Lakes Timber Supply Area

Timber Supply Review

Data Package

UPDATE

April 2019

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1. Introduction

Under Section 8 of the *Forest Act* the chief forester must review the timber supply and determine a new allowable annual cut (AAC) for each timber supply area (TSA) at least once every 10 years. The chief forester may also extend the current AAC an additional five years if the current timber supply is stable and recent developments would unlikely change the AAC. The AAC of the Lakes timber supply area (TSA) was last determined in 2011 and the need for a new AAC determination has been identified.

The timber supply review (TSR) and AAC determination is a multistep process that involves: 1) public release of a draft data package that describes known information and management; 2) completion of a timber supply analysis based on the information presented in the data package; 3) public release of a discussion paper that outlines the results of the timber supply analysis and an updated data package; 4) presentation to the chief forester of technical information, First Nations consultation information, and public review information; and 5) public release of a rationale that describes the chief forester's AAC determination. For more information about the TSR please visit the following website: www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/timber-supply-areas.

This updated data package summarizes the information and assumptions that were used to conduct a timber supply analysis for the Lakes TSA. The information and assumptions represent current legal requirements and performance for the TSA and for the purpose of TSR are defined by:

- current land base information for land ownership, topography, forest inventories, etc.;
- the current forest management regime — the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management practices used in the area;
- the Lakes District Land and Resource Management Plan (LRMP) which was approved by Cabinet and that guides resource management activities;
- legal objectives from land-use plans, including
    - the Lakes South Sustainable Resource Management Plan (SRMP), which includes biodiversity and wildlife objectives established under the *Forest Practices Code of British Columbia Act (FPC)*;
    - the Lakes North SRMP which includes biodiversity objectives established under the *Land Act*; and,
- other legal objectives established under the *Forest and Range Practices Act* (e.g., visual quality objectives, ungulate winter ranges).

The primary purpose of the TSR program is to identify and if reasonable model the "what is", not the "what if". Changes in forest management objectives and data, when and if they occur, will be captured in future timber supply reviews..

This data package is an update of the June 2018 data package and was prepared following the completion of the timber supply analysis for the Lakes TSA. A discussion paper will be released that presents the results of the timber supply analysis.

As part of the public review and First Nations engagement and consultations, comments around the June 2018 draft data package were requested from First Nations and the public during a formal 60-day review period. Following the release of the April 2019 discussion paper a further 60-day review period will ensue,

2. Overview of the Lakes Timber Supply Area

The Lakes TSA covers about 1.5 million hectares in north-central British Columbia, ranging from Tweedsmuir Provincial Park to Pyramid Peak and the Tildesley watershed in the north (see Figure 1). The TSA contains the headwaters of important tributaries of both the Skeena and Fraser watersheds as well as numerous lakes, which include some of the largest natural freshwater bodies in British Columbia.

The gently rolling terrain of the TSA is typical of the Nechako plateau portion of the central interior of British Columbia. The climate is characterized by seasonal extremes of temperature, including severe and snowy winters, and relatively short and warm summers. Areas in lower elevation – near communities – tend to be drier and slightly warmer than areas in higher elevations. The ecosystems support forests dominated by lodgepole pine, hybrid spruce and subalpine fir (balsam). The forests of the Lakes TSA provide habitat for a variety of wildlife including: moose, deer, black bear, grizzly bear, and small fur-bearing mammals. The abundant lakes also support many freshwater fish species.

In the past two decades, the forests of the TSA have changed significantly as a result of a mountain pine beetle outbreak and salvage activities. It is currently estimated that about 76 percent of the mature pine volume was killed by the mountain pine beetle. This dead timber has been the focus of intensive salvage activities and a significant amount of dead pine remains on the land base. However, as a result of the outbreak and the associated salvage, the live and mature portion of the forested land base is currently dominated by spruce- and balsam-leading stands.

The Village of Burns Lake, with a population of about 2,000, is the largest community within the Lakes TSA. The remainder of the TSA's population – about 6,000 residents - is located in numerous smaller communities including Decker Lake, Grassy Plains, and Danskin.

There are six First Nation communities within the Lakes TSA.. These Nations are: Cheslatta Carrier Nation, Lake Babine Nation, Ts'il Kaz Koh First Nation (formerly Burns Lake Band), Wet'suwet'en First Nation, Skin Tyee First Nation, and Nee Tahi Buhn Band. A central economic development office (Burns Lake Native Development Corporation) represents the economic interests of the six Nations within the Lakes TSA An additional seven First Nations maintain communities outside the TSA; however, they assert rights and title that overlap lands relevant to this TSR. These are: Stellat'en First Nation, Nadleh Whut'en First Nation, Tlazt'en Nation, Ulkatcho First Nation, Takla Lake First Nation, Office of the Wet'suwet'en, and Yekooche First Nation.

The economy of the TSA is largely resource-based and mostly dependent on the regional forest industry. There are three lumber mills and one pellet plant currently in operation within the Lakes TSA. These mills all rely on timber harvested from the Lakes TSA and from neighbouring TSAs (i.e., Prince George, Morice, Bulkley, Kispiox and Kalum TSAs). In addition, there is a lumber mill in Fraser Lake that sources a significant portion of its volume from the Lakes TSA.

The TSA is administered from the Nadina Natural Resource District office of the Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD) in Burns Lake.

On July 12, 2011, the chief forester set the AAC of the Lakes TSA at 2 000 000 cubic metres. Since then, new community forest agreements and First Nations Woodland Licences have been established and consequently the AAC was administratively reduced to 1 648 660 cubic metres.

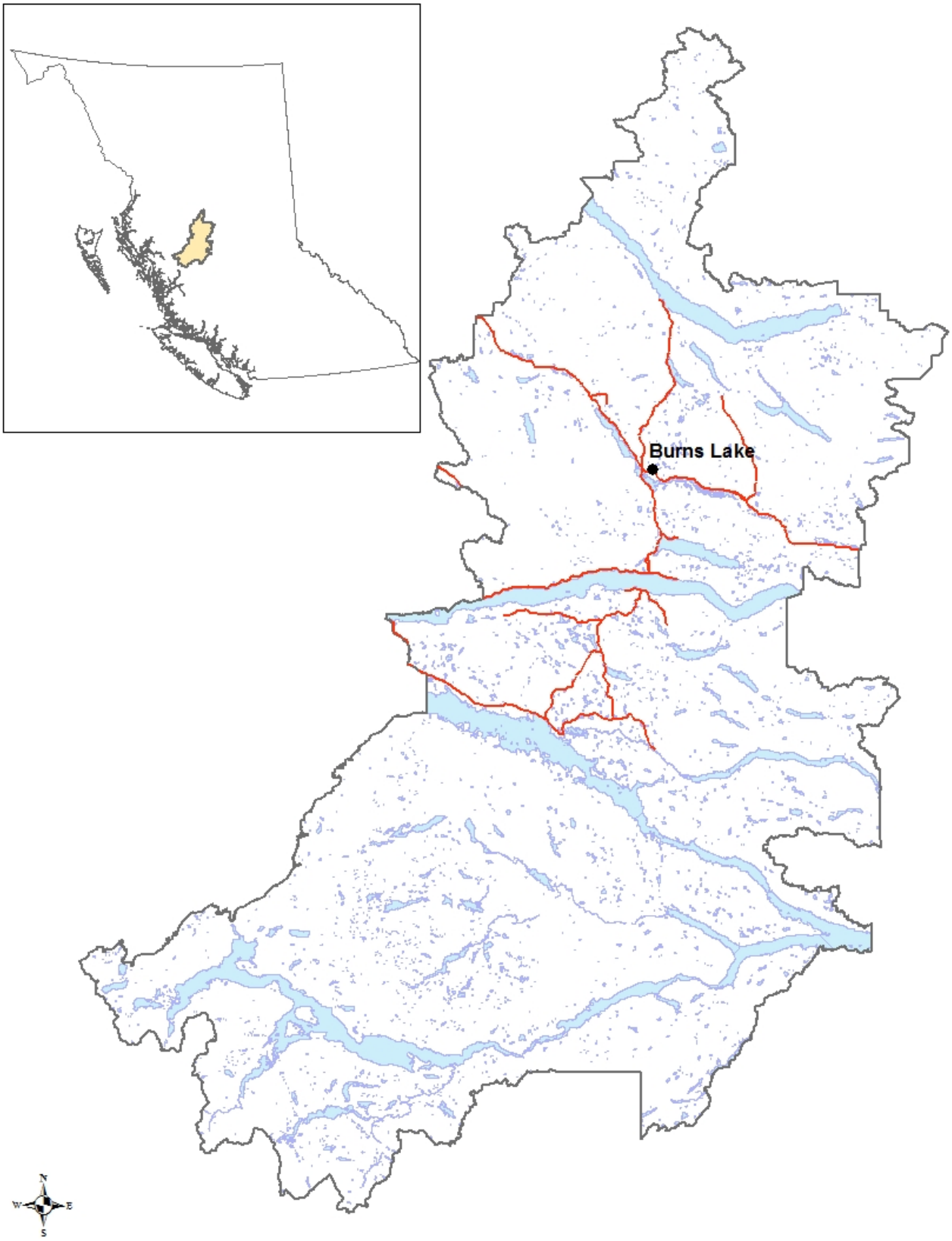

Figure 1. Location of the Lakes timber supply area.

3. Current Forest Management Considerations and Issues

3.1 Base case management assumptions

The assumptions described in this data package reflect current performance and knowledge with respect to the status of forest land base, forest management practices, and timber growth and yield. These assumptions are used to model a timber supply forecast that is called the base case scenario. The forecast of the base case scenario is one component of the information presented to the chief forester for a Section 8 AAC determination.

In developing the base case, the forest land base is categorized into (a) the gross TSA that is all area within the TSA boundary, (b) the crown managed forested land base (CMFLB) that is the area applicable to forest management for the Section 8 AAC determination, and (c) the timber harvesting land base (THLB) that represents the area in the CMFLB on which harvesting is considered to occur.

3.2 Major forest management considerations

Table 1 lists major forest management considerations for the current TSR for the Lakes TSA. Issues that fall within the definition of current management are modelled as best possible within the base case harvest forecast. Other issues that may infer significant uncertainties in current management may be assessed in sensitivity analyses as outlined in Section 9.3. Sensitivity analysis provides information about the timber supply implications around the uncertainties in data and management.

Table 1. Major forest management considerations and issues

Consideration/issue	Description
Equivalent clearcut area	In the rationale of the 2011 AAC determination, the chief forester expressed concern about the hydrologic integrity of watersheds with large-salvage harvest. As such, the chief forester expected the TSR to include Equivalent Clearcut Area (ECA) assumptions. ECA is the area that has been harvested, cleared or burned, with consideration given to the silvicultural system, regeneration growth, and location within the watershed. ECA is a primary factor considered in an evaluation of the potential effect of past and proposed forest harvesting on peak water flows. Sensitivity analyses will investigate the implications of different ECA levels within watersheds.
Forest health: pine (mountain pine beetle)	The Lakes TSA was significantly impacted by the recent mountain pine beetle infestation. The infestation, which started in the late 1990's and peaked in 2005, killed about 54 million cubic metres of pine. In 2001, the AAC was increased to allow for the salvage dead trees. An AAC partition of 350 000 cubic metres attributable to non-pine species was included in the 2011 AAC determination to minimize the impact of the AAC uplift on the live growing stock.
Forest health: spruce	Aerial overview information reveals that since 2014, the area affected by spruce beetle has increased by about 220 percent. Control/suppression is ongoing. Current and future non-recoverable losses will be estimated based on a combination of aerial overview information and ground surveys.

(continued)

Table 1. Major forest management considerations and issues (concluded)

Consideration/issue	Description
Harvest performance	Since 2000, about 75 percent of the total harvest has been from pine. The contribution of pine to the total harvest peaked at 82 percent in 2009-2010 and has since declined.
Lakes District land and resource management plan	The *Lakes District Land and Resource Management Plan* (LRMP) was approved by Cabinet in January 2000. The LRMP provides policy direction on the management of important land and resources in the Lakes TSA. This plan was used to establish legal orders protecting wildlife, biodiversity, and visual quality.
Land base changes	Since the last AAC determination in 2011, the relevant TSA land base has changed due to the expansion of the Burns Lake Community Forest, the creation of the Chinook Community Forest, and the creation of several First Nations Woodland Licences. The creation of further area-based tenures is expected and where necessary land base changes will be examined by a sensitivity analysis.
Marginally economic stands	The 2012 report, *Growing Fibre, Growing Value* from the Special Committee on Timber Supply, identified opportunities for utilizing marginally economic stands to mitigate mid-term timber supply. Sensitivity analysis will present information about the use of stands with significant amount of pine mortality and stands below the base case minimum harvestable volume.
Minimum harvestable volume	Traditionally, stands with more than 140 cubic metres per hectare have been considered to be available for harvest in the Lakes TSA, though lower volume stands are being harvested elsewhere in the province. Less than seven percent of the stands currently harvested have volume below 200 cubic metres per hectare and the lowest average minimum volume observed in the past eight years is 170 cubic metres per hectare. The effects of varying minimum harvestable volume will be explored in a sensitivity analysis.
Regenerated stand yields	There are a number of factors creating a risk to existing managed stands and the expected future volumes. These factors relate to issues such as forest health, and climate change. Available data will be used either within the base case or for sensitivity analyses to examine the timber supply implications around factors impacting managed stand growth.
Shelf life	There is significant uncertainty regarding the length of time that a tree killed by mountain pine beetle is usable as a sawlog (i.e., shelf life). In the Lakes TSA, while only half of the trees killed have been harvested to date, the contribution of both live pine and dead pine to the total harvest is declining, which suggests that trees killed by the MPB are nearing the end of their shelf life. In the timber supply analysis, no specific considerations for changes in merchantability due to shelf-life will be made.
Stand and landscape-level biodiversity	The Lakes South and Lakes North Sustainable Resource Management Plans (SRMP) provide biodiversity objectives for the Lakes TSA. Both plans are consistent with the provisions of the LRMP. The targets associated with the objectives of the SRMPs will be specifically modelled for those landscape units included in the plans.
Visual quality	Visual quality objectives have been legally established to manage the scenic value of designated areas (e.g., Babine Lake, Tchesinkut Lake). The management requirements associated with these established objectives will be modelled in the base case and sensitivity analyses will look at the variation within the requirements.
Wildfire	During the summer of 2018, about 51,000 hectares of timber harvesting land base within the Lakes TSA was impacted by wildfires. Following the fires, a burn severity mapping project was undertaken and inventory attributes adjusted based on severity classes. The updated inventory is being used in the base case. Sensitivity analyses will test uncertainties associated with burn severity classification.
Wildlife	Wildlife is an important component of the Lakes TSA. General wildlife measures have been legally established to address the habitat requirements of mountain goats. Management requirements are also in place to ensure the survival of grizzly bear, caribou (Chelaslie herd) and the winter survival of moose and deer. The habitat requirements for these species will be modelled to reflect existing measures and requirements.

4. Inventories

4.1 Background information

Table 2 lists the spatial data that will be used to define the Lakes TSA land base, areas where specific forest management activities are currently applied, and areas where specific forest resource objectives must be accounted for in the timber supply analysis. Most data are available within the British Columbia Geographic Warehouse; see the BC Data Catalogue for further information on these data sets at https://catalogue.data.gov.bc.ca.

