to be applied to the area

As noted in Table 2, I accept as modelled the factors usually considered under this section, and I will not discuss them further.

Section 8 (8) (a) (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

As noted in Table 2, I accept as modelled the factors usually considered under this section, and I will not discuss them further.

Section 8 (8) (a) (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production

Integrated resource management objectives

- general comments

The Ministry of Forests, Lands and Natural Resource Operations (formerly the Ministry of Forests and Range) is required under the *Ministry of Forests and Range Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. The *Forest and Range Practices Act* (FRPA) and other legislation provide for, or enable, the legal protection and conservation of timber and non-timber values. Accordingly, the extent to which integrated resource management objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

In the Bulkley TSA, the Bulkley Land and Resource Management Plan (LRMP) 1998 and the Bulkley Valley Sustainable Resource Management Plan (SRMP) (2005) provide guidance for integrated resource management. In 2000, government established components of the Bulkley LRMP as legal objectives through issuance of the Bulkley Resource Management Zone Higher Level Plan Order, the Bulkley LRMP Objectives Set by Government Order (2006) and a variety of orders issued under the *Government Actions Regulation* (GAR) of the *Forest and Range Practices Act* and the *Land Use Objectives Regulation* (LUOR) of the *Land Act*.

- cultural heritage resources

In the Bulkley TSA, the location of cultural heritage resources (CHR) have been compiled into the Bulkley Cultural Heritage and Archaeological Resource Inventory (CHARI). The site-specific nature of the CHARI is ideally suited to operational planning and plan adjudication by district staff and it is used extensively by area licensees and BCTS contractors to design, locate and time forest management activities to protect CHR. Modifications to management activities include: avoiding certain areas, incorporating features into buffered reserves, excluding areas from cutblocks and deferring or ceasing harvesting. In this way, most CHR values are able to be accommodated without incurring specific additional reductions to the THLB.

I am aware that the Office of the Wet'suwet'en (OWET) raised a number of questions and concerns regarding CHR during consultation, including how CHARI is used in the timber supply analysis. District staff indicated that although CHARI includes a layer showing archeological potential, this information is broadly based and cannot be incorporated into a strategic level timber supply model.

The OWET questioned how CHR values and uses are addressed when licensees apply to harvest in core ecosystems. District staff advise me that licensees are required to share information with First Nations prior to harvesting and that the district undertakes consultation prior to the issuance of cutting permits.

No comments were received from other First Nations.

I acknowledge the importance of CHR to First Nations and have reviewed the information provided by staff and the questions received from the OWET. For the purposes of this determination, I accept that the assumptions used in the base case are appropriate. In addition,

I take comfort knowing that district staff are working with First Nations and licensees to ensure that CHR are managed appropriately at an operational level.

- community watersheds

There are currently three official community watersheds in the Bulkley TSA. In addition, there is one community watershed pending designation, and two are being managed as *de facto* community watersheds.

Section 8.2 of the *Forest Planning and Practices Regulation* requires that cumulative hydrological effects of primary forest activities do not adversely impact water quantity, quality and timing of stream flow. Harvesting is not prohibited in community watersheds but licensee FSPs commit to “plan and locate operations such that no harmful material will enter water used by licensed waterworks”. Accordingly, in the base case, community watersheds were not modelled with specific forest cover constraints.

I am aware that a comment was received from a licensee that a sensitivity analysis should be completed for the Canyon Creek Community Watershed because of an understanding that FLNR is actively pursuing removal of the CW designation. In response, I am advised by district staff that a repeal of CW designation for this watershed is not being considered.

I conclude that community watersheds were appropriately modelled in the base case.

- fisheries sensitive watersheds

There are five legally established fisheries sensitive watersheds (FSWs) in the Bulkley TSA: Cumming, Gramophone, Five Mile, Jonas and Toboggan Creeks. In addition, four watersheds are under consideration for FSW designation: Five Mile Creek, Heal Creek, Nine Mile Creek, and Tsazakwa Creek.

Government objectives for these watersheds are to conserve hydrological condition, stream bed dynamics, channel integrity, and quality/quantity/timing of streamflow to meet the needs of fisheries values. Licensees address FSW objectives by delaying harvest until a watershed assessment is completed. This process establishes thresholds for four indicators of watershed stability: equivalent clearcut area (ECA), peak flow index, road density, and stream crossing density. Once a threshold is exceeded, development is ceased until a new assessment confirms or establishes new thresholds, or recommends remedial action.

In the base case, the five legally-established FSWs were modelled using a three-pass harvest system with forest cover constraints, as a proxy for the ECA indicator.

According to district staff, some debate exists as to whether the five current FSWs were inappropriately designated and whether Toboggan Creek will remain as a FSW. In response, district staff advise that no plans are underway or planned to repeal the designation of the Toboggan Creek FSW.

Public input was received regarding monitoring the impact of harvesting in FSWs and in particular, the potential of over-harvesting above the H60 line. This line is the elevation above which 60 percent of the watershed lies; snowmelt from this area is the source of major peak flows. As was modelled in the base case, harvesting is constrained in the five FSWs and licensees are required to meet peak flow targets/measures through forest stewardship plan results and strategies. Assessment of any harvesting impacts is considered to be effectiveness monitoring and is outside the scope of this TSR.

I am satisfied that the base case assumptions regarding FSWs reflect current management. Any FSWs established following this determination will be accounted for in the next timber supply review.

- patch size distribution

The Bulkley Higher Level Plan Order specifies targets for patch size distribution as a resource objective. The intent of this resource objective is to distribute harvesting spatially on the THLB while preventing block size limits from being exceeded. In the base case these requirements were modelled through the application of a three-pass harvest system that serves as a proxy for cutblock adjacency and green-up. While this approach does approximate patch size distribution at the time of harvest, it does not provide direction regarding operational harvest blocking and scheduling to maximize future blocking options.

Sensitivity analysis was done to examine the application of the maximum green-up area available in each pass system (three- and four-pass). Results showed that harvest levels are sensitive to adjacency/green-up in the mid-term but not the short term.

Public input was received regarding the application of a three-pass system to Boucher Creek and West Babine River where a two-pass system has been specified. I am advised that these two special management zones were excluded from the three-pass system used in the base case. I am also aware of licensee input that adherence to patch size distribution seems to be overemphasized and that it does not correlate to the criteria used for the three-pass harvesting proxy. In response, I note that the three-pass harvest system does not make assumptions about the patch size distribution nor is it a true patch size objective, but it does recognize the need to separate blocks on the landscape as per Bulkley Higher Level Plan Order patch size distribution targets.

I conclude that the application of adjacency/green-up constraints as a proxy for patch size distribution was reasonable. I acknowledge that further assessment of blocking patterns is required to determine if Bulkley Higher Level Plan Order patch size distribution targets are being met operationally and I encourage further monitoring of harvesting operations by district staff. The confirmed results can then be used to inform the next timber supply review, as noted in **'Implementation'**.

- rare and endangered plant communities

The Bulkley TSA has legal objectives to manage for red- and blue-listed ecological communities. The base case incorporated information from the Conservation Data Centre, a sensitive ecosystems inventory (SEI), and the 2010 Bulkley PEM. This data was used to identify and exclude an additional 88 hectares to account for red-listed species and 65 hectares to account for blue-listed species from the THLB.

Licensees maintain that the SEI and PEM may overestimate the area associated with sensitive ecosystems. Furthermore, they indicate that where a red- or blue-listed plant community is identified, it is generally placed in a wildlife tree reserve (WTR) and consequently no additional THLB reduction is required. Licensees also manage for these species through partial or total avoidance, or through incorporation of habitat areas into wildlife tree patches and other reserves.

District staff confirm that licensees do try and co-locate WTRs with sensitive ecosystems; however, they indicate that WTRs do not adequately protect red- and blue-listed ecosystems within core ecosystems and the Copper River Special Management Zone because they permit small-scale harvesting to address forest health issues. Furthermore, they note that detailed mapping of rare and endangered ecosystems is only available for the Bulkley Valley portion of

the TSA. For these reasons, district staff conclude that the area excluded from the THLB on this account may be underestimated.

