BRITISH COLUMBIA

MINISTRY OF FORESTS, LANDS, NATURAL RESOURCE OPERATIONS AND RURAL DEVELOPMENT

Rationale for Allowable Annual Cut (AAC) Determination for

Okanagan Timber Supply Area

Effective January 27, 2022

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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 Okanagan Timber Supply Area (TSA). This document also identifies where new or better information is needed for incorporation in future determinations.

Acknowledgement

For preparation of the information I have considered in this determination, I am indebted to staff of the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (the "Ministry") in the Okanagan Shuswap Natural Resource District, the Thompson/Okanagan Region, and the Forest Analysis and Inventory Branch (FAIB). I am also grateful to the First Nations, forest industry representatives, local residents, individuals and other 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 Okanagan Timber Supply Area

The Okanagan TSA is located in south-central British Columbia. The boundaries of the TSA range from Shuswap Lake in the north to the Monashee Mountains in the east, to the Canada-United States international border to the south and to the Okanagan mountains in the west.

The Okanagan TSA overlays the territories and areas of responsibility of 28 First Nation communities. There are three unaffiliated First Nation communities as well as 25 First Nations associated with Syilx, Secwepemc and Nlaka'pamux nation groups. Their territories predate the creation of the administrative boundary of the Okanagan TSA.

The TSA is administered by the Okanagan Shuswap Natural Resource District located in Vernon with a field office in Penticton. With a population of about 405,964 in 2010, the TSA has one of the fastest growing populations in British Columbia. The larger communities within the TSA include Penticton, Vernon, Kelowna, West Kelowna, Salmon Arm, and Summerland. The economy of the area is well-diversified and includes agriculture/viticulture, tourism, retail trade, manufacturing, forestry, range, and construction. Emerging industries include film, aviation, health care, and technology industries.

The TSA covers 2.45 million hectares of gross land base. The Crown forest management land base (CMFLB) portion of the TSA is 1.50 million hectares. After excluding areas due to environmental, economic and operability issues the timber harvesting land base (THLB) is 0.76 million hectares. The varied climate and terrain produces a wide range of vegetation and habitats ranging from wet interior hemlock and cedar forests in the north to semi-arid sagebrush grasslands in the south of the TSA. Douglas-fir and lodgepole pine-leading stands represent 25 percent and 30 percent of the THLB respectively. Spruce, subalpine fir, western redcedar, western hemlock and ponderosa pine are also common. The broad variety of habitat types in the TSA support many wildlife species, including approximately 30 red- and blue-listed vertebrates that are associated with forested ecosystems e.g., mountain caribou, mountain goat, grizzly bear, great basin gopher snake, flammulated owl, and spotted bat.

Water is a primary and fundamental resource of the TSA. There are currently 57 community watersheds that cover about 20 percent of the THLB. Given the growing population and changing climate, water stewardship is an important component of forest management in the TSA. Range use is prominent in the

TSA and access to a long-term supply of quality forage on Crown range is essential to the viability for many ranches.

History of the AAC

The AAC for the Okanagan TSA was first established in 1980, at 2.70 million cubic metres. In response to the late 1980's mountain pine beetle (MPB) outbreak, the AAC for the Okanagan TSA was increased by 0.20 million cubic metres. The uplift for MPB remained until 1994 when the AAC was decreased to 2.61 million cubic metres. A partition of 0.05 million cubic metres was added from 1992 to 1996 to harvest old cedar-hemlock stands.

In 2001, the AAC was increased to 2.66 million cubic metres with a 0.08 million cubic metres small scale salvage partition. The AAC decision in 2006 included an MPB uplift of 0.70 million cubic metres with an additional deciduous partition of 0.20 million cubic metres. The 2012 AAC determination was set at 3.1 million cubic metres without any partitions. The chief forester's AAC determination rationale directed licensees to continue to focus harvesting on MPB-impacted pine-leading stands. Subsequent to that determination, the AAC was reduced to 3 078 405 cubic metres following the establishment of a Community Forest Agreement on January 1, 2013.

New AAC determination

Effective January 27, 2022, the new AAC for the Okanagan TSA will be 2 462 800 cubic metres. The new AAC is 20 percent below the current AAC, which included an uplift to allow salvage of MPB-impacted stands. It is seven percent below the AAC that was in place in 2005, prior to the MPB epidemic.

This decision reflects AAC reductions to account for the application of Syilx Okanagan forestry principles, limited harvesting in community watersheds, alternative harvesting practices in the Birch Creek area, cultural heritage resources, Williamson Sapsucker habitat, and the proposed national park reserve area in the South Okanagan-Similkameen.

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

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 related to inventory, growth and yield, and management. 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. The AAC determination is a strategic-level decision for which the Crown maintains a duty to consult and accommodate, as necessary, those First Nations for whom it has knowledge of claimed Aboriginal Interests that may be impacted by a proposed decision. The chief forester must consider the information provided by First Nations through engagement and the consultation process.

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 the AAC for the Okanagan 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

Given the large number of periodic AAC determinations required for BC'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 aware of my obligation as a steward of the forests of British Columbia, of the mandate of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development ("the Ministry") as set out in Section 4 of the *Ministry of Forests and Range Act*, and of my responsibilities under the *Forest Act*, *Forest and Range Practices Act* (FRPA), and *Professional Governance Act*.

AAC determinations should not be construed as limiting the Crown's obligations under court decisions in any way, and in this regard, 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.

These guiding principles focus on: responding to uncertainties; incorporating information related to First Nations' rights, title and interests; and considering information related to integrated decision making, cumulative effects, and climate change.

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 addressing this uncertainty are:

(i) managing risks by evaluating the significance of specific uncertainties associated with the current information and assessing the potential current and future social, economic, and environmental risks associated with a range of possible AACs; and,

(ii) re-determining AACs regularly to ensure they incorporate current information and knowledge, and greater frequency in cases where projections of short-term timber supply are not stable and/or substantial changes in information and management are occurring.

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 consistent with legislative requirements and not substantiated by demonstrated performance.

It is not appropriate to speculate on timber supply impacts that may eventually result from land-use designations not yet finalized by government. Where specific protected areas, conservancies, or similar areas have been designated by legislation or by order in council, these areas are deducted from the 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 that helps meet resource management objectives such as biodiversity.

In some cases, even when government has made a formal land-use decision, it is not necessarily possible to fully analyse and immediately account for the consequent timber supply impacts in an AAC determination. Many government land-use decisions must be followed by detailed implementation decisions requiring, for instance, further detailed planning or legislated designations such as those provided for under the *Land Act* and FRPA. In cases where government has been clear about the manner in which it intends land-use decisions to be implemented, but the implementation details have yet to be 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 may be 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 precautionary response to uncertainty with respect to a single value.

Nevertheless, in making a determination, allowances may need to be made to address risks that arise because of uncertainty by applying judgment as to how the available information is used. 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.

First Nations

The BC government has committed to true, lasting reconciliation with Indigenous Peoples, including fully adopting and implementing the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). The *Declaration on the Rights of Indigenous Peoples Act* of 2019 (the '*Declaration Act*') commits the provincial government to aligning provincial laws with UNDRIP. Reconciliation and implementation of UNDRIP will likely require changes to policies, programs and legislation, which will take time and involve collaborative engagement with Indigenous Peoples. While this work is undertaken, BC is committed to fulfilling its legal obligations to consult and accommodate potential impacts to established and asserted Aboriginal rights, title and/or treaty rights ('Aboriginal Interests') consistent with the Constitution, case law, and relevant agreements between First Nations and the government of BC.

Where First Nations and the Province are engaged in collaborative land and resource planning, the Province may make commitments regarding stewardship and other aspects of resource management. Where such commitments have been made, I will consider them when determining AACs, within the scope of my statutory authority.

Where collaborative planning between First Nations and the Province is ongoing, there may be preliminary but not yet finalized and formalized land use zones or management objectives. As is the case for land use and management planning in general, it is beyond the statutory authority of the chief forester to speculate on final outcomes. If the timber supply implications of final designations are substantial, application of the Allowable Annual Cut Administration Regulation to reduce a management unit AAC between Section 8 determinations, or a new AAC determination prior to the legislated deadline may be warranted.

Where the nature, scope and geographic extent of Aboriginal rights and title have not been established, the Crown has a constitutional obligation to consult with First Nations regarding their Aboriginal Interests in a manner proportional to the strength of their Aboriginal Interests and the degree to which they may be affected by the decision. The Crown also has a constitutional obligation to consult with First Nations regarding their treaty rights. The manner of consultation must also be consistent with commitments made

in any agreements between First Nations and the Province. In this regard, full consideration will be given to:

(i) the information provided to First Nations to explain the timber supply review process and analysis results;
(ii) any information brought forward through consultation or engagement processes or generated during collaboration with First Nations with respect to treaty rights or Aboriginal Interests, including how these rights or interests may be impacted;
(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; and,
(iv) existing relevant agreements and policies between First Nations and the BC Government.

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*, and with consultation obligations defined in court decisions. 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 treaty rights or Aboriginal Interests that could have implications for the AAC determination are addressed in the various sections of this rationale where it is within the statutory scope of the determination.

The timber on established Aboriginal title lands (meaning Aboriginal title declared by a court or defined under an agreement with necessary federal and provincial implementation legislation), Treaty Settlement Lands or Indian Reserves, is no longer likely to be provincial Crown timber, depending on the particular circumstances. Consequently, if it is not provincial Crown timber, it does not contribute to the AAC of the timber supply area or tree farm licence overlapped by those lands. Prior to establishment of Aboriginal title, it is not appropriate for the chief forester to speculate on how potential establishment of Aboriginal title in an area could affect the AAC determination, given uncertainties about the scope, nature and geographic extent of title. Unless land has been established to be Aboriginal title land, Treaty Settlement Land or reserve land it remains as provincial land managed by the Province and will contribute to timber supply.

Integrated decision making and cumulative effects

One of the responsibilities 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 relevant available information on timber and non-timber resources in the management unit, including information on the interactions among those resources and the implication for timber supply.

With respect to cumulative effects, I must interpret related information according to my statutory authority. As emphasized above, the chief forester is authorized only to make decisions on allowable harvest levels, not to change or institute new management regimes for which other statutory decision makers have specific authority. However, cumulative effects information can highlight important issues and uncertainties in need of resolution through land use planning, which I can note and pass to those responsible for such planning. Information on cumulative effect can also support considerations related to Aboriginal Interests.

Climate change

One key area of uncertainty relates to climate change. There is substantial scientific agreement that climate is changing and that the changes will affect forest ecosystems. Forest management practices will need to be adapted to the changes and can contribute to climate change mitigation by promoting carbon uptake and storage. Nevertheless, the potential rate, amount, and specific characteristics of climate

change in different parts of the province are uncertain. This uncertainty means that it is not possible to confidently predict the specific, quantitative impacts on timber supply.

