

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

**Arrow
Timber Supply Area**

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

November 16, 2017

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Table of Contents

Objective of this document 1

Acknowledgement 1

Statutory framework 1

Description of the Arrow Timber Supply Area 1

History of the AAC for the Arrow TSA 2

New AAC determination 2

Information sources used in the AAC determination..... 2

Role and limitations of the technical information used 5

Guiding principles for AAC determinations 5

 Integrated decision making5

 Information uncertainty.....5

 Climate change.....6

 First Nations.....7

The role of the base case 7

Base case for the Arrow TSA 8

Consideration of factors as required by Section 8 of the *Forest Act*..... 9

 Land base contributing to timber harvesting 10

 - general comments10

 - areas considered inoperable11

 - steep slopes11

 - non-merchantable forest types: problem stands12

 Existing forest inventory 12

 - volume estimate for managed stands12

 - Armillaria root disease13

 - log grade changes13

 Utilization..... 14

 - residual waste.....14

 - grade 4 credit14

 Integrated resource management objectives..... 15

 - landscape-level biodiversity: old-growth management area15

 - stand-level biodiversity16

 - scenic resources16

 - ungulate winter range.....17

 - wildlife habitat area for grizzly bear18

Other information.....	18
- historic harvest performance.....	18
- climate change	19
- First Nations consultation	20
- wildlife habitat supply	23
Alternative rates of harvest.....	25
- alternative harvest flows	25
Economic and social objectives	26
- Minister’s letters	26
- local objectives	26
Reasons for Decision	26
Determination	28
Implementation	28
Appendix 1: Section 8 of the <i>Forest Act</i>	30
Appendix 2: Section 4 of the <i>Ministry of Forests and Range Act</i>	33
Appendix 3: Minister’s letter of July 4, 2006	34
Appendix 4: Minister’s letter of October 27, 2010	36

List of Tables

Table 1. Apportionment of the 2005 AAC	2
Table 2. Section 8 of the Forest Act: factors accepted as modelled in the base case	9

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 Arrow 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 British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (“the Ministry”) in the Selkirk Natural Resource District 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 Arrow Timber Supply Area

The Arrow TSA, located in southern British Columbia (BC) in the Kootenay Boundary Natural Resource Region, covers approximately 1.286 million hectares and is administered from the Selkirk Natural Resource District offices located in Nelson, Castlegar, Grand Forks and Revelstoke.

The Arrow TSA is located within all or portions of twelve First Nations’ territories: Adams Lake Indian Band, Ktunaxa Nation Council, Lower Similkameen Indian Band, Neskonlith Indian Band, Okanagan Indian Band, Okanagan Nation Alliance (ONA), Osoyoos Indian Band, Penticton Indian Band, Shuswap Indian Band, Splots’in, Upper Nicola Band, and Westbank First Nation. None of these First Nations’ have communities within the Arrow TSA.

The Arrow TSA is bounded to the south by the Canada – U.S.A. border, to the west by the Monashee Mountains, and to the east, by the Selkirk Mountains. Forests in the interior of the Arrow TSA are among the most productive and diverse in the interior of the province. The predominant tree species at higher elevations are subalpine fir and Engelmann spruce. At lower elevations they are Douglas-fir, lodgepole pine, western larch, western hemlock and western redcedar, with other species also being common in the TSA. The distinct ecological features and the unique nature of the Arrow TSA contribute to high biodiversity values; for example, most BC ungulate species are present including: bighorn sheep, white-tailed deer, mule deer, moose, mountain goats, elk and caribou. The diverse ecology and mountainous terrain and lakes provide a wide range natural resource values within the Arrow TSA including: timber, fish, wildlife habitat, water, recreation and tourism.

The TSA includes four major communities: Trail, Castlegar, Fruitvale, and Rossland. Smaller communities include: Warfield, Nakusp, Salmo, Montrose, New Denver, Slocan, and Silverton. The most recent economic dependency estimates provided by BC Stats (*2006 Economic Dependency Tables for forest districts*, Garry Hornes, BC Stats, February 2009) show that the main sources of employment in the Arrow Boundary area are the public sector (31 percent), forestry (19 percent) and tourism (14 percent).

History of the AAC for the Arrow TSA

In 1981, the AAC for the Arrow TSA was set at 640 000 cubic metres. In 1983, the AAC was reduced to 619 000 cubic metres after the creation of Valhalla Provincial Park and this AAC level was maintained in the 1995 determination.

The 2001 AAC determination reduced the AAC to 550 000 cubic metres due to additional constraints on the timber harvesting land base. In 2005, the AAC was maintained at 550 000 cubic metres.

Between 2008 and 2016, there were two uplifts, under the Innovative Forest Practices Agreement (IFPA), for 34 000 and 22 000 cubic metres per year for four-year terms, respectively. These were not included in the chief forester's AAC (and have since expired), therefore, the AAC was maintained at 550 000 cubic metres.

On December 11, 2011, the AAC was adjusted to 513 700 cubic metres under the AAC Administration Regulation to account for the creation of two new Community Forests (Slocan Integral Forestry Cooperative and Nakusp and Area Community Forest).

Subsequent to this, there were small land base withdrawals for a woodlot licence and the creation of the Cascadia TSA, resulting in an effective AAC of 505 853 cubic metres.

Table 1. Apportionment of the 2005 AAC

Type of licence	Total m ³	Percent
Forest Licences Replaceable	346 882	63.07
BCTS	157 587	28.65
Community Forest Agreement	40 000	7.27
Woodlot Licence	3 000	0.55
Forest Service Reserve	2 531	0.46
Total	550 000	100

New AAC determination

Effective November 16, 2017, the new AAC for the Arrow TSA is 500 000 cubic metres. 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

The information sources considered in determining this AAC for the Arrow TSA include but are not limited to, the following:

- 2006 Economic Dependency Tables for forest districts, (Feb 2009), Garry Hornes, BC Stats.
- A field guide to site classification and identification for southeast British Columbia – Volume 1: the south-central Columbia Mountains. Prov. BC, (2016), MacKillop, D.J. and E.J. Ehman, Victoria, BC Land Manag. Handb. 70.
- A Temporary Supplement to Land Management Handbook 70 – A field guide to ecosystem classification and identification for southeast British Columbia: four biogeoclimatic subzones/variants in the Boundary-Okanagan. Prov. BC, (2016), MacKillop, D.J., A.J. Ehman, and M. Ryan. Victoria, BC.

- Adapting forest management to climate change in the West and South Coast Regions: Considerations for planners and practitioner, (2014 draft), BC Ministry of Forests, Lands, and Natural Resource Operations.
- Adapting forest and range management to climate change in the Kootenay Boundary Region: Considerations for practitioners and Government staff, (February 22, 2016).
- Arrow Innovative Forest Practices Agreement operational adjustment factor project needs analysis, (2001), Timberline Forest Inventory Consultants Ltd., Victoria, BC.
- *ARROW TSA Documentation of Analysis for Vegetation Resources Inventory Statistical Adjustment*, (January, 2006), Jahraus & Associates Consulting Inc., Prepared for Springer Creek Forest Products Ltd. On Behalf of the Arrow TSA Forest Licence Group.
- *Arrow Timber Supply Area Analysis Report*, (April, 2004), Timberline Forest Inventory Consultants Ltd., Victoria, BC.
- *Arrow Timber Supply Area: Rationale for Allowable Annual Cut determination*, (2005), BC Ministry of Forests, Forest Analysis Branch, Victoria, BC.
- *Arrow Timber Supply Area Timber Supply Review: Data Package*, (April, 2016), BC Ministry of Forests, Lands, and Natural Resource Operations, Forest Analysis and Inventory Branch, Victoria, BC.
- *Arrow Timber Supply Area Timber Supply Review: Public Discussion Paper*, (September, 2016), BC Ministry of Forests, Lands, and Natural Resource Operations, Forest Analysis and Inventory Branch, Victoria, BC.
- *Biogeoclimatic Ecosystem Classification (BEC) Program and climate change*. Available: <https://www.for.gov.bc.ca/hre/becweb/>.
- *British Columbia's southern interior forests: Armillaria root disease stand establishment decision aid*, (2008), Cleary, M., van der Kamp, B. and Morrison, D., BC Journal of Ecosystems and Management 9(2):60–65.
- Demonstrating growth and yield adjustments (TIPSY OAFs) for Armillaria root disease in a timber supply analysis, (2004), Stephen Stearns-Smith, Gordon Neinaber, Michael Cruickshank and Albert Nussbaum.
- *Documentation of Analysis for Vegetation Resources Inventory Statistical Adjustment*, (March 2002), BC Ministry of Sustainable Resource Management, Terrestrial Information Branch, Victoria, BC.
- *Effectiveness of Existing GAR Orders in Meeting Mule Deer Winter Range Needs*, (2016), Day, K, Sullivan, T. P. and Peel, D., Alex Fraser Research Forest, Williams Lake, BC, Applied Mammal Research Institute, Summerland, BC, BC Ministry of Forests, Lands and Natural Resource Operations, Kamloops, BC.
- *Forest Act and Regulations*, R.S.B.C. c.157 (1996). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/96157_02 (consolidated to November 1, 2017).
- *Forest Planning and Practices Regulation*. (2004). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/14_2004 (consolidated to November 7, 2017).
- *Forest Practices Code of British Columbia Act and Regulations*, R.S.B.C. c. 159 (1996). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/96159_01 (consolidated to November 1, 2017).
- *Forest and Range Practices Act and Regulations*, S.B.C. c.69 (2002). Available: http://www.bclaws.ca/Recon/document/ID/freeside/00_02069_01 (consolidated to November 1, 2017).
- *Forest Roads and Grizzly Bear Management in the Kettle-Granby Area*, (2017), Forest Practices Board. FPB/IRC/210. Available: <https://www.bcfpb.ca/wp-content/uploads/2017/08/IRC210-Kettle-Granby.pdf>.
- *Government Actions Regulation*. (2004). Available: www.bclaws.ca/civix/document/id/complete/statreg/582_2004 (consolidated to November 7, 2017).