During consultation, the OWET asked how non-timber forest products, medicinal plants and rare ecosystems are incorporated into the timber supply analysis. District staff responded that the base case accounts for all legal objectives and practice requirements of the *Forest and Range Practices Act*. These legal requirements specifically include rare and endangered ecosystems, but do not directly account for non-timber forest products or medicinal plants.

I have reviewed the assumptions used in the base case to account for red- and blue-listed species and note that detailed information is only available for a portion of the TSA. I am also mindful that licensees indicated that in order to conserve sensitive ecosystems they co-locate these areas with WTRs during operations. In the absence of additional information regarding both the location and management of rare and endangered ecosystems it is difficult for me to determine whether the area excluded from the THLB on this account has been over- or underestimated. Therefore, I accept that the information, albeit limited, used in the base case is the best available.

I agree with the district's response to the OWET regarding non-timber forest products and medicinal plants. However, in considering these aboriginal interests I am aware that the assumptions used to account for other forest values in the base case, such as riparian areas, FSW, seral stage distribution, rare and endangered ecosystems and wildlife habitat, also provide for a wide range of values. Consequently, to some unknown extent, the legal requirements for and the assumptions used in the base case to account for these requirements, accommodate aboriginal interests in non-timber forest products and medicinal plants. In the event that new legal orders are issued that relate specifically to these values, they will be incorporated in the next timber supply review.

In order to reduce the level of uncertainty associated with this factor, I encourage licensee and district staff to work together to improve the information available for the next determination. In the interim, I take some measure of comfort knowing that legal objectives have been established that govern the management of red- and blue-listed ecological communities within the Bulkley TSA.

- *recreation*

In the base case, visually sensitive areas (VSAs) with a 'preservation' visual quality objective (VQO) that are important for both scenic and recreational values, were fully excluded from the THLB. In order to account for recreation reserves administered by FLNR (i.e. commercial and other designated recreation reserve areas, and forest recreations sites) in which harvesting is permissible, 25 percent of recreation reserves, or 1079 hectares, were excluded from the THLB.

Licensees commented that there is no legal requirement to avoid harvesting within recreation reserves and that current practice is to move the trail head instead of buffering the entire length of trails.

District staff agreed with licensees that there is no legal requirement to support the 25-percent recreation reserve area exclusion; however, they note that some forest cover is being retained within harvested recreation reserves. They also indicate that since the recreation information was assembled for this timber supply review in 2008, new recreation reserves have been established. Application of the 25-percent area exclusion to the new reserves would result in a further 600-hectare decrease in the THLB.

Public input was received that "wilderness" values are not accounted for in the analysis. In response, district staff indicated that there are no legal objectives set by government for the

Bulkley TSA to protect “wilderness” as defined in the Recreation Opportunity Spectrum (ROS) classes of *Primitive*, *Semi-primitive Non-motorized* or *Semi-primitive motorized*. As a result, wilderness objectives were not modelled in the base case.

While I acknowledge the observations made by district staff, I am also mindful of the licensee comment that highlighted the absence of a legal requirement to avoid harvesting within recreation reserves. As noted in my guiding principles, it is not my practice to speculate on land-use decisions that have yet to be made by government. Consequently, for this determination I conclude that the THLB used in the base case was underestimated by 1079 hectares or 0.4 percent. Given the magnitude of the THLB underestimation it is questionable whether this would have a significant, if any, impact on the base case harvest forecast. On this basis, I will not adjust the base case on this account.

- riparian management

In order to account for stand retention in riparian management zones, buffers were applied to the streams identified in the Corporate Watershed Base (CWB) and the resultant 10 623 hectares were excluded from the THLB.

A member of the public recommended that the 2007 Triton Critical Stream Reach Project information should have been used in place of the CWB. District staff responded indicating that there are significant issues with the information in the Triton file (e.g. the presence and absence of fish along right/left banks of the same reach of the Bulkley River). For this reason, the district continues to support the process used in the base case.

One licensee commented that the stream buffers used in the base case are too high, resulting in the exclusion of too much area from the THLB. District staff responded indicating that the buffer widths were based on a review of licensee forest stewardship plans.

For this determination, I accept that the assumptions used to account for riparian management in the base case appropriately reflect current management and the best available information and I will make no adjustments to the base case on this account.

- landscape level biodiversity

The *Bulkley LRMP HLPO Objectives Set By Government* establish seral stage targets for old, mature plus old, and early seral stages by landscape unit and biogeoclimatic ecosystem classification (BEC) variant. The base case accounted for all of these targets. In the timber supply model, the age class distribution of stands outside of the THLB was maintained throughout the forecast period by not allowing these stands to age. This prevents stands from outside of the THLB aging indefinitely and inappropriately contributing to seral stage targets.

Public input was received regarding the approach used to account for natural disturbance outside the THLB when applying seral stage targets. According to one respondent freezing the age class distribution outside the THLB would prevent stands from aging, thereby causing a bottleneck in meeting future old and mature plus old seral stage targets. Another member of the public indicated that natural disturbance should be applied outside of the THLB using actual rates of disturbance otherwise the model assumes that the old forest will remain old and that this is unrealistic.

In response, I recognize that the approach used in the model is necessarily a simplification of reality, but I accept that it is reasonable given the strategic level of the timber supply analysis prepared for the purposes of an AAC determination.

Public input included a comment that the new woodland subzone was ecologically unique and should not contribute to the seral stage targets of other subzones. In the analysis, the seral stage requirements established under the Bulkley LRMP HLPO were applied in the base case. However, legal seral stage requirements have yet to be established for the woodland subzone. Consequently no seral stage targets specific to the woodland subzone were applied in the base case.

I accept the use of the woodland subzone for the purposes of defining ecological operability in the base case. In the event that legal seral stage objectives are established for the woodland subzone, they can be accounted for in the next timber supply review.

Public input was received about the importance of conserving stands greater than 150 years of age because if logged they will not be replaced by mature and old stands with similar structure and function—even if they were allowed to grow old (i.e., managed under extended rotations). In response to this concern, I note that many of the older stands are of marginal and pulpwood quality, and/or often coincide with areas of high conservation value or environmental sensitivity. Consequently, many of these stands would not be available for harvesting in the base case.

Public input included a suggestion that the early seral stage for managed stands be defined as 30 years or younger because these stands may provide the equivalent or better forest cover than 40-year old natural stands. I acknowledge the opinion but I note that the seral stage definitions are established as part of legal objectives under the HLPO and cannot be altered for this analysis. On this basis, I accept the seral stage definitions used in the base case.

In considering the appropriateness of the seral stage targets used in the base case I am mindful that the Bulkley LRMP and subsequent legal objectives reflect the balance of social, economic and environmental objectives identified by the public, First Nations and stakeholders and endorsed by government. The base case reflects all of the legal objectives established under the LRMP including: seral stage targets for old and mature plus old forest, wildlife habitat requirements, and the established special management zones. In addition, the THLB excludes protected areas, riparian areas, the woodland subzone and significant areas of marginal timber as described above, all of which serve to conserve older stands.

- core ecosystems and landscape corridors

The base case addressed legal objectives for core ecosystems and landscape corridors, which form the ecosystem network in the Bulkley TSA. Core ecosystems capture a representation of old seral forest, mature forest, rare and endangered ecosystems, concentrations of non-productive and non-forested areas, and valuable features such as cultural heritage features, headwaters, and wilderness lakes. Landscape corridors connect forests with interior forest conditions across the landscape.

Public input included a suggestion that core ecosystems be excluded from the THLB for the first two decades of the base case forecast given the focus on harvesting pine in other areas and the need to retain dead pine in representative ecosystem areas.

In response, district staff indicated that excluding core ecosystems from the THLB is inconsistent with the legal objectives that permit small-scale harvesting to address forest health issues but also require that some dead pine be retained to avoid harvesting rare and endangered ecosystems.

I conclude that the assumptions used in the base case appropriately reflect the current legal requirements for core ecosystems and landscape corridors. On this basis, I will make no adjustment to the base case on this account.