When determining AACs, I consider available information on climate trends, potential impacts to forest ecosystems and communities that depend on forests and related values, and potential management responses. As research provides more definitive information on climate change and its effects, I will incorporate the new information in future AAC determinations. Where forest practices are implemented to mitigate or adapt to the potential effects of climate change on forest resources, or where monitoring information indicates definite trends in forest growth and other dynamics, I will consider that information in my determinations.

I note, however, that even with better information on climate change, in many cases there will be a range of reasonable management responses. 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, which appear to be likely in some areas. Hypothetically, focused harvests in at-risk forests could forestall losses of timber and allow for planting of stands better adapted to future conditions. Conversely, lower harvest levels could provide buffers against uncertainty. The appropriate mix of timber supply management approaches is ultimately a social decision.

Deciding on the preferred management approach will involve consideration of established climate change strategies, and available adaptation and mitigation options together with social, economic, cultural, and environmental objectives. Analysis will be useful for exploring options and trade-offs. Any management decisions about the appropriate approach and associated practices will be incorporated into future AAC determinations. In general, the requirement for regular AAC reviews will allow for the incorporation of new information on climate change, on its effects on forests and timber supply, and on social decisions about appropriate responses as it emerges.

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 (TSR) Program 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 projections 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 harvest projections, 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 projection and it forms the basis for comparison when assessing the effects of uncertainty on timber supply. The base case is designed to reflect current management practices, demonstrated performance and established management requirements.

Because it represents only one in a number of theoretical projections, 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 projection of timber supply, whose validity, as with all the other projections 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 the assumptions made in generating the base case are realistic and current, and the degree to which

resulting projections 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 data 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 analyses I am provided are 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, particularly in cases characterized by a large degree of unquantified uncertainty, 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 Okanagan TSA

The base case for Okanagan TSA was prepared by FAIB staff using version 1 of the Ministry's spatial timber supply model (STSM) which was developed using the raster-based, spatially explicit landscape event simulator (SELES) modelling framework. STSM was used to project harvesting and growth over an analysis horizon of 250 years.

The data and assumptions used in the base case are intended to provide a reasonable representation of current forest management practices based on evidence of actual practices, using the best available information. The base case is used as a reference point to assess the timber supply in the Okanagan TSA, including exploration of the potential impacts of uncertainties through sensitivity analyses.

The timber supply projections are not predictions, because many unforeseeable events will certainly occur, and practices and knowledge will change and evolve. Given this change and uncertainty, the projections may change in the future. Changes in practices and information will be incorporated into future AAC determinations. However, the projections developed to support this AAC determination were designed to provide a rigorous and reasonable basis for the AAC decisions.

Much of what follows in the considerations outlined below is an examination of the degree to which the assumptions made in generating the base case are accurate, realistic and current, and of the degree to which resulting projections of timber supply must be adjusted to more properly reflect the current situation. These adjustments are made on the basis of informed judgment, using currently available information about forest management some of which may have changed since the original data package was assembled. Even though the timber supply analysis was integral to my considerations, the AAC determinations are syntheses of judgment and analysis in which numerous risks and uncertainties are weighed. The AAC determinations I have made reflect the outcomes of these considerations. As a result, the AACs determined may or may not coincide with the base case projections. Judgments that in part may be based on uncertain information are often qualitative and general in nature and, as such, are subject to an element of risk.

A *Discussion Paper*, which contained the results of the timber supply analysis, was published in January 2021. In the published base case, the harvest in the first decade is 2.65 million cubic metres per year, which is similar to the pre-MPB uplift AAC set in 2001 and is 14.5 percent lower than the current AAC. The harvest in the second decade is 2.46 million cubic metres per year and for the remaining 23 decades the harvest is 2.29 million cubic metres per year. Since publishing the base case, staff noticed that there was an error in the amount of non-recoverable losses which are deducted from the harvest projection. As

a result, the corrected base case is 28 663 cubic metres lower than the published base case. Therefore, the corrected harvest projection is 2.62 million cubic metres per year for the first decade, 2.43 million cubic metres per year for the second decade and 2.26 million cubic metres per year for the remainder of the planning horizon.

The base case was used only as a point of reference for the consideration of many factors that affect timber supply and the determination of the AAC. I reviewed all inputs to the base case, including how the legally required environmental objectives in the Okanagan Shuswap Land and Resource Management Plan (OSLRMP) were incorporated into the analysis. I also reviewed in detail the assumptions and methodology incorporated in the base case, as well as the model output, including species distribution over time; growing stock projections; age class distribution over time; average age, area, and volume harvested annually; and other factors as described in my considerations below. For this determination I am satisfied that the base case and the sensitivity analyses have provided a suitable basis for my assessment of timber supply for the TSA.

Collaborative engagement with First Nations

The AAC considers the sustainable harvest level from a geographic area, which may include lands claimed as Aboriginal title lands but not yet declared by a court to be such. While under claim, such lands remain Crown lands and are part of the harvestable land base. Whether timber is ultimately harvested from those lands is an issue that is subject to allocation decisions, and the AAC determination does not determine allocation. However, the timber harvesting authorized through the AAC may affect various resource values and therefore the ability of Aboriginal Peoples to meaningfully exercise their Aboriginal rights. Information gained through consultation with potentially affected First Nation communities about their Aboriginal Interests has been considered in the development of this AAC determination.

During this timber supply review there was extensive consultation and collaborative engagement with First Nations. Syilx and Secwepemc identified a wide range of interests and concerns that may be impacted by forestry operations. In order to address these concerns, a Joint Technical Forestry Working Group (JTWG) was formed between Syilx and Ministry staff through which Syilx produced a work plan titled *Syilx Perspectives on the Okanagan TSR* which provided a comprehensive basis for collaboration and information for me to consider in this decision. The Syilx and Secwepemc concerns included the need for further wildlife habitat protection to ensure First Nations may continue to practice their right to hunt, the need to protect cultural heritage resources for cultural survival, and the need to safeguard water quality and quantity. In addition to the several meetings between staff and First Nations, I met with First Nations representatives on four occasions, and I participated in a field tour organized by the Syilx and JTWG, that supported their concerns.

In order to represent the interests and concerns of Syilx and with Secwepemc in the analysis process, the JTWG co-created a series of 17 sensitivity analyses. The results of these sensitivity analyses were shared with the First Nations.

Table 1. Sensitivity analyses conducted in collaboration with First Nations

First Nation	Factor	Sensitivity analysis
Syilx & Secwepemc	Permanent Access Structures	1. To test the impact of addressing high road densities which adversely impact the sustainability of wildlife populations within the CMFLB.
Syilx	Birch Creek	2. To test the removal of Birch Creek (formerly Brown's Creek).
Syilx	Birch Creek	3. To test the implementation of Syilx forestry practices in Birch Creek.
Syilx	Recreation Resources	4. To test the removal of recreation resources.
Syilx	Terrain Stability	5. To test the removal of potentially unstable terrain.
Syilx & Secwepemc	Wildlife Habitat Areas	6. To test excluding additional WHAs.
Syilx & Secwepemc	Ungulate Winter Range	7. To test excluding additional UWRs.
Syilx & Secwepemc	Stand-level Retention	8. To test increased stand-level retention.
Syilx & Secwepemc	Archaeological Sites	9. To test the removal of archaeological sites.
Syilx & Secwepemc	Cultural Heritage	10. To test the removal of cultural heritage resources.
Syilx & Secwepemc	Community Watersheds	11. To test the management of community watersheds.
Syilx	Wildlife Management Areas	12. To test the removal of the WMAs.
Syilx	Williamson's Sapsucker	13. To test the implementation of best management practices in areas of occupancy.
Syilx	Moose Habitat	14. To test excluding additional moose habitat.
Syilx	Mountain Caribou Habitat	15. To test excluding additional mountain caribou habitat.
Syilx	Bighorn Sheep Habitat	16. To test excluding additional bighorn sheep habitat from the THLB.
Syilx	Grizzly Bear Habitat	17. To test excluding additional grizzly habitat.

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

I have reviewed the information for 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 is a reasonable reflection of current legal requirements, demonstrated forest management and the best available information, and uncertainties about the factor have little influence on the timber supply projected in the base case, no discussion is included in this rationale. These factors are listed in Table 2.

For other factors, 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 issues raised and the reasoning that led to my conclusions.

Table 2. List of factors accepted as modelled in the base case

***Forest Act* section and description**	**Factors accepted as modelled and not discussed further in the rationale**
8(8)(a)(i) the composition of the forest and its expected rate of growth on the area	• Non-Provincial Crown land • Area-based tenures • Non-forest and non-productive forest • Low productivity sites • Inoperable areas • Deciduous-leading stands • Site productivity estimates
8(8)(a)(ii) the expected time that it will take the forest to become re-established following denudation	• Regeneration delay • Backlog not satisfactorily restocked areas
8(8)(a)(iii) silviculture treatments to be applied to the area	• Genetic gain • Site productivity estimates • Stand establishment • Silviculture systems
8(8)(a)(iv) the standard of timber utilization and the allowance for decay, waste, and breakage expected to be applied with respect to timber harvesting on the area	• Harvest performance • Harvest rules and priority • Minimum harvestable criteria • Decay, waste and breakage
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	• Cutblock adjacency • Fisheries sensitive watersheds • Landscape-level biodiversity • Stand-level biodiversity • Visual quality management • Registered archaeological sites • Higher level plans • Wildlife management areas
8(8)(a)(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber	• Forest health • Rose Swanson sensitive area
8(8)(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area	• Alternative harvest projections
8(8)(d) 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 of the Crown
Section 8(8)(e) Abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area	• Non-recoverable losses

***Forest Act* Section 8 (8)**

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

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

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

Land base contributing to timber harvesting

- general comments

The total land area of the Okanagan TSA is 2.45 million hectares. After removing areas not managed by the Province, non-forest and non-productive areas, and areas managed by area-based tenure holders the remaining forested area is 1.50 million hectares (61 percent of the TSA area). This area is considered Crown managed forest land base (CMFLB) and contributes to timber and non-timber objectives.

The timber harvesting land base (THLB) is an estimate of the land where timber harvesting is considered both legally available and economically feasible, given the objectives for all relevant forest values, market values and applicable technology. It is a strategic-level estimate developed specifically for the timber supply analysis and, as such, could include some areas that may never be harvested or could exclude some areas that may be harvested.

As part of the process used to define the THLB, a series of deductions were made from the Crown managed forest land base. These deductions account for biophysical, economic or ecological factors that reduce the forested area available for harvesting. For the Okanagan TSA, the THLB that is available after deductions are applied is 760 781 hectares. The THLB represents about 31 percent of the total area and about 50 percent of the Crown managed forest land base.

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

For this determination, I accept that the approach used to determine the THLB for the Okanagan TSA base case was appropriate.

- permanent access structures

Forest roads, logging trails, and landings are considered permanent access structure as they are constructed through soil or rock that is not suitable to the growth of a commercial crop of trees or because they are required for a long enough time that prevents the timely growth of a commercial crop of trees. For these reasons, they are considered non-forest and are removed from the CMFLB.

To estimate the reductions for roads, a buffer was applied to each side of the road using a geographic information system (GIS): 25 metres for class 1 (highways and paved roads), 12.5 metres for class 2 (unpaved local roads and forest service roads), and 5 metres for all other roads and trails.