Table 2. Inventory information

Data	Source	File name
Area-based tenures	BCGW*	WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY _SVW
Biogeclimatic zones	BCGW	WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY
Burn severity	FLNRORD	ftp://ftp.geobc.gov.bc.ca/publish/Provincial/burn_severity/2018/
Chelaslie Caribou migration corridor	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW
Crown tenures	BCGW	WHSE_TANTALIS.TA_CROWN_TENURES_SVW
Deer winter habitat	DND*	LakesTSA_Deer
Fertilized stands	BCGW	WHSE_FOREST_VEGETATION.RSLT_ACTIVITY_TREAT_UNT_POLY
Forest cover openings (recent)	BCGW	WHSE_FOREST_VEGETATION.RSLT_OPENING_SVW; WHSE_FOREST_TENURE.FTEN_HARVEST_AUTH_POLY_SVW
Grizzly Habitat	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_NON_LEGAL_POLY_SVW
Indian Reserves	BCGW	WHSE_ADMIN_BOUNDARIES.CLAB_INDIAN_RESERVES
Kimsquit special protection area	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_SPECIAL_PROTECTION_AREA
Lakes North connectivity corridors	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW
Lakes South connectivity corridors	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW
Landscape units	BCGW	WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_POLY_SVW
Mineral/wildlife management resource management zone	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_LEGAL_POLY_SVW

(continued)

Table 2. Inventory information (concluded)

Data	Source	File name
Moose winter habitat	BCGW	WHSE_LAND_USE_PLANNING.RMP_PLAN_NON_LEGAL_POLY_SVW
Mountain Goat ungulate winter range	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP
Old growth management area	BCGW	WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW
Ownership	DND	Lakes Ownership
Predictive ecosystem mapping	IFPA*	Pemdec
Private lands	BCGW	WHSE_CADASTRE.CBM_CADASTRAL_FABRIC_PUB_SVW
Protected areas	BCGW	WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW
Provincial site productivity layer	FAIB*	SITE_PROD_BC
Recreation reserves	BCGW	WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW
Riparian reserves and riparian management zones	IFPA/DND	RIPARIAN_BUFFERS
Roads	DND	ROAD_BUFFER_WIDTHS
Slopes	DND	SlopesLakesTSA_40%
Timber supply areas	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_TSA
Vegetation resource inventory	BCGW	WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY
Visual landscape inventory	BCGW	WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY
Wildfire	BCGW	WHSE_LAND_AND_NATURAL_RESOURCE.PROT_CURRENT_FIRE_POLYS_SP
Wildlife tree retention	BCGW	WHSE_FOREST_VEGETATION.RSLT_FOREST_COVER_RESERVE_SVW

(*) BCGW: BC Geographic Warehouse; DND: Nadina Natural Resource District; FAIB: Forest Analysis and Inventory Branch; IFPA: Morice and Lakes Innovative Forest Practices Agreement.

Comments:

Area-based tenures

This spatial layer shows the boundaries of area-based tenures including Community Forest Schedule A and B lands, Woodlot Licence Schedule A and B lands, and First Nation Woodland Licence Schedule A and B lands. The area associated with woodlots, First Nation woodland licences, and community forests will be removed from the CMFLB.

Biogeoclimatic zones

Biogeoclimatic zones, subzones, and variants are identified in this spatial layer. Together with data on landscape units and landscape unit biodiversity emphasis options, the biogeoclimatic zones will be used to account for seral stage requirements and for wildlife tree retention requirements.

Burn severity

This burn severity classification is based on the near infrared (NIR) and short wave infrared (SWIR) bands of pre- and post-fire Landsat 8 or Sentinel-2 imagery for 2018. This data was created using post-fire imagery from shortly after a fire was declared out or was considered to have stopped growing in size.

Burn severity determined immediately post-fire may not capture the true impact on vegetation; heat damage to vegetation (i.e. needle drop) may not be fully realized until a full growing season has passed, and so this classification may over- or under-estimate some burn severity categories, particularly in areas of dense canopy cover where the ground may not be visible in the post-fire satellite imagery.

The classification is used to adjust the basal area/ha @ 7.5cm utilization, stems/ha @ 7.5cm utilization, and crown closure.

Chelaslie Caribou migration corridor

This layer contains spatially identified and mapped legal objective polygons for the Chelaslie Caribou Migration Corridor. The *Lakes South Sustainable Resource Management Plan (SRMP)* specifies seral stage distribution targets for the Chelaslie Caribou Migration Corridor.

Crown tenures

This layer represents crown land dispositions that are issued for specific purposes and periods of time under an agreement between an individual or company and the provincial government for an interest in crown land. Some crown designations (e.g., Use, Recreation and Enjoyment of the Public Reserve (UREP)) are included in the CMFLB while others (e.g., miscellaneous Crown Leases or reserves) are not.

Deer winter habitat

This layer identifies deer winter habitat. In the Lakes TSA, deer winter habitat – mapped in the early 1990's - is typically associated with steep south facing slopes which have shallow snow accumulations and which become snow-free in early spring. Specific forest cover requirements apply for deer winter habitat.

Fertilized stands

In the RESULTS database, silviculture activities conducted within an opening, including fertilization, are identified. Since 2000, about 10 000 hectares of stands were fertilized to improve growth and yield in order to mitigate the impact of the mountain pine beetle. Separate analysis units are assigned to these stands.

Forest cover openings

Various layer files will be used to account for harvesting that has occurred since the last VRI disturbance update.

Grizzly habitat

This layer identifies non-legalized planning polygons for specific land and/or resource use as determined through a strategic land and resource planning process. High value grizzly bear habitat mapping exists for Klaytahnkut Lake and the Sutherland River drainage areas. Forest cover requirements will be modelled based on the *Kalytahnkut, Tildesly Riparian Zone Timber Harvesting Guidelines (1990)* and the *Notice – Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Survival of Species at Risk in the Nadina Forest District*.

Indian Reserves

This layer provides the administrative boundaries (extent) of Canada Lands which include Indian Reserves. Administrative boundaries were compiled from Legal Surveys Division's cadastral datasets and survey records archived in the Canada Lands Survey Records. Indian Reserves will be removed from the CMFLB.

Kimsquit special protection area

This dataset contains information on areas of the Province set aside for special protection by legislation. Special Forest Management Areas (SFMA) are enacted under Order in Council (OIC). There is some overlap between the Kimsquit Protected Area, which is south of Tweedsmuir Provincial Park, and the Lakes timber supply area. All the area associated with the Kimsquit will be removed from the CMFLB.

Lakes North connectivity corridors

This layer contains spatially identified and mapped legal objective polygons, including those for the *Lakes North Sustainable Resource Management Plan* (SRMP). The SRMP, approved in 2009, includes an objective aimed at maintaining habitat connectivity.

Lakes South connectivity corridors

This layer contains spatially identified and mapped legal objective polygons, including those for the *Lakes South SRMP*. The *SRMP*, approved in 2003, includes a land use objective for habitat connectivity.

Landscape units

This layer contains landscape unit boundaries and their associated biodiversity emphasis options which will be used to account for seral stage forest cover requirements. Landscape units will also be used for the accounting for wildlife tree retention requirements. The table below lists the landscape units that are part of the Lakes South SRMP and of the Lakes North SRMP.

Landscape units in the Lakes South SRMP	Landscape units in the Lakes North SRMP
Cheslatta	Babine East
François East	Babine West
François West	Bulkley
Intata	Burns Lake East
Ootsa	Burns Lake West
	Fleming
	Taltapin

Mineral/wildlife management resource management zone

This layer contains spatially identified and mapped legal objective polygons. In the Lakes TSA as per the *Order Establishing Resource Management Zones and Resource Management Zone Objectives for the Lakes District (2000)*, a mineral/wildlife management resource management zone was established that prohibits commercial timber harvesting. This zone will be removed from the CMFLB.

Moose winter habitat

This layer identifies non-legalized planning polygons for specific land and/or resource use as determined through a strategic land and resource planning process. In the Lakes TSA, moose winter habitat was mapped in the early 1990's that identifies lowland riparian areas where forage is available even under severe winter conditions. In the base case, specific forest cover requirements will be applied for moose winter habitat.

Mountain Goat

This dataset contains approved legal boundaries for ungulate winter range. Forest cover requirements associated with the general wildlife measures identified in the Order for Ungulate Winter Range #U-006-017 Lakes TSA Mountain Goats (2018) will be included in the base case.

Old growth management area

This dataset contains legally established old growth management areas (OGMA). OGMA were established under the Lakes North and Lakes South SRMPs and amended in 2016. Under the SRMPs timber harvesting and road building is prohibited in an OGMA.

Ownership

This Nadina Natural Resource District layer combines data identifying area-based tenures, private lands, Indian Reserves, protected areas, and recreation reserves with the Lakes TSA. It identifies land types and ownerships that are not available for timber supply purposes.

Predictive ecosystem mapping

This data set identifies ecosystem attributes, including site series. In 2004, the licensees of the Morice and Lakes Innovative Forest Practices Agreement (IFPA) undertook a PEM project. Further, the accuracy of this PEM was improved in 2007 to meet accuracy requirements for timber supply analysis. The PEM will be used to identify rare and endangered ecological communities and hydro-riparian ecosystems within the Lakes North landscape connectivity matrix.

Private lands

The Integrated Cadastral Fabric (ICF) is a geo-referenced, spatial dataset that represents the structure of registered land parcels in the Province of BC. The dataset provides a fabric of private and crown administered parcels which have been defined by various surveys (including *Land Act* and *Land Title Act* surveys). Private lands, municipal parcels, and federal reserves will be removed from the CMFLB.

Protected areas

This dataset contains parks and protected areas managed for important conservation values. The following protected areas will be removed from the timber harvesting land base.

Babine Lake Marine Park	Ethel F. Wilson Memorial Park	Uncha Mountains Red Hills Park
Burns Lake Park	Sutherland River Park	Wisteria Park
Dead Man's Island Park	Tweedsmuir Corridor Protected Area	
Entiako Park	Tweedsmuir Park (North)	

In addition, Entiako Park and Tweedsmuir Park will also be removed from the CMFLB as there are no biodiversity management objectives or forest management expectations for these parks.

Provincial site productivity layer

The Provincial Site Productivity Layer provides estimated of potential site indices for areas likely to grow trees. This layer is typically based on available ecosystem data from predictive ecosystem mapping (PEM) or terrestrial ecosystem mapping (TEM) coupled with site index estimates from the Site Index/Biogeoclimatic Classification (SIBEC) project. In areas where no acceptable PEM or TEM data are available, site index estimates in the provincial site productivity layer are based on a biophysical model.

Recreation reserves

The dataset contains a spatial representation of a recreation feature. This can be either a recreation reserve, recreation site, or an interpretative forest. Recreation reserves are excluded from the THLB.

Riparian reserves and riparian management zones

This district dataset is a GIS buffer that was created in 2018 to estimate the area that will be managed as riparian reserve zones and the area managed as riparian management zones. Harvesting, except for specific reasons, is not permitted in riparian reserve zones and may be limited in riparian management zones.

Roads

This district dataset is a GIS buffer (RoadWidths) that was originally created in 2008 and updated in 2017 to estimate the area of THLB occupied by roads in the Lakes TSA.

Slopes

This district dataset is the result of a slope analysis that was conducted to identify slopes greater than 40 percent as conventional ground-based harvesting systems cannot safely operate in steeper ground. Slopes greater than 40 percent are excluded from the THLB.

Timber supply areas

The BCGW layer identifies the boundaries of the timber supply areas. The Lakes TSA covers approximately 1.5 million hectares.

Vegetation resource inventory

This dataset contains the British Columbia forest inventory for the rank 1 layer including attributes for species, age, height, and volume and a dead layer that captures specifically identifies the dead volume from stands with greater than 30% mortality based on density loss . The invenory dataset is updated regularly for depletions, such as harvesting, and for growth projections. The Lakes TSA was re-inventoried based on air photography taken in 2012 and ground samples collected between 2012 and 2014. All data attributes are projected to 2018.

Visual landscape inventory

This data layer contains the Visual Landscape Inventory (VLI). The VLI for the Lakes TSA has been completed for all scenic areas, and updated by the regional visual specialist in 2010 to reflect amendments to the scenic areas and visual quality objectives done under the Government Actions Regulation. This VLI will be used to model the forest cover requirements associated with visual landscape management.

Wildfire

This layer contains the boundaries of known fires. For the Lakes TSA, it will be used to identify areas that burned since 2012. Attributes for live species, age, height and volume are adjusted as needed.

Wildlife tree retention

The spatial layer from the RESULTS dataset contains a representation of retention areas associated with a silvicultural system. Reserves are forest patches or individual trees retained during harvesting or other forestry operations to provide habitat, scenic, biodiversity, and other values.

5. Division of the Area into Management Zones

5.1 Management zones

Management zones are used to differentiate areas for the application of management objectives. Zones may be based on legal definitions (e.g., landscape units) or a descriptive definition (e.g., pine-leading stands). For the Lakes TSA timber supply analysis, management zones are derived from the Lakes District LRMP, the Lakes North and Lakes South SRMPs, GAR orders and other forest management considerations. Zones may overlap each other.

Table 3 outlines the zones or objectives that will be incorporated in the timber supply analysis as a forest management requirement. It does not list objectives that will be modelled by excluding areas from the timber harvesting land base (e.g., riparian reserve zones). Further information on the forest cover requirements to be applied to these areas can be found in Section 7.4, '*Resource Management Objectives*'.

Table 3. Management zones and objectives to be tracked

Management zones objectives	Purpose
Chelaslie Caribou migration corridor	Targets for seral stage distribution have been established for the Chelaslie caribou migration corridor through the Lakes South SRMP. These targets apply to broad zones (low, moderate, high), depending on the level of use during migration periods.
Wildlife tree retention	For the Lakes South SRMP area, wildlife tree retention targets are applied by BEC subzones and landscape units.
Habitat connectivity	Landscape corridors have been established through the Lakes South SRMP and Lakes North SRMP to provide habitat connectivity and to permit movement and dispersal of plants and animal species. There are specific targets that apply to the corridors.
Seral stage distribution	Targets for seral stage distribution have been established for the Lakes TSA through the Lakes South SRMP and the Lakes North SRMP. These targets apply at the landscape unit level based on the biogeoclimatic zone and biodiversity emphasis option.
Grizzly Bear habitat	Specific forest cover constraints apply in areas identified as critical habitat for grizzly bear.
Moose and Deer habitat	Forest cover constraints apply in areas identified as critical winter habitat for moose and deer.
Riparian management zone	For some riparian features, a proportion of the volume present in riparian management zones will be retained to meet riparian management objectives. The reduction will be applied to the Crown forested portion of the RMZ.
Scenic areas	Areas identified as visually sensitive, and established as scenic areas, require varying percentage of forest cover retention based on their associated visual quality class. The visual requirements apply to the crown forested area within a scenic area.

5.2 Analysis units

An analysis unit simplifies or defines the forest for growth and yield modelling purposes. An analysis unit is typically composed of forest stands with similar tree species composition, timber growing potential and treatment regimes. A timber volume projection is created for each analysis unit based on a growth and yield model. This projection is based either as an aggregate of yield tables from within the analysis unit or a yield table derived from an aggregate or average of forest characteristics for the analysis unit. The growth and yield models used are further described in Section 8.

For the Lakes TSA, analysis units are divided into existing natural stand and managed stand analysis units.

Table 4 shows the criteria used to define analysis units for existing natural stands in the Lakes TSA. These analysis units are divided by species composition and site productivity classes. The growth and yield model and the source of initiation data for the models are identified for the current and future conditions. See Sections 7.3, '*Silvicuture*' and 8.2, '*Volume table types*' for further explanation.

Douglas-fir-leading stands were grouped with balsam-leading stands because of the small area occupied by this Douglas-fir-leading stands in the Lakes TSA. Deciduous-leading stands are not considered economically merchantable as such are not included within the analysis unit definition.

The site index classes will be determined by the timber supply analyst based on forest inventory site indices.

Table 5 shows the characteristics of the proposed managed stand analysis units. The managed stand analysis units are classified by when the stand was established (i.e., different genetic gains among periods), the species composition, and the site productivity. The analysis units in Table 5 will be further divided into a separate analysis unit for stands that have been fertilized stands (based on standard reponse curves within TIPSY model) and those stands that have not be fertilized e.g., there will be an MPGN (for no fertilizer) and an MPGF (for fertilized). The proposed managed analysis units may be aggregated or sub-divided, if necessary, for analysis purposes.