- wildlife habitat

caribou

In the Bulkley TSA, legal objectives have been established that specify seral stage targets for key-forested caribou habitat and the Telkwa Caribou Herd Recovery Area, which includes some key-forested caribou habitat. These seral stage requirements were applied in the base case.

A new wildlife habitat area (WHA) is proposed for the Telkwa Caribou Herd Recovery Area established under Order #6-3333 for Northern Caribou in the Bulkley and Morice TSAs. The new WHA will establish a no-harvest area and new requirements for seral stage targets, wildlife tree patches and visual screening around wetlands. A legal order to establish the new WHA is expected.

Based on my review of the information regarding caribou habitat requirements, I accept that the assumptions used in the base case appropriately reflect current legal requirements. Any changes in forest management that result from future legal orders to establish a new caribou WHA can be incorporated in the next timber supply review.

mountain goat

In the base case, 6522 hectares of mapped high-value mountain goat habitat were excluded from the THLB.

According to government staff involved in the original mountain goat habitat mapping and strategic planning process, habitat areas were intentionally mapped in areas that were not being harvested either at that time or in the foreseeable future. Since then, harvest operations in the TSA have expanded and now overlap with mapped habitat. Regional staff inform me that they are now preparing an order under the Government Actions Regulation to establish legal objectives for mountain goat habitat.

During the review process, licensees commented that there were no legal objectives set by government for mapped mountain goat habitat management that precluded harvesting. Consequently, these areas should have been included in the THLB.

In order to estimate how much of the mapped mountain goat habitat to include in the THLB, district staff reviewed the historic harvest information in operable portions of mountain goat habitat. They found that past harvesting in these areas was incidental and scattered, and accounted for only 706 hectares or about 0.8 percent of historic harvest levels. Based on the ratio of the habitat area proposed for harvesting to the habitat area harvested in the past, district staff estimated that 2350 hectares of the mapped habitat should have been included in the THLB. This represents 0.8 percent of the THLB used in the base case.

Having considered the mountain goat habitat assumptions, licensee input and the information provided by district staff, I conclude that the base case harvest levels have been underestimated by about one percent and I will account for this in my determination as discussed in '**Reasons for Decision**'. If legal objectives for mountain goat are established following this determination, they can be accounted for in the subsequent AAC determinations.

other species

Public input was received questioning if wildlife and habitat inventories were considered in this TSR and recommending that a resource supply analysis be completed for the Bulkley TSA.

District staff inform me that baseline inventories are available for ungulate, grizzly bear and fish habitat in the Bulkley TSA and that these inventories were used to set legal objectives in the Bulkley TSA. These legal objectives were accounted for in the base case.

On this basis, I conclude that the wildlife assumptions used in the base case appropriately reflect current legal requirements and the available ungulate, grizzly bear and fish habitat information available for the Bulkley TSA. With regard to resource supply analysis, I note that work is currently underway in BC to develop a variety of resource analysis tools. For example, there is currently a pilot project underway in three TSAs currently engaged in timber supply reviews to develop wildlife habitat supply forecasts for use in the upcoming AAC determinations. As suitable resource supply models are developed, and where the results relate to the factors specified in Section 8 of the *Forest Act*, the results can be considered during AAC determinations.

- *wildlife tree retention*

The *Bulkley LRMP Objectives Set by Government* established legal objectives for wildlife tree retention with targets by landscape unit and BEC subzone, and for certain management zones within the Bulkley TSA. These targets are reflected in licensee forest stewardship plans (FSP) and were applied in the base case as exclusions from the THLB.

During the public review, a licensee asserted that the wildlife tree retention targets for the Babine Special Management Zone 2 (SMZ2) used in the base case are overstated because they do not consider the ability to utilize stem retention (smaller merchantable and stubs) to address forest health considerations by allowing larger blocks, or the ability to use partial cutting to harvest a broader portion of the SMZ2.

In response, district staff explained that the area reduction for wildlife tree retention was calculated based on the best interpretation of the licensee's FSP results and strategies for the Babine SMZ2. The concerns raised by the licensee were considered during the district's interpretation of the FSP. District staff offered to meet with the licensee to discuss this matter further; however, the offer was not pursued by the licensee.

Another licensee asserted that application of the full legal wildlife tree retention rate in deriving the THLB does not account for wildlife tree retention within areas excluded from the THLB to account for other factors, in particular riparian areas.

District staff responded, indicating that the legal objectives for wildlife tree retention already accounted for this overlap. They noted that at the time the legal objectives were established, wildlife tree retention was reduced by 50 to 75 percent from the maximum levels specified in the *Biodiversity Guidebook* to account for overlaps with areas excluded for other purposes.

In a third comment received from licensees it was noted that the base case incorrectly applied a 20-percent wildlife tree retention requirement for the sub-boreal spruce (SBS) BEC zone in the Telkwa Caribou Recovery Area, and that the correct retention requirement is the same as for the corresponding landscape units. District staff advised the licensee that this particular retention requirement was designed to reflect the deferral strategy used by the licensee to meet the retention requirement. After receiving this comment, the base case was revised to use the appropriate landscape unit target and a separate harvest deferral.

After considering the wildlife tree retention assumptions used in the base case, I conclude that the base case, which was revised as described above, appropriately accounted for wildlife tree retention.

Section 8 (8) (a) (vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber:

Other information

- harvest performance

Harvest performance in the Bulkley TSA was significantly impacted between 2001 and 2008, when harvesting operations were transferred to the Lakes and Prince George TSAs to address the mountain pine beetle infestation. Since then harvest rates in the Bulkley TSA have increased to about 66 percent of the current AAC.

The current AAC for the Bulkley TSA includes two partitions: one for sawlogs and the other for marginal sawlogs and pulpwood. The latter partition is intended to promote the harvest of lower quality timber in the marginal sawlog/pulpwood stands, while protecting the higher quality sawlog stands from over-harvesting. Marginal sawlog/stands occupy about 41 percent of the THLB; however, this percentage is expected to decrease over time as these stands are harvested and replaced with sawlog quality stands.

In the base case, sawlog, marginal sawlog and pulpwood stand quality types were identified using inventory criteria for stand quality. Inventory type groups (ITG) used in the 1995 data package are no longer used in the new vegetation resources inventory so new groupings were created for this analysis. The base case harvest forecast depends on full harvest and regeneration of stands in the marginal sawlog/pulpwood partition to support future harvesting with high quality stands.

Based on a review of harvest information for the period 2006 to 2010, 76 percent of the harvested volume was attributable to the sawlog partition and 24 percent was attributable to the marginal sawlog/pulpwood partition. This represents 54 percent of the available AAC in the sawlog partition was harvested and 24 percent of the available AAC in the marginal sawlog/pulpwood partition was utilized.

Public input was received questioning whether licensees will log marginal sawlog and pulpwood stands, and whether BC Timber Sales will ever log stands in the marginal sawlog and pulplog partition because the Pacific Inland Resources sawmill already has access to these stands through its own licence.

During consultation, the OWET asked what the expectations are for the future harvest of decadent balsam stands. District staff indicated that the current partition for marginal sawlog and pulpwood stands specifically provides an opportunity to harvest up to 41 percent of the AAC in these stand types; however, the partition is not a harvest target for these stands.

In considering the input received from the public and the OWET regarding harvest expectations in marginal sawlog/pulpwood stands, including balsam stands, I note that the objective of the current partitions is to provide opportunities to harvest marginal timber, while ensuring that the entire AAC is not harvested from sawlog stands. AACs and AAC partitions represent the maximum volumes available for harvest; however, they do not represent targets that must be met.

A comment was received from a licensee asserting that the AAC partition proportions for sawlog and marginal sawlog/pulpwood based on the area in each type is invalid because sawlog stands have more volume than the other stand types.

The current AAC includes a volume-based partition attributable to marginal sawlog/pulpwood stands. This partition is not based on the area of sawlog stands compared to the area of sawlog/pulpwood stands. Rather, it is based on the volume contribution from each stand type to the harvest levels projected in the base case.