- *Heritage Conservation Act*, R.S.B.C. c. 187 (1996). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/96187_01 (consolidated to November 1, 2017).
- *Identified Wildlife Management Strategy, Procedures for Managing Identified Wildlife*, (2004), BC Ministry of Water, Land and Air Protection, Victoria, BC. Available: <http://www.env.gov.bc.ca/wld/frpa/iwms/procedures.html>.
- *Kootenay-Boundary Higher Level Plan Order*. BC Ministry of Sustainable Resource Management, October 2002, and variances. Available: <https://www.for.gov.bc.ca/tasb/slrp/lrmp/cranbrook/kootenay/pdf/KBHLPOrder0925.pdf>.
- *Kootenay-Boundary Land Use Plan Implementation Strategy*, Kootenay Inter-Agency Management Committee, 1997. Available: <https://www.for.gov.bc.ca/tasb/slrp/pdf/LRMP/Kootenay%20Boundary%20Land%20Use%20Plan%20Implementation%20Strategy.pdf>.
- *Land Act*, R.S.B.C. c. 245 (1996). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/96245_01 (consolidated to November 1, 2017).
- Letter conveying government's objectives regarding the achievement of acceptable impacts on timber supply from biodiversity management, August 25, 1997, Deputy Ministers of Forests and of Environment, Lands and Parks.
- Letters from the Minister of Forests and Range to the chief forester, dated July 4, 2006 and October 27, 2010, stating the Crown's economic and social objectives for the province.
- *Mark Monthly Billing History Reports* (2000-2014), BC Ministry of Forests, Lands, and Natural Resource Operations, Harvest Billing System.
- *Ministry of Forests and Range Act*, R.S.B.C. c. 300 (1996). Available: http://www.bclaws.ca/civix/document/id/complete/statreg/96300_01 (consolidated to November 1, 2017).
- Order Establishing Provincial Non-Spatial Old Growth Objectives (2004). Available: https://www.for.gov.bc.ca/tasb/slrp/policies-guides/old-growth/Old_Growth_Order_May18th_FINAL.pdf
- Predictive Ecosystem Mapping (PEM) of the former Arrow District: Arrow and Cascadia TSA's TFL 3, TFL 23 and Associated Provincial Parks Final Report, (2014), Ketcheson, M.V., Produced for Forest Analysis and Inventory Branch, BC Ministry of Forests, Lands and Natural Resource Operations.
- *Procedures for Factoring Visual Resources into Timber Supply Analyses*, (1998), BC Ministry of Forests, Forest Practices Branch, REC-029, Victoria, BC.
- *Revised snow recovery estimates for pine-dominated forests in interior British Columbia*, (2015), Winkler R. and S. Boon., Prov. BC, Victoria, BC. Exten. Note 116. Available: www.for.gov.bc.ca/hfd/pubs/Docs/En/En116.htm.
- *Root Disease Management Guide for BC*, (In Prep), BC Ministry of Forests, Lands and Natural Resource Operations.
- Update to BGC Nomenclature for Predictive Ecosystem Mapping (PEM) of the former Arrow District: Arrow and Cascadia TSA's TFL 3, TFL 23 and Associated Provincial Parks Addendum 1, (2015), Ketcheson, M.V., Produced for BC Ministry of Forests, Lands and Natural Resource Operations.

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. Many of the factors used as inputs to timber supply analysis have differing levels of uncertainty associated with them, due in part to variation in physical, biological and social conditions.

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 Arrow 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.

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 my approach in these matters explicit, I have considered and adopted the following body of guiding principles, which have been developed over time by BC's chief foresters and deputy chief foresters. However, in any specific circumstance in a determination where I consider it necessary to deviate from these principles, I will explain my reasoning in detail.

When considering the factors required under Section 8, I am also mindful of my obligation as a steward of the forests of British Columbia, of the mandate of the Ministry as set out in Section 4 of the *Ministry of Forests and Range Act*, and of my responsibilities under the *Forest Act* and *Forest and Range Practices Act* (FRPA).

Integrated decision making

One of the key purposes of the Ministry is to plan the use of forest and range resources such that the various natural resource values are coordinated and integrated. In addressing the factors outlined in Section 8 of the *Forest Act*, I will 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, nor is it possible at this time to speculate about the possible effect on timber supply that could result from possible eventual legal proof of Aboriginal title. 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 (THLB) 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, I 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.

I acknowledge the perspective that alternate strategies for dealing with information uncertainty are to delay AAC determinations or to generally reduce AACs in the interest of caution. However, given that there will always be uncertainty in information, and due to the significant impacts that AAC determinations can have on communities, I believe that 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 judgment to the available information. Where appropriate, the social and economic interests of the government, as articulated by the Minister of Forests, Lands, Natural Resource Operations and Rural Development, 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, I 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, I will consider related information in my 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.

I 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 (MPB) 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 MPB 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. I 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

Established (declared) Aboriginal title lands and other areas, such as Treaty Settlement Lands or Indian Reserves, are not provincial Crown land. Consequently, the timber on these lands does not contribute to the AAC of the timber supply area or tree farm licence with which they overlap. For other areas, where Aboriginal title has not been legally proven, the Crown has a constitutional obligation to consult with First Nations regarding their asserted Aboriginal 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 process;
- (ii) any information brought forward through engagement and consultation respecting First Nations' Treaty rights or Aboriginal Interests, including how these rights or interests may be impacted; and,
- (iii) any operational plans and/or other information that describe how First Nations' Treaty rights or Aboriginal Interests are addressed through specific actions and forest practices.

Treaty rights or 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 scope of statutory authority, 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 AAC 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, Natural Resource Operations and Rural Development 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 projections provided to me through the work of the Timber Supply Review Program (TSR) for TSAs and TFLs.

For most AAC determinations, a timber supply analysis is carried out using an information package including data and information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model, 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 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 and legal requirements.

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 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 are realistic and current, and the degree to which resulting predictions of timber supply must be adjusted to more properly reflect 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. 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 Arrow TSA

The timber supply forecasts, including the base case, were prepared for this determination using Remsoft's Spatial Woodstock Model in optimization mode. The data and assumptions used in the base case are intended to reflect current legal requirements, the best available information, demonstrated forest management practices and current conditions in the Arrow TSA as documented in the *Data Package* (April 2016).

Harvest level projections, even those prepared using the same information, data and timber supply model, are dependent on the harvest flow objectives used in the analysis. The harvest flow objectives used in preparing the base case for this determination included:

- Maximize total harvest volume subject to meeting all management constraints, including stable future growing stock; and,
- Maximize the mid-term harvest level, and then maximize the long-term harvest level.

The projection begins in 2015 and maintains a harvest level of 506 000 cubic metres per year for the first six decades, and then increases to 680 000 cubic metres per year for the remainder of the 100-year forecast period. The higher long-term harvest level is mainly due to the application of SIBEC site indices and genetically improved future managed stands.

In addition to the base case, I was provided with a number of sensitivity analyses and alternative harvest forecasts carried out using the base case as a reference. These analyses and others have been helpful in specific considerations and reasoning in my determination as documented in the following sections. I am satisfied that the base case, and the other analyses as noted and described, represent the best information currently available to me respecting various aspects of the projection of the timber supply in this TSA, and that as such they are suitable for reference in my considerations in this determination.

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

I have reviewed the information for all of the factors required to be considered under Section 8 of the *Forest Act*. Where I have concluded that the modelling of a factor in the base case represents current legal requirements, demonstrated forest management and/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.

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

<i>Forest Act</i> section and description	Factors accepted as modelled
8(8)(a)(i) Composition of the forest and its expected rate of growth	<ul style="list-style-type: none"> • Land ownership and forest tenures not contributing to timber supply • Land classified as non-forested areas • Parks and protected areas • Existing and future roads, trails and landings • Non-merchantable forest types - low site productivity • Non-merchantable forest types - low volume • Terrain stability • Forest inventory • Site productivity estimates • Volume estimates for natural stands • Operational adjustment factor • Genetic gain • Minimum harvest criteria
8(8)(a)(ii) Expected time that it will take the forest to become re-established following denudation	<ul style="list-style-type: none"> • Impediments to prompt regeneration • Not satisfactorily restocked and backlog
8(8)(a)(iii) Silvicultural treatments to be applied	<ul style="list-style-type: none"> • Silviculture systems • Incremental silviculture
8(8)(a)(iv) Standard of timber utilization and allowance for decay, waste, and breakage	<ul style="list-style-type: none"> • Utilization standards
8(8)(a)(v) Constraints on the amount of timber produced by use of the area for purposes other than timber production	<ul style="list-style-type: none"> • Land and resource management plan • Landscape biodiversity – connectivity corridors • Cutblock size, adjacency and green-up • Community and domestic watersheds • Riparian management • Identified wildlife • Disturbance outside the THLB • Recreation resources • Experimental and permanent sample plots • First Nations and cultural heritage resources
8(8)(a)(vi) Any other information	<ul style="list-style-type: none"> • Slocan Valley

Forest Act section and description	Factors accepted as modelled
8(8)(d) Economic and social objectives of the government	<ul style="list-style-type: none"> • Socio-economic information • Summary of public review and comments
8(8)(e) Abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area	<ul style="list-style-type: none"> • Unsalvaged losses and abnormal infestations and devastations of , and major salvage programs planned for, timber on the area

For other factors, where more uncertainty exists, or where public or First Nations input indicates contention regarding the information used, modelling, or some other aspect under consideration, this rationale incorporates an explanation of how I considered the essential issues raised and the reasoning leading to my conclusions.