Table 4. Definition of analysis units – Existing natural stands analysis units with associated current and future volume table model and initiation information

			Current stand			Future stand		
Existing AU identifier	**Leading species**	**Site index range**	**Model**	**Initiation data**	**Future AU identifier**	**Model**	**Table 22 regeneration species composition**	**Weighted AU proportion**
NFG - 3000	Balsam or Douglas-fir	Good	VDYP	VRI	3100	TIPSY	P50S50 S70P30 S50P40B10	80% 15% 5%
NFM - 2000	Balsam or Douglas-fir	Medium	VDYP	VRI	2100	TIPSY	P50S50 S70P30 S50P40B10	80% 15% 5%
NFP - 1000	Balsam or Douglas-fir	Poor	VDYP	VRI	1100	TIPSY	P50S50 S70P30 S50P40B10	80% 15% 5%
NSG - 9000	Spruce	Good	VDYP	VRI	9100	TIPSY	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
NSM - 8000	Spruce	Medium	VDYP	VRI	8100	TIPSY	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
NSP - 7000	Spruce	Poor	VDYP	VRI	7100	TIPSY	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
NPG – 6000	Pine	Good	VDYP	VRI	6100	TIPSY	P50S50 P100 P90S100	92% 1% 7%
NPM - 5000	Pine	Medium	VDYP	VRI	5100	TIPSY	P50S50 P100 P90S10	92% 1% 7%
NPP - 4000	Pine	Poor	VDYP	VRI	4100	TIPSY	P50S50 P100 P90S10	92% 1% 7%

Comments:

In the AU identifier the first character refers to the general type of stand (i.e., N = existing natural stands), the second character refers to the leading species (i.e., F = Balsam or Douglas-fir, S = spruce, P = Pine), and the third character refers to the site index class (i.e., G = Good, M = Medium, P = Poor). The first digit refer to species and site productivity (i.e., 1=Balsam poor, 2=balsam medium), 3=Balsam good, 4=pine poor, 5=pine medium, 6=pine good, 7=spruce poor, 8=spruce medium, 9=spruce good) and the second digit refers to the type of stand (i.e., 0=existing natural stand, 1=future managed stand). These AU identifiers are for clarification purposes within the data package and may not reflect identifiers used in the analysis.

The Regeneration Species Code refers to the initial species mix at regeneration, as specified in Table 22. The percentage refers to the proportion of existing natural stands analysis units that will be regenerated with the specified regeneration species code. For example; 80 percent of existing balsam natural stands on good sites will be regenerated as a mix of 50 percent pine and 50 percent spruce; 15 percent as a mix of 70 percent spruce and 30 percent pine; and the remaining 5 percent as a mix of 50 percent spruce, 40 percent pine, and 10 percent balsam.

Table 5. Definition of analysis units – managed stands analysis units with associated current and future volume table model initiation information

Analysis unit definition				Current stand initiation			Future stand initiation			
AU Identifier	**Regeneration period**	**Lead species**	**Site index range**	**Regen table**	**Regen species comp**	**Weighted AU %**	**Regen table**	**AU Identifier**	**Regen species comp**	**Weighted AU %**
MSG - 9530	2008 to 2017	Spruce	Good	23	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%	23	9500	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
MSM - 8530	2008 to 2017	Spruce	Medium	23	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%	23	8500	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
MSP - 7530	2008 to 2017	Spruce	Poor	23	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%	23	7500	P50S50 S100 P70S30 S70P30	82% 1% 7% 10%
MPG - 6530	2010 to 2017		Good	23	P50S50 P100 P90S10	92% 1% 7%	23	6500	P50S50 P100 P90S10	92% 1% 7%
MPM - 5530	2010 to 2017		Medium	23	P50S50 P100 P90S10	92% 1% 7%	23	5500	P50S50 P100 P90S10	92% 1% 7%
MPP - 4530	2010 to 2017		Poor	23	P50S50 P100 P90S10	92% 1% 7%	23	4500	P50S50 P100 P90S10	92% 1% 7%
MFG – 3530	2010 to 2017		Good	23	P50S50 S70P30 S50P40B10	80% 15% 5%	23	3500	P50S50 S70P30 S50P40B10	80% 15% 5%
MFM - 2530	2010 to 2017		Good	23	P50S50 S70P30 S50P40B10	80% 15% 5%	23	2500	P50S50 S70P30 S50P40B10	80% 15% 5%
MFP - 1530	2010 to 2017		Good	23	P50S50 S70P30 S50P40B10	80% 15% 5%	23	1500	P50S50 S70P30 S50P40B10	80% 15% 5%
EAP – 4850	1988 to 2007 for spruce and 1988 to 2009 for pine	Any	Good	22	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%	22	4851	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%

Table 5. Definition of analysis units – managed stands analysis units with associated current and future volume table model initiation information (concluded)

Analysis unit definition				Current stand initiation			Future stand initiation			
AU identifier	**Regeneration period**	**Leading species**	**Site index range**	**Regen table**	**Regen species comp**	**Weighted AU %**	**Regen table**	**AU Identifier**	**Regen species comp**	**Weighted AU %**
EAM – 4860	1988 to 2007 for spruce and 1988 to 2009 for pine	Any	Medium	22	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%	22	4861	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%
EAG – 4870	1988 to 2007 for spruce and 1988 to 2009 for pine	Any	Good	22	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%	22	4871	P40S30B30 P50S50 P70S30 P90S10 S70P30 S90P10	8% 51% 21% 6% 13% 1%
OAG - 4660	1967-1987	All	Good	21	P100 P80S20 S100 S80P20 P90S10	36% 3% 5% 2% 54%	21	4661	P90S10	100%
OAM - 4650	1967-1987	All	Medium	21	P80S20 P90S10	46% 54%	21	4651	P90S10	100%
OAA - 4710	Fertilized Stands	All	All	24	P90S10 S70P30	86% 14%	24	4711	P90S10 S70P30	86% 14%

(continued)

Comments:

In the AU identifier the first character refers to the general type of stand (i.e., E = harvested stands from 1988 to 2007 for spruce leading and 2010 for pine leading, M = harvested stands after 2007 for spruce and 2009 for pine), O = harvested stands from period 1967-1987; the second character refers to the leading species (i.e., S = Spruce-leading (≥50%), P = Pine-leading (≥50%), A = All); and the third character refers to the site index class (i.e., G = Good, M = Medium, P = Poor). The site index range for the various site quality classes will be determined by the timber supply analyst based on the site index estimates by biogeoclimatic site series (SIBEC) project. The Regeneration Species Composition refers to the initial species mix at regeneration, as specified in Table 21 and 22. The Weighted AU Proportion refers to the proportion of an analysis unit that will be regenerated with the specified regeneration species composition. The forest estate model enables multiple yield tables to be assigned to each analysis units.

6. Land base classification

6.1 Details on land base classification

This part of the data package outlines the steps used to identify and classify the land base. For modelling and information purposes, the Lakes TSA land base is classified based on four nested categories:

Gross Land Base (GLB), which is the total area within the Lakes TSA boundary;

Crown Forest Management Land Base (CMFLB), which is the portion of the GLB which contributes to forest management objectives in the context of the timber supply analysis;

Gross Harvesting Land Base (GHLB), which is the portion of the CMFLB where timber harvesting is permitted, subject to forest management objectives and constraints; and,

Timber Harvesting Land Base (THLB), which is the portion of the GHLB where timber harvesting is projected to occur over the long term in the context of the timber supply analysis.

Table 6 below defines the four categories and identifies areas that are excluded from each category.

Table 6. Classification categories definition and exclusions

Classification step	Definition	Exclusions
Gross land base (GLB)	All area within the TSA boundary	▪ None. The Lakes TSA GLB is 1 577 450 hectares;
Crown forest management land base (CMFLB)	Forested areas that contribute to Crown forest management objectives in the context of the Lakes TSA AAC determination	▪ Private land; ▪ Federal land and reserves; ▪ Long-term leases; ▪ Area-based tenures (e.g., woodlot licence [WL], First Nations Woodland Licence [FNWL], community forest agreement [CFA]); and, ▪ Non-forested and non-productive forest land;
Gross harvesting land base (GHLB)	Area within the CMFLB where timber harvesting is permitted, subject to forest management objectives and constraints	▪ Miscellaneous provincial Crown land not contributing to timber supply; ▪ Provincial protected areas, including conservancies; ▪ Biodiversity, mining or tourism areas; ▪ Areas with legally established boundaries and objectives that prohibit timber harvesting (e.g., old growth management areas [OGMA]);

Timber harvesting land base (THLB)	Area within the GHLB where timber harvesting is projected to occur	▪ Areas that are unsuitable or uneconomic for timber production, such as:
		  ▪ Environmentally sensitive areas;
		  ▪ Inoperable areas;
		  ▪ Areas with low site productivity;
		  ▪ Non-merchantable forest types
		▪ Surrogate areas for legally established management objectives for resource values that may prohibit timber harvesting but for which the location is decided operationally (e.g., wildlife tree retention areas, riparian management areas).

6.2 Identifying the Crown forest management land base (CMFLB)

The CMFLB is the portion of the GLB which contributes to forest management objectives in the context of the timber supply analysis supporting the AAC determination (see Figure 4). Lands that do not contribute to the CFLMB are identified in the sections below.

6.2.1 Land not administered by FLNRO for timber supply purposes

Section 8 of the *Forest Act* specifically excludes lands of a timber supply area for the purpose of an AAC determination. In the Lakes TSA, these exclusions include private lands, Indian Reserves, federal and municipal parcels, and miscellaneous land tenures are excluded as they are not managed by the FLNRO. Additionally area based timber tenures, for which there are separate AAC determination processes, are excluded: community forest agreement areas, woodlots and First Nations woodland licences. Some protected areas that do not contribute, from a modelling perspective, to forest management objectives outside their own boundary are also excluded from the CMFLB (e.g., Tweedsmuir Provincial Park).

Table 7 and Figure 2 show ownership type contributions to the CMFLB. In total, 894 643 hectares of land are excluded from the CMFLB as they are not administered by FLNRO for the purpose of this timber supply review. The area classification and exclusions presented in the data package are preliminary estimates. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 7. Land ownership type contributions to the Crown forest management land base

Land ownership code	Crown forest management land base	Total area (hectares)
40 – Private Land	No	73 189
52 – Indian Reserves	No	2 143
54 – Federal Parcels	No	603
61 – Crown Reserves for Use, Recreation and Enjoyment of the Public (UREP)	Yes	972
62 – Crown Forest Management Unit (TSA)	Yes	664 260
63 – Crown Provincial Park Class A	Yes	23 116
63 – Crown Provincial Park Class A (Entiako)*	No	73 513
63 – Crown Provincial Park Class A (Tweedsmuir)*	No	446 106
66 – Crown Provincial Park Class C	Yes	0.5
67 – Crown Provincial Park or Equivalent	Yes	334
67 – Crown Provincial Park or Equivalent (Kimsquit Protected Area)*	No	327
67 – Crown Provincial Park or Equivalent (LRMP Wildlife and Mineral Zone)*	No	9 235
68 – Crown Biodiversity, Mining and Tourism Area (BMTA)	Yes	377
69 – Crown Miscellaneous Reserve	Yes	127
77 – Crown and Private Woodlots	No	24 470
78 – Crown Tenure First Nation Woodland License	No	41 359
79 – Crown Tenure Community Forest Agreement	No	223 525
80 – Municipal Parcels	No	157
91 – Unknown Ownership	No	16
99 – Crown Miscellaneous Leases	No	0.2

Comments:

(*) Areas with land ownership codes of 63 (class A provincial parks) and 67 (provincial park or equivalent) are normally included in the CMFLB for biodiversity purposes. However, since there are no biodiversity management objectives (i.e., seral stage) for Tweedsmuir Provincial Park, Entiako Provincial Park, Kimsquit Protected Area, and for the Lakes LRMP wildlife and mineral zones, these areas will not contribute to the CMFLB.

Municipal parcels, land where the ownership is unknown, and miscellaneous Crown leases are also excluded from the CMFLB.

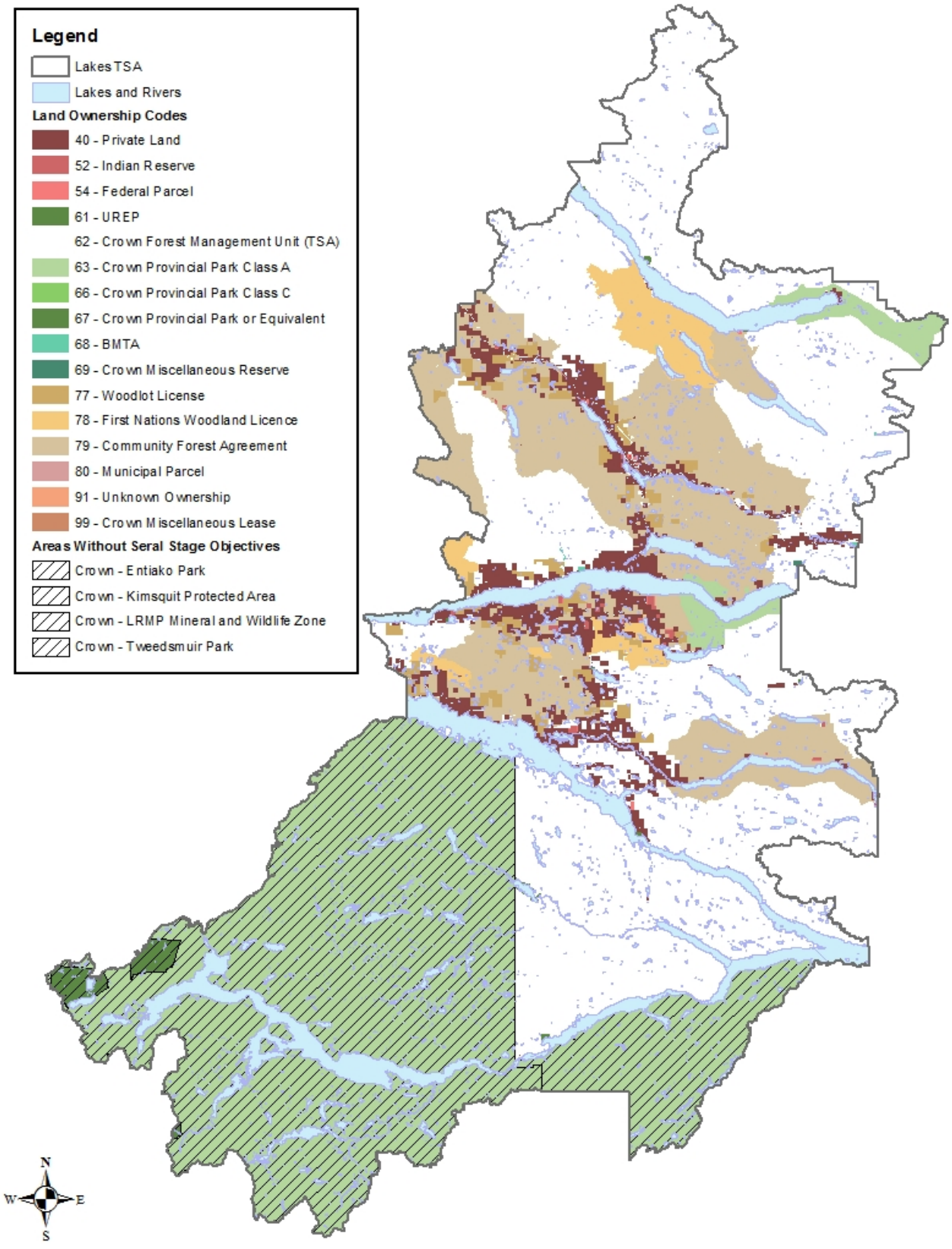

Figure 2. Land ownership type exclusions from the Crown forest management land base.

6.2.2 Non-forest and non-productive forest areas

Non-vegetated areas and areas with non-productive forest (e.g., wetlands) are excluded from the CMFLB, unless they were logged in the past. Areas classified as non-forest and non-productive do not contribute to other forest management objectives such as seral objectives for landscape-level biodiversity.