In order to develop the base case, stands are assigned to yield curves generated by either VDYP (for existing stands) or by TIPSYP (for managed stands). Marginal sawlog/pulpwood stands are typically assigned to lower yield curves. Consequently, at similar ages marginal sawlog/pulpwood stands have lower volumes per hectare than sawlog stands. Consequently, the base case accounts for both the total area of each stand type available for harvest and the differences in stand volume.

I have considered the harvest performance information provided and the input received from the public and licensees and have reasoned as follows. The intent of the marginal sawlog/pulpwood partition was to make low quality timber available for harvest, while ensuring that stands with higher quality timber were not over harvested. Although performance in marginal sawlog/pulpwood stands has been relatively low, this was due to the need to transfer harvest capacity to TSAs heavily impacted by mountain pine beetle. After the harvest transfer ended, market conditions have limited the rate of increase in harvesting in the Bulkley TSA. However, to the extent that conditions have allowed, licensees have operated in accordance with the partition as much as possible. This leads me to conclude that there continues to be a demand for marginal sawlog/pulpwood timber and on this basis I will maintain a partition in the AAC attributable to marginal sawlog/pulpwood stands as discussed in '**Reasons for Decision**'.

It is my expectation that following this determination, district staff will continue to monitor harvest performance. The confirmed results can then be used to inform the next determination, as described in '**Implementation**'.

- First Nations consultation

The Crown has a duty to consult with, and accommodate if necessary, those First Nations for whom it has knowledge of the potential existence of aboriginal interests that may be impacted by a proposed decision, including strategic-level decisions such as AAC determinations. As chief forester, I must therefore consider information arising from the consultation process with First Nations respecting aboriginal interests and treaty rights that may be affected by my AAC determination. As well, I will consider other relevant information available to the ministry regarding aboriginal interests, including information gathered during other consultation processes.

The First Nations groups with traditional territory that overlaps the Bulkley TSA include: Office of the Wet'suwet'en (OWET), Moricetown Band, Lake Babine Nation, Wet'suwet'en First Nation (formerly the Broman Lake Band), the Gitksan Hereditary Chiefs, the Kitselas First Nation and the Skin Tye Band. It is acknowledged that these First Nations have historically exercised their aboriginal interests throughout the TSA and that recognition of these practices takes place primarily at the operational level. Specific to the Gitksan Nation, the Government of British Columbia acknowledges that Justice Tysoe of the British Columbia Supreme Court has found that the Gitksan have a good *prima facie* claim of aboriginal title and a strong *prima facie* claim of aboriginal rights to at least part of the area(s) covered by Gitksan territory. There has not been any advancement with respect to the identification of those particular areas within the Bulkley TSA but I will consider any new information during subsequent timber supply reviews as it becomes available.

The Moricetown Band, Wet'suwet'en First Nation, Lake Babine Nation, and Kitselas First Nation each have a Forestry Consultation and Revenue Sharing Agreement (FCRSA) with the province of BC. The details of the information regarding the various agreements can be found in the consultation record. The FCRSAs provide opportunities for revenue sharing and forest tenure and contain a framework for establishing consultation processes to guide consultation on administrative decisions, including AAC determinations. There are no other agreements with any of the other First Nations within the Bulkley TSA.

All of the First Nations except the Skin Tye Band are involved in Treaty negotiations in various degrees. I am aware that the Lake Babine Nation (LBN) recently signed an incremental Treaty Agreement (November 2012) under which a 13-hectare parcel of land within the Bulkley TSA has been offered to the Lake Babine Nation. This parcel is very small and largely outside of the THLB and therefore any impact on the base case timber supply projection is considered negligible.

As part of the consultation process, preliminary assessments were undertaken by district staff that considered existing information provided by First Nations regarding the strength of aboriginal interests and the potential impact this decision will have on these interests. Based on these assessments, the consultation undertaken for First Nations belonging to the Moricetown Band and Kitselas Band was carried out at a 'normal' level, and consultation for the Wet'suwet'en First Nation and Lake Babine Nation was done at the 'information prior' and 'normal' levels.

Initial contact with all First Nations (the Wet'suwet'en First Nation excepted) began in 2009, with the issuance of letters explaining the TSR process and an invitation for input. Meetings with representatives of the three main FN groups (OWET, Lake Babine Nation and Gitksan Hereditary Chiefs) also took place during that time. The Wet'suwet'en First Nation were informed of the TSR process in the fall of 2012 and invited to comment as soon as the province formally recognized adjustments to the Wet'suwet'en First Nation asserted traditional territory that now includes part of the Bulkley TSA. A copy of the data package was sent to all First Nations in late 2010. A public discussion paper on the results of the timber supply analysis was sent to all First Nations in late fall 2012, and this commenced the formal consultation period. All communication to First Nations included a request to provide further information and an invitation to meet as required.

District staff advise that no concerns were raised by Moricetown Band, Lake Babine Nation, Wet'suwet'en First Nation, or Kitselas First Nation. Comments from OWET are addressed above under *volume estimates for regenerating stands, cultural heritage resources, harvest performance*. A comment from one Gitksan Hereditary Chief stated that there are no concerns with the TSR process. A representative from the Gitksan Chief's Office emphasized that there should be no new developments on Gitksan territory until a new long-term forestry agreement with the province is in place. District staff advise that there are no specific concerns that affect this TSR. Additional comments and questions received from First Nations during consultation are discussed below.

Based on my review of the information sharing and consultation processes followed, the aboriginal interest information available to FLNR staff, and the potential impact my decision may have on these interests, I conclude that FLNR has engaged in consultation at an appropriate level on the consultation spectrum as outlined in the *Haida* decision and as per current provincial guidance and applicable case law. Furthermore, I note that district staff will continue to be available to meet and consult with First Nations on issues at the operational planning level.

Opportunities were provided to all First Nations to share their concerns related to specific aboriginal interests that may be impacted by this decision. If new information regarding First Nations' aboriginal interests becomes available that significantly varies from the information that was available for this determination and that may affect timber supply, I am prepared to revisit this determination sooner than in 10 years, as required by legislation.

- *First Nations use of wildlife*

In the Bulkley TSA, the Wet'suwet'en Hereditary Chiefs through the Office of the Wet'suwet'en were involved in a wildlife needs-analysis in the 1990's. More recently in 2010, a draft Sustainable Resource Management Plan (SRMP) for the Gitsegucla Watershed was completed by

the Gitsxan Chiefs from this area, in conjunction with local resource consultants. Forty percent of the plan area is located within the Bulkley TSA. This SRMP contains an extensive section that pertains to Gitsxan wildlife interests in their territorial area located within the Bulkley TSA. The plan states that traditionally, a wide range of wildlife species were used for sustenance, cultural and ceremonial purposes. It describes general wildlife management practices applicable to all wildlife species, and specific practices for six species including: grizzly bear, moose, mountain goat, fur-bearers, goshawk and coastal tailed-frog.

Habitat objectives for four of the above species were included in the Bulkley TSA TSR modelling (mountain goat and coastal tailed frog were excluded) and wildlife use by First Nations was also considered through site specific provisions, where information was available, for northern caribou and mountain goat. The base case accounts for wildlife requirements through the exclusion of areas from the THLB and the application of forest cover constraints that limit harvesting. In the base case, the THLB was reduced by a total of 49 127 hectares to account for wildlife habitat and wildlife tree patches. An additional 17 631 hectares were excluded for riparian areas, and in some of the area remaining in the THLB forest cover constraints restrict the rate of harvest.

Results of current habitat analysis indicate that habitat supply in the short term is generally good but I acknowledge that these conditions could change as forests within the THLB are converted from existing to managed stands. I encourage staff to work at a provincial scale to continue in-depth study of wildlife abundance, diversity and habitat supply, and work with First Nations to improve understanding of First Nations uses of wildlife and of interactions between forest operations and those needs.

Section 8(8) (b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area.

Alternative rates of harvesting

- harvest sequencing

The base case was produced using in optimization model. Harvest priorities are not implemented in the same way as in a simulation model, e.g., an oldest-first rule. However, an optimization model tends to harvest the oldest stands first because they generally have the highest yield, which contributes most to the objective of maximizing total harvest volume. Harvest priorities can be achieved in an optimization model by setting constraints in the model with soft targets. The targets are allowed to be under achieved, but only with a penalty imposed on the overall model results. The model acts to minimize the penalty and this ensures that the targets are met as fully as possible.