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

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

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

Land base contributing to timber harvesting

- general comments

The total area within the boundary of the Arrow timber supply area (TSA) is 1 285 631 hectares. Excluding areas under area-based tenures, private land, areas not managed by the Crown for timber supply, non-productive land, and existing roads, the area of Crown forest management land base (CFMLB) is 501 246 hectares. Not all of this area is included in the timber harvesting land base (THLB).

The THLB is an estimate of the land where timber harvesting is considered both acceptable and economically feasible, given the objectives for all relevant forest values, existing timber quality, market values and applicable technology. It is a strategic-level estimate used for timber supply analysis and as such could include some areas that may never be harvested or could exclude some areas that may be harvested. Furthermore, whether or not an area is included in the THLB, or excluded from the THLB has no bearing on subsequent operational decisions. Consequently, the THLB estimate used in the base case has limited utility outside of the timber supply review process.

As part of the process used to define the THLB, a series of deductions was made from the CFMLB. These deductions account for economic or ecological factors that 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 has been taken to avoid any potential double-counting associated with overlapping objectives. Hence, a specific deduction for a given factor reported in the analysis or in this document does not necessarily reflect the total area with that classification; some portion of it may have been deducted earlier under another classification.

The THLB used in the base case was 186 466 hectares. This is 11 percent smaller than the THLB used in the previous timber supply review (2005). This reduction reflects the removal of area-based tenures that awarded since the last timber supply review, the 2009 Caribou Government Actions Regulation Order, and additional wildlife habitat areas. Another difference includes the way wildlife tree retention (WTR) was modelled. In this base case, a five percent netdown reduction was applied to the THLB compared with the previous TSR that applied a 2.5 percent reduction to the yield tables.

For the Arrow TSA, I accept that the above approach was used appropriately to identify the THLB used in the base case and related analyses.

- areas considered inoperable

In deriving the THLB for the base case, those portions of the TSA that are not physically accessible for harvesting, or that are not feasible to harvest economically, were excluded as inoperable. The operability mapping used in the base case was completed in 1991.

The total area identified as inoperable with no logging history was 362 938 hectares.

In the previous timber supply review, the chief forester suggested monitoring harvest performance on both sides of the operability line and tracking the creation of newly isolated areas. For this timber supply review, the total area isolated between cutblocks and inoperable was identified, minus the total area of cutblocks within the inoperable mapping. After accounting for the area that would be excluded from the THLB to account for other constraints, 7.4 percent of the harvested area was identified as being isolated.

As no updated operability mapping is available, the area considered inoperable used in the base case represents the best available data. However, as the base case included isolated stands in the THLB, and after reviewing the assumptions and methodology above, I conclude the base case short- and long-term timber supply could be overestimated by up to seven percent and I will account for this in my determination as discussed under '**Reasons for Decision**'.

As summarized in the '**Implementation**' section of this rationale, I expect that prior to the next determination district and licensee staff review and, if necessary, revise the operability mapping for the Arrow TSA.

- steep slopes

Areas where the slope exceeds 40 percent are defined as steep slopes. Although they account for 32 percent of the THLB in Arrow TSA, only 20 percent of steep slope areas are demonstrating performance as evidenced by harvest information from 2004 to 2014. A review, comparing the actual harvest performance profile with the THLB profile modelled in the base case, showed an underperformance of 12 percent.

During public consultation, staff from Interfor and I discussed the changing perspectives on safety. It is no longer acceptable to risk injury on steep terrain and Interfor is beginning to utilize equipment designed to harvest in this terrain thereby reducing the number of people working in high-risk areas. These techniques do not have the same range and therefore access may be more limited when compared to earlier methods of harvesting on steep slopes. Interfor also suggested that I consider a steep slope partition in order to encourage all licensees to access this profile.

I commend the harvest performance demonstrated by the licensees in effectively targeting MPB-killed stands over the past 10 years. I also recognize that this harvest strategy has restricted harvest to certain stand types and portions of the TSA. This has resulted in a disproportionate accumulation of harvest on flatter terrain area where MPB-infested stand types generally occur. It is important that the current operational harvest profile align with the profile modelled in the base case. Current underperformance in steep slopes could reflect that the THLB modelled in the base case is operationally unattainable resulting in an overestimation in the base case timber supply.

As summarized in the '**Implementation**' I expect that, prior to the next determination, district and licensee staff review and revise the operability mapping in light of current practice. I expect district staff monitor steep slope harvest performance and report this information to me annually. In the future, depending on licensee performance, I may consider the application of a partition; however, considering the information provided for this TSR, it is not warranted at this time.

I have reviewed the assumptions and methodology used to compare the harvest performance profile on steep slopes with the profile modelled by the base case. I am mindful that harvest in the past decade was not focused on the forest types found on steep slopes given the mountain pine beetle epidemic. The underperformance within steep slopes leads me to assume that the mid-slope and valley bottoms could be overharvested. For this determination to be sustainable, the THLB profile in the base case must align with the harvest profile. For the portion of steep slopes that is operable, it is my expectation that licensees work

towards achieving a harvest distribution that better represents the timber harvesting profile with respect to steep slopes, as I have discussed in **‘Implementation’**.

- non-merchantable forest types: problem stands

A net area of 3340 hectares was excluded from the THLB to account for ‘problem stands’. These stand types were predominantly older stands comprised of hemlock or balsam, deciduous-leading stands greater than 40 years in age, or white bark pine-leading stands.

White bark pine was classified as endangered in 2012 by the Canadian government. Although white bark pine-leading stands were excluded from the THLB in the base case, problem stands as defined above did not exclude mixed stands with a white bark pine component.

Operationally, some harvest of white bark pine has occurred. Since 2005, 213 cubic metres of white bark pine has been reported as harvested; district staff note that this number is likely slightly higher as white bark pine is often confused with western white pine.

I recognize that white bark pine is endangered whether it is a leading species or a small component of a mixed-species stand. As summarized in **‘Implementation’**, I expect every effort be made in the management and conservation of white bark pine in mixed stands.

In terms of my determination, I have considered the information regarding problem forest types and, given the very small contribution of white bark pine in mixed stands, I accept the information used in the base case was adequate for this determination and I will make no adjustments in the base case on this account.

Existing forest inventory

- volume estimate for managed stands

For the timber supply analysis, the Tree And Stand Simulator (TASS) model was used to estimate the growth and yield of stands established after 1973. TASS is a decision support tool, with over four decades of development that has synthesized and integrated extensive multi-disciplinary and multi-agency research and data.

As a modelling simplification, yield projections used average regeneration and site input values for a given analysis unit. Regeneration inputs were determined from several sources including silviculture survey data from the RESULTS database, and stand development monitoring (SDM) data gathered as part of the Forests and Range Evaluation Program.

The Ministry recognizes that modelled projections while highly useful strategically, may not fully capture local forest growth for a variety of reasons. For example, staff expressed concerns that planting did not always achieve maximum densities. To address this knowledge gap, the Ministry has initiated several monitoring programs, such as the young stand monitoring (YSM) program, that enables the comparison of modelled projections to yield projections based on data from ground samples. Projected volume yields compared with YSM ground sample data indicated that it is likely the yield projections used in the analysis could be marginally overestimated.

Managed stand yield projections primarily influence the long-term and mid-term levels during the transition from the harvest of existing stands to managed stands. The mid-term and long-term timber supply, for the current determination, influences how I view the overall sustainability associated with short-term timber supply, projected from existing stand yield models. In future determinations, the importance of managed stand yield models will increase.

Managed stands are critical in maintaining a sustainable mid-term timber supply. Therefore, in order to meet their projected yield targets I expect licensees to plant higher densities that will ensure the full capacity of the land is utilized.

I have considered the information presented to me and summarized above. The current YSM results suggest a slight overestimation in the long-term timber supply and I will account for this in my determination as discussed under '**Reasons for Decision**'. I encourage Ministry staff to continue to develop young stand monitoring programs and to improve the link between our managed stand growth and yield models and operational data.

- Armillaria root disease

Ministry staff were concerned that losses due to Armillaria root disease are likely not accounted for sufficiently by operational adjustment factor 2 (OAF 2), set at the default value of five percent.

A customized, Armillaria-specific operational adjustment factor 2 (DRA OAF 2) was developed based on the work of Dr. Mike Cruickshank (Canadian Forest Service). To better account for losses due to Armillaria, DRA OAF 2 incorporates information from a 2004 Armillaria OAF study based on the Arrow TSA and species impact differences from a root disease trial near Salmon Arm.

A sensitivity analysis was completed using DRA OAF 2, which includes growth and mortality losses for three levels of infection severity. One level was assigned to each analysis unit and leading species combination to account for the relative impact Armillaria has on different tree species. The adjustments were applied to all analysis units, not just those units found within the ICH biogeoclimatic zone, as was done in the last timber supply review. The sensitivity analysis did not consider the implications of reduced Armillaria impacts resulting from forest management treatments such as stumping.

The sensitivity analysis using the customized DRA OAF 2 to account for Armillaria root disease shows a long-term harvest level that is 12.1 percent lower than in the base case.

I have considered the sensitivity analysis described above and I agree with Ministry research staff that the base case did not adequately account for potential losses due to Armillaria root disease in the Arrow TSA. On this basis, I conclude the long-term harvest level was overestimated by up to 12.1 percent, as discussed in '**Reasons for Decision**'.

As indicated under '**Implementation**', I expect Ministry staff and licensees utilize stumping techniques where appropriate, use species less susceptible to Armillaria and mixed species where possible, and follow the updated *Root Disease Management Guide for BC* when it becomes available.

- log grade changes

Prior to April 2006, logs were assessed as alive or dead at the time of harvest. 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 the lumber produced is merchantable) were not charged against the AAC. In April 2006, new interior log grades took effect that assigned the grade at the time of scale, based on log size and quality. This resulted in Grade 3 endemic and Grade 5 logs being charged against the AAC for the cut control period.