Table 8 and Figure 3 describe the broad classes of non-forested areas in the Lakes TSA. After accounting for overlap, the net area removed from the CMFLB to account for non-forested areas is 118 314 hectares. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 8. Description of non-forest and non-productive areas

Attributes	Description	Logging history	Total area (hectares)
Non-vegetated (BCLCS_lv_1 = 'N')	Waterbodies and areas where the total cover of trees, shrubs, herbs and bryoids is less than 5% of the total surface area	No	225 963
Non-treed (BCLCS_lv_1 = 'V' and BCLCS_lv_2 <> 'T' and BCLCS_lv_3 = 'A' or 'W')	Non-treed wetlands and alpine areas	No	34 395
Non-productive areas (BCLCS_lv_1 = 'V' and BCLCS_lv_2 <> 'T' and (BCLCS_lv_3 = 'U' and SITE_INDEX ≤ 5))	Non-treed areas with a site index equal to or less than 5	No	3 263
Treed wetlands (BCLCS_lv_1 = 'V' and BCLCS_lv_2 = 'T' and BCLCS_lv_3 = 'W' and BCLS_lv_5 <> 'DE')	Areas having the water table at or above the soil surface or which is saturated for a long enough period to promote wetland or aquatic processes	No	9 028
Non-productive brush (PROJ_AGE_1 IS NULL and SITE_INDEX IS NULL and BCLCS_LEVEL_1 = 'V' and BCLCS_LEVEL_3 = 'U' and BCLCS_LEVEL_2 = 'N')	Non-treed areas undisturbed by logging, fire or insects	No	26 233
Boreal altai fescue alpine (BAFA) biogeoclimatic zone	Vegetated areas within the BAFA are considered non-forested for the purposes of timber supply	No	363

Comments:

The vegetation resource inventory (VRI) includes the British Columbia Land Cover Classification Scheme (BCLCS). Under the BCLCS, land is first classified based on the presence or absence of vegetation. Vegetated polygons are then classified as treed or non-treed. Non-treed polygons are classified as 'non-forested areas' if they correspond to wetlands, alpine areas or have a site index equal to or less than 5.0. Treed wetlands are also classified as non-forested areas. As the classification may identify recently harvested stands as non-treed, only polygons that were not previously harvested are classified as non-forest areas.

Vegetated areas classified as boreal altai fescue alpine (BAFA) in the biogeoclimatic ecosystem classification system are also considered non-forested for the purpose of the TSR.

The areas shown in Table 8, above, represent the summary of all areas classified as non-forest or non-productive. As these areas may overlap with each other and fall within ownership categories (e.g., a wetland may be within a woodlot) excluded from the CMFLB, the amount of net area that will be removed from the CMFLB to account for non-forest or non-productive areas is different than the sum of the values shown above.

6.2.3 Existing roads, trails and landings

Existing roads, trails and landings are considered non-productive and are removed from the CMFLB. Table 9, below, shows the estimated gross area by road type.

To estimate reductions associated with the existing road network, a GIS buffering process was applied to road data. The buffer widths used are based on data collected on 1330 randomly selected sampling points within the Lakes TSA.

There is a total of 17 211 hectares of roads in the Lakes TSA. After accounting for overlap with land not administered by FLNRO (e.g., community forests) and non-forested areas (e.g., stream and barge crossings), the net area of roads removed from the CMFLB is 10 955 hectares.

For future roads, it is assumed that road access will be deployed in all unharvested stands. For these stands, the THLB will be reduced by 2.2 percent – or 4194 hectares – to account for permanent access structures. This percentage is based on actual permanent access structure reported into RESULTS. It is assumed that unharvested stands will require the same percentage of permanent access structure as current managed stands. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 9. Estimates for existing and future roads, trails, and landings

Existing roads, trails and landings	Road width (m)	Reduction %	Total area (hectares)	Net area (hectares)
Forestry mainlines	27.3	100	1 614	1 306
Operational roads (e.g., branch)	19.0	100	9 431	5 335
In-block roads	8.4	100	6 166	4 314
Future roads, trails and landings				4194

Comments:

Forestry mainlines are main arteries that provide access to a given geographic area. Examples of forestry mainlines in the Lakes TSA include the Augier, Maxan, Dearhorn, Ootsanee and the Marilla.

Operational roads typically branch off a mainline and lead to one or more cutblocks.

In-blocks roads are those roads sometimes referred to as ‘spur’. They are wholly contained within a cutblock and are not expected to continue outside the cutblock in the future.

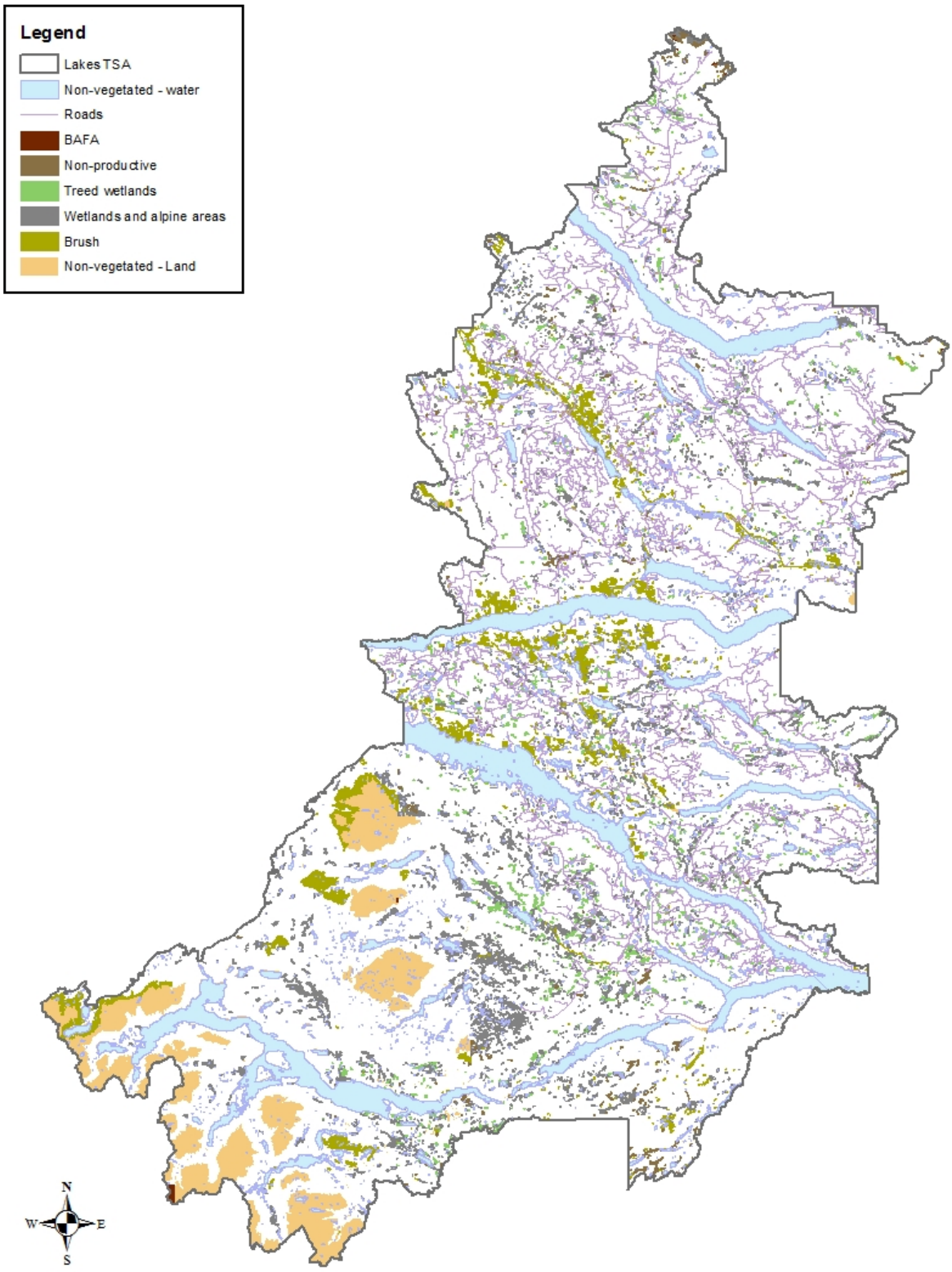

Figure 3. Non-forest and non-productive areas in the Lakes TSA.

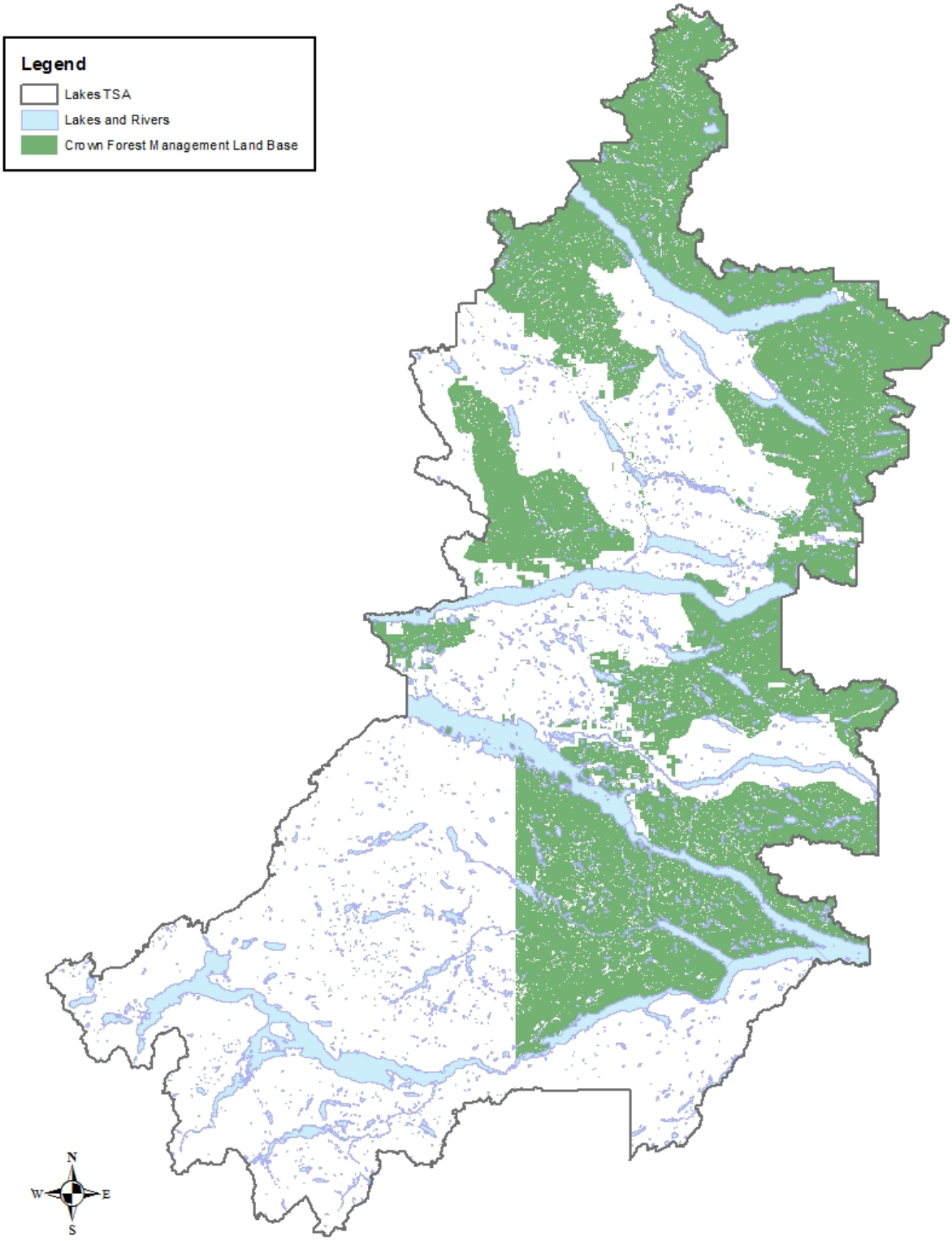

Figure 4. Crown forest management land base.

6.3 Identifying the gross harvesting land base (GHLB)

The GHLB is the portion of the CMFLB where timber harvesting is permitted and is subject to forest management objectives and constraints. Figure 6 shows the GHLB.

6.3.1 Protected areas and miscellaneous reserves

Harvesting is not permissible in protected areas such as provincial parks and ecological reserves. These areas are identified as land ownership codes 63, 66, and 67 in Table 7.

Provincial parks and ecological reserves contribute to meeting landscape-level targets (e.g., old growth requirements). In some cases, they are excluded from the CMFLB – and thus, the GHLB – when they are outside of a landscape unit or when they correspond to a landscape unit without seral stage requirements. In the Lakes TSA, Entiako and Tweedsmuir Provincial Parks, Kimsquit Protected Area, and the LRMP Wildlife and Mineral Zone are excluded from both the CMFLB and the GHLB.

For this analysis, non-contributing Crown parcels (land ownership code 68 and 69 in Table 7) are also excluded.

The total forested area in protected areas and miscellaneous reserves is 22 488 hectares.

This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

6.3.2 Old growth management areas (OGMAs)

Old growth management areas 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.

The forested area associated with OGMAs is excluded from the GHLB. The total area in OGMAs is 86 864 hectares. Some of that area overlaps area-based tenures and non-forested areas, therefore, the amount of net area that will be removed from the GHLB to account for OGMAs is 57 177 hectares. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

6.3.3 Wildlife habitat reserves

Wildlife habitat may be identified and managed through several tools, including ungulate winter range (UWR), wildlife habitat areas (WHA), notices, and management practices specified in plans that establish legal objectives. Where the objective prohibits timber harvesting, these areas are excluded from the GHLB.

In the Lakes TSA, a net area of 3037 hectares is excluded from the GHLB to address ungulate winter range where harvesting is not allowed.

Table 10. Wildlife habitat exclusions from GHLB

Category	Criteria	Reduction (%)	Forested area (ha)	Net area (ha)
Mountain Goat ungulate winter range	No harvest	100	5166	3037

Comments:

On February1, 2018, a Government Action Regulation Order to establish Ungulate Winter Range (UWR) U-6-017 for mountain goat was established. This UWR includes a General Wildlife Measure (GWM) that prohibits timber harvesting over a total area of 5166 hectares.

6.3.4 Red- and blue-listed ecological communities and hydro-riparian ecosystems

Timber harvesting is prohibited in the red- and blue-listed ecological communities and hydro-riparian ecosystems located within the landscape connectivity matrix (LCM). Therefore, these areas will be removed from the GHLB. In total, 8727 hectares of land will be removed from the GHLB to account for rare and endangered ecological communities and hydro-riparian ecosystems. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 11. Red- and blue-listed ecological communities and hydro-riparian ecosystems exclusions

Category	Criteria	Reduction (%)	Forested area (ha)	Net area (ha)
Red- and blue-listed ecological communities within LCM	SBS dk 04*, 08*, 81, 82 SBS mc2 81, 82	100%	1 264	549
Hydro-riparian ecosystems within LCM	SBS dk 04, 07, 08, 09, 09/10,10 SBS mc2 07, 09, 09/10, 10, 12, 12/07 ESSF mc 07, 08, 09, 09/10, 10 ESSF mv1 04, 05 ESSF mv3 07	100%	10 340	8716

(*) These site series are also considered hydro-riparian ecosystems. Therefore, the overall net area removed to account for this factor is 8727 hectares.

Comments:

The areas listed above are a component of the landscape connectivity matrix identified in the Lakes North Sustainable Resource Management Plan (SRMP). Land use objectives for these areas were established on March 8, 2017.