In the base case model, a priority was set on harvesting pine-leading stands in accessible areas of mountain pine beetle infestation for the first two decades of the forecast. The model also required that 41 percent of the annual harvest occur in marginal sawlog and pulplog stands within the same accessible areas of the mountain pine beetle infestation in the first six decades of the forecast.

In one public comment, it was asserted that the selection of cutblocks to harvest in the timber supply model should be based on realistic short-term economic goals (e.g., distance to mill and stand volume). Currently, the model harvests stands in an order that maximizes timber supply (e.g., harvesting older slower growing stands first), but may make little economic sense (i.e., lacks realism). District staff acknowledged that this may be a valid operational concern but emphasize that the schedule of stands harvested by the model is not used to guide harvesting operations.

I have reviewed the harvest priorities used in the base case and conclude that they are appropriate for use in this determination. With regard to the assertion that the model should select cutblocks for harvesting based on “realistic, short-term goals”, I note that an AAC determination is a strategic decision made in the context of a longer time period than is used in operational planning and decision making. Consequently, although the base case operability assumptions attempt to reflect the full economic cycle, they do so without regard to short-term fluctuations in economic conditions.

Section 8(8) (c) repealed [2003-31-2 (B.C. Reg. 401/2003)]

This section of the *Forest Act* has been repealed [2003-31-2 (B.C. Reg. 401/2003)].

Section 8(8) (d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia

Economic and social objectives

- Minister's letters

The Minister of Forests and Range expressed the economic and social objectives of the Crown in two letters to the chief forester, dated July 4, 2006 (attached as Appendix 3) and October 27, 2010. The minister asked for consideration, during AAC determinations, of the importance of a stable timber supply in maintaining a competitive and sustainable forest industry while being mindful of other forest values.

In respect of this, in the base case projection and in the alternative harvest flow projections described above, a primary objective in the harvest flow has been to attain a stable, long-term harvest level where the growing stock also stabilizes.

Finally, the minister suggested that the chief forester should consider the local social and economic objectives expressed by the public, and relevant information received from First Nations.

During my consideration of the factors required under Section 8 of the *Forest Act*, I have been mindful of the local objectives, as provided in the Bulkley Land Use Plan and associated plans and orders. I have also reviewed the public consultation process undertaken by the district and considered the input received in making my determination. On this basis, I am satisfied that this determination accords with the objectives of government as expressed by the minister.

- other public input

The Minister's letter of July 4, 2006 suggests that the chief forester consider important social and economic objectives that may be derived from public input during the timber supply review, where these are consistent with government's broader objectives as well as any relevant information received from First Nations (see '*First Nations consultation*' above). To this end, two 60-day public review periods were provided, one for the data package and one for the public discussion paper. The submissions received during these reviews were either used to amend the data package on which the timber supply analysis was based and/or were presented for my consideration prior to determining a new AAC for the Bulkley TSA.

Submissions were received from local residents, Office of the Wet'suwet'en, Babine River Foundation, Bulkley Valley Community Resources Board and Pacific Inland Resource Ltd.

At the determination meeting with staff, I was provided with all of the public input. Where the input relates to a factor that I must consider in making my determination, I discuss that input in this rationale under the appropriate factor.

There were also some issues raised as part of the public review that did not relate to a specific factor. For example, there was input regarding the implications of climate change. I discuss the issue of climate change in the deputy chief foresters and chief forester's '*Guiding principles for AAC determinations*' above. Some input addressed concerns not directly related to my AAC determination, such as forest stewardship plan (FSP) monitoring, cumulative effects, or tenure issues. These issues are important and I would encourage the public to consult with district staff regarding how best to pursue these concerns. Some input expressed concern about the general TSR process or non-timber values including habitat supply which I cannot address in my AAC determination. I note that I am limited in considering only those habitat factors for which legal objectives have been established under the *Forest and Range Practices Act* or the *Land Act*.

I would like to thank all of the individuals and groups who participated in this timber supply review and note that their input has helped to inform my considerations in determining an AAC for the Bulkley TSA.

- employment and community dependence

The TSA lies within the Bulkley-Nechako Regional District, which is part of the Nechako Development Region (NDR). The NDR, which also includes the Stikine Regional District, encompasses about one-fifth of BC's total land base. With a population of about 40 000 residents, the NDR is the least populated development region in the province.

The major economic sectors in the regional district include: forestry, mining, tourism, and agriculture. The forest sector in the Bulkley TSA has been impacted by the decrease in lumber prices, but the emergence of new markets in China has allowed manufacturing of forest products to remain the leading industry in TSA.

Pacific Inland Resources, a division of West Fraser Mills Limited, operates a large sawmill in Smithers. It employs approximately 350 full-time equivalent employees in two shifts per day, and produces about 21 million board feet of lumber per month. Northern Engineered Wood Products operates a particleboard and melamine plant in Smithers. It employs approximately 50 full-time equivalent employees in two shifts per day and produces about 4.5 million square feet of panel product per month. Several small sawmills and log home builders also operate in the area.

Section 8(8)(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Unsalvaged losses

- unsalvaged losses - general

District staff estimated unsalvaged losses of 2600 cubic metres per year for wildfire and 5500 cubic metres per year for windthrow. These estimates are based on data from the Northwest Fire Centre for 1977 to 1996 and a study of windthrow losses in the 1990s. These losses apply to the TSA and the Wetzink'wa Community Forest Agreement. The base case applied an unsalvaged loss of 7700 cubic metres per year to the TSA, which was calculated by prorating the

total unsalvaged loss of 8100 cubic metres per year for the portion of the THLB located outside of the Wetzink'wa Community Forest Agreement.

A member of the public asserted that the unsalvaged loss estimate for fire was too low and that the historical time period used to derive this estimate does not represent the long-term timeframe of major fire cycles. District staff responded that the estimate reflects the fire history of the 17 years since the estimate was made, which provides almost 40 years of fire history. In addition to this reply, I note that periodic redetermination of the AAC will provide opportunity in the future to address any changes in fire history.

The last TSR contained an unsalvaged loss estimate for balsam bark beetle but subsequent research indicates that natural stand yield tables account for losses due to balsam bark beetle. The last TSR also contained an unsalvaged loss estimate for hard stem rusts, leader weevils and *Tomentosus sp.* root rot. These losses occur sporadically throughout the TSA and in the base case it is assumed that they are accounted for by operational adjustment factor 2 (OAF 2) applied to managed stand yield tables. Losses due to mountain pine beetle and *Dothistroma septosporum* (*dothistroma*) needle blight are addressed separately below.

A member of the public commented that unsalvaged loss due to balsam bark beetles should not be reduced to zero without better evidence. While this indicates that balsam bark beetle mortality may already be accounted for in VDYP volume estimates, it also indicates that the new VRI may overestimate volume. District staff advise that considerable work was done to estimate balsam bark beetle losses and compare with inventory predictions of volume. This work confirmed that VDYP accounts for endemic levels of balsam bark beetle. I also note that FAIB staff continue to work on VRI issues as described under '*Base case for the Bulkley TSA*' and '*volume estimates for existing stands*', and I am confident that the application of VRI Phase II adjustments in the revised base case reduces uncertainty about timber supply in the Bulkley TSA.

Several members of the public feel that there is evidence of climate change having a direct effect on the frequency and severity of natural disturbances. They feel that it would be prudent to increase the annual unsalvaged loss projection due to forest health factors (wildfire, disease, and insects) to better reflect the increased probability of greater levels of disturbance. One person suggested that in the interests of caution, a one-percent reduction should be applied each for the increasing frequency of wildfires and increasing occurrence of spruce and balsam bark beetles due to warmer winters and ageing stands. District staff advise that no data were presented to support this statement, and I concur that it is speculative.