The gross area of permanent access structures removed from the CMFLB to account for permanent access structures was 41 405 hectares. District staff reviewed the road classification and estimated that about 2200 kilometres of class 3 roads should have been class 2. This resulted in an over-estimation of the base case timber supply by about 0.22 percent.

Secwepemc suggested that the area removed for roads is likely underestimated due to the presence of unclassified roads. I note that some licensees have acquired light detection and ranging (LiDAR) data and this will provide better mapping of roads. Secwepemc and the Ministry have established a forum for

resolving forestry issues known as the QS Forestry Working Group (QSFWG) and I encourage the parties to improve the road data for consideration in future AAC decisions.

Syilx expressed concern that a road density greater than 0.6 kilometres per square kilometre is detrimental to wildlife populations and availability of certain food items for social and ceremonial purposes. Syilx was also concerned about roads altering the natural flow of water across the landscape. Members of the public also expressed concerns regarding the effect of high road density on wildlife and water quality. Staff estimated that road density throughout much of the TSA is greater than two kilometres per square kilometre. Lower road densities typically occur in the northeast and southwest portions of the TSA.

Syilx enquired about the possibility of reforesting roads not being actively used. Syilx estimated that the THLB could be increased by 0.34 percent if this occurred. Forest roads are returned to a productive state when they are decommissioned through a rehabilitation process where all structures (including bridges, culverts, water bars and cross ditches) are removed, the road surface is loosened, the surface is re-contoured, the natural drainage pattern is restored, and trees are planted. While I do not have the authority to direct road rehabilitation, I note that anticipated amendments to the *Forest and Range Practices Act* (FRPA) is expected to provide direction regarding road rehabilitation. I strongly suggest licensees work with the Ministry and First Nations to address fish and wildlife habitats impacted by road densities and consider road rehabilitation efforts.

For this factor, I conclude that the base case underestimated the area occupied by roads by about 0.22 percent. I account for this underestimation of roads in my determination as discussed under '**Reasons for Decision**'.

- *parks and Crown reserves*

Parks and Crown reserves totalling 188 759 hectares (12.5 percent of the CMFLB) are excluded from harvesting in the TSA. Syilx commented that these areas are not wholly representative of the biodiversity and special natural ecosystems. I agree that these areas may not be wholly representative of the biodiversity in the TSA. However, I note that 744 656 hectares (almost one half of the CMFLB) are excluded from harvesting and these areas all contribute to meeting biodiversity requirements. I will not make any adjustments to the base case harvest projection to account for parks and Crown reserves.

- *terrain stability and environmentally sensitive areas*

Landslide hazard information is useful for planning safe operations and avoiding environmental issues. Terrain stability mapping (TSM) provides an assessment of where existing or potential development may be affected by landslide hazards or slope stability. Approximately 80 percent of the TSA has terrain stability mapping. The remainder of the TSA is covered by the older environmentally sensitive area (ESA) mapping.

TSM has three hazard classes (stable, potentially unstable and unstable). In the base case, all unstable areas and 20 percent of the potentially unstable areas were removed from the THLB. All of the ESA class 1 (extremely fragile or unstable soil) areas were also removed from the THLB. Subsequent investigation revealed that some of the ESA mapping overlapped TSM areas categorized as stable but were removed from the THLB. Staff estimated that correcting for this overlap would increase the THLB by about 1.47 percent.

Syilx commented that all potentially unstable areas, rather than just 20 percent, should be removed from the THLB. Staff estimated that this would reduce the THLB by about 2.61 percent. Comments were received from the public regarding increased landslide activity due to forestry activities in sensitive areas. I note that a geomorphologist is required to assess all potentially unstable sites before harvesting occurs.

I also note that harvesting records show that harvesting is concentrated on slopes less than 30 percent. I encourage licensees to increase performance on slopes greater than 30 percent. Failure to do so will result in those areas being removed from the THLB in the future.

The base case underestimated the THLB by about 1.47 percent, but acknowledging the concerns expressed by First Nations and the public regarding terrain stability, I will not make any adjustments to the base case.

- *non-merchantable forest types*

Non-merchantable forest types (NFTs) are stands that are physically operable and exceed low site criteria yet are not currently used or have marginal merchantability due to species, quality, piece size or volume. These stand types are excluded from the THLB. In this analysis all NFTs previously harvested were included in the THLB because those sites were planted with desirable species and will receive silvicultural treatments if necessary.

Syilx suggested that, with some effort, NFTs could be in the THLB since those types are ideal for secondary users such as post and rail facilities. Licensees have shown very little interest in these stand types and it is uncertain whether interest will increase. Given this uncertainty, I will not make any adjustments to the base case but I acknowledge an unquantified upward pressure on timber supply for the TSA.

- *old growth management areas*

Old growth management areas (OGMA) have been spatially established to retain or restore the ecological attributes associated with old forest, and to maintain areas that are subject to natural forest succession. They may also contribute to the preservation of other features important for biodiversity or other values. A large proportion of OGMAs are also co-located with caribou habitat, scenic areas and landscape corridors. In this TSA, the OGMAs have not been legally established but licensees have not harvested these areas and they are excluded from the THLB.

Syilx commented that the current OGMAs do not represent the objectives intended by government. Secwepemc stated that many First Nations do not support provincial OGMA objectives because Indigenous communities did not have input to the objectives, and the OGMAs do not support traditional or cultural values. Furthermore, enabling a temporary reduction of old forest retention of up to one-third of the requirement is unacceptable.

In this determination, I do not have the authority to make land use decisions such as the amount of area to be set aside for old growth. I note that First Nations participation in the proposed amendments to FRPA will be indispensable in making land use decisions and partnering in landscape planning. The results of those decisions will be reflected in future AAC decisions. For this determination, I will not make any adjustments to the base case to account for OGMAs.

On April 30, 2020, an independent panel appointed by the BC Government submitted their report *A New Future for Old Forests: A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems*. Currently, the BC Government is engaging with First Nations across the Province about how recommendations from the report will be implemented within the context of a Provincial Old Growth Strategy. As the elements of this strategy come into effect, any necessary changes to the AAC for the Okanagan TSA will be addressed at that time and incorporated in subsequent timber supply reviews.

- *wildlife habitat areas/ungulate winter ranges*

Wildlife habitat may be identified and managed by establishing wildlife habitat areas (WHA) or ungulate winter ranges (UWR). WHAs and UWRs are established to provide habitat for identified wildlife species that are at risk or are of regional importance. Management objectives may prevent harvest or set conditions under which harvesting can occur. Almost all of the WHAs and UWRs in this TSA prohibit harvesting. Section 10 of the Government Action Regulation (GAR) authorizes the Minister of Environment and Climate Change Strategy to establish wildlife habitat areas. Section 12 of the Government Action Regulation authorizes the Minister of Environment and Climate Change Strategy to establish ungulate areas. Since 2001, 126 WHAs have been established in the Okanagan TSA for a

variety of mammals, birds, reptiles, amphibians and plant communities. Five UWRs have also been established in the TSA.

Secwepemc suggested that WHAs should be expanded to cover all traditionally and culturally significant wildlife. I encourage Secwepemc to use the QS Forestry Working Group to discuss their interests in this regard.

Syilx was concerned that not enough areas were set aside for bighorn sheep, moose, mule deer and mountain caribou. Syilx was also concerned about the amount of disturbance (roads and harvesting) permitted in UWRs. Adam's Lake Indian Band was concerned that no areas were set aside for elk. Syilx suggested that wildlife values should be placed ahead of timber values and that government needs to look at habitat connectivity. Addressing Syilx's concerns regarding WHAs would reduce the THLB by about 2.91 percent and by an additional 2.81 percent for UWRs.

In this determination, I do not have the authority to make land use decisions such as the amount of area to be set aside for wildlife habitat. I note that First Nations participation in the proposed amendments to FRPA will be indispensable in making land use decisions and partnering in landscape planning. The results of those decisions will be reflected in future AAC decisions. I am satisfied that the base case has appropriately accounted for the current legal requirements for WHAs and UWRs in the Okanagan TSA. For this determination I will not make any adjustments to the base case to account for WHAs or UWRs.

- *very dry sites*

Very dry sites in the Bunchgrass, Interior Douglas-fir and Ponderosa Pine biogeoclimatic zones were excluded from the THLB. However, staff reported that there was some harvesting in these areas to mitigate the risk of wildfires.

In 2020, the Forest Practices Board published a report *Reforestation in the Interior Douglas-fir Subzone: Are Reforestation Choices Meeting Objectives?* which suggested that more than 60 percent of reforested cutblocks in dry-belt Douglas-fir stands in the Southern Interior were in poor or marginal stand condition because licensees did not follow best management practices. I note that the Office of the Chief Forester is developing an interior Douglas-fir strategy to address practices in this forest type.

For this determination I will not make any adjustments to the base case to account for harvesting in very dry sites, but recognize that anticipated management practices associated with the aforementioned strategy may influence future determinations.

- *riparian management*

Riparian areas are transition zones between aquatic areas such as streams or wetlands, and drier upland areas. Riparian areas provide habitat for various plant and animal species and provide for habitat connectivity.

Riparian management objectives have been established to minimize or prevent impacts of forest and range practices on these aquatic resources. The Forest Planning and Practices Regulation requires protection of riparian areas. The *Riparian Management Area Guidebook* defines riparian classes and specifies minimum widths of reserve and management zones for streams, wetlands and lakes. The OSLRMP requires enhanced riparian reserves and lakeshore management zones which are not legally enacted, but licensees have complied with the requirements.

The Province does not have complete stream classification information for the Okanagan TSA, and as such, spatial buffers could not be accurately created to account for riparian reserve and management zones in the timber supply model. In this analysis, riparian reserves, riparian management zones, enhanced riparian retention, and lakeshore management zones were accounted for by applying an aspatial reduction of 13 percent to the THLB. The retention reduction was based on the results of 106 Forest and Range Evaluation Program (FREP) surveys conducted between 1998 and 2016 which indicated that

stand-level retention amounts to 13 percent of the THLB. This retention is intended to meet both riparian and wildlife tree requirements. In this analysis, 109 887 hectares were removed from the THLB to account for riparian management and wildlife tree requirements.

Syilx provided information that the legal and enhanced stream buffers do not adequately protect streams and that all streams should be provided with a significant buffer based on the stream, riparian zone, habitat, and wildlife needs. Secwepemc recommended that licensees should go beyond the enhanced reserves required by the OSLRMP. Members of the public also suggested that there should be wider buffers around streams.

A sensitivity analysis showed that if the stand-level retention was increased from 13 percent to 23 percent, short-term timber supply would be reduced by 7.8 percent and long-term timber supply by 11.9 percent. Increasing stream buffer width is a land use decision and I do not have the authority to make such decisions. I note that First Nations participation in the proposed amendments to FRPA will be indispensable in making land use decisions and partnering in landscape planning. The results of those decisions will be reflected in future AAC decisions. I am satisfied that the base case has appropriately accounted for the current legal requirements for stand-level retention in the Okanagan TSA. For this determination, I will not make any adjustments to the base case to account for stand-level retention.