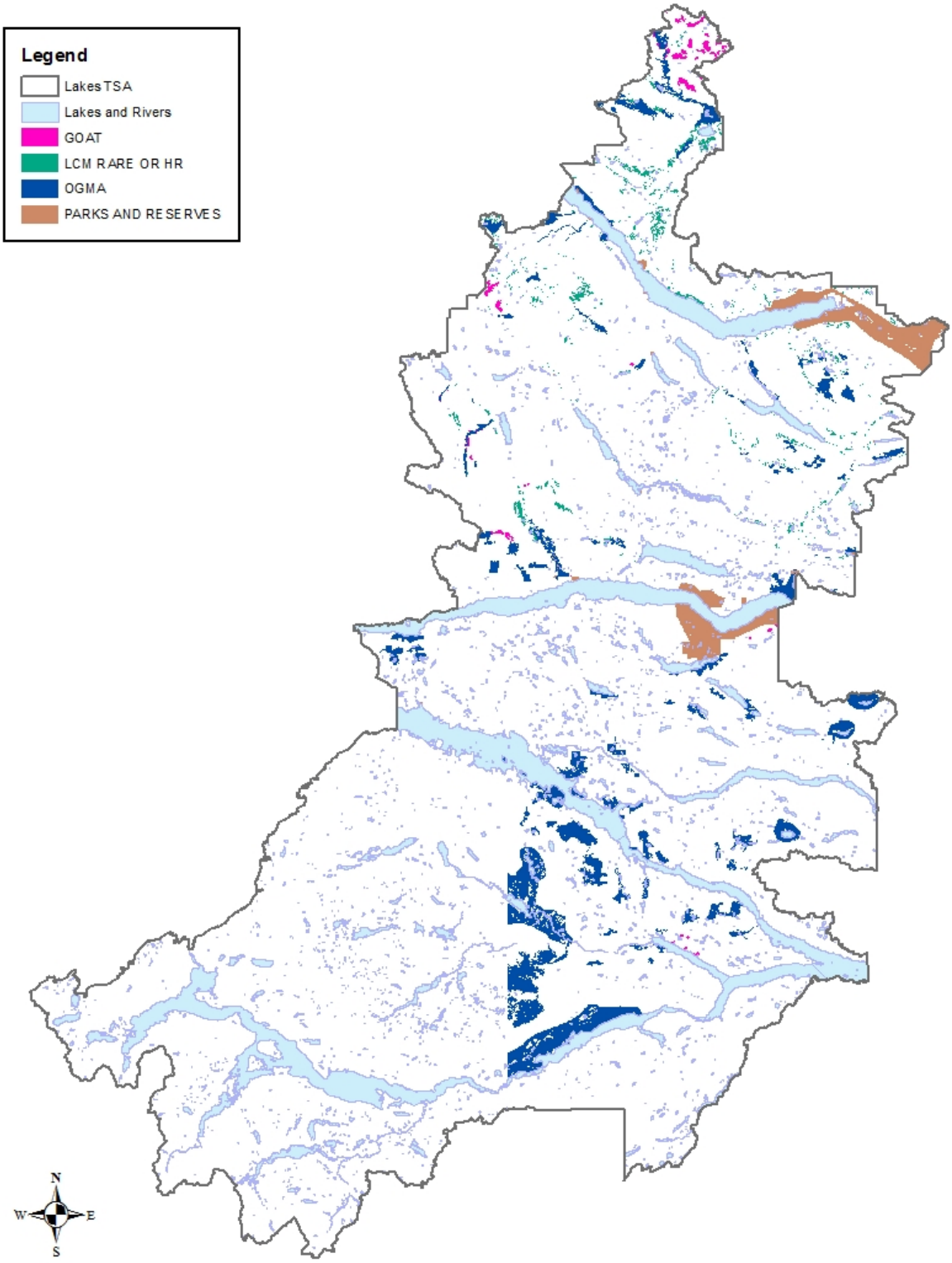

Figure 5. Reductions to the gross harvesting land base.

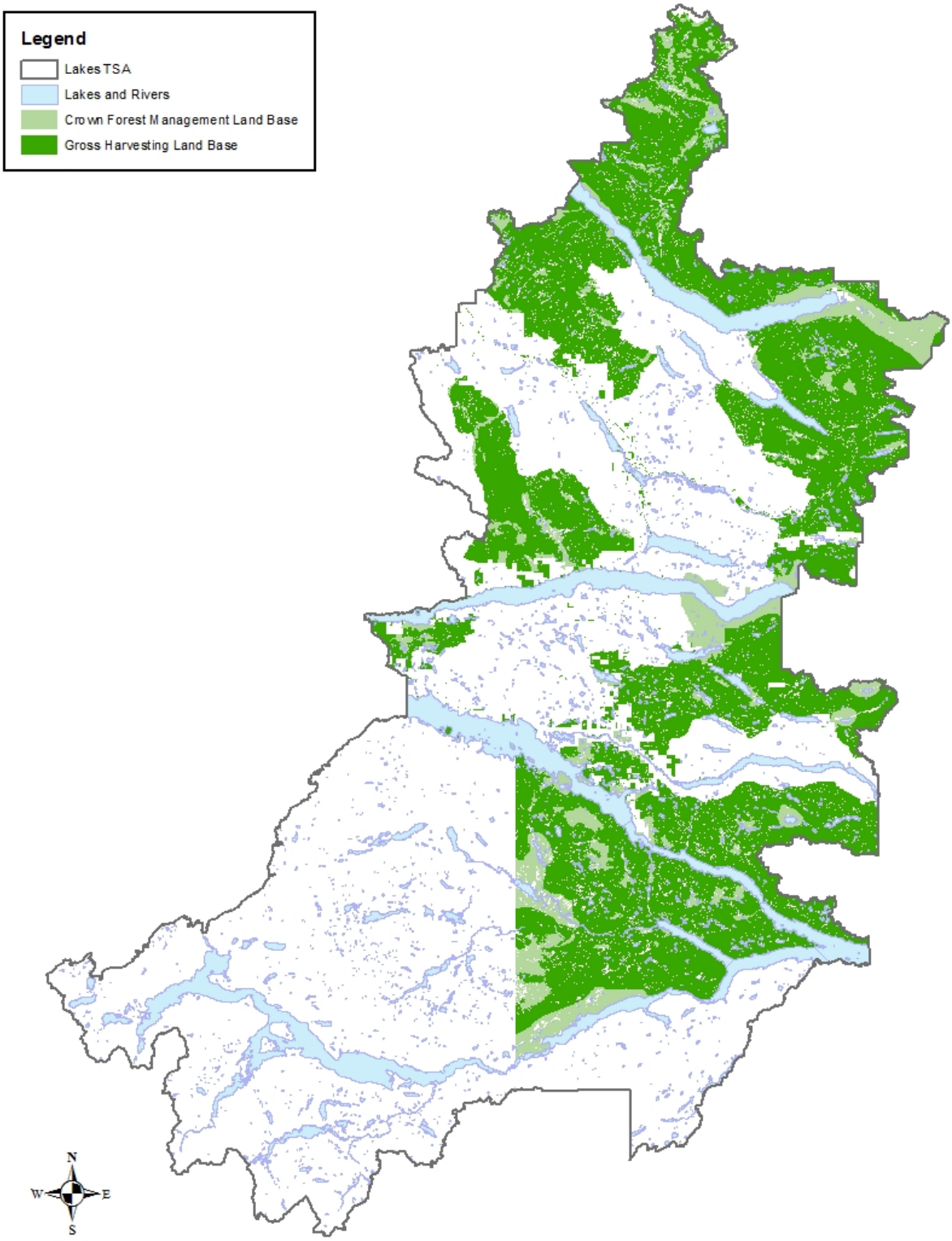

Figure 6. Gross harvesting land base.

6.4 Identifying the timber harvesting land base (THLB)

The THLB is the portion of the GHLB where timber harvesting is projected to occur in the context of the timber supply analysis supporting the AAC determination.

6.4.1 Inoperable areas

Physical barriers sometimes limit harvesting or the merchantability of stands. While the terrain in the Lakes TSA is relatively absent of physical barriers to harvesting, stands located on slopes steeper than 40 percent are typically not harvested because they are considered unsafe for conventional ground-based systems. This is supported by recent analyses that show that 99.6 percent of slopes steeper than 40 percent are not harvested. Therefore, stands located on slopes steeper than 40 percent will be excluded from the THLB.

There is a total area of 76 886 hectares with steep slopes. After accounting for overlap with other factors – such as parks and OGMA – the net area removed from the THLB is 8355 hectares. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

6.4.2 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors such as nutrient availability, exposure, or excessive moisture. These stands are unlikely to grow a merchantable crop of trees in a reasonable amount of time. As such, these stands are identified and removed from the THLB.

For the base case scenario a minimum site index criteria was established to identify stands that are removed from the THLB due to low timber growing potential. The site index criteria was determined as the site index value more than two standard deviations from the mean of the VRI site index of all old stands (see age criteria in Table 12) with less than 170 cubic metres per hectares. The value of 170 cubic metres per hectare is consistent with the value used in Sections 6.4.3, '*Problem Forest Types'* and 7.1.3, '*Minimum Harvestable Volume/Age Derivation*'.

The net area removed from the THLB to account for sites with low timber growing potential is 2776 hectares.

Table 12. Description of sites with low timber growing potential

Logging history	Leading species	BEC zone	Age (years)	Minimum volume (m^3/ha)	Minimum site index	Reduction (%)
No	B, BA, BL	ESSF	≤250	140	5.0	100%
No		SBS	≤140	140	9.1	100%
No	PL, PLI	ESSF	≤140	140	7.7	100%
		SBS	≤140	140	9.0	100%
No	S, SB, SE, SW, SX	ESSF	≤250	140	5.0	100%
		SBS	≤140	140	8.4	100%

Comments:

The age criterion reflects the old seral stage as described in Section 7.4.2, '*Seral Stage Distribution*', except for pine-leading stands in the ESSF where the minimum age was set at 140 years. This exception reflects that 95 percent of these stands are less than 188 years old with an average age of 90 years.

In previous TSRs, stands that did not achieve a minimum of 140 cubic metres per hectare by the time they reached 'old growth' status were considered to have low timber growing potential. Changing the minimum volume from 170 to 140 cubic metres per hectare would change the net area removed at this step from 3693 hectares to 2776 hectares. Based on public feedback, the base case uses a minimum harvestable volume of 140 cubic metres per hectares. The impact of varying the minimum volume criterion will be examined under sensitivity analyses.

6.4.3 Problem forest types

Problem forest types are stands that are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability due to quality, size or volume. These stand types are excluded from the THLB.

Table 13 identifies the three problem forest types to be modelled in the base case scenario. Deciduous-leading stands are not currently being harvested in the Lakes TSA. In the ESSF and SBS stands are excluded that do not reach 140 cubic metres per hectare by the time that they reach "old growth" status (i.e., 140 years for the SBS and 250 years for the ESSF).

The net area removed from the THLB to account for problem forest types is 43 056 hectares. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 13. Problem forest types criteria

Description	Logging history	BEC zone	Age (years)	Minimum volume (m^3/ha)	Reduction percent (%)
Deciduous	No	All	All	All	100
Old stands - ESSF	No	ESSF	> 250	140	100
Old stands - SBS	No	SBS	> 140	140	100

Comments:

The deciduous component of conifer-leading stands is also not utilized and is excluded from the volume tables of conifer-leading stands (see Section 7.1.2).

The minimum volume per hectare combines the live and dead volume in a stand so that stands are not removed due to MPB losses. Stands with previous harvest history are not included in this netdown.

As described in Section 6.4.3 above, the previous TSR used a minimum volume per hectare of 140 cubic metres per hectare. Changing the minimum volume from 140 to 170 cubic metres per hectare would change the net area removed at this step from 43 056 hectares to hectares 46 940. The impact of varying the minimum volume criterion will be examined under sensitivity analyses.

6.4.4 Cultural heritage resources

The *Forest Act* defines a cultural heritage resource (CHR) 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" *(Forest Act, 1996, 1(1)*). CHRs include culturally modified trees (CMTs), cache pits, burial sites, trails, habitation sites, tools, and historic sites and items.

CHRs are continually being identified and documented throughout the Lakes TSA and their documentation aids in landscape and site level planning as well as providing valuable information on the history of resource use in the TSA.

For the purposes of the Lakes TSR timber supply analysis, the protection of CHRs is considered to be modelled through addressing the netdown and management requirements of other values (e.g., wildlife tree retention).

6.4.5 Riparian management areas

Riparian areas occur next to the banks or edges of streams, lakes, and wetlands. Riparian areas frequently contain the highest number of plant and animal species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. Biologically diverse, these areas maintain ecological linkages throughout the forest landscape, connecting hillsides to streams and upper headwaters to lower valley bottoms.

Table 14 lists the riparian management area (RMA) reductions that will be applied to account for riparian reserve zones (RRZ) and riparian management zones (RMZ) along streams and around lakes and wetlands. In the base case scenario, riparian retention will be modelled as a netdown based on the average current practice (i.e., as obtained from Forest and Range Evaluation (FREP) sampling) and the average FSP commitment where FREP values are absent. In total, 19 619 hectares are removed from the THLB to account for riparian management area. This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

There is often overlap between riparian management areas and wildlife tree retention areas. This overlap is addressed in Section 6.4.6 below.

Table 14. Riparian reserve zones and riparian management zones

Riparian class	Description	RRZ width (m)	RMZ width (m)	RMA width (m)	RMA Avg FSP Width (m)	RMA Avg FREP width (m)
S1	Fish stream, width > 20 m	50	20	70	50	
S2	Fish stream, width ≥ 5 m & < 20 m	30	20	50	33	
S3	Fish stream, with ≥1.5 m and < 5 m	20	20	40	23	30
S4	Fish stream, < 1.5 m	0	30	30	9	14.5
S5	Non-fish stream, > 3 m	0	30	30	10	
S6	Non-fish stream, ≤ 3 m	0	20	20	4	8.5
L1B	Lake, 5 – 1000 ha	10	0	10	10	
L3	Lake, > 1 ha and < 5 ha	0	30	30	6	
W1	Wetland > 5 ha	10	40	50	16	
W3	Wetland > 1 ha and ≤ 5 ha	0	30	30	7	
W5	Complex of wetlands	10	40	50	16	

Comments:

Lakes and wetlands were identified and classified based on VRI attributes and streams were classified through a project under the Morice and Lakes Innovative Forest Practices Agreement (IFPA).

Minimum widths for riparian reserve zones (RRZ), riparian management zones (RMZ), and riparian management areas (RMA) are specified by the Forest Planning and Practices Regulation (FPPR) and these are reflected in approved Forest Stewardship Plans (FSPs).

The amount of reduction to the timber harvesting land base was determined, in part, by reviewing current FSP commitments. FSP commitments are typically expressed as a minimum percent of retention within the RRZ and RMZ. To accommodate modelling requirements, the RMZ specifications were converted to an equivalent width with full retention. Thus, a 20 percent minimum retention commitment in the 30 metres wide RMZ for a S4 became a six metres wide 100 percent retention. The final width for each riparian class was determined by prorating approved FSP commitments against existing AAC apportionment for replaceable forest licences and the British Columbia Timber Sales (BCTS) program. These values are shown under "FSP width" in Table 14.

As an example, the calculation for the RMA reduction for a S3 riparian class based on FSP commitments looks like:

- Equivalent no harvest RMA width = [(20 m RMZ * 25% basal area retention * 25% AAC apportionment) + (20 m RMZ * 4% basal area retention * 39% AAC apportionment) + (20 m RMZ * 20% basal area retention * 36% AAC apportionment)] + [20 m RRZ] = 23 m

However, since FSP commitments are usually expressed as minimums and may differ from actual practice, data collected under the Forest and Range Evaluation Program (FREP) was analyzed to determine the average retention level in the field. This average only applies to S3, S4 and S6 as these are the only riparian classes with sufficient samples. The results of these samples are shown in Table 14 under "Avg FREP width".