The deputy chief foresters and I have described our approach to considering climate change in our '**Guiding principles**', which indicate that the impact of climate change and management responses to it are uncertain. In practice this means that although we acknowledge that climate is changing, we cannot account for the changes in any single AAC determination; however, the cyclic nature of AAC determinations ensures that as information and forest management practices evolve, the timber supply can be regularly reassessed.

In addition to climate change, the guiding principles also describe our reasoning regarding uncertainty, as follows: given there will always be uncertainty and due to the significant impacts that AAC determinations can have on communities, we cannot make AAC determinations solely on the basis of a response to uncertainty. In this situation, in the absence of data, I am unwilling to speculate on changes in wildfires and forest pests; however, as information becomes available it will be considered in subsequent determinations.

I have considered the base case information and the public input and I conclude that the base case used an appropriate estimate of unsalvaged losses.

- dothistroma needle blight

Dothistroma needle blight is affecting the growth and survival of pine-leading plantations, primarily in the Interior Cedar-Hemlock (ICH) BEC zone, with a minor incidence found in the Sub-Boreal Spruce (SBS) and Englemann Spruce – Subalpine Fir (ESSF) BEC zones. Multiple dothistroma infections over several years have reduced growth and can cause mortality. Spread of the disease has been facilitated by a series of wet summers, which may be tied to long-term climate change.

Pine-leading plantations in the ICH were surveyed in 2006 and 2008. The surveys assessed the total stocking level of the stand, and the level of dothistroma present. The stands were grouped into one of three categories based on the perceived risk of maintaining minimum stocking levels: ‘stocking likely without pine’, ‘wait and see’, and ‘action imperative’. In the base case, stands classified as ‘stocking likely without pine’ were assigned to an appropriate managed stand yield table according to the BEC variant and PEM moisture class with stand ages reduced by 10 years to represent the layer of younger conifers growing below the main pine canopy. The expectation is that the younger conifers will form the next harvestable stand, as the pine overstorey dies back. Stands classified as ‘wait and see’ were assigned to an appropriate managed stand yield table according to BEC variant and PEM moisture class, and normal growth was assumed. Stands classified as ‘action imperative’ were assigned to an appropriate managed stand yield table with stand ages reduced by 20 years to represent the layer of fill-planted conifers that are expected to produce the next harvestable stand.

A licensee commented that the dothistroma losses assumed in the base case are overstated, and that formal surveys are required. The licensee recommended reviewing this as a sensitivity analysis as very little area in the Bulkley TSA has been affected by dothistroma to date. District staff confirm that surveys have been conducted and that the base case incorporates the results of these studies. They also advise that that total affected area amounts to about one percent of the THLB.

A member of the public suggested that ‘wait and see’ stands be assigned a 15-year delay as they are not as predictable as “stocking likely without pine” stands. District staff advised that the amount of area in this category represents only 0.3 percent of THLB, so the effect of a 15-year delay instead of a 10-year delay on the base case harvest levels would be negligible.

I have considered the approach used in the base case to account for dothistroma, the amount of area involved, and I conclude that the base case appropriately accounted for dothistroma.

- mountain pine beetle

Mountain pine beetle (MPB) attack levels in the Bulkley TSA are lower than many other areas of the province because the TSA is upwind of the primary source of MPB infestation, terrain impedes spread, and pine inventory is relatively low with pine-leading stands representing only 24 percent of the THLB.

The assumptions for MPB that were incorporated into the base case were: the volume of MPB-killed pine remained static as of 2010 – regular harvesting and small scale salvage would address any incremental MPB-killed pine; dead pine merchantability would be 20 years (first 10 years as sawlog; then changed to pulpwood quality); and infestation would return to endemic levels after two decades, with MPB-killed pine treated as non-recoverable losses.

A sensitivity analysis examined the impact of a ‘worst case scenario’ using the BCMPB (FLNR’s MPB model) 2012 projection compared with the initial base case. In this analysis, 65 percent of all pine in stands older than 60 years was killed in the first decade. Results showed that the first decade harvest level of the initial base case could be maintained in the first decade although the

mid-term harvest level was 11 percent lower than in the initial base case. To be clear, the reduction in mid-term harvest level occurred even when the first decade harvest level was lower than that of the initial base case. Thus, the mid-term harvest level reduction is not caused by maintaining the first decade harvest level of the initial base case. Applying this sensitivity analysis to the revised base case would be expected to demonstrate a proportional result because total inventories were increased but the percent of pine killed would be maintained at 65 percent.

Public comments were received about the possible impact of aging stands and climate change (specifically warmer winters) on MPB spread. In British Columbia, the BCMPB model is used to project the annual volume of pine killed by mountain pine beetle. These projections do account for continued warm winters. The 2012 BCMPB projection for the Bulkley TSA indicated that the MPB peak had occurred in 2012 and that 65 percent of pine would be killed by 2022.

Preliminary results from the 2013 projection indicate that the peak actually occurred in 2011 and that 57 percent of pine will be killed by 2022. Actual attack levels in both the Bulkley TSA and the province have been consistently lower than projected each year by the BCMPB. District staff are reasonably confident that the infestation has peaked and is falling. For this reason, the base case forecast assumed a lower rate of mortality for pine than was projected with the BCMPB.

I concur with the approach used in the base case.

I am aware that a licensee asserted that the data package overstates pine species composition at 25 percent of the inventory, and that most of the accessible pine in the TSA will be infested and subsequently harvested over the next decade. District staff responded indicating that the data package was revised and the new estimate of pine composition is 19 percent of THLB volume. District staff agree with the opinion regarding the infestation projection, hence the harvest priority on accessible infested stands used in the timber supply model.

A public comment was received, in which it was asserted that the Babine River corridor, Babine SMZ2 and landscape corridors will be most impacted by beetles, that no strong case can be made that salvage will control beetle population and prevent spread, and that green wood harvest will likely have higher negative impact on non-timber values. In addition, the effectiveness of using pheromone plus green harvest in controlling spread of MPB was questioned. In response, district staff indicated that experience in Babine SMZ2 is that a well-designed pheromone program coupled with green wood harvest of infested stems is effective for controlling the spread of small localized beetle populations into surrounding areas. Harvesting is permitted in SMZ2 and forest cover constraints for these areas were included in the base case.

A member of the public stated that productivity estimates have increased significantly since the last TSR and that the MPB losses in the public discussion paper appear to have been over-estimated. They question the sensitivity analysis that showed the Bulkley TSA will experience the 11 percent loss projected in the mid-term and suggested that these results not be decisive in this AAC determination. I note that the sensitivity analysis presented a worst case scenario and based on current projections and district experience, I accept that the base case appropriately modelled a lower rate of MPB infestation.

A member of the public asserted that the data package did not account for the long-term impacts of beetle epidemics and that doing modelling now may head-off anticipated scenarios with an aging tree inventory and species under threat. I note that the base case does address long-term impacts of the current beetle epidemic and, as described above, I consider the base case to have modelled the MPB infestation appropriately.

In another comment received from the public, it was asserted that increasing the AAC to allow the harvest of stands with greater than 50 percent mortality, or stands with abundant advanced regeneration, will negatively impact mid-term timber supply, and that there is no justification for

increasing the AAC. District staff responded, indicating that the base case focussed short-term harvest effort into beetle-infested pine-leading types within the current AAC level, while not compromising achievement of non-timber objectives. I concur with this response.

I have considered the public comment and the advice provided by district staff. I conclude that the base case appropriately modelled a lower rate of MPB infestation than projected by the BCMPB model. I have considered the sensitivity analysis of a worst case scenario for MPB and I have reasoned as follows regarding the effect of a higher MPB infestation rate on timber supply. The sensitivity analysis showed that the first decade harvest level could still be maintained for one decade in the initial base case, and I accept that a similar result would occur with the revised base case. Since maintaining the first decade harvest level in a worst case scenario does not exacerbate the impact on mid-term harvest levels, I conclude that there is a low risk to the first decade harvest level if the MPB infestation increases beyond current levels.

Reasons for Decision

In reaching my AAC determination for the Bulkley TSA I have considered all of the factors required under Section 8 of the *Forest Act* and I have reasoned as follows.