I agree with Secwepemc that there should be a database identifying all streams in the TSA and as discussed under '**Implementation**', I urge the Inventory Section of FAIB to explore the possibility of using LiDAR to develop such a database for use in future timber supply reviews.

- forest inventory

The vegetation resources inventories (VRI) developed by the Ministry is a photo-based, two-phased inventory consisting of phase I: photo interpretation and phase II: ground sampling. The VRI for Okanagan TSA is based on aerial photography taken in 2001 and 2007. The ground sampling consisted of 110 plots and was completed in 2002. Ground sampling provides a field check of the values (species, age, volume etc.) interpreted from the aerial photos. The provincial VRI is updated annually to reflect stand growth, harvesting, silviculture activities and to adjust for wildfires and insect epidemics. The VRI used in this analysis was updated to January 2017.

In 2019 FAIB conducted a review of the mature (greater than 50 years old) forest inventory. In this review, inventory attributes were compared to ground attributes collected from 96 sample plots. The comparison showed that age and volume were not significantly different from ground measurements.

Syilx commented that the inventory used was outdated and requested that LiDAR be used to produce a new inventory. This new inventory would better reflect the effects of climate change. Secwepemc commented on the age of the inventory as well and wondered whether it reflected recent fires in the TSA.

The Ministry is actively pursuing the acquisition of LiDAR data as funding becomes available. I note that field sampling indicated that the mature inventory was sufficiently accurate for AAC determinations, and I accept the suitability of the forest inventory for this analysis. I therefore will not make any adjustments to the base case to account for the forest inventory estimates.

-wild fires (2021)

Wildfire reporting for the 2021 fire season (*Land and Forests Within 2021 Wildfire Perimeters Report 13_09_2021*) indicated there were 85 075 hectares within the CMFLB of the Okanagan TSA affected by wildfires. The THLB affected by the 2021 fires was 26 614 hectares. There were about 1800 hectares of old seral forest in the THLB within the fire perimeter. Fire salvage operations are occurring within the TSA.

The corrected base case harvest projection deducts 69 763 cubic metres annually to account for non-recoverable losses. Approximately 50 percent of these losses are attributable to wildfires. Given this

allowance for losses to wildfires and the ongoing salvage operations, I will not make any adjustments to the base case to account for the 2021 wildfires.

- *growth and yield*

The volume available from stands was projected using yield tables that are based on stand attributes, growth characteristics, and the most suitable growth and yield model. The Variable Density Yield Projection (VDYP) model was used to project volumes for existing natural stands while Table Interpolation Program for Stand Yields (TIPSY) was used to project volumes for existing and future managed stands.

Existing managed stands are defined as those stands that have already been harvested and reforested. An existing natural stand is defined as a stand that has not been harvested and has not had any management activities applied to it. An existing natural stand will become a future managed stand after it has been harvested.

Data from the provincial site productivity layer was used to assign site index values by species that was applied to each VRI polygon. Instead of aggregating similar natural stands into analysis units, a VDYP yield curve was assigned to each existing natural stand.

FAIB has developed a new process to produce yield tables for managed stands. This process uses the Reporting Silviculture Updates and Land Tracking System (RESULTS) data to incorporate both planting data as well as RESULTS survey data, thus accounting for species changes after planting due to ingress or mortality. A managed stand yield table (MSYT) is developed for every existing managed stand. The MSYT reflects the current management prescription for species composition as documented in the RESULTS system.

Where data is insufficient to generate a yield table, the stand is flagged for review. The data is examined and if possible is corrected in RESULTS. The yield table for these stand uses an aggregate species composition based on BEC zone and subzone.

For future managed stands, a MSYT is developed using an aggregation of the current species composition of managed stands within the BEC zone and subzone.

In the Okanagan TSA, version 1.0 of the MSYT process was used. This uses BatchTipsy Composer version 1.0.14.0 Beta which is based on Tipsy 4.4.

I commend FAIB for developing this process for developing MYSTs using RESULTS data. I also note that the yield projections for managed stands in this TSA is corroborated by the data obtained from the young stand monitoring program. For this determination I accept the volume projections for natural and managed stands and will not be adjusting the base case to account for growth and yield estimates.

- *operational adjustment factors*

Yield projections in TIPSY are based on potential yields of a healthy stand where the site is fully occupied. Because a stand may not fully occupy a site or be able to reach its potential growth (e.g., due to forest health issues), it is necessary to adjust the potential yields of TIPSY to reflect an operational yield.

In TIPSY, there are two operational adjustment factors (OAFs) that are used to modify the potential yields. These OAFs differ in their application. OAF 1 is a static reduction across all time periods and, for example, may reflect non-productive openings within a forest. OAF 2 is a dynamic reduction that increases over time and, for example, may reflect a forest health issue that increases as a stand grows older. Standard OAF values of 15 percent for OAF 1 and 5 percent for OAF 2 were used in this analysis.

Armillaria root rot occurs in Douglas-fir leading stands in the Interior Cedar Hemlock and Interior Douglas-fir moist warm BEC zones and subzone in this TSA. The Regional pathologist determined that further work is required in the Okanagan to determine the extent and impact of armillaria root rot. Staff

estimated that the OAF 2 should be increased to 10 percent to account for armillaria root rot. Applying an OAF 2 of 10 percent in these zones and subzone reduces timber supply by about 0.74 percent. I account for this overestimation of timber supply as discussed under '**Reasons for Decision**'.

- *research installations*

The Sicamous Creek Research Area and the Upper Penticton Creek Research Area were identified as resource features in January 2015 pursuant to Section 5(1)(c) of the GAR. Harvesting is allowed in these research areas if the harvest meets the research objectives, therefore these areas were included in the THLB. Exclusion of these areas from the THLB would reduce the base case harvest projection by about 0.1 percent.

Secwepemc expressed interest in participating in research. Syilx commented that data collected from research areas should inform AAC decisions. I recognize the need to protect research areas and under '**Reasons for Decision**' I will reduce the base case harvest projection by 0.1 percent to account for the protection of research areas. I would also like to encourage First Nations participation in forest research and under '**Implementation**' I ask Regional and Branch research staff to invite First Nations participation.

- *unharvested volume disposition*

In January 2018 the Ministry introduced a *Policy Regarding the Administration of Unharvested Volumes, Uncommitted Volumes and Unused BCTS Volumes* (collectively referred to as accumulated volume). The accumulated volume in this TSA is currently 457 449 cubic metres. The base case harvest projection is predicated on the condition of the forest, including the amount of merchantable timber growing stock present, as of the date of the timber supply analysis. The standing forest was not depleted to account for potential harvesting of any accumulated ('undercut') volume in the Okanagan TSA. In the future, if disposition plans become finalized that make use of this volume, it is important to note that any volume harvested (including accumulated volume) that is above the AAC in this determination, constitutes use of the growing stock at a greater rate than projected in the base case, if the AAC were fully utilized.

I am not aware of plans to dispose of any portion of the accumulated volume and will therefore not make any adjustments to the base case harvest projection.

- *waste reporting*

The volume projections used in the base case are based on provincial utilization standards and were reduced to account for the 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 is exceeded, the excess volume is charged to the licensee's AAC and the licensee is required to pay stumpage on that volume.

During the past 10 years staff have observed a trend towards increased logging waste throughout the province. Recent studies have found that ocular estimates of waste performed by licensees significantly underestimated the actual amount of waste.

Government is promoting increased utilization of the timber resource and has banned the practice of burning waste piles in many areas of the province. In addition, government implemented the *Provincial Logging & Waste Measurement Procedures Manual* which eliminated the practice of ocular estimates in April 2019. As discussed under '**Implementation**', I urge licensees to meet government's expectations regarding improved timber utilization and provide more accurate estimates of waste.

- grade 4 credit

AACs reflect the merchantable volume understood to be available using the information contained in the forest inventory, research plots and projected by growth and yield models.

Operationally, the harvest level within a TSA is monitored through various tenure decisions and billing of harvest to those tenures. However, 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 volume attributed to their licence (referred to as "grade 4 credit"). This allows the licensee to harvest an additional cubic metre of timber for each cubic metre that is approved under Section 17(6). In the Okanagan TSA, grade 4 logs are mostly harvested from dead pine stands but can also originate from other species and be either live or dead. Grade 4 credit is a tool that was developed to provide an incentive for the salvage of dead pine or harvest of low-quality logs and to promote higher levels of fibre utilization.

District staff conducted a review of harvest records which indicated that during the period 2015 to 2019, approximately 816 000 cubic metres total (or 163 000 cubic metres per year), qualified for grade 4 credit in the Okanagan TSA. I note that the salvage of mountain pine beetle-killed wood is essentially finished and therefore the volume of grade 4 logs harvested was decreasing accordingly. However, since 2017, the grade 4 credit volume has been increasing and now exceeds levels credited during the period of mountain pine beetle salvage.

Syilx expressed concern regarding the volumes attributed to grade 4 credits in the TSA and suggested that all grade 4 volume should be charged to the AAC. I share their concern and agree that the practice of harvesting additional volume through grade 4 credit could result in over-harvesting that would put the sustainability of the current AAC at risk.

With regards to grade 4 credit, I am mindful of balancing better fibre utilization that encourages forest sector diversity, while ensuring that the future use of grade 4 credit does not negatively impact timber supply sustainability. It is my expectation that the total annual live harvest (including grade 4 credit) should not exceed the AAC set by this determination. I will therefore make no adjustment to the base case to account for grade 4 credit. As I will discuss further under '**Reasons for Decision**' and '**Implementation**', I expect Ministry staff to monitor the use of grade 4 credit and report any concerns to the chief forester.

- dead potential volume

Prior to April 1, 2006, grade 3 endemic (the 'normal' mortality observed in a mature stand) and grade 5 (dead trees with greater than 50% firmwood and log has defects such as twists, knots and heart rot) were not charged to the AAC if harvested.

In April 2006, changes were made to the Interior log grades to enable logs that were previously considered grade 3 endemic or grade 5 to be charged to the AAC. Estimates of timber volume in the base case do not include the dead logs that could potentially be used as sawlogs (dead potential). Possible sources of data about dead potential include inventory audit plots, VRI phase II ground samples, permanent sample plots, and temporary sample plots.

At this time, the inventory audit is considered the best of the above-mentioned sources of data regarding dead potential timber in the Okanagan TSA. These data indicate that dead potential volume could be up to 4.9% of the green volume for the forest over 60 years of age in this TSA.

The grade 4 credit volume discussed in the previous factor was introduced after the changes were made to the Interior log grades. In effect, this regulation allows dead wood harvested to not be charged to the AAC, thus negating the intended purpose of the changes made to the interior log grades. As noted above, I am concerned that grade 4 crediting could result in over-harvesting the AAC. Therefore, while the practice of grade 4 crediting is in effect, I will not make any adjustments to the base case to account for dead potential volume that may be harvested.