6.4.6 Wildlife tree retention

Wildlife trees are retained to promote healthy functioning ecosystems that provide wildlife habitat elements at the forest stand level. Wildlife tree retention (WTR) may include the retention of individual wildlife trees in a cutblock or the retention of an area specifically identified for protecting current or the recruitment of suitable wildlife trees. WTR can include living and dead trees, and both standing and down.

Table 15, below, identifies the wildlife tree retention requirements for the Lakes TSA. There is currently a total of 16 551 hectares of CMFLB spatially identified as WTR reserves. After accounting for overlaps with other area exclusions such as riparian areas (see Figure 7 below), the net area excluded from the THLB to account for WTR is 10 166 hectares.

Future reductions to the THLB to account for WTR will be applied by removing current cutblock area from current THLB estimates. It is assumed that the current percentage of WTR will be retained in the future. Future WTR reductions are estimated at 17 714 hectares.

This area classification is a preliminary estimate. The final area classification summary will be presented in a timber supply analysis discussion paper, as described in Section 10 of this document.

Table 15. Wildlife tree retention targets

Landscape unit	BEC zone	Percentage of cutblock to be retained for WTR based on SRMP (%)	Current average percentage of cutblock retained for WTR
Babine East	SBS	>10	16
	ESSF		
Babine West	SBS	>10	14
	ESSF		
Bulkley	SBS	>10	17
	ESSF		
Burns Lake East	SBS	>10	19
	ESSF		
Buns Lake West	SBS	>10	15
	ESSF		
Chelaslie*	SBS	>12	22
	ESSF	>9	13
Cheslatta	SBS	>12	19
	ESSF	>9	10
Fleming	SBS	>10	23
	ESSF		
Francois East	SBS	>14	18
	ESSF	>9	18
Francois West	SBS	>13	18
	ESSF	>12	11
Intata	SBS	>16	22
	ESSF	>9	14
Ootsa	SBS	>12	22
	ESSF	>9	N/A
Taltapin	SBS	>10	22
	ESSF		

(*) The Chelaslie landscape unit includes the caribou migration corridor.

Comments:

The WTR requirements are specified in the Lakes South and Lakes North SRMPs and are reflected in approved FSPs. The current management practice, as evidenced through reporting submissions in the RESULTS database, is to reserve an average of 19 percent of the gross cutblock area to meet WTR requirements. In the timber supply analysis, the current management practice, as identified through the RESULTS database, will be modelled.

The future WTR reduction percentage was obtained by assuming that unharvested stands and stands harvested without WTR (i.e., stands harvested prior to 1996) will require the same percentage of net WTR as current managed stands. There is a total of 252 795 hectares of THLB that is either unharvested or that was harvested prior to 1996. Since a net area of 11 627 hectares was reserved for WTR for a total harvest of 133 517 hectares, an additional net area of 22 014 hectares will be needed for the remainder of the THLB.

6.4.7 Environmentally sensitive areas

Some forest lands are environmentally sensitive (e.g., for slope stability) and/or significantly valuable for other resources (e.g., wildlife). These areas may be identified by specific surveys such as terrain stability mapping (TSM) or the older environmentally sensitive area mapping associated with the previous forest cover inventory. These environmentally sensitive areas may preclude or have reduced harvesting.

In the Lakes TSA, district staff identified that environmentally sensitive areas, including mapped potentially unstable terrain, overlap with areas that are identified above as unavailable for harvest (e.g., parks, inoperable areas) or overlap with areas that can be managed within the context of other values (e.g., visual management, riparian reserves, wildlife tree patches). As such, the district concluded that no specific modelling reduction was necessary for environmentally sensitive areas.

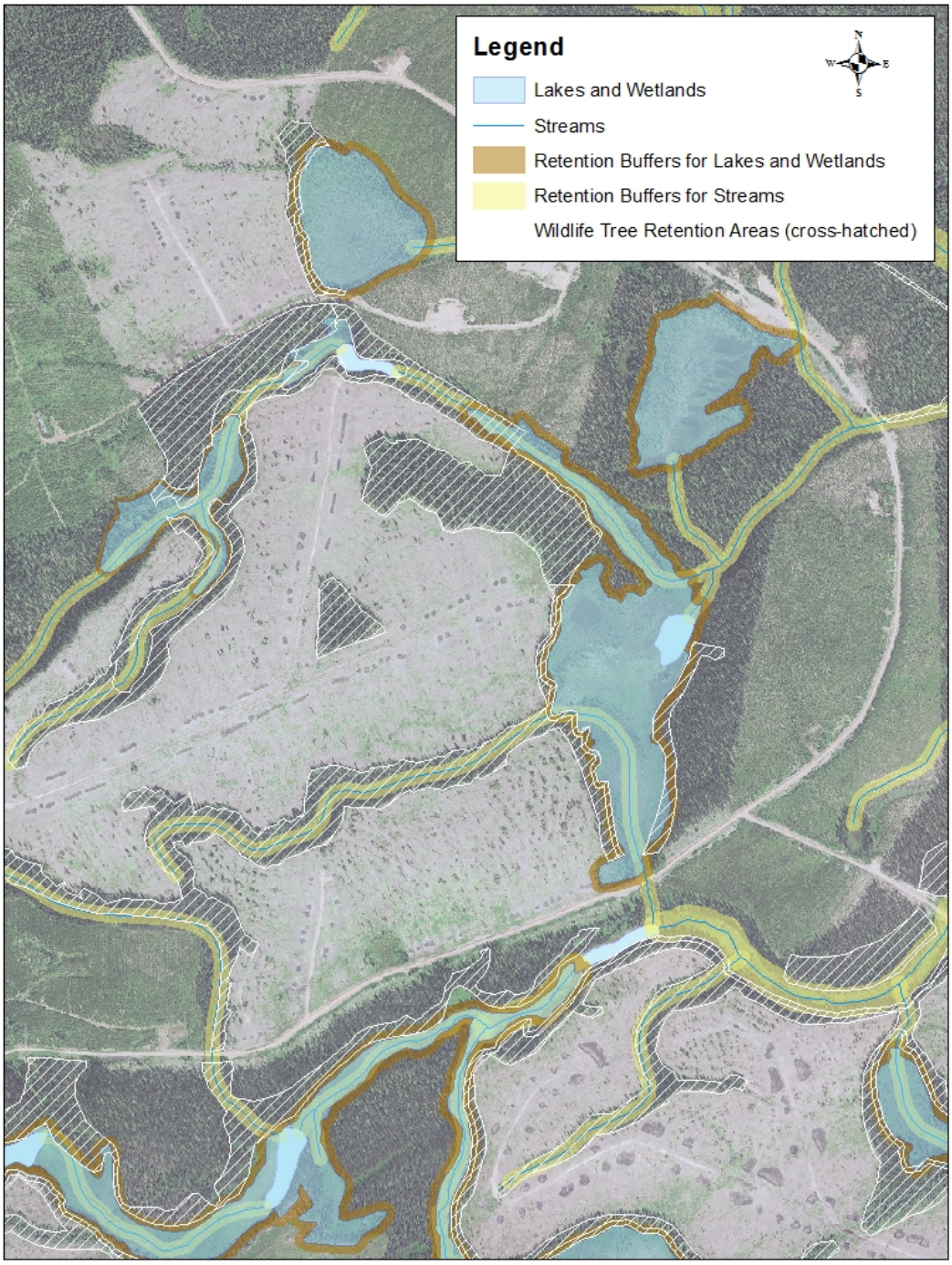

Figure 7. Retention buffers for riparian areas and wildlife tree retention areas.

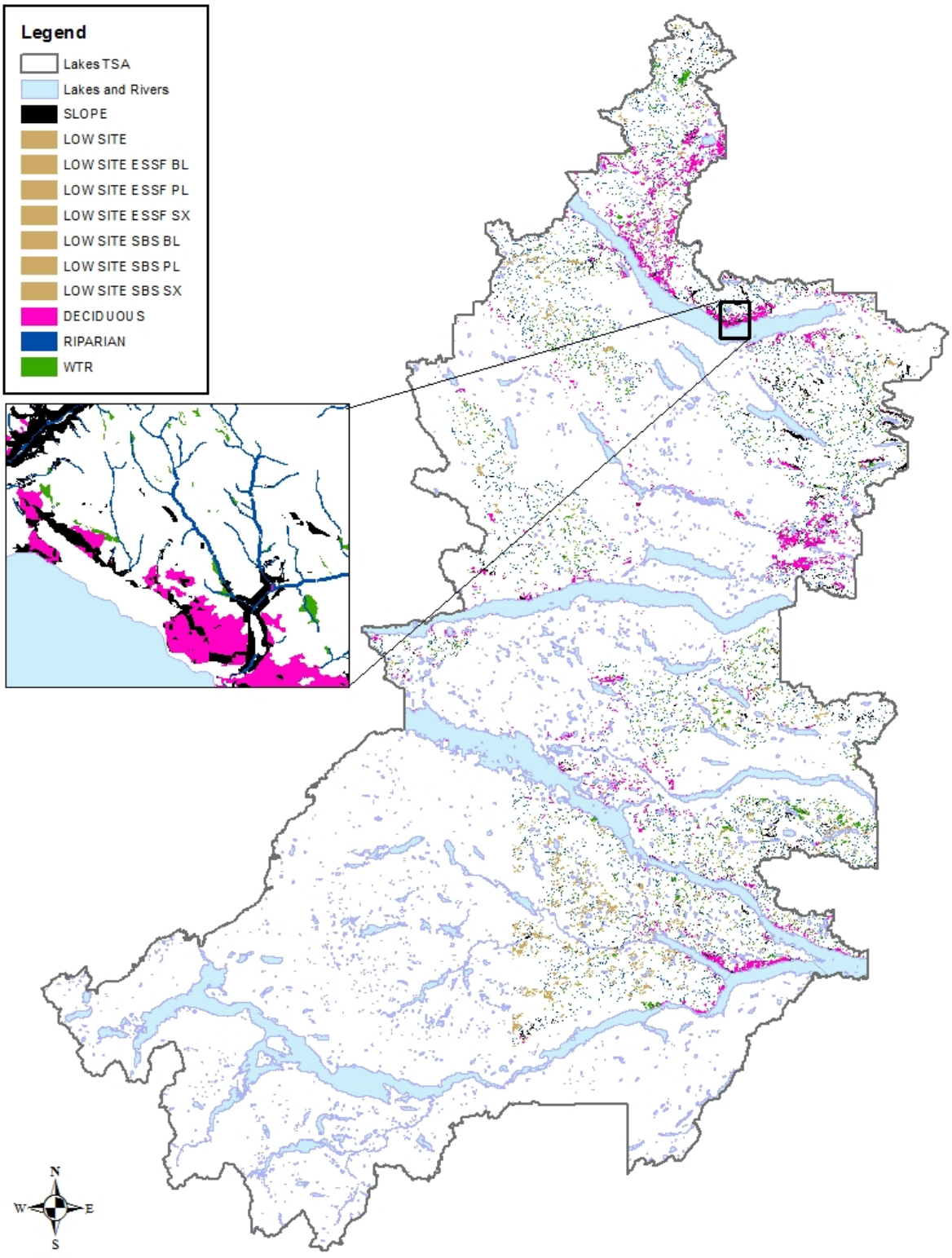

Figure 8. Reductions to the timber harvesting land base.

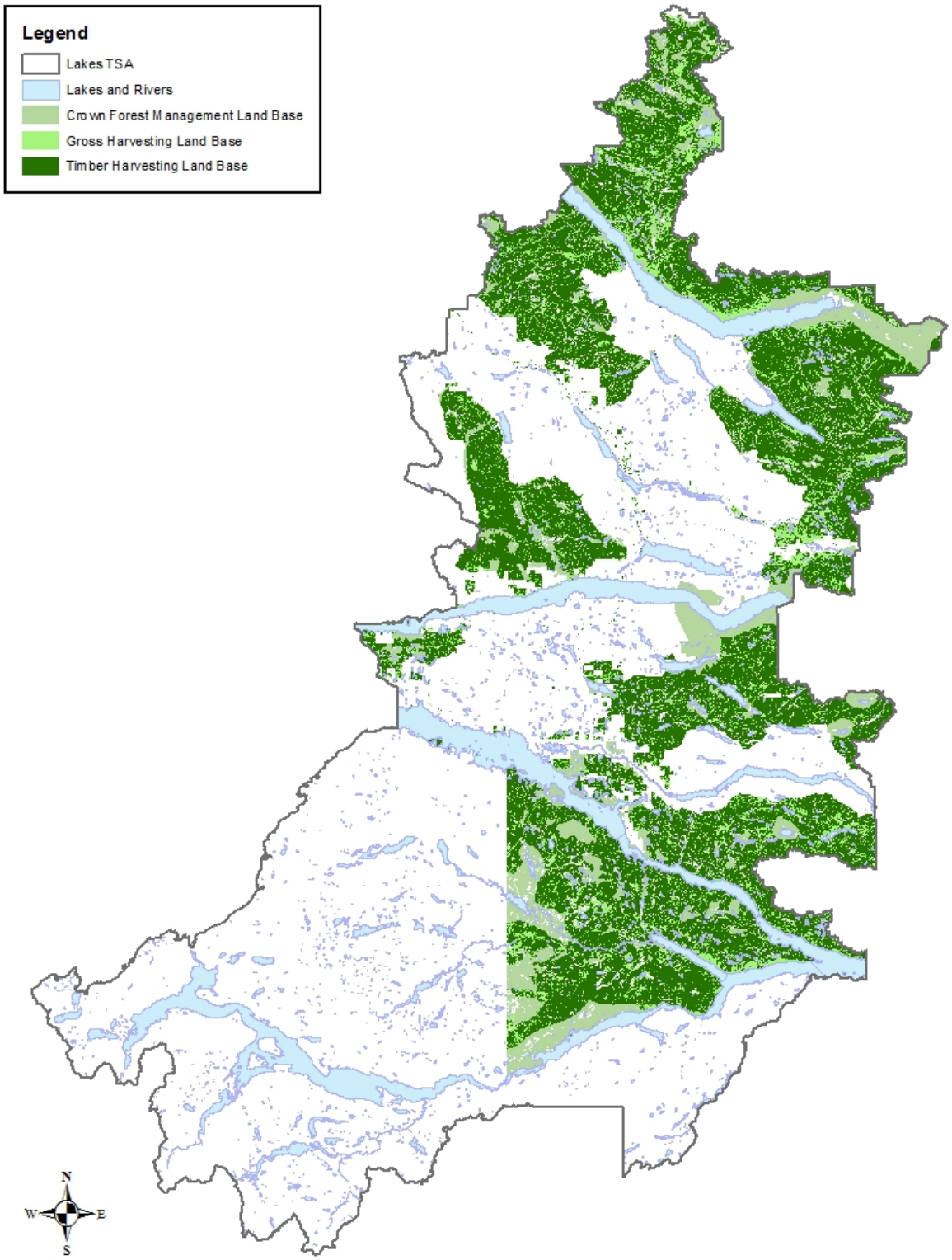

Figure 9. Timber harvesting land base.

6.5 Base case scenario land base classification summary

This section of the data package summarizes the land classification used in the base case scenario considering inventories currently available and modelling assumptions, as described in Sections 6.1 to 6.4, above.

Table 16. Lakes TSA initial land base classification summary (as of October 2018)

Land classification	Total area (ha)	Total forested area (ha)	Net area removed (ha)	% of total area	% of CMFLB
Total area	1 577 450			100	
Land not administered by FLNRO for timber supply purposes	894 643		894 463	56.7	
Non-forested and non-productive	299 285		118 314	7.5	
Roads	17 211		10 955	0.7	
Total Crown forest management land base	**553 718**			**35.1**	**100**
Parks and protected areas	23 955	22 488	22 488	1.4	4.1
OGMA	86 864	57 385	57 177	3.6	10.3
Wildlife – ungulate winter range	5 166	3 722	3 037	0.2	0.5
Lakes North LCM – rare and hydro-riparian ecosystems	21 677	11 604	8 727	0.6	1.6
Total gross harvesting land base	**462 289**			**29.3**	**83**
Inoperable areas	76 886	13 471	8 355	0.5	1.5
Low productivity sites	6 427	4 630	2 776	0.2	0.5
Problem forest types	229 172	73 125	43 056	2.7	7.8
Riparian areas	87 319	31 821	19 619	1.2	3.5
Wildlife tree retention areas	25 157	16 551	10 166	0.6	1.8
Future wildlife tree retention areas			17 714	1.1	3.2
Total current reductions			*193 115*	*12.2*	*34.9*
Timber harvesting land base	**360 603**			**22.9**	**65.1**
Future reductions					
Future roads			4194	0.3	0.8
Future timber harvesting land base	356 409			22.6	64.4

The Lakes THLB is about 30 percent smaller than in the previous timber supply review. The difference is mostly due to community forests expansions and the creation of First Nations woodland licences.