Interim species adjustment factors were developed to provide licence holders with an opportunity to adjust their operations in response to the implementation of the April 2006 interior log grades. These interim adjustments contributed to observed higher harvest levels that were above the current allowable annual cut. The Minister will remove the adjustment factors concurrent with the new AAC determination.

In this determination, I have accounted for the underestimation in base case volume due to the new interior log grades. District staff conducted a review of harvest billing system data and reported the overall dead potential volume from inventory audit data for the Arrow TSA was approximately 5.3 percent of all potential volume.

Stand yield information used in the base case did not account for the contribution of dead potential volume; therefore, I conclude that the short- and mid-term harvest levels were underestimated by about 5.3 percent. I will account for this in my determination as discussed in '**Reasons for Decision**'.

Utilization*- residual waste*

The yield projections used in the base case are based on provincial utilization standards that exclude modelled estimates of volume lost to decay, waste and breakage. The decay, waste, and breakage estimates of losses have been developed for different areas of the province based on field samples.

I am aware that licensees are allowed to leave waste on logging sites up to a benchmark volume. When the benchmark has been exceeded, waste is billed through stumpage charges and the excess volume is counted towards the licensee's apportioned volume of the AAC.

Waste assessments, carried out as ocular estimates since 1999, are submitted to the ministry's cut to cruise database. The vast majority of waste assessments submitted are below the waste volume benchmark threshold of three percent of stand volume.

District staff are concerned that waste assessments are not accurate. Results from a small pilot study conducted for the Selkirk Natural Resource District (including the Arrow TSA) showed average waste was about 14 percent of the cut control cruise volume, 11 percent higher than the three percent allowable waste benchmark. While district staff acknowledge this was a preliminary study, the results suggest waste levels may be higher than the submissions that are based on ocular estimates. I have expressed concerns regarding underestimates of residual waste in other TSAs and I expect further efforts to ensure better information on the measurements of waste, as discussed in '**Implementation**'.

The Selkirk Natural Resource District has implemented a district-wide fibre recovery project. Waste volumes are determined prior to harvest completion and waste material is then transported to a whole log chipping facility. Recoveries in waste fibre including residual waste, over a three-year period, was 600 000 cubic metres overall. Annually, the portion attributable to Arrow TSA is about 50 000 cubic metres.

I support the continued use of fibre recovery and other Forest Licence to Cut tenures that make use of post-harvest fibre and reduce the fibre left as waste, and expect licensees to fully utilize the volume harvested and consider ways in which potential waste could be used in fibre-based products, while balancing the ecological value of leaving the appropriate levels of coarse woody debris on site, as discussed in '**Implementation**'.

- grade 4 credit

Section 17 (6) of the Cut Control Regulation allows licensees to apply to have grade 4 logs that are delivered to a non-lumber or veneer facility not count towards the AAC volume attributed to their licence (this is often referred to simply as "grade 4 credit"). As this grade 4 credit volume is not accounted for in any AAC apportionment, this may enable the total harvest in a TSA to exceed the Section 8 AAC. Grade 4 logs were expected to be mostly from dead pine stands but can also include other species and can be from dead or living stands.

In the Arrow TSA, the grade 4 credit is intended to provide an incentive to licensees to utilize low quality logs. A review of cut control information between 2007 and 2015 shows that an average of 30 318 cubic metres per year, or about six percent of the AAC, was attributed to grade 4 credits. District staff are concerned that this practice results in harvest levels that are higher than the AAC and creates sustainability issues. I share their concern and agree that if the practice of grade 4 credits continues, the sustainability of the AAC that I determine may be jeopardized.

In 2014, the *Forest Act* and the Cut Control Regulation were amended to allow the minister to set a maximum volume limit on grade 4 timber that may be credited in a TFL or TSA in situations where sustainability of the timber supply is a concern. No maximum has been set for the Arrow TSA. As discussed under '**Implementation**', I expect district staff to continue to monitor the volumes attributed to grade 4 credit, and in the event that the volume of grade 4 credits could result in harvesting above the

level of the AAC that I determine, it is my expectation that staff will request that the Minister implement a maximum volume limit.

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

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

In my determination, I have considered the IRM objectives set by government in *Forest and Range Practices Act* (FRPA), the Forest Planning and Practices Regulation (FPPR), and additional guidance provided by the Kootenay Boundary Higher Level Plan Order (KBHLPO) and subsequent amendments.

- landscape-level biodiversity: old-growth management area

Old-seral stage forest retention is an important aspect of landscape-level biodiversity. Landscape units with biodiversity emphasis options (BEO) and requirements for old and mature forest retention have been legally established and are specified in KBHLPO. Biodiversity targets are expressed as the percentage of area that must retain old-seral stage characteristics within the CFMLB for each biogeoclimatic subzone/variant (BGC unit) in each landscape unit (LU), with percentage targets varying by BGC unit, natural disturbance type, and BEO.

In the Arrow TSA, old-growth management areas (OGMAs) were spatially identified, but have not been legally established. Licensees have included language to manage and respect the spatial, non-legalized OGMAs in their respective forest stewardship plans; when licensees harvest or otherwise impinge upon an OGMA, the area is replaced with another suitable stand within the licensee's operating area.

Because licensees manage their own OGMA layer information, the corporate non-legal spatial OGMA layer was reconciled with licensee data current to 2015. In the base case, non-legal spatial OGMAs were excluded from the THLB.

Ministry staff inform me that overall, it is likely that the area removed from the THLB is close to the area required to meet legal targets, but accurately calculating the area required to meet compliance with KBHLPO targets within the Arrow TSA is challenging for the following reasons.

BEC updates –A new Biogeoclimatic Ecosystem Classification (BEC) version was released in 2016 for the Arrow TSA. As OGMA targets are defined separately for BGC units, an updated BEC changes the target area calculations, and consequently the deficits and surpluses. Initial evaluation suggested that the 2016 version of BEC results in a 3303 hectare deficit, an increase of 1332 hectares over the deficit calculated using the previous version. In other LU / BGC units there were surpluses, totalling 19 679 hectares. The deficits and surplus included areas both within the THLB and outside the THLB.

Wildfires - Current OGMA policy is unclear as to whether areas defined as OGMAs, once they have been severely burnt, with few remaining live trees, require replacement. In 2017, there were a few insignificant fires in the TSA less than 400 hectares in size. In the base case, the assumption was that OGMAs remain the same during the full 100-year modelling horizon.

One-third drawdown - Currently, in LUs with low BEOs, KBHLPO allows for old-seral stage requirements to be reduced by one-third of the required target, but the full target must be met by the end of the third rotation - a rotation being defined as 80 years in KBHLPO. In the base case, as this time frame is outside the forecast horizon, it was not modelled, but I am aware that recruitment is a concern in the long term.

For this determination, I accept that the base case appropriately accounted for landscape biodiversity - old growth and mature. I have considered the information above and agree that the need to recruit old forest in order to meet future targets introduces an unquantified overestimate to the long-term harvest supply, as discussed in **'Reasons for Decision'**.

During public consultation, Interfor staff informed me that reviews were underway to identify BEO units that could be better placed to both increase the effectiveness of the BEO and the operational ability of licensees to access more THLB. They confirmed that their intent was to engage First Nations and local non-governmental organizations in this process. I encourage and support this effort.

Concerns have been raised by staff and licensees regarding the current location of the spatial non-legally established OGMAs. As discussed in **'Implementation'**, I expect a comprehensive review of OGMAs with respect to the new version of BEC. I encourage the co-location of OGMAs with other spatial reserves for riparian, visual quality objectives, and wildlife habitat features. This will best support the species discussed under *'wildlife habitat supply'* while maintaining a viable THLB.

- stand-level biodiversity

Stand-level biodiversity planning is a requirement under the *Forest and Range Practices Act (FRPA)*. FRPA establishes an objective to maintain structural diversity in managed stands by retaining wildlife-tree patches in each cutblock. The default practice requirement for wildlife-tree retention under FRPA is a minimum of 3.5 percent retention in each block and seven percent retention overall for blocks logged in a 12-month period. Licensees in the Arrow TSA have chosen not to specify alternative wildlife tree strategies in their Forest Stewardship Plans.

To determine a reasonable deduction for wildlife-tree retention in the base case, district staff checked data from licensees, a neighbouring TSA's percentage reduction for wildlife-tree retention, and reviewed data from the Reporting Silviculture Updates and Land Status Tracking System (RESULTS) database.

Two licensees responded to a district staff request that licensees supply their wildlife-tree retention data and this sample showed an area reduction of five percent. A 5.1 percent reduction was used in the base case in the last timber supply review for the comparable, neighbouring Kootenay Lake TSA.

A review of the data for the Arrow TSA in the RESULTS database for 10 years showed a range of 8 to 12 percent retention. District staff inform me that there have been RESULTS coding errors and accurate collection of wildlife tree retention data was identified as an issue in the last timber supply review, although this has improved in the last five years.

Based on the above research a five percent reduction was used to model stand-level biodiversity in the base case. Because the data from RESULTS suggested this number was conservative, a seven percent reduction was used in a sensitivity analysis. Using seven instead of five percent reduced the base case short-term timber supply by two percent and the long-term timber supply by 2.2 percent.

I agree with district staff that the base case used the best available data to adequately model wildlife-tree retention areas. I suggest better monitoring of the wildlife-tree retention data is needed to ensure greater confidence in the percentage reduction in the next timber supply review. Towards that effort and as discussed in **'Implementation'**, I expect staff to make use of the stand-level biodiversity sampling data available from the Forest and Range Evaluation Program, and I expect licensees to work with district staff to ensure correct reporting.

- scenic resources

Visual resource management includes identifying and classifying scenic landscapes, and managing forestry activities on the landscape to meet the needs of the public, visitors and other resource users. The management of known scenic areas is guided by visual quality objectives (VQOs) that were established by the district manager for scenic areas in the Arrow TSA through an order under the Government Actions Regulation (GAR) on December 31, 2005. The visually sensitive areas in the TSA cover 77 246 hectares, or 41 percent, of the THLB.