In the base case, a harvest level of 849 000 cubic metres per year is maintained for one decade before decreasing by four percent to 813 480 cubic metres per year. This harvest level is then maintained into the long term.

In determining an AAC for the Bulkley TSA, I have identified a number of factors which, if considered separately, indicate reasons why the timber supply may be greater or less than that projected in the base case. Some of these factors can be quantified and their impact on the harvest level assessed with reliability. Others may influence timber supply by adding an element of risk or uncertainty to the decision, but cannot be reliably quantified at this time.

In my considerations for the Bulkley TSA, the following factors have been identified as a reason why the timber supply projected in the base case may have been underestimated:

- log grade adjustments – the new interior log grade system requires in logs to be charged to the AAC if they meet grade specifications regardless of whether they were alive or dead at the time of harvest. This volume was not included in the base case harvest forecast. I have concluded that on this account the base case short- and mid-term harvest levels have been underestimated by about eight percent.
- mountain goat - a small area (2350 hectares) equal to 0.8 percent of the current THLB, of operable mountain goat winter range was inappropriately excluded from the base case harvest forecast. I have concluded that on this account the base case harvest levels throughout the forecast period have been underestimated by about one percent.

In considering the above-mentioned factors, I find that the combined effect of the log grade changes and the exclusion of mountain goat habitat from the THLB represent an underestimation of about nine percent for at least the first decade of the base case.

The current AAC in the Bulkley TSA is 852 000 cubic metres with partitions of 520 000 cubic metres (59 percent of the AAC) for sawlog stands and 362 000 cubic metres (41 percent of the AAC) for marginal sawlog and pulpwood stands. After accounting for the issuance of the Wetzink'wa Community Forest Agreement, the AAC for the remainder of the TSA is 849 000 cubic metres. The base case confirmed that 59 percent of the THLB occurs in sawlog stands and 41 percent of the THLB occurs in marginal sawlog and pulpwood stands.

The current AAC in the Bulkley TSA is 852 000 cubic metres with partitions of 520 000 cubic metres (59 percent of the AAC) for sawlog stands and 362 000 cubic metres (41 percent of the AAC) for marginal sawlog and pulpwood stands. After accounting for the issuance of the Wetzink'wa Community Forest Agreement, the AAC for the remainder of the TSA is 849 000 cubic metres. The base case confirmed that 59 percent of the THLB occurs in sawlog stands and 41 percent of the THLB occurs in marginal sawlog and pulpwood stands.

Given that the base case harvest forecast demonstrated that a harvest level of 849 000 cubic metres can be maintained for the first decade while still maintaining a harvest that consists of 59 percent for sawlog stands and 41 percent for marginal sawlog and pulpwood stands, and that a possible nine percent underestimation of timber supply was not accounted for in the base case, I conclude that it is possible to maintain the current AAC of 852 000 cubic metres without impacting mid- and long-term timber supply. At the same time, I do not believe it would be appropriate to increase the harvest in the first decade on the basis of this underestimation. Given the projected decline in harvest level in the second decade, this would exacerbate that future adjustment. A future timber supply analysis may find that this underestimation helps mitigate that future adjustment.

With respect to marginal sawlog and pulpwood stands, I am mindful that in spite of the temporary transfer of harvest activity to other TSAs to support the salvage of pine killed by mountain pine beetle and a period of low lumber prices, harvest activity in the marginal sawlog and pulpwood stands continued. This confirms that there is a demand for this lower quality timber and the continued ability to harvest in these stands represents a viable economic opportunity. However, I am also aware that sawlog stands have a consistently higher value than marginal stands, and consequently these stands would likely be harvested in preference to the marginal sawlog and pulpwood stands. On this basis, I have decided to include the harvest volume attributable to marginal sawlog and pulpwood stands in the new AAC. However, in order to avoid a concentration of harvesting in sawlog quality stands I am also establishing a partition in the AAC as discussed below.

Determination

I have considered and reviewed all the factors as documented above, including the risks and uncertainties of the information provided. It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next 10 years and that reflects current management practices as well as the socio-economic objectives of the Crown, can be best achieved in the TSA by establishing an AAC of 852 000 cubic metres that includes a partition of 502 700 cubic metres attributable to sawlog stands. Further details regarding the AAC partition are provided under “**New AAC determination**” on pages 2-3 of this document.

This determination is effective January 29, 2014, and will remain in effect until a new AAC is determined, which must take place within 10 years of the effective date of this determination.

If additional significant new information is made available to me, or major changes occur in the management assumptions upon which I have predicated this decision, then I am prepared to revisit this determination sooner than the 10 years required by legislation.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage Ministry of Forests, Lands and Natural Resource Operations (FLNR) staff and licensees to undertake or support the tasks and studies noted below, the particular benefits of which are described in appropriate sections of this rationale document. I recognize that the ability of staff and licensees to undertake or support these projects is dependent on available resources,

including funding. These projects are; however, important to help reduce the risk and uncertainty associated with key factors that affect the timber supply in the Bulkley TSA.

1. I encourage district staff and licensees to carry out additional monitoring in the *cable – marginal sawlog* zone so that more comprehensive information can be made available for the next TSR.
2. I encourage ongoing collaborative work between FLNR staff and licensees for stand development monitoring so as to enhance understanding of the stocking and viability of future second-growth stands; particularly those regenerated from Class A seed.
3. I request that FLNR staff monitor forest stewardship plans to determine if the Higher Level Plan Order objectives for patch size distribution are being met.
4. I request further monitoring of partition performance; particularly in the marginal sawlog/pulpwood partition to determine if these stands are being converted to second growth at a reasonable rate to protect future timber supply. I also request that this information be incorporated into the next timber supply review.



Dave Peterson, RPF
Chief Forester

January 29, 2014

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the *Forest Act*, Revised Statutes of British Columbia 1996, c. 157, (current to December 31, 2013), reads as follows:

Allowable annual cut

8 (1) The chief forester must determine an allowable annual cut at least once every 10 years after the date of the last determination, for

(a) the Crown land in each timber supply area, excluding the Crown land in the following areas:

- (i) tree farm licence areas;
- (ii) community forest agreement areas;
- (iii) first nations woodland licence areas;
- (iv) woodlot licence areas, and

(b) each tree farm licence area.

(2) If the minister

(a) makes an order under section 7 (b) respecting a timber supply area, or

(b) amends or enters into a tree farm licence to accomplish a result set out under section 39 (2) or (3),

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

(c) within 10 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 10 years after the date of the last determination.

(3) If

(a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and

(b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 10 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).

(3.1) If, in respect of the allowable annual cut for a timber supply area or tree farm licence area, the chief forester considers that the allowable annual cut that was determined under subsection (1) is not likely to be changed significantly with a new determination, then, despite subsections (1) to (3), the chief forester

(a) by written order may postpone the next determination under subsection (1) to a date that is up to 15 years after the date of the relevant last determination, and

(b) must give written reasons for the postponement.

(3.2) If the chief forester, having made an order under subsection (3.1), considers that because of changed circumstances the allowable annual cut that was determined under subsection (1) for a timber supply area or tree farm licence area is likely to be changed significantly with a new determination, he or she

(a) by written order may rescind the order made under subsection (3.1) and set an earlier date for the next determination under subsection (1), and

(b) must give written reasons for setting the earlier date.

(4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).

(5) In determining an allowable annual cut under subsection (1) the chief forester may specify that portions of the allowable annual cut are attributable to one or more of the following:

(a) different types of timber or terrain in different parts of Crown land within a timber supply area or tree farm licence area;

(a.1) different areas of Crown land within a timber supply area or tree farm licence area;

(b) different types of timber or terrain in different parts of private land within a tree farm licence area.

(c) [Repealed 1999-10-1.]

(6) The minister must determine an allowable annual cut for each woodlot licence area, in accordance with the woodlot licence for that area.

(7) The minister must determine an allowable annual cut for

(a) each community forest agreement area in accordance with the community forest agreement for that area, and

(b) each first nations woodland licence area in accordance with the first nations woodland licence for that area.