7. Current Forest Management Assumptions

7.1 Harvesting

This section of the data package contains the timber supply analysis assumptions related to timber harvesting activities and practices.

7.1.1 Utilization levels

The Interior Timber Merchantability Specifications of the *Interior Appraisal Manual* specifies the utilization levels for the billing of harvested timber.

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and the minimum diameter (outside bark) at stump height. However, for yield table projections, the specifications for minimum stump diameter are converted to a corresponding breast height diameter.

Table 17 shows the utilization levels used in the base case scenario of the timber supply analysis for the Lakes TSA.

Table 17. Harvest merchantability specifications for major species utilized within the Lakes TSA

Leading species	Minimum DBH (cm)	Minimum diameter at stump height (cm)	Maximum stump height (cm)	Minimum top diameter (cm)
Lodgepole pine	12.5	15.0	30.0	10.0
Balsam	17.5	20.0	30.0	10.0
Spruce	17.5	20.0	30.0	10.0

7.1.2 Volume exclusions for the deciduous component of conifer-leading stands

In the Lakes TSA deciduous volume within conifer-leading stands is typically not harvested operationally. As such, the deciduous volume within conifer-leading stands will not be considered to contribute to the timber supply of the Lakes TSA.

For the base case, the deciduous component of all conifer-leading analysis units will be excluded from yield tables. As a modelling simplification, no other modelling adjustments (e.g., overlap with WTR) will be made.

Table 18. Volume exclusions for the deciduous component of mixed species types

Mixed stand type	Species	Volume Exclusion (%)
All conifer-leading	**Deciduous**	**100**

7.1.3 Minimum harvestable volume/age derivation

The minimum harvestable volume or age is the model criterion that sets the volume or age that a stand must reach before it is considered to be a harvestable size. While harvesting may occur in stands at the minimum volume to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large changes in harvest levels), most stands will not be harvested until past the minimum criteria due to management objectives for other resource values.

Table 19, below, shows the minimum harvestable volume and age criteria that will be used in the base case scenario. These criteria were derived based on consideration of recent harvest performance. Sensitivity analyses will examine the impact of varying minimum harvestable volumes.

Table 19. Minimum harvestable volume criteria

Stand type	Minimum volume (m^3/ha)	Minimum age (years)
Existing natural stands	140	N/A
Future and existing managed stands	140	80

Comments:

Existing natural stands:

A review of licensee cutting permit cruise data shows that from 2010 to 2017, the average net volume of harvested stands was 272 cubic metres per hectare. During that period, the average net volume of harvested stands declined from an average of 286 m^3/ha to an average of 236 m^3/ha, a 17% decline (Figure 10).

The majority – 95 percent – of all cutting permits harvested since 2010 had volumes of at least 192 cubic metres per hectare. The minimum volume of harvested stands declined from 218 cubic metres per hectare in 2010 to 169 cubic metres per hectare in 2017 (Figure 11).

Although this data suggests that the minimum harvestable volume is declining, there is considerable uncertainty around this factor. For this analysis, the minimum harvestable volume associated with existing natural stands will be 140 cubic metres per hectare. This level is lower than the lowest level of 170 cubic metres per hectareobserved in the past eight years and is 28 percent lower than the average for the period. In the analysis, the minimum harvestable volume will combine the live and dead volume in a stand.

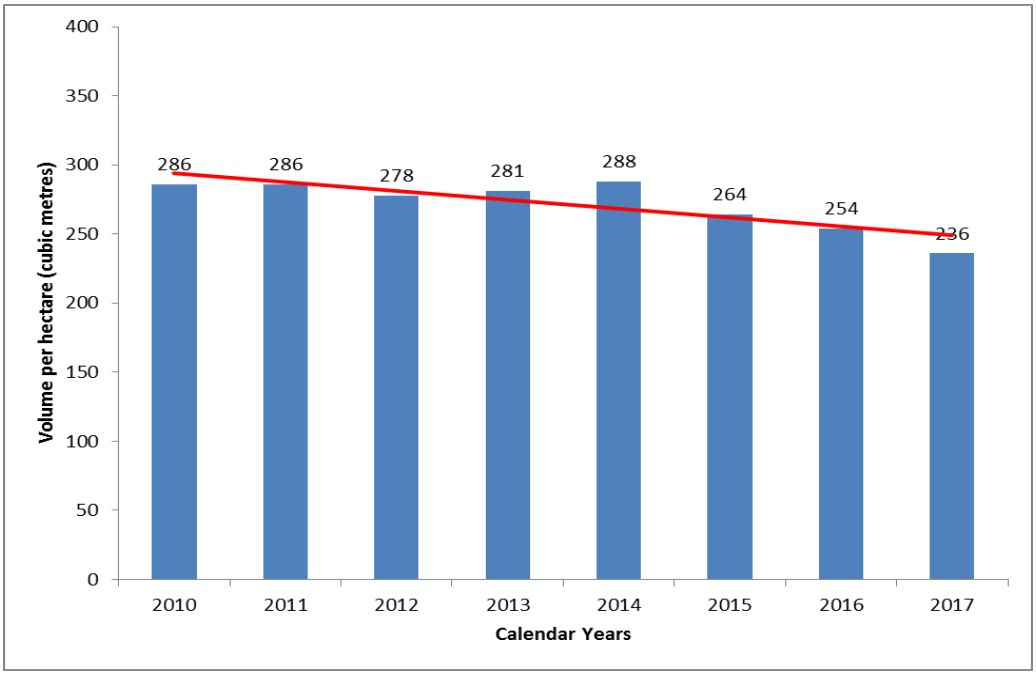

Figure 10. Average net volume of harvested stands in the Lakes TSA.

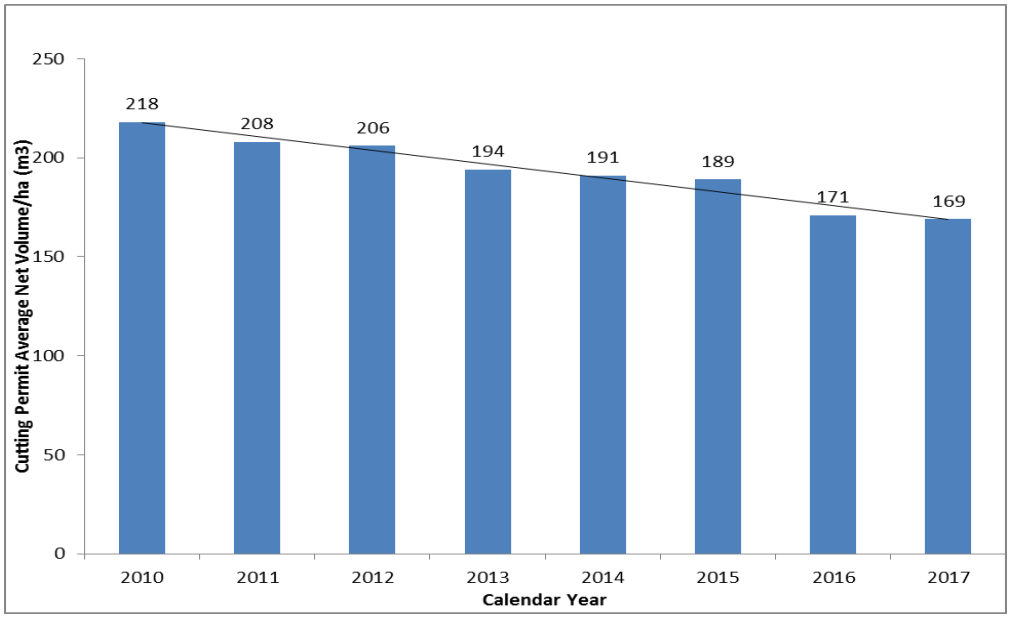

Figure 11. Average minimum net volume of harvested stands in the Lakes TSA.

Existing and future managed stands:

Stands that are regenerated following harvest will not be available for the next harvest until they reach a minimum volume of 140 cubic metres per hectare and are at least 80 years of age. This age was selected as it is the age at which the average pine stand within the Lakes TSA is estimated to reach maximum cumulative productivity. Sensivity analyses will examine the impact of varying the minimum harvest level.

7.1.4 Mountain pine beetle-killed stands

In the Lakes TSA, the mountain pine beetle infestation started in the late 1990's and the peak in MPB mortality occurred in 2005.

According to the Provincial-Level Projection of the Current Mountain Pine Beetle Outbreak, about 54 million cubic metres of pine trees were killed in the Lakes TSA since 2000 (Figure 12). During that time, about 26 million cubic metres of pine were harvested.

Information collected from the Harvest Billing System (HBS) and from cruise information shows that between 2010 and 2016, the proportion of pine as a percent of the total harvest declined by 16 percent (Figure 13). During this period the percentage of dead trees relative to the total harvest has been above 47%, peaking about 2013, and since declining to an average of 57% in 2017 (Figure 13)..

The most recent Vegetation Resource Inventory during photo classificationidentified a dead layer that provided information on the dead component of stands with over 30 percent mortality. In the base case, this dead component will be considered static and assumptions around shelf life are made as separate considerations. .

This information shows that while a significant amount of dead pine was present on the land base at the time of re-inventory, the contribution of both total pine and dead pine to the total harvest is declining (particularly since 2013). While this may suggest that trees killed by the MPB are nearing the end of their shelf life, which previously was estimated as 15 years, there is uncertainty on the continued merchantability of this dead volume

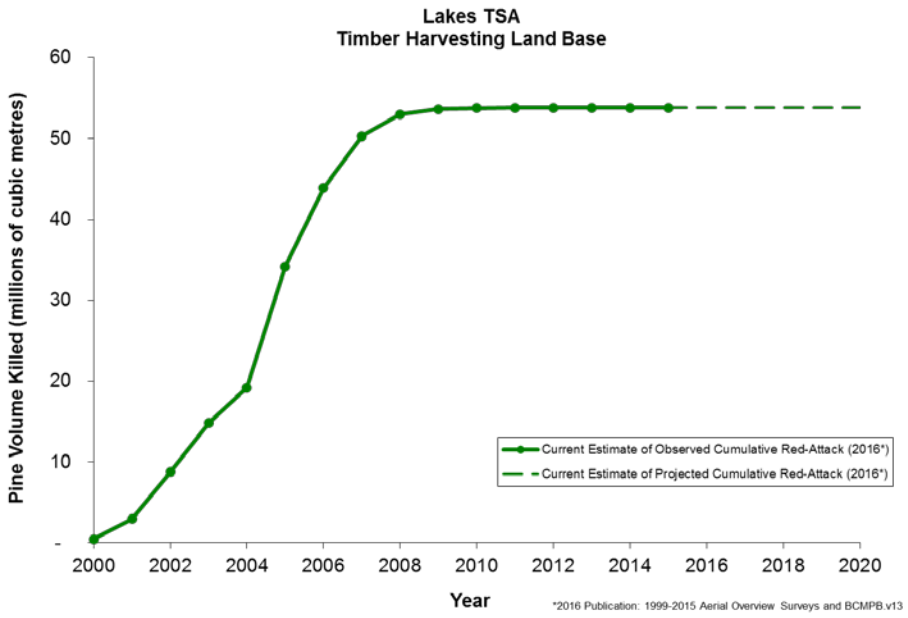

Figure 12. Cumulative pine volume mortality.

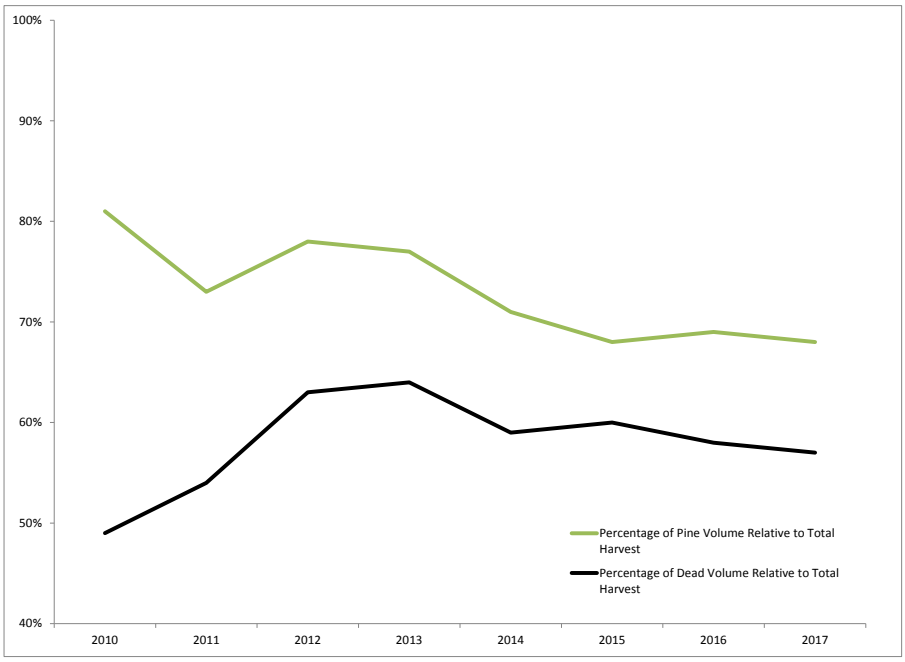

Figure 13. Pine harvest and dead harvest relative to total harvest.

For the purposes of this timber supply review, beetle-killed trees will remain standing and usable for 15 years since the time of death, after which they will be considered unusable for timber, pulp or energy. A sensitivity analysis will examine the impact of a longer shelf life on the harvest forecast.

Stands with MPB mortality that are not harvested by the timber supply model by the end of the shelf life period will continue to contribute to the timber supply if the live volume in the stand meets the minimum harvest criteria of at least 170 cubic metres per hectare of live timber or if the stand will meet the criteria by 140 years of age. The dead volume component of these stands will be considered an unsalvageable loss.

Existing natural stands with MPB mortality that are not harvested prior to the end of shelf life and whose live volume will not meet minimum harvest criteria by age 140 years, are not suitable for harvest. However, these stands will continue to age and address non-timber objectives in the base case scenario. However, there is uncertainty as to whether these stands do address various non-timber objectives. To understand the implications, a sensitivity analysis looked at resetting these unharvested stands to age 0.

Figure 14. Example of a heavily MPB-impacted stand with volume < 170 m3/ha.

7.1.5 Logging method

In the Lakes TSA, harvesting is done using conventional feller-bunchers and ground skidding. There is no timber supply modelling assumption related to logging method.

7.1.6 Silvicultural systems

Clearcut with reserves is the silvicultural system in use in the Lakes TSA. Under this system, a range of patch sizes (one to several hundred hectares) of even-aged forest is produced. A characteristic of this system is the maintenance of older forest remnants within harvest blocks. These remnants are intended to function as wildlife tree patches, riparian reserves and management zones, and island remnants to conserve old growth characteristics. Cutting of adjacent blocks is restricted until green-up conditions are met.

In the base case, the model will assume a clearcut harvest system. Considerations for reserves, as discussed in other sections above, will be made and adjacency requirements will be addressed through forest cover constraints as discussed in the section below on adjacency.