Visual quality assessments were completed using the Forest and Range Evaluation Program (FREP) visual quality monitoring protocol. The 2013 Multiple Resource Value Assessment for the Arrow and Boundary Timber Supply Areas indicated that 37 percent of the assessed landforms were either borderline or clearly did not meet the objectives, and of those, two-thirds were in a partial retention (PR) area. More recent FREP visual quality monitoring in the Arrow TSA indicate similar trends.

In the base case, visually sensitive areas were modelled by applying forest cover objectives consistent with the established VQO. A visual effective green-up height of five metres was applied to all VQO polygons in the base case.

The base case did not identify any initial violations of the modelled objectives; however Ministry staff believed that the modelled constraints are adequate for timber supply assessment and that the difference between modelled planimetric constraints and actual perspective view management has resulted in a negligible overestimation of the short-term timber supply.

I agree with Ministry staff that the base case adequately models the legal requirements of visually sensitive areas and the assumptions used are consistent with current practice generally; however, the limitations of modelling a three dimensional constraint resulted in a negligible overestimation as discussed above and which will not be addressed further. I have considered the information presented to me above, and note the FREP reports show some scenic areas exceed the disturbance limit identified as an objective in the GAR order. I expect that district staff will work with licensees to ensure this particular FRPA value is being met effectively, as discussed in '**Implementation**'.

- ungulate winter range

The Arrow TSA supports three populations of woodland caribou all of which have been in decline since 2004. Government Actions Regulation (GAR) orders U-4-012 and U-4-014 were established in February 2009 for the protection of caribou habitat, replacing the earlier caribou habitat management objectives of the KBHLPO. General wildlife measures (GWMs) implemented as part of the GAR orders exclude timber harvesting and road construction within designated caribou habitat areas, except under specific circumstances. Within the Arrow TSA, the caribou GAR orders exclude timber harvesting from a 77 556 hectare area.

In the base case analysis, caribou GAR order areas were removed from THLB but remained in the CFMLB and may address other constraints, such as old-growth areas.

Ungulate winter range (UWR) habitat for mule deer, white tailed deer, rocky mountain elk and moose in the Arrow TSA is protected under GAR Order U-4-001, established on December 13, 2005. This GAR order establishes minimum forest cover objectives for the retention of snow interception cover and forage areas. In the base case, these objectives were modelled as per the GAR order, with the exception that all stands were assumed to meet the evergreen crown closure requirement; this simplification was necessary as, unlike other inventory attributes, forest inventory crown closure values are not projected into the future, but are identified once at the time aerial photo classification is completed.

A 2016 report, *Effectiveness of Existing GAR Orders in Meeting Mule Deer Winter Range Needs*, concluded that UWR effectiveness monitoring was not optimal. Although I have accepted that UWR was adequately modelled in the base case, I expect that district staff will address the lack of effectiveness monitoring and will keep me informed of significant changes to UWRs, as discussed further in '**Implementation**'.

During public consultation, Interfor staff expressed concerns that any further constraints to the land base to expand caribou habitat will make the task of finding wood to harvest within the Arrow TSA that much more challenging. Although I acknowledge the concerns of industry in find available timber on an already constrained land base, I recognize the importance of UWRs to meet wildlife needs. Therefore, I am satisfied that the base case properly accounted for existing UWRs.

- *wildlife habitat area for grizzly bear*

Management of grizzly bear populations has become a significant issue across the province. In particular, there are concerns that increasing road density across many parts of British Columbia could decrease the sustainability of grizzly bear populations by decreasing the suitability of grizzly bear habitat, changing bear behaviour as a result of road avoidance, and increasing human-caused mortality of bears.

Through the authority of Section 9(1) of the Government Actions Regulation (GAR), the establishment of the Grizzly Bear Specified Area (i.e., wildlife habitat area) #8-373 placed restrictions and requirements on forestry activity and provided legal protection for grizzly bear habitat within the Kettle Granby Grizzly Bear Population Unit (GBPU).

Regional staff has informed me that, based on data from 2013, GAR Order 8-373 recommendations for long-term road density targets within the non-legal *Recommended Management Guidelines (Appendix 2)* have not been met in over half the Kettle Granby GBPU. To meet short-term target recommendations, approximately 1,800 kilometres of road within the GBPU should be rehabilitated. A Forest Practices Board report, *Forest Roads and Grizzly Bear Management in the Kettle-Granby Area*, (2017) concluded that government has not taken adequate action to address road density in the Kettle-Granby. As such, roads remain a significant risk to the sustainability of the Kettle-Granby GBPU. There is an urgent need to incorporate access planning into future management practices. Regional staff recommend that reducing current road densities is best achieved by road rehabilitation (removing the road surface); however, this method is expensive. Targeted road rehabilitation in areas that represent high grizzly bear habitat suitability can reduce overall rehabilitation costs and maximize the benefit to grizzly bear. Short-term funding for road rehabilitation could be appropriated through sources such as the Forest Enhancement Society of BC but long-term solutions are required. This could include licensee-led resourcing by implementing legislated road density targets or by providing an allowance through the Appraisal System for road rehabilitation in designated sensitive areas. Although a solution to this is outside of my authority for an AAC determination, I encourage the district and licensees to follow up on a plan for road rehabilitation.

I have considered the information presented regarding grizzly bear and GAR Order 8-373 recommendations and, as noted by Ministry staff, recognize these are recommendations and not legislative requirements. Therefore, I accept that grizzly bear management was adequately modelled in the base case to reflect the legally applicable GAR orders. As discussed in '**Implementation**', and under '*wildlife habitat supply*', I expect improved access management planning within Arrow TSA.

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

- *historic harvest performance*

An objective in timber supply analysis is to model, through the base case harvest sequencing assumptions, the actual harvesting behaviour in the TSA as accurately as possible to ensure that the information used in determining the AAC reflects historic harvest performance. It is my expectation that the volume harvested within the TSA will not exceed the AAC.

To examine harvest performance, Ministry staff reviewed the harvesting data from 2005 to 2015 using the harvest billing system and a compilation of the cut control letters.

The percentage of various species harvested was compared to the profile of species by volume in the current inventory. This comparison showed the harvest of cedar, lodgepole pine, and spruce exceeds their contribution in the profile, with other species being underharvested relative to the profile. While I commend licensees for harvesting more lodgepole pine than present in the profile, given the recent mountain pine beetle activity, I caution licensees against overharvesting other species. As I have said previously in this determination and in '**Implementation**', wherever the harvesting performance does not match the profile, there will likely be a correction needed in the next timber supply review, as the accuracy of the base case projection is only as good as the assumptions it shares with current management practices. Where those

assumptions differ, in this case, in the inventory profile, there exists the chance the projection will not reflect future timber supply.

District staff informed me that on average, overharvesting has occurred in Arrow TSA – approximately 6.2 percent (31 722 cubic metres a year) above the average current effective AAC of 505 853 cubic metres. A number of factors contributed to the overharvest as described below.

- *Cascadia TSA* - When Cascadia TSA was created, BCTS mistakenly combined their apportionment in the Cascadia and Arrow TSAs. Plans are now in place to balance the cut over the next three to five years bringing the average 15-year cut close to the average allocation.
- *Forest Service Reserve* - Significant projects occurred between 2005 and 2015, including the Red Mountain Ski Hill expansion, additional utility lines, and highway daylighting. Salvage operations within the Arrow TSA included substantial harvest of mountain pine and fir beetle-attacked forest. The harvest for these projects and tenures was allotted to the Forest Service Reserve; however, the total apportionment for the Forest Service Reserve is only 2531 cubic metres annually.
- *Licences awarded volume additional to AAC* - Between 2008 and 2015 the Regional Executive Director increased the AAC of replaceable forest licences associated with holders of an innovative forestry practices agreement (IFPA) that are presently expired. These IFPAs were not part of the chief forester's AAC decision as the increased volume was based on new information not fully available at the time of the last determination.
- *Timing of harvest* - Additionally, non-replaceable forest licences, that harvested a total of 144 326 cubic metres, were awarded based on volume from previous years where annual cuts were below the AAC.
- *Grade 4 credit* - As discussed in the factor 'grade 4 credit', this volume was not accounted for in any licence, contributing to a total harvest in the Arrow TSA that exceeded the AAC.
- *Log grade changes* - As discussed in the factor, 'log grade changes', dead potential volume was not assumed part of the AAC. Interim non-billable credit that was available to licence holders under the cut control regulation prior to a new AAC determination contributed to the total harvest in the Arrow TSA exceeding the Section 8 AAC.

I have heard the concerns described by Ministry staff about the overharvest, and understand the contributing factors have been addressed. This AAC determination is based on current inventory that has incorporated past harvest, and therefore past overharvesting does not influence the base case projections and has no impact on my current decision. However, I expect that given past situations in this TSA that careful consideration will be given to the sustainability of the harvest for any future awards of harvesting.

- climate change

It is predicted that climate change will affect forest ecosystems in a number of ways, including general increases in temperature, changes in precipitation patterns and increased frequency and severity of disturbances.

The report, *Adapting Forest Management to Climate Change in the Kootenay Boundary Region* (Pacific Climate Impact Consortium, 2016) shows changes, based on a standard set of Global Climate Models, projected to the 2080's in average temperature, precipitation and derived climate variables. The report notes that climate change modelling suggests a potential decline in timber supply over the long term due to increased natural disturbance and lower precipitation in the growing season. Modelling by the Canadian Forest Service suggested that there could be a minimum of at least three to four times greater an area burned by the 2050s, than burned today, with an upper range of 15 times greater an area burned than today in the southern portion of the TSA up to 300 times greater in the northern portion of the TSA.