- *timber merchantability*

The *Interior Appraisal Manual* specifies the criteria defining merchantable timber in this TSA. The merchantability criteria are the maximum stump height, minimum top diameter (inside bark) and the minimum diameter (outside bark) at stump height. For volume projections in the timber supply analysis, the minimum stump diameter is converted to a corresponding diameter at breast height.

The minimum top diameter inside bark specified for cedar is 15 centimetres but was modelled as 10 centimetres due to limitations of the growth and yield model used by the Ministry. As a result, the base case overestimates the volume of cedar harvested.

The timber supply model used tracks the volume harvested based on the leading species of the stand harvested. Since cedar is often the secondary or tertiary species in stand composition, staff were unable to quantify the overestimation of cedar volume in the base case. I therefore recognize an unquantified overestimation of cedar volume in '**Reasons for Decision**'.

- *community watersheds*

There are 57 community watersheds in the Okanagan TSA covering a total area of 358 371 hectares. Approximately 20 percent (153 252 hectares) of the THLB in the TSA occurs within community watersheds.

The objective set by government contained in Section 8.2 (2) of the Forest Planning and Practices Regulation (FPPR) stipulates that the cumulative hydrological effects of primary forest activities in a community watershed do not have a material adverse impact on the quantity of water or the timing of the flow of the water to the waterworks, or do not have a material adverse impact on human health that cannot be addressed by water treatment.

Forest management constraints for community watersheds are not standardized but are based on a hydrological assessment of the watershed. At present, licensees in the Okanagan TSA have commitments in Forest Stewardship Plans requiring them to complete hydrologic assessments of community watersheds and to abide by the recommendations of the assessments.

The base case modelled a constraint where no more than 30 percent of the THLB within each watershed could be less than six metres in height at any given time over the planning horizon.

The regional hydrologist for Thompson Okanagan Region suggested the constraint modelled for community watersheds in the base case underestimated the effect of the practice requirements and recommended implementing hydrological recovery curves. Staff were unable to incorporate the hydrological recovery curves in the timber supply model but estimated that implementing these curves would reduce the base case harvest projection by about two percent.

Syilx commented that allowing 30 percent of the THLB in sensitive watersheds to be below six metres is unacceptable and that it does not recognize constitutionally protected water rights. Syilx suggested that there should be no separation between sensitive and other watersheds; they should all be considered sensitive and protected accordingly.

Secwepemc was concerned that salvage harvesting of beetle-killed pine stands in watersheds other than community watersheds adversely affected fish habitat. Other key concerns expressed were related to the severity of freshets causing increased debris flow; the amount of water flow during spawning season; and water temperature being too high for fish survival. For these watersheds Secwepemc recommended that the legislation should require a minimum hydrological recovery height of five metres rather than the current height of two metres.

I understand that water is a primary and fundamental resource of the TSA. Given the growing population and changing climate, water stewardship is important to meet the needs of the community. Agriculture, ranching, tourism, recreation and households all require a clean, steady supply of water. I was informed

that Syilx, licensees and staff have initiated joint planning for any harvesting activities that may occur in the Peachland and Trepanier community watersheds. I endorse this effort and recommend that joint planning of operations occur for all community watersheds in the TSA.

Reducing or eliminating harvesting in community watersheds are land use decisions which are beyond the scope of the chief forester. First Nations participation in the proposed amendments to FRPA will be indispensable in making land use decisions. The results of those decisions will be reflected in future AAC decisions. I note that the base case does not adequately reflect the regional hydrologist's recommendations regarding hydrological recovery in community watersheds. In this regard, I will accept the estimate provided by staff that implementing the recovery curves recommended by the hydrologist would reduce the base case harvest projection by about two percent. As discussed under '**Reasons for Decision**' I will reduce the base case harvest projection by two percent to account for hydrological recovery in community watersheds including the Peachland community watershed discussed below.

- *Peachland community watershed*

The Peachland community watershed, located in the Okanagan TSA, is 12 470 hectares in size. Within the watershed there are 201 hectares of private land and 6769 hectares of THLB (approximately 0.9 percent of the total THLB). Since 1972 there have been 3467 hectares harvested in the watershed. The primary method of harvest in the TSA is clearcutting.

Concern was raised during the timber supply review that harvesting within the watershed is having an adverse effect on water quality downstream. First Nations and public input requested a cessation of all harvesting and road construction within the watershed. However, licensees conducted a hydrologic assessment in 2018 and propose to harvest an additional 1043 hectares in the watershed during the next five years.

A Forest Practices Board investigation of harvest practices in the Peachland and Trepanier watersheds was conducted in 2018/2019. The Board determined that forest licensees' management of risks to water quality was reasonable. The Board found that forestry activities complied with the legal requirements and the investigation determined that forestry activities did not cause impacts on human health that could not be addressed through water treatment.

Construction of a new water treatment plant for the residents of Peachland is expected to be completed in 2021. In a report titled *Beyond the Conflict in the Peachland Watershed*, O.R. Travers questioned whether this new water treatment plant has the capacity to handle large, rapid discharges of muddy water associated with wildfire or snowmelt at an acceptable cost. He suggested that if this cannot be done responsibly, the right thing to do is to exclude these community watersheds from logging. Until such time as formal decisions are made to exclude harvesting from specific community watersheds, I will not be making any adjustments to the base case to account for these land use decisions.

- *timber licence reversion*

Timber licences are a form of tenure that provides the holder with exclusive rights to harvest merchantable timber from defined areas of Crown land. These licences have an expiry date after which they become a part of the TSA. Portions of the licence area that have been harvested before the expiry date also become a part of the TSA.

The base case included the entire area of all the timber licences in the THLB. Subsequent investigation revealed that this overestimated the forested area of the TSA by about 16 000 hectares. A sensitivity analysis which deferred harvesting from the unexpired timber licence area (16 000 hectares) until their expiry in 2031 showed no impact to the base case harvest projection. Given this result, I will not make any adjustments to the base case.

- *Birch Creek*

The Birch Creek area, formerly known as Brown's Creek, consists of 30 458 hectares located west of Vernon and on the western side of Okanagan Lake. This area was a part of TFL 49 until 2012 when it was deleted from the TFL and added to the TSA. There is a history of direct action and litigation related to the management of the Birch Creek area.

The Okanagan Indian Band has a current litigation file open against the Province, however there are no legislative measures to prevent harvest in Birch Creek. In 2017, the Okanagan Indian Band (OKIB) was issued a 200 000 cubic metre non-replaceable forest licence in Birch Creek. To date, the OKIB has not harvested any timber from this licence, but the area is still part of the THLB.

In January 2018 the OKIB completed the Brown's Creek Restoration and Management Plan, also known as Birch Creek Management Plan (BCMP), with the goal of restoring the productivity of the area.

In April 2019, Forsite Forest Management Specialists prepared a report titled *Timber Supply Analysis for Okanagan Indian Band Forestry Limited Partnership*. This analysis included land base reductions and constraints not modelled in the current Okanagan TSA TSR. Those reductions included a forest ecosystem network and the removal of recreation sites as well as increased land base reductions for riparian and future wildlife tree retention areas.

In the base case, Birch Creek contributed 50 062 cubic metres per year to the harvest projection. The Forsite analysis indicated that available timber supply would be 38 550 cubic metres per year (a reduction of 23 percent). Should Birch Creek be harvested in accordance with Syilx forestry practices the reduction to the base case harvest projection will be 0.46 percent.

Syilx is concerned that the AAC for the TSA is too high and should be reduced by about 35 percent. They also stated that Birch Creek is viewed as for the exclusive use by Syilx and should not be a part of the TSA.

Taking Birch Creek out of the TSA is beyond the authority of the chief forester. However, I note that apart from the licence issued to OKIB, no other licences were issued for operations in Birch Creek. The preparation of the Birch Creek Restoration and Management Plan and commissioning the Forsite timber supply analysis indicate to me that harvesting may occur in Birch Creek according to Syilx forestry standards. As discussed under '**Reasons for Decision**' I will reduce the base case harvest projection by 0.46 percent to account for management practices in Birch Creek.

- *cultural heritage resources*

Cultural heritage resource (CHR) is defined under the *Forest Act* as "an object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance to British Columbia, a community or an aboriginal people". CHRs include, but are not limited to, archaeological sites, structural features, heritage landscape features and traditional use sites. Many of these sites may overlap with areas already excluded from the THLB to account for non-timber resources such as riparian areas, ungulate winter ranges, wildlife habitat areas and old growth management areas.

Section 10 of the *FPPR* requires licensees to incorporate specific information with respect to cultural heritage resources within their Forest Stewardship Plans. The objective of Section 10 is to conserve or protect cultural heritage resources that are important to Aboriginal Peoples but are not regulated under the *Heritage Conservation Act*.

In the base case, registered archaeological sites were acknowledged as excluded from the harvesting but in the analysis, the area was too small to be accounted for in the THLB. As no information was available regarding cultural heritage resources, the base case did not account for cultural heritage resources. After the timber supply analysis results were published, information was received from First Nations showing cultural heritage resource covering an area of 111 384 hectares in the TSA. After accounting for overlaps

with other excluded areas, the area removed from the THLB to account for CHRs was 29 837 hectares. A sensitivity analysis removing the CHRs from the THLB reduced the base case harvest projection by 2.27 percent.

Syilx commented that a greater reduction of the land base is necessary to account for sacred areas. However, no specific information was provided to indicate where those areas may be located. Secwepemc commented that tenures are still being issued in sacred areas such as Mt. Ida and Harper Lake.

In 1999, a protocol limiting harvesting on Mt. Ida was signed by the District Manager and chiefs of Adams Lake First Nation and Neskonlith First Nation. In early 2020, Ministry staff worked with the Pespesellkwe te Secwepemc (PteS) Campfire of the Quelminte Secwepemc to create a Terms of Reference for a Forestry Working Group. The Ministry-PteS Forestry Working Group (Lakes Division) is currently discussing how forestry operations may proceed in Mt. Ida and other cultural sites.

I acknowledge Government's legal duty to consult with Aboriginal Peoples, and to accommodate their interests, including interests associated with practices integral to Aboriginal culture. While I do not have authority to prescribe forest management practices within the TSA, I encourage the Ministry-PteS Forestry Working Group (Lakes Division) to continue working to resolve forest practices in Mt. Ida and other cultural sites.

Under '**Reasons for Decision**' I will account for cultural heritage sites by reducing the base case harvest projection by 2.27 percent.

- *climate change*

The consideration of climate change impacts in AAC determinations aligns with the Ministry's Climate Change Strategy to incorporate this important factor into decision making. Recognizing that projections of future climate are highly uncertain, and can only indicate trends in climate variables, climate monitoring for 1945 to 2012 and projections based on results from a combination of climate models for the period 2041 to 2070 for the Okanagan TSA show the following results and trends:

- Mean annual precipitation has increased by 13.2 percent over 1945-2012, mainly driven by increasing spring, summer, and fall rain; winter precipitation has declined. During the period 2041 to 2070, mean annual precipitation is projected to increase by an additional 3.8 percent. Spring precipitation is expected to increase by 11.3 percent, whereas summer precipitation will likely decrease by 11.4 percent.
- During the period 1945-2012 mean annual temperature has increased by 1.3oC with winter warming the most (2.2oC). Mean annual temperature is forecasted to increase by an additional 3.1oC.
- Extreme maximum temperatures have increased by slightly over 1.0oC but are projected to increase by an additional 3.9oC in the future.
- Extreme minimum temperatures have increased by 4.3oC and are expected to increase by an additional 6.3oC.