(8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

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

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

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

(iii) silviculture treatments to be applied to the area,

(iv) the 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 the chief forester's opinion, relates to the capability of the area to produce timber,
 - (b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,
 - (c) [Repealed 2003-31-2.]
 - (d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and
 - (e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.
- (9) Subsections (1) to (4) of this section do not apply in respect of the management area, as defined in section 1 (1) of the *Haida Gwaii Reconciliation Act*.
- (10) Within one year after the chief forester receives notice under section 5 (4) (a) of the **Haida Gwaii Reconciliation Act**, the chief forester must determine, in accordance with this section, the allowable annual cut for
- (a) the Crown land in each timber supply area, except the areas excluded under subsection (1) (a) of this section, and
 - (b) each tree farm licence area
- in the management area, as defined in section 1 (1) of the *Haida Gwaii Reconciliation Act*.
- (11) The aggregate of the allowable annual cuts determined under subsections (6), (7) and (10) that apply in the management area, as defined in section 1 (1) of the *Haida Gwaii Reconciliation Act*, must not exceed the amount set out in a notice to the chief forester under section 5 (4) (a) of that Act.

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

Section 4 of the *Ministry of Forests and Range Act* (current to December 31, 2013) reads as follows:

Purposes and functions of ministry

- 4 The purposes and functions of the ministry are, under the direction of the minister, to do the following:
 - (a) encourage maximum productivity of the forest and range resources in British Columbia;
 - (b) manage, protect and conserve the forest and range resources of the government, having regard to the immediate and long term economic and social benefits they may confer on British Columbia;
 - (c) plan the use of the forest and range resources of the government, 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 government and with the private sector;
 - (d) encourage a vigorous, efficient and world competitive
 - (i) timber processing industry, and
 - (ii) ranching sectorin British Columbia;
 - (e) assert the financial interest of the government in its forest and range resources in a systematic and equitable manner.

Appendix 3: Minister's letter of July 4, 2006



JUL 04 2006

Jim Snetsinger
Chief Forester
Ministry of Forests and Range
3rd Floor, 1520 Blanshard Street
Victoria, British Columbia
V8W 3C8

Dear Jim:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the responsibility for determining Allowable Annual Cuts—decisions with significant implications for the province's economy, communities and environment. This letter outlines the economic and social objectives of the Crown you should consider in determining Allowable Annual Cuts, as required by Section 8 of the *Forest Act*. This letter replaces the July 28, 1994 letter expressing the economic and social objectives of the Crown, and the February 26, 1996 letter expressing the Crown's economic and social objectives for visual resources. The government's objective for visual quality is now stated in the *Forest Practices and Planning Regulation of the Forest and Range Practices Act*.

Two of this government's goals are to create more jobs per capita than anywhere in Canada and to lead the world in sustainable environmental management. The Ministry of Forests and Range supports these objectives through its own goals of sustainable forest and range resources and benefits. In making Allowable Annual Cut determinations, I ask that you consider the importance of a stable timber supply in maintaining a competitive and sustainable forest industry, while being mindful of other forest values.

The interior of British Columbia is in the midst of an unprecedented mountain pine beetle outbreak. Government's objectives for management of the infestation are contained in British Columbia's Mountain Pine Beetle Action Plan. Of particular relevance to Allowable Annual Cut determinations are the objectives of encouraging long-term economic sustainability for communities affected by the epidemic; recovering the greatest value from dead timber before it burns or decays, while respecting other forest values; and conserving the long-term forest values identified in land use plans.

Page 1 of 2

Minister of
Forests and Range
and Minister Responsible
for Housing

Office of the
Minister

Mailing Address:
PO Box 9049 Stn Prov Govt
Victoria BC V8W 9E2
Telephone: 250 387-6240
Facsimile: 250 387-1040

Location:
Parliament Buildings
Victoria BC V8V 1X4
e-mail: FOR.Minister@gov.bc.ca



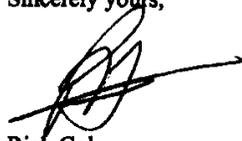
Jim Snetsinger

To assist the province and affected communities in planning their responses to the beetle infestation, it would be best to have realistic assessments of timber volumes that can be utilized economically. Therefore, in determining the best rate of harvest to capture the economic value from beetle-killed timber, I ask that you examine factors that affect the demand for such timber and products manufactured from it, the time period over which it can be utilized, and consider ways to maintain or enhance the mid-term timber supply.

The coast of British Columbia is experiencing a period of significant change and transition. In making Allowable Annual Cut determinations I urge you to consider the nature of timber supply that can contribute to a sustainable coast forest industry, while reflecting decisions made in land and resource management plans.

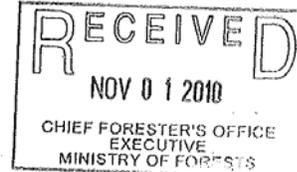
You should also consider important local social and economic objectives expressed by the public during the Timber Supply Review process, where these are consistent with the government's broader objectives as well as any relevant information received from First Nations.

Sincerely yours,

A handwritten signature in black ink, appearing to be 'Rich Coleman', with a long horizontal stroke extending to the right.

Rich Coleman
Minister

Appendix 4: Minister's letter of October 27, 2010



File: 280-30/MPB
Ref: 126097

OCT 27 2010

Jim Snetsinger, Chief Forester
ADM Forest Resource Stewardship Division
Ministry of Forests and Range
3rd Floor, 1520 Blanshard Street
Victoria, British Columbia
V8W 3C8

Dear Mr. Snetsinger:

Re: Economic and Social Objectives of the Crown Regarding Mid-Term Timber Supply in Areas Affected by the Mountain Pine Beetle

On July 4, 2006, Rich Coleman, former Minister of Forests and Range, wrote to you outlining the social and economic objectives of the Crown for AAC determination (in accordance with Section 8 of the *Forest Act*) with respect to issues associated with the Mountain Pine Beetle (MPB) epidemic. The aforementioned letter articulated the Crown's objectives of ensuring long-term economic sustainability for communities affected by the epidemic; recovering the greatest value from dead timber before it burns or decays, while respecting other forest values; and conserving the long-term forest values identified in land use plans. I am writing to you regarding the Crown's objectives with respect to mid-term timber supply in areas affected by the mountain pine beetle.

The MPB infestation has had a profound impact on the timber supply outlook for the interior of the province. In particular, forecasts of timber supply in the mid-term—the period between the ending of the economic shelf life of killed pine and the time when the forest has re-grown and again become merchantable—are now significantly lower than prior to the infestation. These shortages threaten the wellbeing of forest-dependent cities and towns. The

Page 1 of 2

Ministry of Forests and Range and
Minister Responsible for Integrated
Land Management Bureau

Minister's Office

Mailing Address:
P.O. BOX 9049 Stn Prov Govt
Victoria, BC V8W 1X4

Tel: (250) 387-6240
Fax: (250) 387-1040
Website:
gov.bc.ca/forlmbwww.gov.bc.ca

Jim Snetsinger, Chief Forester

Government of British Columbia is working closely with beetle action committees, municipalities, and the private sector to diversify economies. However, for many forestry-dependent towns mid-term timber supply shortages could still have significant socio-economic impacts.

During this challenging time it will be necessary to reassess management objectives and administrative approaches that were developed when forest conditions in the province's interior were very different than now exist. In this reassessment it will be important to enhance the understanding of how best to balance objectives for non-timber forest values with objectives for timber supply to achieve a range of socio-economic benefits. It will also be important to assess how innovative practices and incremental silviculture could mitigate mid-term timber supply shortfalls in MPB affected areas, and if flexibilities can be found in timber supply administration.

During the Timber Supply Review process, in addition to the considerations included in the July 2006 letter, I would like you to undertake analysis that can provide information on how changes to current management practices and administration could increase mid-term timber availability in MPB-affected areas. This information should be shared with Ministry of Forest and Range Executive and used to inform discussions among interested parties, and considered by appropriate land use and management decision makers. If formal changes are made to management objectives and administration, you will be in a position to incorporate those changes in Timber Supply Reviews and AAC determinations.

Sincerely,



Pat Bell
Minister

pc: Dana Hayden, Deputy Minister