In a sensitivity analysis, a linear increase in non-recoverable losses (NRLs) demonstrated the potential impact of increased disturbance on timber supply. The total NRLs were increased by 10 percent per decade over the time of the timber supply analysis such that in the first decade, the change was 10 percent, in the second decade; the change was 20 percent, and so on. Increasing unsalvaged losses by 10 percent per decade resulted in doubling the NRLs over the 100-year timber supply analysis time frame.

The sensitivity analysis using the linear increase of NRLs showed a mid-term harvest level nine percent lower than the base case and a long-term harvest level 12 percent lower than the base case. The relationship between climate change, time, and disturbance is likely exponential, but the magnitude of change is highly uncertain given the uncertainty around future climate. Using a linear approach helps to demonstrate what could happen to timber supply with climate change while recognizing that there is high uncertainty in the future.

I have considered the work done to predict changes in climate across the TSA. Projected climate changes are likely to affect forest productivity, growth, natural disturbances, forest pests and hydrological balances; however, the magnitude and extent of the impacts are not yet certain.

I am aware that to the extent that some of these impacts are observable, they were modelled in the timber supply analysis; for example, recent disturbances from wildfires and increased damage from pests. I request that Ministry staff continue to monitor changes and where possible, collect information to inform decisions.

Any additional information or corresponding analysis that increases the understanding of how forest management decisions can be adapted to mitigate impacts requires incorporation into future timber supply reviews.

I have provided a more detailed description of how I consider climate change in AAC decisions under the '*Guiding principles for AAC determinations*' section of this rationale.

- First Nations consultation

The member bands of three First Nation Councils have traditional territories that encompass areas within the Arrow TSA: the Ktunaxa Nation Council (KNC), the Shuswap Nation Tribal Council (SNTC) and the Okanagan Nation Alliance (ONA). None of the member bands have communities within the Arrow TSA.

The KNC member bands do not have traditional territories separate from the Nation Council. The KNC carries out consultation on behalf of the nation and individual bands, and disseminates referral information to the member bands as they see fit.

Four SNTC member bands have traditional territories that overlap the Arrow TSA, the Adams Lake Indian Band (Chase), Neskonlith Indian Band (Salmon Arm), Shuswap Indian Band (Invermere) and Splots' in First Nation (Enderby). The member bands carry out their own consultation. They occasionally inform each other of referrals, or defer referrals to each other, that are closer to or of greater interest to another member band.

In addition to the ONA, which has its own boundary which some, but not all, member bands share, six member bands have traditional territories which overlap the Arrow TSA, the Lower Similkameen Indian Band (Keremeos), Penticton Indian Band (Penticton), Upper Nicola Band (Merritt), Okanagan Indian Band (Vernon), Osoyoos Indian Band (Oliver), and the Westbank First Nation (Kelowna). In addition to the member bands, the ONA receives all consultation letters but generally defers the exchange of consultation comments to the member bands.

With the exception of the ONA which does not have any agreements with the province, although all of the ONA member bands do, all First Nations have entered into one or more of the following agreements with the province: Strategic Engagement Agreement / SEA (Ktunaxa), Secwépemc Reconciliation Framework Agreement / RFA (some Shuswap bands), Forestry Consultation and Revenue Sharing Agreements (FCRSAs), Economic Development Agreements (ECDAs), Forest Tenure Opportunity Agreements (FTOAs), Interim Agreement on Forest and Range Opportunities (IAFRO) and Mountain Pine Beetle Agreements (MPBs). These provide for revenue sharing, and contain a framework for establishing consultation processes to guide consultation on administrative decisions, including AAC determinations.

ECDA, FTOA and MPB agreements provide forest tenures to First Nations, supplying them with direct access to timber volume. All agreements are designed to aid in improving the government-to-government relationship between the province and each First Nation, and to close the social and economic gap between First Nations and other British Columbians.

In addition to the above agreements, the KNC was presented with a land and cash offer on October 2010 that was accepted, with some conditions, in February 2012. They have had a community forest agreement (CFA) since 2009 and a range tenure opportunities agreement since 2016. The Shuswap Band is very interested in forestry opportunities, and is working with the Selkirk Natural Resource District to increase access to fibre volumes. Splats'in has an active forestry operation in the form of their band-owned company, Yucwmenlúcwu (Caretakers of the Land) 2007 LLP which is a stand-alone Forest Management Company wholly owned by Splats'in and guided by an independent board of Directors. The Splats'in have two non-replaceable forest licences. The Lower Similkameen Indian Band holds a CFA jointly with the community of Keremeos. The Penticton Indian Band has two non-replaceable forest licences with about 60 percent of the volume available to them, volume that is outside the Arrow TSA. An FTOA has been offered to bring the balance of their volume under licence. The Westbank First Nation has a woodlot, a CFA and a replaceable forest licence (RFL), the last under conversion to a First Nation woodland licence (FNWL).

Two First Nations whose territory overlaps the Arrow TSA and who have participated in the BC Treaty Process are the Ktunaxa and the Westbank First Nation (ONA member). The Ktunaxa Kinbasket Treaty Council (KKTC) represents the KNC in treaty negotiations that have been ongoing since 1993. The negotiations are nearing completion of Stage 4 producing an Agreement-in-Principle that is currently under review by Ktunaxa Communities and Ktunaxa Government Sectors. A decision to proceed to Final Agreement negotiations is pending. The Westbank First Nation suspended their participation in the treaty process in November 2009.

The SNTC member bands, though not involved in the BC treaty process, are engaged with the Province in New Relationship and other discussions associated with land and resource use within their asserted traditional territories. In 2013, the Province signed a memorandum of understanding (MOU) with the ONA, which was extended to April 2017. The MOU provides a potential opportunity to work collaboratively, advance a government-to-government relationship and discuss natural resource interests.

The ONA has filed a civil claim challenging the Incremental Treaty Agreement between the province and Ktunaxa.

First Nations within the Arrow TSA were identified by using the Consultative Area Database. A review of the ethno-historic and cultural heritage information for these First Nations was reviewed along with an Initial Assessment of Impacts from the proposed works, as well as strength of claim (SOC) with respect to Rights.

The preliminary assessment considered First Nations' asserted territorial boundaries, readily available information, information from previous consultation processes, comments provided by First Nations regarding the strength of Aboriginal Interests, and the potential impact this AAC determination decision may have on those interests.

There is insufficient information to support the assertion that any particular First Nation currently identified in the Consultative Area Database extensively occupied portions of the Arrow TSA. No comments were provided by any of the bands identifying how or where their Aboriginal rights could be affected by this decision. Based on all of the above, none of the bands were found to have a high SOC in the Arrow TSA.

As the AAC determination is a strategic decision that sets the stage for other decisions such as AAC apportionment and disposition, leading to issuance of cutting authorities, the AAC determination is considered to have a moderate potential to impact asserted Aboriginal rights and title.

Consistent with the Ktunaxa SEA, the Secwepemc RFA, FCRSA's, and *Updated Procedures for Meeting Legal Obligations When Consulting First Nations*, the suggested level of consultation was considered 'normal' (60 days).

The First Nations consultation process was comprised of three main phases of engagement, and in each phase, all First Nations with traditional territories overlapping the Arrow TSA were sent information packages through the regional Kootenay Boundary First Nations Relations team:

- The initial engagement package included a cover letter, *TSR Backgrounder, Involvement of First Nations in the Timber Supply Review*, and Arrow TSA map (e-mailed December 2014).
- The draft data consultation packages included a cover letter and the draft *Data Package* (e-mailed May 2016).
- The public discussion paper consultation packages included a cover letter, the *Arrow TSA Public Discussion Paper*, Information Bulletin, shape files and Google Earth kml files (e-mailed September 2016).

There was no response from any of the First Nations to any of the above packages. In contrast, extensive engagement including numerous phone conversations, e-mails and meetings, between the Province and Ktunaxa occurred between 2014 and 2016 during timber supply reviews for the Cranbrook and Invermere timber supply areas (TSAs).

To address this inconsistency, after the consultation periods were over, FLNRO staff contacted the Ktunaxa to ensure there was opportunity for them to provide any input they wished to submit for consideration. On March 17, 2017, it was communicated to Rick Fraser (FLNRO Advisor, First Nations Relations) by Ktunaxa staff that as they had invested so much time and resources into providing comments for the Cranbrook and Invermere TSA timber supply reviews, it was a considered decision by Ktunaxa directors that they would not invest the same level of resources for the Arrow TSA timber supply review.

During the First Nations consultation carried out for the timber supply review in the Cranbrook and Invermere TSAs, the Ktunaxa were heavily involved in the selection of wildlife species included in Habitat Supply Modelling (HSM). This same wildlife information was utilized in the Arrow TSA HSM, as discussed above under '*wildlife habitat supply*'.

I have reviewed the information sharing and consultation processes described above, available information regarding Aboriginal Interests, and evaluated the potential impacts my decision may have on those interests. I conclude that Ministry staff has engaged in consultation with the First Nations to the best of their ability, and in accordance with applicable government-to-government agreements and the *Updated Procedures for Meeting Legal Obligations When Consulting First Nations*.

The level of consultation has been appropriate given the information on Aboriginal Interests available. Furthermore, I note that FLNRO staff will continue to be available to meet and consult with First Nations at the operational planning level.

I believe that First Nations have much to contribute and there is a lot that we can learn from each other. I encourage First Nations to engage as early as possible in the timber supply review process in order to participate in the collection of information and build comfort with the assumptions used. Participation in early stages also offers more opportunity for FLNRO staff to learn how to more effectively work with First Nations in a collaborative way and enable relationship building in the processes of timber supply reviews.

I have considered the information received from First Nations and, where appropriate, I have addressed these concerns in my decision. I have reviewed the information regarding the consultation undertaken with First Nations and discussed it in detail with district, regional and branch staff. I am satisfied that the consultation was conducted appropriately and that reasonable efforts were made by district staff to engage and inform First Nations in the timber supply review process, collect information regarding their interests and understand how these may be affected by the AAC determination.