Potential impacts to forests inferred from climate trends include:

- Current climate trends of warmer winters are more conducive to forest pest overwinter survival. Warmer conditions overall can mean some insects can shorten their life cycles and therefore increase populations. Wet and warm minimum temperatures in the spring can be a risk for increasing rust incidence, such as those affecting lodgepole pine.
- Future climate trends indicate a higher drought risk in the summer, but also in all seasons as large temperature increases will likely outweigh the minor precipitation increases and enhance evaporation demand. While the increases in growing degree days and frost-free period may mean some vegetation will see enhanced growth, moisture availability may limit that potential.

- A reduced snow season will likely also mean less soil moisture storage available for the growing season. The potential for stressed trees due to hot dry conditions will also limit natural defenses from other disturbances such as pests and wildfire, of which the climate projections are favourable for these to increase as well.

The draft *Climate Action Plan for the Thompson/Okanagan* and *Adapting natural resource management to climate change in the Thompson Okanagan Region* contain a set of actions aimed to assist adaptation to and mitigation of the effects of climate change on values associated with water, fish, wildlife, forested ecosystems, grasslands, natural disaster management and public safety and infrastructure.

Syilx expressed concerns regarding the effect of climate change on water resources. Several members of the public also expressed similar concerns. In addition, the public also commented on the effect of climate change on other values such as forest health, carbon sequestration, biodiversity and tree growth.

I share these concerns, however, as noted under '*Guiding principles for AAC determinations*' incorporating climate conditions in decisions like AAC determinations is highly challenging due to the high uncertainty, and the wide range of potential responses. The requirement for regular AAC determinations provides the ability to incorporate mitigative actions taken in response to the climate change as described in the *Climate Action Plan for the Thompson/Okanagan Region (2016-2020)* and *Adapting natural resource management to climate change in the Thompson Okanagan Region*. As stated elsewhere in this rationale, I do not have the authority to prescribe forest management actions and it is not within my authority to speculate on what events may occur. Any actions to mitigate or adapt to climate change in the TSA will be incorporated in future AAC determinations.

- *cumulative effects*

Cumulative effects are changes to social, economic and environmental conditions caused by the combined impact of past, present and potential human activities or natural events. The provincial cumulative effects team is developing policies and procedures for assessing cumulative effects on high priority values and implementing cumulative effects assessments across the province.

The Thompson Okanagan Region's cumulative effects team selected six values for cumulative effects assessments: watersheds/aquatic ecosystems, forest biodiversity, moose, visual quality, pine marten and grizzly bear. To date, the team has reported on three values: visual quality, watersheds/aquatic ecosystems and moose.

The report on visual quality published in June 2016 found that due to MPB-related harvesting visual quality objectives were not met in 18 percent of scenic areas. Prior to salvage harvesting, objectives were not met in nine percent of scenic areas.

In February 2017, the team published its report on watersheds/aquatic ecosystems. The team found that from 2003 to 2016 there was an increase in the number of watersheds with high and very high hazard ratings for streamflow, sedimentation, and riparian function. The primary factor in the increase was extensive MPB mortality in pine-leading stands and subsequent salvage harvesting. The report recommended field-based assessments by qualified professional to support operational-level actions to mitigate potential downstream impacts of the increased hazard ratings.

The assessment of moose population, conditions and trends in the region was published in May 2017. The team found that there was a moderate to low risk of lost hunting opportunities due to moose population decline in the region. The decline is due to high wolf predation and increase in habitat-related hazards following MPB salvage. The reported recommended that the Province undertake management actions in the high-risk areas that were identified in the report.

Secwepemc commented that they were not provided enough information regarding cumulative effects, resource values important to them were not addressed and efforts to work with the Regional cumulative effects team have not been productive. They suggested that assessment of watersheds should include

impacts from agriculture and cattle since these activities tend to add nitrogen and phosphorous to the water. Secwepemc expressed concerns that high road density is affecting moose and grizzly bear populations.

I am aware that through the QS Forestry Working Group, Secwepemc is working with the Ministry to address their interests and concerns. Capacity funding was provided to some Secwepemc communities to help them engage in this timber supply review.

I have considered the information on cumulative effects, including comments from First Nations, and I conclude that the base case reflects current management, the status of the effects of past and present industrial activity on the land base, and the legal objectives established by government for various non-timber resources. I will not make any adjustments to the base case on this account.

- *recreation resources*

Recreation resources include recreation sites and trails, interpretive forest sites, recreation reserves, and areas designated for the use, recreation and enjoyment of the public (UREP). These resources are intended to provide safe, high quality recreation opportunities for the public.

Section 56 of FRPA authorizes the Minister to establish interpretive forest sites, recreation sites and recreation trails. Section 15 of the *Land Act* authorizes the Lieutenant Governor in Council to reserve Crown land from disposition, including for recreation purposes.

Within the TSA there are 175 recreation sites, 60 recreation reserves and 24 trails that are established, plus an additional 124 sites and 77 trails that are managed by the Ministry but are not established. Establishment or management of recreational resources does not preclude industrial activity or harvesting. The district recreation officer must authorize industrial activity or harvesting before it occurs.

Recreation sites and reserves total 102 737 hectares within the TSA. Of that area, 20 percent is inside the THLB and eight percent of the total area has been harvested. There are 165 UREP areas consisting of 2808 hectares within the TSA. Of that area, 30 percent is inside the THLB and five percent of the total area has been harvested.

The district recreation officer noted that use of recreational sites and trails has increased by about 10 percent annually and there is significant pressure to maintain and expand recreation opportunities. During the period that coincided with the COVID-19 pandemic the pressure for outdoor recreation has further increased.

Syilx commented that increased road access has led to increased human activity in the backcountry and this has affected their ability to gather food and medicinal plants. Increased use of recreational vehicles has allowed the public to wander throughout the TSA thus increasing pressure on wildlife and affecting water resources as well. Syilx suggested that all recreation resources should be outside of the THLB. Secwepemc questioned whether the increased recreation sites and trails were approved.

Several members of the public recommended that there should be no harvesting in recreation areas to preserve their cultural and environmental values. Considerable interest was expressed from recreational users of the Rose Swanson Sensitive Area located above the community of Spallumcheen. The Rose Swanson Sensitive Area Order was established by the Ministry in 1997 to address recreation and timber values. The majority of respondents were seeking to prevent logging and to protect the sensitive area as a park. The Order has objectives to address trails, visual quality, recreation values and protection from vandalism and timber theft but does not restrict timber harvesting. District staff have conducted numerous public engagement meetings and inform me that an FSP amendment has been implemented based on the Order that limits timber harvesting to low impact silviculture systems.

The Ministry recognizes the importance of public recreation and the significant increase in use of recreation resources by the public especially during the COVID-19 pandemic. District staff have noted

the concerns expressed about parks and recreation resources and are investing in the enhancement of existing recreational features.

I note that some harvesting is permitted in recreation areas, and I urge licensees to use this opportunity to practice alternate silviculture systems to demonstrate best management practices to the public. For this determination I accept that the management of recreation resources followed accepted procedures and I will not make any adjustment to the base case.

- *forest carbon*

The 'carbon cycle' refers to the constant movement of carbon from land and water through the atmosphere and living organisms. Forests are a vital part of the carbon cycle, both storing and releasing carbon in a dynamic process of growth, decay, disturbance and renewal, thus making them important from a carbon and climate change mitigation perspective.

Forests act either as carbon sources or carbon sinks. A forest is considered a carbon source if it releases more carbon than it absorbs. A forest is considered a carbon sink if it absorbs more carbon from the atmosphere than it releases. The net ecosystem carbon balance (NECB) is used to describe the net change between the given ecosystem and atmosphere. If the atmosphere is used as a base, a positive NECB means the atmosphere carbon pool is increasing and the given ecosystem is a carbon source, while a negative NECB means the atmosphere carbon pool is decreasing and the ecosystem is a carbon sink.

Five terrestrial carbon pools have been defined by the Intergovernmental Panel on Climate Change: above ground biomass carbon, below ground biomass carbon, dead organic matter, forest floor litter, and soil organic carbon. The sum of all five pools is referred to as total ecosystem carbon (TEC).

A carbon analysis of the base case harvest projection was completed by using a carbon budget model – Canadian forest sector version 3 (CBM-CFS3) – to project carbon dynamics over the first 100 years. Sources of greenhouse gases modelled were harvesting, wildfires, non-recoverable losses due to insects and disease, and road building. On the areas outside the THLB, TEC increased by about 11.6 percent over the 100 years modelled whereas TEC decreased by about 17.8 percent on the THLB. The cause of decrease on the THLB is largely due to harvesting and considering all the harvested logs as a one-time emission.

Accounting for emissions projected from harvesting (2.2 metric tons of carbon dioxide equivalent (Mt CO_2e) per year), wildfire (0.3 Mt CO_2e per year), slash burning (0.4 Mt CO_2e per year), road building (0.03 Mt CO_2e per year), and non-recoverable losses (0.02 Mt CO_2e per year), the TSA is considered a carbon source. After accounting for the carbon stored in harvested wood products (HWP) the TSA is considered a carbon sink.

The depth of the carbon analysis conducted for the Okanagan TSA and the detailed information is particularly useful to understand the impact of the base case projection on forest carbon and greenhouse gas emissions. The information demonstrates the value of carbon to forest ecosystems and shows how forest management practices can contribute to climate change mitigation efforts by promoting carbon uptake and storage. Specifically, I note the significant loss of ecosystem carbon from slash burning and I recognize that practices enabling better biomass utilization can reduce greenhouse gas emissions. I have considered this information in my determination, as discussed above under '*waste reporting'*, I expect less slash burning in the TSA. I will not make any adjustment to the base case to account for forest carbon.

- *mountain caribou habitat*

Southern mountain caribou populations occur within the TSA. They are listed as "Threatened" under the Government of Canada's *Species at Risk Act* (SARA) and are provincially red-listed (i.e., species at risk of extinction or extirpation).

In this TSA, ungulate winter range (UWR) areas and wildlife habitat areas (WHA) were created to protect mountain caribou. Mountain caribou WHAs (8-226 to 8-230) were excluded from the THLB and harvesting was constrained in the portion of WHA 8-233 that remained within the THLB.

UWR u-3-005 for mountain caribou was excluded from the THLB. The gross area for UWR u-8-004 is 192 623 hectares while the THLB area is 21 366 hectares. Harvesting is not constrained in the portion of u-8-004 within the THLB.

Syilx commented that all remaining caribou habitat must be excluded from the THLB, and travel corridors must be restored and protected. Syilx suggested that I reduce the AAC by two percent to conserve caribou habitat and connectivity corridors.

As noted elsewhere in this rationale, I do not have the authority to make land use decisions such as the amount of area to be set aside for caribou habitat. I encourage the QS Forestry Working Group to work with the Ministry's wildlife habitat biologist to determine what adjustments should be made to protect caribou. I note that First Nations participation in the proposed amendments to FRPA will be indispensable in making land use decisions and partnering in landscape planning. The results of those decisions will be reflected in future AAC decisions. I am satisfied that the base case has appropriately accounted for the current legal requirements for caribou habitat in the Okanagan TSA. For this determination will not make any adjustments to the base case to account for caribou habitat.

- *grizzly bear habitat*

Grizzly bears are of "Special Concern" under SARA and are provincially blue-listed (i.e., species not immediately threatened, but of concern because of characteristics that make them particularly sensitive to human activities or natural events).

Objective 2 of the *Order Establishing Objectives in Okanagan-Shuswap LRMP Area*, dated 2007, requires the retention of basic and enhanced levels of coarse woody debris to conserve habitat for grizzly bears; and objective 10(b) requires adverse impacts of forest road construction on the habitat of grizzly bears to be limited.

There are 12 WHAs created to protect the most critical habitat for grizzly bears in the TSA. The total area of the WHAs is 4965 hectares and no harvesting is allowed in these WHAs. There is one large grizzly bear WHA (915 396 hectares) created to provide habitat and forage. This WHA allows timber harvesting with minor restrictions which can be met operationally with little impact to timber supply.

Syilx commented that grizzly habitat requires a 500-metre buffer around roads and recreation trails in addition to a secure core area of 10 square kilometres.

I am aware that roads have a significant impact on grizzly bears and caribou. Grizzly bears tend to avoid roads and surrounding areas. As stated above under *'mountain caribou habitat'*, I encourage the QS Forestry Working Group to work with the Ministry's wildlife habitat biologist to determine what adjustments should be made to protect grizzly bears. I was informed that licensees are following current guidelines regarding forest practices in grizzly bear habitat and are meeting the expectations of the regional wildlife biologist. I recommend that licensees consider further opportunities to apply best management practices in grizzly bear habitat.

- *moose habitat*

Because of the importance of moose to First Nations, FAIB analyzed the effect of current and potential future forest harvesting on moose populations within the TSA. The results of the analysis were published as 'Appendix I Moose Habitat Analysis' of the 2020 *Okanagan TSA Timber Supply Analysis Discussion Paper*.

Forestry-related indicators of moose habitat and population analyzed were: percentage of watershed area that is 5 to 30 years old, percentage of watershed area that is conifer stands greater than five hectares in size and 15 metres tall, and road density in a watershed area. The moose population and habitat indicators used in this study suggested that moose populations are at least stable across most of the TSA.

There were no clear indications that previous forestry and other land use activities have negatively affected the sustainability of moose populations in the region. Interestingly, road densities are high across much of the TSA, but they do not appear to be correlated with declining moose populations or high hunting pressure. In addition, there are high densities of cutblocks in the west-central portion of the TSA, but moose population indicators do not suggest a declining population there.

Simulated future harvesting projected in the base case suggested that road density may increase in portions of the TSA. However, this small increase in future roads may not be a particularly large concern for moose management. Future cutblock densities are projected to be lower across the TSA, and their distribution less dispersed. This lower cutblock density may create a shortage of forage for moose in some areas.

The report concluded that the indicators suggest that previous and future forestry activity has not, and potentially will not, have any clear negative impact on moose.

Syilx commented that they would like their concerns for moose habitat be addressed by reducing the AAC by two percent. Concerns were expressed by the public regarding adequate management for moose habitat, the necessity of an adequate moose population for First Nations cultural purposes, the impact of road density on moose populations, and the importance of maintaining adequate forest cover for moose habitat.

I note that, in general, forest harvesting has improved moose habitat and populations. I will therefore not make any adjustments to the base case.

- *Williamson's sapsucker*

Williamson's Sapsucker (WISA) is listed as "Endangered" under SARA and are protected by SARA measures for listed wildlife species. It is also protected under the federal government's *Migratory Birds Convention Act*. The Federal Government has implemented a recovery strategy with the objectives of maintaining WISA at or above current abundance and current distribution. In the Okanagan TSA, the Province has established 579 hectares of WHAs for WISA where harvesting is prohibited.

Improving the suitability of WISA habitat is critical to the recovery of WISA populations. Forestry is the primary land management activity that affects WISA habitat suitability. To improve habitat suitability, the provincial government instituted best management practices (BMP) for each area of occupation (AOO) in the province. The intent of the BMPs is to reduce the effects of forestry-related activities within AOOs. There are 14 942 hectares of AOOs within the outer boundaries of the Okanagan TSA. However, about two-thirds of this area is in TFL 59; there are only 5622 hectares of AOOs in the area managed for TSA timber supply.

The regional ecosystem biologist's interpretation of the best management practices was that in AOOs there should be an average of 225 stems per hectare retained. In stands with greater that 70 percent lodgepole pine he recommended that the pine be removed and an average of 125 stems per hectare of

non-pine species be retained. This recommendation was not modelled in the base case. Staff estimated that modelling this requirement would have reduced the base case harvest projection by 0.03 percent.

Syilx commented that best management practices should occur on all WISA areas of occupancy. As discussed under '**Reasons for Decision**', I will account for the management of Williamson's sapsucker by reducing the base case harvest projection by 0.03 percent.

- *range practices*

Forage supply is affected by management practices in forested areas. Forage opportunities can increase for the first 10 to 15 years after timber harvesting due to the growth of native forage species. In forest types where native species are less palatable cutblocks may be grass seeded.

The timing of timber harvesting over the timber rotation within grazing areas affects the reliability of forage supply. Encouraging timber harvesting practices that meet forage supply and livestock use objectives is critical in many range areas to avoid forage shortfalls and maintain a viable beef industry.

The district's approved forage supply objective is 95 000 animal unit months. To achieve the forage objective, the district has initiated a pilot project with licensees to selectively strip harvest and grass seed one site in the TSA.

Syilx was concerned about the impact of cattle on forest regeneration. Ministry staff suggested that the effect of strip harvesting and grass seeding on timber supply can be re-examined in the next TSR to determine the impact to the THLB.

District staff informed me that management practices to improve forage supply include reduced stocking, obstacle planting and grass seeding in areas of the TSA that are utilized for both forest management and livestock grazing. At present, these practices to improve forage do not affect timber supply but I would like to re-visit this issue at the next TSR. For this determination, I will not make any adjustments to the base case to account for range practices.

- *national park reserve*

In July 2019, a memorandum of understanding (MOU) to work towards establishing a national park reserve (NPR) in the South Okanagan-Similkameen was signed by the Provincial and Federal governments and Syilx. The MOU outlines the plan, including a working boundary, for the NPR. The total draft area of the NPR is 27 322 hectares while the THLB area within it is 945 hectares or 0.1 percent of the total THLB. No firm date for establishment of the NPR has been announced.

The NPR includes areas of importance to Syilx within the northern portion of the Great Basin Desert. The NPR will also protect unique plant and wildlife habitat.

The Regional Executive Director has sent a letter to licensees to direct them not to make cutting permit applications in the national park reserve.

Several members of the public expressed concerns about potential harvesting in the proposed NPR. They suggested that this area should be for the protection of ecosystems, and for managing species at risk (mountain caribou, American badger, northern goshawk, western rattlesnake, and Williamson's sapsucker) within this reserve area.

I share many of the concerns expressed by members of the public and I note that there was a directive from the Regional Executive Director that no applications for cutting permits should be made for this area. Since the current practice is to not harvest in the NPR, I will reduce the base case harvest projection by 0.1 percent under '**Reasons for Decision**'.

Reasons for Decision

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

Following an adjustment to the base case to account for to account for non-recoverable losses, the base case showed a harvest projection is 2.62 million cubic metres per year for the first decade, 2.43 million cubic metres per year for the second decade and 2.26 million cubic metres per year for the remainder of the planning horizon. I note that the initial harvest level in the corrected base case is about 15 percent below the current AAC.

I am satisfied that the assumptions applied in the base case for the majority of the factors applicable to the Okanagan TSA were appropriate, as detailed in Table 2 or as described elsewhere in this rationale. However, I have identified factors which, considered separately, indicate that the timber supply may be either greater or less than 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 readily quantified at this time.

I have identified the following factors in my considerations as indicating that the timber supply projected in the base case may have been overestimated, to a degree that can be quantified:

- *Permanent access structures* – District staff stated that some of class 2 roads were misclassified as class 3 roads. This resulted in an overestimation of the THLB by about 1650 hectares or 0.22 percent due to the difference in buffer widths applied to the different road classes. This overestimation affects both short-term and long-term timber supply.
- *Operational adjustment factors for managed stands* – The yield projections for managed stands did not account for the effects of armillaria root rot on managed stand yield. Staff estimated that accounting for root rot would reduce timber supply by about 0.74 percent.
- *Research areas* – Harvesting is permitted in research areas only if it meets research objectives. Recognizing the importance of research, it was unlikely any harvesting will occur in these areas in the short term. This resulted in an overestimation of about 0.1 percent in the short term.
- *Community watersheds* – The analysis did not model the regional hydrologist's recommendation to use hydrological recovery curves to limit harvesting in community watersheds. Staff estimate that implementing the recommendations will reduce timber supply by about two percent.
- *Birch Creek* – The forest practices most likely to be implemented in this area are different from the practices representative of the entire TSA which were modelled in the base case. When harvesting is modelled in accordance with Syilx standards timber supply will be reduced by about 0.46 percent.
- *Cultural heritage resources* – Staff acknowledged that there may be more cultural heritage sites than were removed in the analysis. It was estimated that timber supply may be reduced by more that 2.27 percent to account for cultural heritage resources.
- *Williamson's sapsucker* – Applying the Province's best management practices to the Williamson's sapsucker area of occupation reduces the base case projection by about 0.03 percent.
- *National park reserve* – Licensees are not currently harvesting in the national park reserve proposed for the South Okanagan-Similkameen area. Exclusion of this area from the THLB would reduce timber supply by about 0.1 percent.

I have identified the following factors in my considerations as indicating that the timber supply projected in the base case may have been overestimated, but are not quantifiable at this time:

- *Waste reporting* – Staff indicated that some volume that should be charged against the AAC is reported as waste thus over-harvesting the AAC.
- *Timber merchantability (utilization)* – The appraisal manual specifies that the minimum top diameter of a merchantable cedar log is 15 centimeters whereas the analysis used a 10-centimeter top diameter to estimate log volume.

I have also identified the following factors in my considerations as indicating that the timber supply projected in the base case may have been underestimated, but are not quantifiable at this time:

- *Non-merchantable forest types* – These forest types are not currently used, however, it was suggested by Syilx that these types could be used by secondary manufacturers such as post and rail facilities.

In considering the above-mentioned influences, I find that the combined effect of accounting for the quantifiable factors represents a net overestimation of timber supply by almost six percent.