If new information regarding First Nations' Aboriginal Interests becomes available that significantly varies from the information that was available for this determination, I am prepared to revisit this determination sooner than the 10 years required by legislation.

- *wildlife habitat supply*

Recent court decisions have said that decision makers must consider the potential implications of their decisions on First Nations' rights to harvest wildlife (e.g., hunting, trapping, fishing and trading) using credible information. To address this need for timber supply reviews, habitat supply modelling (HSM) was completed for seven wildlife species in the Arrow, Cranbrook and Invermere TSAs. The species selected were determined through consultations with the Ktunaxa Nation Council and included flammulated owl, northern goshawk, Williamson's sapsucker, Rocky Mountain elk, mule deer, grizzly bear and American marten. The results for a subset of three species (i.e., northern goshawk, grizzly bear and American marten) are the focus of consideration in my AAC decision. These three species were selected as focal species because results of the modelling indicated they were the most influenced by forestry activities in the TSA. In particular, these species are dependent on old forest and are sensitive to road development.

Current habitat suitability and capability was modelled for each of the three species within the Arrow TSA. Future habitat suitability and capability was modelled for the Arrow TSA THLB based on the simulated harvest scenario in the base case, and was also compared to a no harvest simulation. The model was simulated 100 years into the future.

American marten are widespread throughout BC forests and harvest records suggest their population is stable in BC. However, population size and trend is unknown due to a lack of science-based population assessments. Marten are highly selective of habitats that provide thermal and security cover and are associated with late seral-stage forests. Marten populations have been found to decline with removal of forested habitat, increased human access, and unrestricted trapping.

The HSM summary presented to me suggests that current marten habitat quality is variable within the Arrow TSA THLB, with over 55 percent of the suitable habitat rated as high or moderately-high quality. Capability ratings for the high quality habitat class were proportionally larger compared to suitability ratings, suggesting the THLB has a deficit of forest in high-quality habitat compared against the optimal capability condition.

The HSM revealed that harvest practices as projected in the base case under the 100 year projection will reduce the amount of high and moderately-high quality winter habitat for marten in the THLB by approximately 63 percent, when compared to the same quality habitat today. Reduced habitat quality will likely result in lower population densities.

The Ktunaxa raised the concern that the HSM did not explicitly model large diameter snags with cavities used by marten for denning, which regional staff agree can be a limiting factor for marten. Although data on the location of large diameter snags across the TSA is not available, stand characteristics were considered in the HSM indirectly based on site characteristics and structural stage.

Northern goshawk nest in mature and old-growth stands with a closed canopy and open understory for foraging. Populations are relatively widespread, with goshawk nests observed in both coniferous and deciduous forests that contain their preferred nesting and foraging features. The most significant factor threatening northern goshawk populations in British Columbia is the loss of mature and old forests.

The interior subspecies of the northern goshawk was removed from the Identified Wildlife list in 2004 and does not have formal protection measures beyond best management practices that were established in 2012.

The HSM results presented to me suggests that Arrow TSA THLB currently contains relatively large areas of high quality goshawk nesting and foraging habitat, with approximately 53 percent of habitat rated as high or moderately-high nesting suitability and 73 percent of habitat rated as high-foraging suitability. Given that the model does not account for spatial configuration of habitats, it is possible the amount of high quality habitat is lower. Capability ratings for high-quality nesting and foraging habitat were proportionally larger compared to suitability ratings (67.2 and 99.8 percent respectively). The HSM revealed that harvest practices as simulated in the base case will decrease the amount of high-quality nesting habitat by about 60 percent compared with today, over the 100 year simulation. Foraging habitat quality is predicted to decrease until 2050, stabilize and begin to slowly increase again by 2113.

The Ktunaxa raised the concern that the HSM assumed regular spacing between northern goshawk breeding areas, which is not supported by long-term published studies. Spatial configuration of northern goshawk habitat and territories were not accounted for in the HSM, and some of the best predictor variables for nesting areas in the Kootenay region, such as tree height and canopy closure, were not used. The HSM generalizes habitat based on studies from other areas, and more localized studies should replace these generalizations. FLNRO staff agree that these assumptions limit the accuracy of the HSM.

The Arrow TSA contains six Grizzly Bear Population Units (GBPUs). Population estimates conducted in 2012 by the BC Ministry of Environment reported that two GBPUs within the Arrow TSA (Kettle-Granby and South Selkirk) had a conservation status of *threatened*, as the estimated population is believed to be less than 50 percent of the habitat carrying capacity for that GBU. Grizzly bears are found in all available ecological areas within the region at different times of the year. They require large tracts of suitable habitat where they can move freely and forage effectively. The home range for a male grizzly bear averages 1972 square kilometres, and for a female averages 354 square kilometres.

The HSM rated grizzly bear habitat based on its capacity to provide forage during four seasons (early spring, late spring, summer and fall). The HSM results presented to me suggest that both within and outside the THLB, high quality grizzly bear feeding habitat is less than optimal. Less than seven percent of spring habitat was rated as having high to moderate suitability or capability, and less than 15 percent of summer or fall feeding habitat was rated as moderately-high or high suitability.

The HSM revealed that harvest practices as simulated in the base case will have little impact on the availability of spring feeding habitat but will cause a reduction in the availability of higher quality summer and fall feeding habitat by 15 to 20 percent between 2060 to 2110 in the Arrow TSA THLB. This is due to the reliance on mature forest that is subjected to forestry operations. The utility of the model to predict forestry-related impacts to grizzly bear populations is limited as it does not account for the effects of climate-change and natural disturbance, changes to secure core areas, or the impacts of road development on grizzly bear mortality rates.

The Ktunaxa also raised the concern that the HSM did not account for grizzly bear mortality risk from road development. Regional staff inform me a separate analysis was conducted on the effects of road density on grizzly bear populations in southeast BC and that was provided to the Ktunaxa. This report described a model of grizzly bear population trends in the region based on a predicted amount of road development from the base case timber harvest simulations from the Arrow, Cranbrook and Invermere TSAs TSR models. The model suggested that road development could increase in some GBPUs, resulting in impacts to grizzly bear habitat, as well as increased human access, which puts the population at risk. Although the latest survey data suggest the grizzly bear population may be increasing, the Kettle Granby Population Unit (KGPU) received *threatened* status due to the estimated population being below 50 percent of the unit's carrying capacity (CC).

I have considered the information presented regarding the HSM work completed in the Arrow TSA and discussed it with regional staff. They inform me the HSM is a valuable management tool. Three improvements to the model would increase their confidence in it as a tool to inform management direction. First, including habitat features, such as snags, would make the suitability assessment more accurate and reduce uncertainty. Second, including habitat fragmentation metrics in the model would allow attributes such as patch size and connectivity to be used in habitat assessment. Third, expanding the model to the greater TSA, rather than limiting it to the THLB, would offer a more complete assessment.

I note that there are very similar trends between the HSM results for northern goshawk and marten since both species are dependent on old-growth forest. Regional staff inform me that new inventory data collected using LIDAR have the potential to better identify suitable breeding and home range habitats for the northern goshawk and will assist planning for long-term protection. Similarly, the LIDAR inventory data have potential to refine marten habitat mapping, identify fragmentation and improve connectivity planning. I expect Ministry staff to further investigate this new data to refine and reduce the uncertainty in the HSM and recommend that any new results be included in the timber supply analysis for the next AAC determination, as discussed in '**Implementation**'.

I have reviewed the results of the analysis simulating trends in road density and grizzly bear populations across southern BC given the base case harvest scenario. As discussed previously in this determination, and in **'Implementation'**, I request that licensees utilize existing road systems as much as possible rather than adding to existing road densities and prioritize the planning of road rehabilitation. I expect district staff to work with regional staff and licensees to initiate access management planning to decrease road density while supporting operations and grizzly bear requirements in the TSA.

I am aware that the resource values assessed are of particular importance to First Nations. I also expect Ministry staff and licensees continue to work with First Nations on planned actions for wildlife habitat management and mitigate the effects of timber harvesting on habitat values.

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 harvest

- alternative harvest flows

The base case projected an initial harvest level of 506 000 cubic metres per year that was maintained for six decades after which it increased to the stable, long-term level of 680 000 cubic metres per year for the remainder of the 100-year forecast. A range of alternative harvest forecasts were developed that varied the harvest rate over time with different initial harvest levels and correspondingly different mid-term levels.

One alternative examined the maximum harvest level where an even-flow (i.e., the same harvest through all time periods) was maintained. The maximum even-flow harvest level is 541 000 cubic metres per year. It is seven percent higher than that of the base case initial harvest level but 20 percent lower than the long-term harvest level in the base case.

Two alternative harvest forecasts began with an initial higher level of harvest: 550 000 and 650 000 cubic metres.

When the harvest is initiated at the previous determination level of 550 000 cubic metres per year, nine percent higher than the initial harvest in the base case, the initial harvest level after 10 years decreased to a mid-term harvest level of 480 000 cubic metres per year, three percent lower than the base case. After 50 years the long-term harvest level increased to 692 000 cubic metres, two percent higher than the base case long-term harvest.

When the harvest is initiated significantly above the previous determination at 650 000 cubic metres per year, 28 percent higher than the base case, the initial harvest level after 10 year levels decreased to a mid-term harvest level of 480 000 cubic metres per year, five percent lower than the base case. After 50 years, the long-term harvest level equalled that of the long-term base case at 680 000 cubic metres per year.

During public consultation, staff from Interfor commented that the base case should not allow the total volume of timber available for harvest in any one period to be drawn down below a reasonable buffer. They believe such a buffer (i.e., a volume that is over and above what is needed for harvesting) is required since timber operations in some areas may be more constrained than assumed in the timber supply model, for example, to maintain social licence with local communities. I commend licensee operations for maintaining a social licence with local communities and recognize this could result in harvesting less than the maximum timber available. However, I understand that the base case attempts to harvest the highest volume available given the data and management practices modelled.