In my considerations for Okanagan TSA, I am mindful of the significant interest shown by First Nations in the harvest level of this management unit and of the Province's desire for reconciliation with First Nations. I am also aware of government's intention to change the way forests are managed in this province as described in the June 2021 document titled *Modernizing Forest Policy in British Columbia Setting The Intention and Leading the Forest Sector Transition* (Intentions Paper).

On four occasions during this TSR process I met with First Nations whose traditional territory overlaps the Okanagan TSA, and I am especially cognizant of their high level of engagement and the significant investment of time and effort to inform me of the importance of the AAC decision to their interests. I also attended a field tour organized by the Syilx and Ministry JTWG to see a demonstration of Syilx forestry standards. The harvest plan prepared by Syilx prescribed various levels of retention and a range of residual stand density adapted to the complexity of the Interior Douglas-fir ecosystem. I heard from Sylix representatives that the post-harvest stand still provides a multitude of values important to their communities; maintaining stand-level biodiversity with representative leave-trees and the protection of immature patches and the use of natural regeneration. The Sylix harvest plan also included a prescription for a post-harvest burn that has yet to be implemented and we discussed the importance of fire to maintain the ecosystems values important to Sylix. In this determination, I decreased the base case harvest projection to account for cultural heritage resources, alternative harvesting practices in the Birch Creek area and for the proposed reserve in the South Okanagan-Similkameen.

Given the dry climate of the southern Okanagan, water is a primary and fundamental resource of the TSA. While water has always been important to First Nations, residents, farmers, and ranchers, the rapidly growing population in the TSA has increased the demand for drinking water and for recreation purposes. I recognize the role of forests in water quality and quantity, and in this determination, I reduced the base case projection to account for water management practices.

As mentioned previously under '*grade 4 credit*', to ensure the future use of grade 4 credit does not negatively impact timber supply sustainability, I will make no adjustment to the base case to account for grade 4 volume.

Following the comprehensive public review of the analysis results for the Okanagan TSA, I have considered the many comments and concerns regarding harvest levels expressed by First Nations, licensees, and numerous residents of the TSA. I expect that the reductions I made to the base case harvest projection will address the concerns raised.

Determination

I have considered and reviewed the factors as documented above, including the risks and uncertainties of the information provided. It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next 10 years and that reflects current management practices as well as the socio-economic objectives of the Crown, can be best achieved in Okanagan TSA by establishing an AAC of 2 462 800 cubic metres. This new AAC is 20 percent below the current AAC and seven percent below the AAC set in 2006, prior to the MPB epidemic.

This determination becomes effective on January 27, 2022, 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 or establish AAC partitions sooner than the 10 years required by legislation.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage Ministry staff, other agencies and licensees (as appropriate) to undertake or support the tasks noted below, the particular benefits of which are described in greater detail in appropriate sections of this rationale.

I recognize that the ability of staff and licensees to undertake projects is dependent on available resources, including funding. However, I have highlighted here what I view to be the most critical needs to help reduce the risk and uncertainty associated with key factors that affect the timber supply in the Okanagan TSA.

1. *Riparian management* – I urge the Inventory Section of FAIB to explore the possibility of using LiDAR to develop a stream classification database for use in future timber supply reviews.
2. *Research installations* – I ask Regional and Branch research staff to invite First Nations participation in research projects in the TSA.
3. Grade 4 credit – The total annual harvest of live timber (including grade 4 credit) should not exceed the AAC set by this determination. To ensure that the future use of grade 4 credit does not negatively impact timber supply sustainability, I expect all Ministry staff to monitor the use of grade 4 credit and report any concerns to the chief forester.
4. *Residual waste* – I expect licensees to meet government expectations regarding timber utilization and waste measurement procedures respecting the *Provincial Logging & Waste Measurement Procedures Manual*.

Shane Berg, RPF
Deputy Chief Forester

January 27, 2022

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the *Forest Act*, Revised Statutes of British Columbia 1996, c. 157, (current to January 19, 2022), reads as follows:

Allowable annual cut

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

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

(i)tree farm licence areas;

(ii)community forest agreement areas;

(iii)first nations woodland licence areas;

(iv)woodlot licence areas, and

(b)each tree farm licence area.

(2)If the minister

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

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

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

(c)within 10 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and

(d)after the determination under paragraph (c), at least once every 10 years after the date of the last determination.

(3)If

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

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

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

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

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

(b)must give written reasons for the postponement.

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

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

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

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

(5)In respect of an allowable annual cut determined under subsection (1), the chief forester may, at any time, 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.]

(5.1)The chief forester may, at any time, amend or cancel a specification made under subsection (5).

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

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

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

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

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

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

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

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

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

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

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

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

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

(c)[Repealed 2003-31-2.]

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

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

(9)Subsections (1) to (4) of this section do not apply in respect of the management area, as defined in section 1 (1) of the **Haida Gwaii Reconciliation Act**.

(10)Within one year after the chief forester receives notice under section 5 (4) (a) of the **Haida Gwaii Reconciliation Act**, the chief forester must determine, in accordance with this section, the allowable annual cut for

(a)the Crown land in each timber supply area, except the areas excluded under subsection (1) (a) of this section, and

(b)each tree farm licence area

in the management area, as defined in section 1 (1) of the **Haida Gwaii Reconciliation Act**.

(11)The aggregate of the allowable annual cuts determined under subsections (6), (7) and (10) that apply in the management area, as defined in section 1 (1) of the **Haida Gwaii Reconciliation Act**, must not exceed the amount set out in a notice to the chief forester under section 5 (4) (a) of that Act.

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

Section 4 of the *Ministry of Forests and Range Act* (current to January 19, 2022) 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 sector

in 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 October 30, 2017

Reference: 230810

October 30, 2017

Diane Nicholls, Chief Forester and Assistant Deputy Minister
Ministry of Forests, Lands, Natural Resource Operations
and Rural Development
Victoria, British Columbia
V8W 2H1

Dear Diane

The British Columbia *Forest Act* conveys the responsibility to determine an Allowable Annual Cut (AAC) to the Chief Forester of the Province of BC for each timber supply area and tree farm licence in the province. It also specifies considerations that must be brought to bear during the course of such determinations including, among others, the economic and social objectives of the government.

This letter is intended to provide you with guidance regarding the objectives of the British Columbia (BC) government that require your consideration when determining an AAC.

Your office implements a rigorous Timber Supply Review Process to help ensure that each AAC you determine responds to a broad array of objectives and aligns with land use and management decisions established by provincial statutes and regulations. The objectives identified below are to be considered and as part of the review process to ensure that AAC determinations, and the timber harvest rates they enable, continue to support government goals.

This letter replaces two letters previously issued by the Minister of Forests and Range to the chief forester, dated July 4, 2006 and October 27, 2010. It is intended to be used in concert with direction provided by the Minister of Forests, Lands and Natural Resource Operations to the chief forester in a letter dated April 12, 2013, concerning objectives outlined in the Shared Decision Making Process pursuant to the Nanwakolas Reconciliation Protocol.

The BC government has committed to building a strong, sustainable, innovative economy and creating well paid jobs in the province. The health of the forest sector, and its ability to respond to an array of short and long term social, economic and environmental interests, is a key to delivering on this commitment. As such, Government has identified specific objectives for the management of BC's forests and Crown lands. Those relevant to AAC determinations include:

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Office of the Minister
Mailing Address: PO BOX 9049 Stn Prov Govt Victoria, BC V8W 9E2
Telephone: (250) 387-6240
Fax: (250) 387-1040
Website: www.gov.bc.ca/for

Diane Nicholls, Chief Forester and Assistant Deputy Minister

- modernizing land-use planning to effectively and sustainably manage BC's ecosystems, rivers, lakes, watersheds, forests and old growth forests
- expanding investments in reforestation; and
- collaborating to develop strategies to manage wildlife resources and habitat

Strategies for delivering on these objectives will be developed in collaboration with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, relevant Natural Resource Ministries, indigenous partners and industry. Once approved by government, I ask that you ensure such strategies are integrated into the Timber Supply Review Process to support AAC determinations.

The BC government has committed to full and lasting reconciliation with Indigenous peoples. As chief forester, your responsibility includes continuing to ensure that AAC determinations take into consideration relevant agreements between First Nations and the Government of BC, court decisions that define Aboriginal title and rights as well as moving forward on reviewing policies, programs, and legislation to determine how to bring the principles of the United Nations Declaration on the Rights of Indigenous Peoples into action for AAC determinations. You also have a responsibility to continue to carefully consider traditional knowledge and other input from BC First Nation communities and organizations in the course of AAC determinations as they pertain to the AAC determination.

The *Forest Act* requires that the chief forester consider a range of forest health issues as part of AAC determinations, including the impacts of circumstances such as infestations, devastations and salvage programs. This is particularly relevant as BC's forest sector emerges from a period of significant, compounding challenges. The infestation of the Mountain Pine Beetle that peaked in the late 2000s has largely subsided but with continuing effects to the size and composition of the forest inventory. Currently, the north area is experiencing Spruce Beetle infestations which also pose impacts. Recently, the Province has experienced record levels of wildfires that have impacted timber supply, community stability and multiple forest values.

In response to these challenges, it is a government objective to focus on planning and sustainable resource management in a way that supports robust forest recovery and timely and effective responses to emerging threats. Please consider how your AAC determinations can support these objectives while promoting forest health and values. In some cases AAC determinations may encourage management practices that avert another infestation in the province's forests. In certain regions, they will need to reflect the reality of a lower timber supply. Some regions will require expanded investment in reforestation and/or an increased focus on timber utilization and recovery. In the wake of extensive natural disasters, the extent of damage in certain areas may also warrant re-determining AACs earlier than scheduled.

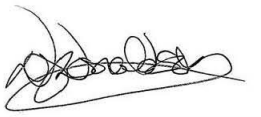
In order to ensure that AAC determinations align with government objectives to modernize land-use planning and sustainably manage B.C.'s ecosystems, rivers, lakes, watersheds, forests and old growth forests, the Timber Supply Review process should incorporate the best available information on climate change and the cumulative effects of multiple activities on the land base. Management options that align with established climate change strategies, adaptation and mitigation practices should be explored. Where the cumulative effects of timber harvesting and other land based activities indicate a risk to natural resource values, the process should identify those risks for consideration in land-use planning.

Diane Nicholls, Chief Forester and Assistant Deputy Minister

This government recognises that the forest sector is of critical importance to BC. The needs of rural communities and forest based industries are evolving in response to a number of the factors mentioned above. To support BC's forest-dependent communities, I ask that your AAC determinations consider the environmental, social and economic needs of local communities as expressed by the public during Timber Supply Review processes, including strategies that contribute to community economic stability, and the jobs that the forest sector creates in communities, where these are consistent with the government's broader objectives. I also ask that when faced with necessary reductions in AAC's, that those reductions be no larger than necessary to avoid significant longer term impacts.

Thank you Diane, for your continued service and considerable efforts in these regards.

Sincerely,



Doug Donaldson
Minister

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