The alternative harvest forecasts demonstrate to me the expected dynamics related to changing the initial harvest levels. I will discuss harvest forecasts further in **'Reasons for Decision'**.

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

Government provided direction regarding the economic and social objectives of the Crown to the chief forester in two letters dated July 4, 2006 and October 27, 2010.

The first letter is dated July 4, 2006 (attached as Appendix 3). In this letter, 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. As well, 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.

With respect to the 2006 letter, I note that in the base case as well as in the alternative harvest projections prepared for this determination that a primary objective has been to attain a stable, long-term harvest level where the growing stock is also stable. Ministry staff noted that there is a relatively stable timber supply in the Arrow TSA. During my consideration I was mindful of the context of this stable timber supply within the broader timber supply pressures faced in other parts of the region and across the province. The Minister, in another letter dated October 27, 2010 provided the Crown's objectives with respect to mid-term timber supply in areas affected by the mountain pine beetle. Stands susceptible to mountain pine beetle contribute only 13.1 percent to the total volume in the Arrow TSA THLB. Mountain pine beetle infestation levels peaked in 2006, and have been steadily declining since then. I am satisfied that the base case has incorporated the best available information regarding the impacts of the mountain pine beetle epidemic on stands in the Arrow TSA.

During my consideration of the factors required under Section 8 of the *Forest Act*, I have been mindful of both the local objectives as well as the interests and objectives of First Nations. 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 province as expressed by the Minister, as noted in '**Reasons for Decision**'.

- local objectives

The Minister's letter of July 4, 2006, suggests that the chief forester should consider important social and economic objectives expressed by the public during the timber supply review process, where these objectives are consistent with the government's broader objectives as well as any relevant information received from First Nations. In the applicable sections of this document I have provided my consideration of input from the public as well as First Nations.

Reasons for Decision

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

The base case suggests an initial harvest level of 506 000 cubic metres per year could be maintained for six decades after which it would increase to the stable, long-term level of 680 000 cubic metres for the remainder of the 100-year forecast. I am satisfied that the assumptions applied in the base case forecast for the majority of the factors applicable to the Arrow TSA were appropriate. However, I have identified a number of factors, which, considered separately, indicate that the timber supply may be either greater or less than that projected in the base case. Some of these factors can be readily 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. Following is my consideration of those factors for which I consider it necessary to further account for their implications to the timber supply.

I have identified the following quantifiable factors in my considerations as indicating that the timber supply projected in the base case may have been overestimated:

- *Armillaria root disease* - a sensitivity analysis, that applied *Armillaria*-specific operational adjustment factor 2 (DRA OAF 2), resulted in a 12.1 percent overestimation of the long-term timber supply, indicating the amount of *Armillaria* present is more prevalent than what was modelled by the base case.
- *Areas considered inoperable* - isolated areas, located between mapped inoperable and harvested areas, were part of the modelled THLB in the base case. However, it is unlikely harvesting will occur in these areas and many were overlapping with areas identified as steep slopes. These areas represent up to a seven percent overestimation of the short- and long-term harvest.

I have identified one quantifiable factor as indicating that the timber supply projected in the base case may have been underestimated:

- *Log grade changes* - the need to account for log grade changes not reflected in the modelled stand volume projections results in a 5.3 percent underestimate of the short-term harvest level.

In addition, I have concluded that the following factors have a potential influence on timber supply to a degree that currently cannot be quantified with accuracy:

- *Volume estimate for managed stands* - preliminary data from young stand monitoring plots suggest long-term volumes may be overestimated.
- *Landscape-level biodiversity, wildlife habitat supply* – future recruitment for OGMAs represents a marginal unquantified downward pressure in the short- and long-term harvest supply.
- *Wildlife habitat supply* - future recruitment for wildlife habitat supply and actions for wildlife habitat management represent an unquantified downward pressure in the short- and long-term harvest supply.

In the short term, the factors with a marginal unquantifiable over- or underestimation in the base case timber supply, described above, are not of sufficient magnitude to warrant an adjustment. However, I have concerns regarding the impact of short-term timber supply on other values in the future.

I have considered the links between wildlife habitat supply and the sustainability of wildlife, and how critical that is to the ability of First Nations to practice their Aboriginal rights. There is much uncertainty around the wildlife habitat supply information brought forward. However, that information was brought forward in recognition that it is going to be hard to recruit those habitat features in a short amount of time, leading me to recognize the implications of maintaining current harvest levels.

Further as I have noted throughout my considerations, both for timber supply and on non-timber values, additional pressure will be created when harvest performance does not match the assumptions that went into the base case. If areas that are being avoided are not harvested in the future, then these areas will be over represented in the modelled future harvests. Unless performance is demonstrated or can reasonably be expected, I will consider the implications of a smaller timber harvesting land base from both a timber supply and a non-timber values perspective; in particular, I am concerned about habitat supply within areas currently being harvested if the AAC is maintained at a level based on an operational harvest profile that is not aligned with the timber harvesting land base profile.

In addition to the adjustments to the base case listed above, and as discussed throughout this document, I have also considered the information and recommendations that I received from First Nations and the public through written submissions and meetings.

Given the above, in my AAC determination I recognize a small decrease is necessary to address current timber and habitat supply needs given the current harvest profile and forest management. However, my decision also includes some expectation that future harvest performance will match the profile of the timber harvesting land base as modelled in the base case.

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, that reflects current management practices, and meets the socio-economic objectives of the Crown as expressed by the Minister, can be best achieved in the Arrow TSA by establishing an AAC of 500 000 cubic metres.

This AAC is nine percent lower than the previous AAC of 550 000 cubic metres established in 2005, but only one percent lower than the effective AAC of 505 853 cubic metres.

This determination is effective November 16, 2017, 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 expect Ministry staff and licensees to undertake or support the tasks and studies summarized below. The benefits of these tasks have already been described in the appropriate sections of this rationale document. I recognize that the ability of all parties to undertake or support these projects is dependent on provincial priorities and available resources, including funding. However, these projects are important to help reduce the risk and uncertainty associated with key factors that affect the timber supply in the Arrow TSA.

1. *Areas considered inoperable* - I expect district staff to work with licensees to review, and revise if necessary, current operability information.
2. *Steep slopes* - I expect licensees, district and analysis staff to develop measures that ensure progress is made towards achieving a harvest distribution that better represents the terrain profile of the THLB. It is my expectation that district staff will report harvest performance on steep slopes to me annually.
3. *Non-merchantable forest types* - I expect licensees to remain vigilant in identifying stands where white bark pine grows and make every effort to minimize the incidental harvest of this species.
4. *Armillaria root disease* - I expect Ministry staff and licensees to use species less susceptible to Armillaria and mixed species where possible and utilize stumping techniques where appropriate.
5. *Residual waste* - I expect work to continue in improving the accuracy of waste measurements. I expect licensees to fully utilize the volume harvested and consider ways in which potential waste could be used in fibre-based products, while balancing the ecological value of leaving the appropriate levels of coarse woody debris on site.
6. *Landscape-level biodiversity* - I expect Ministry staff and licensees to conduct a comprehensive review of old-growth management areas with respect to the recently published version of BEC.
7. *Stand-level biodiversity* - I expect licensees to work with district staff to ensure that wildlife tree retention areas are properly coded and submitted to the RESULTS database and district staff use the Forest and Range Evaluation Program data where available to identify and monitor these areas.
8. *Scenic resources* - I expect that district staff work with licensees to ensure visual quality objectives meet legal requirements.
9. *Ungulate winter range* - I expect Ministry staff to work with First Nations and licensees to research the effectiveness of ungulate winter range areas previously established by GAR orders, and if necessary, to modify GAR orders to make them more effective. I expect FLNRO staff will keep me informed of significant changes to caribou GAR orders resulting from the provincial caribou recovery program.

10. *Wildlife habitat area for grizzly bear* - I expect licensees to utilize existing road systems and rehabilitate roads across the Arrow TSA to mitigate the impacts of forestry development on grizzly bear and other wildlife species sensitive to roads. I expect district staff to work with regional staff and licensees to implement access management in the Arrow TSA.
11. *Grade 4 credit* - I expect that staff monitor the volumes attributed to the grade 4 cut control credit and if such volume becomes a sustainability concern for the timber supply, request a maximum volume limit be implemented by the Minister.
12. *Wildlife habitat supply* - I expect that staff will work to improve our ability to model wildlife habitat supply, including investigating the use of LIDAR data to improve our inventory of important stand structure attributes.
13. *Harvest profile* - I expect Ministry staff to work with licensees to achieve an operational harvest distribution that more closely aligns with the timber harvesting profile with respect to lower volume stands, species composition, and terrain.



Diane Nicholls, RPF
Chief Forester

November 16, 2017



Appendix 1: Section 8 of the *Forest Act*

Section 8 of the *Forest Act*, Revised Statutes of British Columbia 1996, c. 157, (current to November 1, 2017), 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 tree farm licence areas, community forest agreement areas and woodlot licence areas, and
- (b) each tree farm licence area.

(2) If the minister

- (a) makes an order under section 7 (b) respecting a timber supply area, or
- (b) amends or enters into a tree farm licence to accomplish a result set out under section 39 (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 regional manager or district manager must determine an allowable annual cut for each woodlot licence area, according to the licence.

(7) The regional manager or the regional manager's designate must determine an allowable annual cut for each community forest agreement area, in accordance with

(a) the community forest agreement, and

(b) any directions of the chief forester.

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

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

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

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

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

(iv) the 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 November 1, 2017) 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

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Location:
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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.

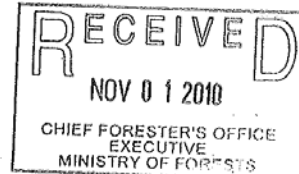
You should also consider important local social and economic objectives expressed by the public during the Timber Supply Review process, where these are consistent with the government's broader objectives as well as any relevant information received from First Nations.

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

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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