7.2. Unsalvaged losses

Table 20 shows the estimate of average annual unsalvaged volume loss to epidemics caused by insect or disease, fire, wind damage or other agents on the timber harvesting land base. The unsalvaged loss column reflects only losses on the THLB where the volume is not expected to be recovered or salvaged. Losses due to the mountain pine beetle infestation are modelled separately.

Table 20. Unsalvaged losses

Cause of loss	Total loss (m^3 for the 1999-2017 period)	Annual unsalvaged loss (m^3/year)
Blowdown	0	0
Spruce Bark Beetle	214,932	11,312
Balsam Bark Beetle	301,212	15,853
Fire	1,135,072	59,741

Comments:

The estimates for unsalvaged losses for the 1999 to 2017 period were obtained from Resource Practices Branch, which provides standardized updates to the non-recoverable loss estimates by TSA. These updates are based on aerial overview survey data, VRI data and harvest data (e.g., RESULTS). The total volume of affected tree species is adjusted based on the mid-point for each severity class. Details can be found at https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/NRLs/.

The standardized estimates do not capture root diseases or pine rusts. Losses attributed to pine rusts are discussed in the following section (Silviculture).

There are no reductions associated with blowdown as catastrophic blowdown events are typically salvaged and losses due to endemic blowdown are captured by cruise information and growth and yield assumptions.

7.3 Silviculture

7.3.1 Basic silviculture

Since 1987 major licensees have had a legal responsibility for basic silviculture. To enable assessment of this responsibility, licensees conduct surveys of the regeneration on a cutblock and report this information in the FLNRO database RESULTS. Summary information from RESULTS will be the basis for regeneration assumptions in the base case analysis.

Since 2007, 100 percent of the spruce seedlings planted are from class A seeds with an estimated average genetic gain of 20 percent. The planting of genetically improved pine seedlings began in 2009 and about 64 percent of the pine seedlings currently planted are from genetically improved seed with an estimated weighted average gain of nine percent.

For the purpose of this timber supply analysis, current practice represents basic silviculture practices that took place within the last decade. Within the Lakes TSA, these include: planting (about 50 000 hectares) and brushing (about 5700 hectares). Information on current practice will be the basis for future harvested stands.

The breakdown of species planted over the last 10 years is shown in Figure 15 below.

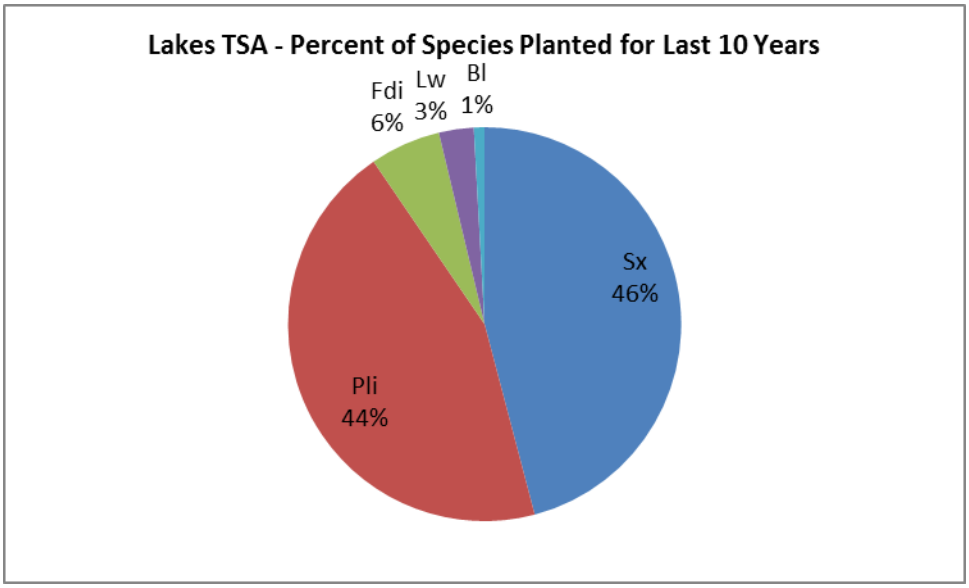

Figure 15. Proportion of species planted for the last 10 years.

7.3.2 Regeneration activities in managed stands

All existing stands that have a history of harvesting or stands harvested in the future will be modelled with managed stand yield tables (MSYTs) produced by the TIPSY growth and yield model. Due to differences in regeneration method, managed stands will be grouped as follows:

- Managed stands greater than or equal to 31 years of age (regenerated prior to 1987);
- Managed stands 11 to 30 years of age (regenerated from 1988 to 2007);
- Managed stands 10 years or younger (regenerated from 2008 to 2017); and,
- Future stands.

Currently, there are about 23 000 hectares of existing managed stands that were regenerated prior to 1988, 63 000 hectares that were regenerated between 1988 and 2007, and about 50 000 hectares that have been regenerated since 2007.

7.3.2.1 Managed stands greater than or equal to 31 years of age (regenerated prior to 1987)

Regeneration practices prior to 1987 are assumed different than post-1987 practices when legislation established basic silviculture obligations for licensees.

The general yield assumptions for managed stands 31 years of age and older are as follows:

- Regeneration delay for Planted (P) is two years and for Natural (N) is seven years.
- Improved stock was not planted until 2007 so there is no genetic gain applied to any species.
- Standard operational adjustment factors – OAF 1 (15%) and OAF 2 (5%) will be used. These may be adjusted to address forest health factors, as described in Section 7.3.4, below.

Table 21 identifies the five groups of stands that were determined to represent the regeneration assumptions for harvested stands equal to or greater than 31 years of age. The information in Table 20 was obtained from RESULTS. The proportion of each stand type within the analysis units for harvested stands equal to or greater than 31 years of age (OAG, OAM, OAP) is shown in Table 5. There are about 23 000 hectares of managed stands equal to or greater than 31 years of age.

Table 21. TIPSY regeneration composition inputs for stands equal to or greater than 31 years of age

ID	Regeneration species composition	Regeneration delay (years)	Regeneration method		Initial density (sph)	Operational adjustment factor	
			Type	%		OAF 1	OAF 2
1	P100	2	Plant	100	1469	15	5
2	P80S20	2	Plant	100	1208	15	5
3	S100	2	Plant	100	1313	15	5
4	S80P20	2	Plant	100	1389	15	5
5	P90S10	7	Natural	100	940	15	5

Comments:

The species composition is abbreviated by species (S = Spruce, P = pine, B = Balsam) and the percent. For example P80S20 is 80% pine and 20% spruce. See Section 8.5 for further information on operational adjustment factors.

7.3.2.2 Managed stands 11 to 30 years of age (regenerated from 1988 to 2007 for spruce and to 2010 for pine)

In 1987, legislation established basic silviculture obligations for licensees, including the use of improved stock for planting. In the Lakes TSA, silviculture records show that 75 percent of the spruce trees planted from 1988 to 2007 have a weighted average proven genetic gain of 14 percent. This translate to an extrapolated gain of 10.5 percent to all spruce trees planted in the period.

The general yield assumptions for managed stands 11 to 30 years of age are as follows:

- Regeneration delay for Planted (P) is two years and for Natural (N) is seven years;
- Genetic gain of 10.5 percent for spruce;
- No genetic gain for pine; and,
- Standard operational adjustment factors – OAF 1 (15%) and OAF 2 (5%) will be used. These may be adjusted to address forest health factors, as described in Section 7.3.4, below.

The species composition for these stands is based on an aggregation of RESULTS planting records and VRI information. There is approximately 63 000 hectares of stands within the THLB that were regenerated between 1988 and 2007.

Table 22. TIPSY regeneration composition inputs for stands equal 11 to 30 years of age regenerated from 1998 to 2007 for spruce and to 2010 for pine)

ID	Regeneration species composition	Regeneration delay (years)	Regeneration method		Initial density (sph)	Operational adjustment factor	
			Type	%		OAF 1	OAF 2
1	P40S30B30	2	Plant	100	1447	15	5
2	P50S50	2	Plant	100	1500	15	5
3	P70S30	2	Plant	100	1531	15	5
4	P90S10	2	Plant	100	1458	15	5
5	S70P30	2	Plant	100	1478	15	5
6	S90P10	2	Plant	100	1537	15	5

7.3.2.3 Managed stands younger than 10 years of age and all future managed stands.

After 2007, improved stock has been commonly used in the Lakes TSA, as such specific analysis units were created for these stands. Further, the regeneration assumptions derived for this time period will be used as the assumptions for all future stands harvested by the model.

The general yield assumptions for managed stands younger than 10 years of age (after 2007) for spruce and eight years (after 2009) for pine and for all future managed stands are as follows:

- Regeneration delay for Planted (P) is two years and for Natural (N) is seven years;
- Genetic gain of 20% is applied to planted spruce and 9% to planted pine; and,
- Standard operational adjustment factors – OAF 1 (15%) and OAF 2 (5%) will be used. These may be adjusted to address forest health factors, as described in Section 7.3.4, below.

The information for stands younger than 10 years of age was determined by using information from the RESULTS database, specifically the 'Biological Regeneration Delay' report which provides a consistent methodology to generate achieved biological date based on either the submission of planting information or forest cover submission for natural regenerated area. At the time of planting, the stock is one year old, on average.

Table 23 below, is a summary of the regeneration assumptions for stands harvested since 2007. This summary results in the identification of 10 different regeneration assumptions that will be used to generate volume tables for current (post 2007) and future managed stand analysis units. Table 4 and Table 5 identify how these assumptions are applied for use in determining the volume projection of an existing or future analysis unit. There are about 50 000 hectares of managed stands less than 10 years of age within the THLB.

Table 23. TIPSY regeneration composition inputs for stands younger than 10 years of age and all future stands

Original composition	ID	Regeneration species composition	Regeneration delay (years)	Method		Initial density	Operational adjustment factor	
				Type	%		OAF 1	OAF 2
B	1	P50S50	2	Plant	100	1509	15	5
B	2	S70P30	2	Plant	100	1509	15	5
B	3	S50P40B10	2	Plant	100	1509	15	5
S	1	P50S50	2	Plant	100	1555	15	5
S	2	S100	2s	Plant	100	1555	15	5
S	3	P70S30	7	Natural	100	940	15	5
S	4	S70P30	2	Plant	100	1555	15	5
P	1	P50S50	2	Plant	100	1555	15	5
P	2	P100	2	Plant	100	1066	15	5
P	3	P90S10	7	Natural	100	940	15	5

Comments:

The derivation of the regeneration assumptions (original composition) were derived initially on classes based on the leading species of the previous stand. Several regeneration species composition types were identified within the three original composition types.

Species and densities were determined by analysis of the preliminary ‘Planted Species’ reports using the RESULTS database. This report produces a summary of the tree species and seedlot planted based on the parameters specified by the user. These initial reports were broken down by year and licence number to establish trends by year and volume-based licensees. The numbers were further analysed by prorating densities and species compositions by area. The species percentages and densities reflected in this data package are a direct reflection of licensee reporting in RESULTS.

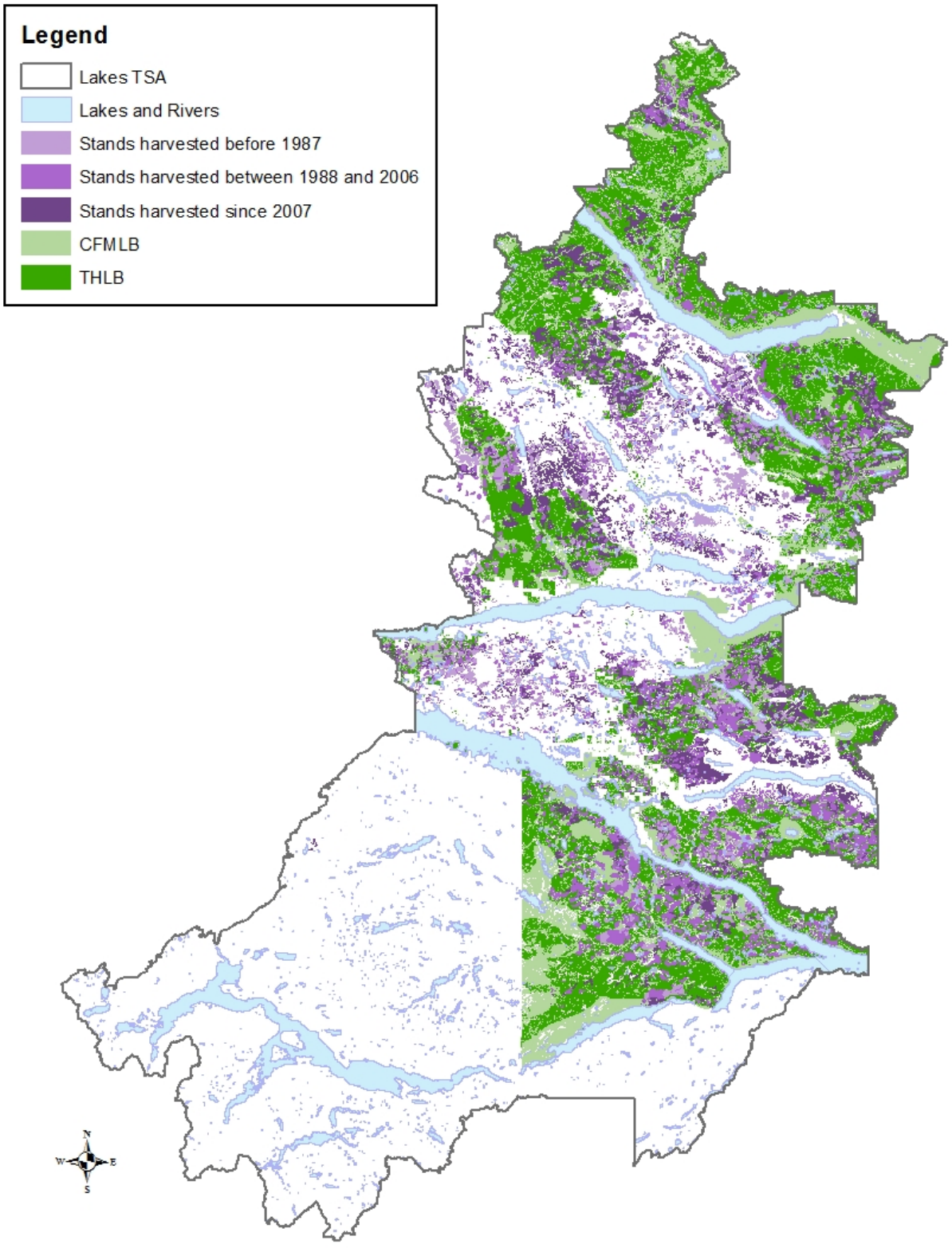

Figure 16. Current managed stands, by harvesting period, within the Lakes TSA.

7.3.3 Incremental silviculture

In previous decades, incremental spacing was a common practice in the Lakes TSA. However, this will not be modelled in this timber supply review because the vast majority of the spaced stands were decimated by the mountain pine beetle.

More recently, an intensive program of fertilization was implemented in the Lakes TSA. In the past decade, about 10 000 hectares of immature stands have been fertilized. Most of these stands (about 9000 hectares) were pine-leading advanced plantations (about 35 years of age) although some spruce-leading stands aged between 50 and 70 were also fertilized. Stands that were fertilized are shown on Figure 17.

In the timber supply analysis, the yield of stands that have been fertilized will be increased based upon the standard fertilization reponse models present within the TIPSY model.

Table 24. TIPSY regeneration composition inputs for fertilized stands

Original composition	ID	Regeneration species composition	Regeneration delay (years)	Method		Initial density	Operational adjustment factor	
				Type	%		OAF 1	OAF 2
P	1	P90S10	2	Plant	100	1339	15	5
S	2	S70P30	7	Natural	100	940	15	5

Initial stand density for fertilized plantation is based on the average planting density of pine-leading plantations from table 21. Initial stand density for natural spruce stands is based on the natural initial density from tables 21 and 23.

It is assumed that in the future, these stands will be planted in with the same species composition. Genetic gains of 20% is applied to planted spruce and 9% to planted pine.

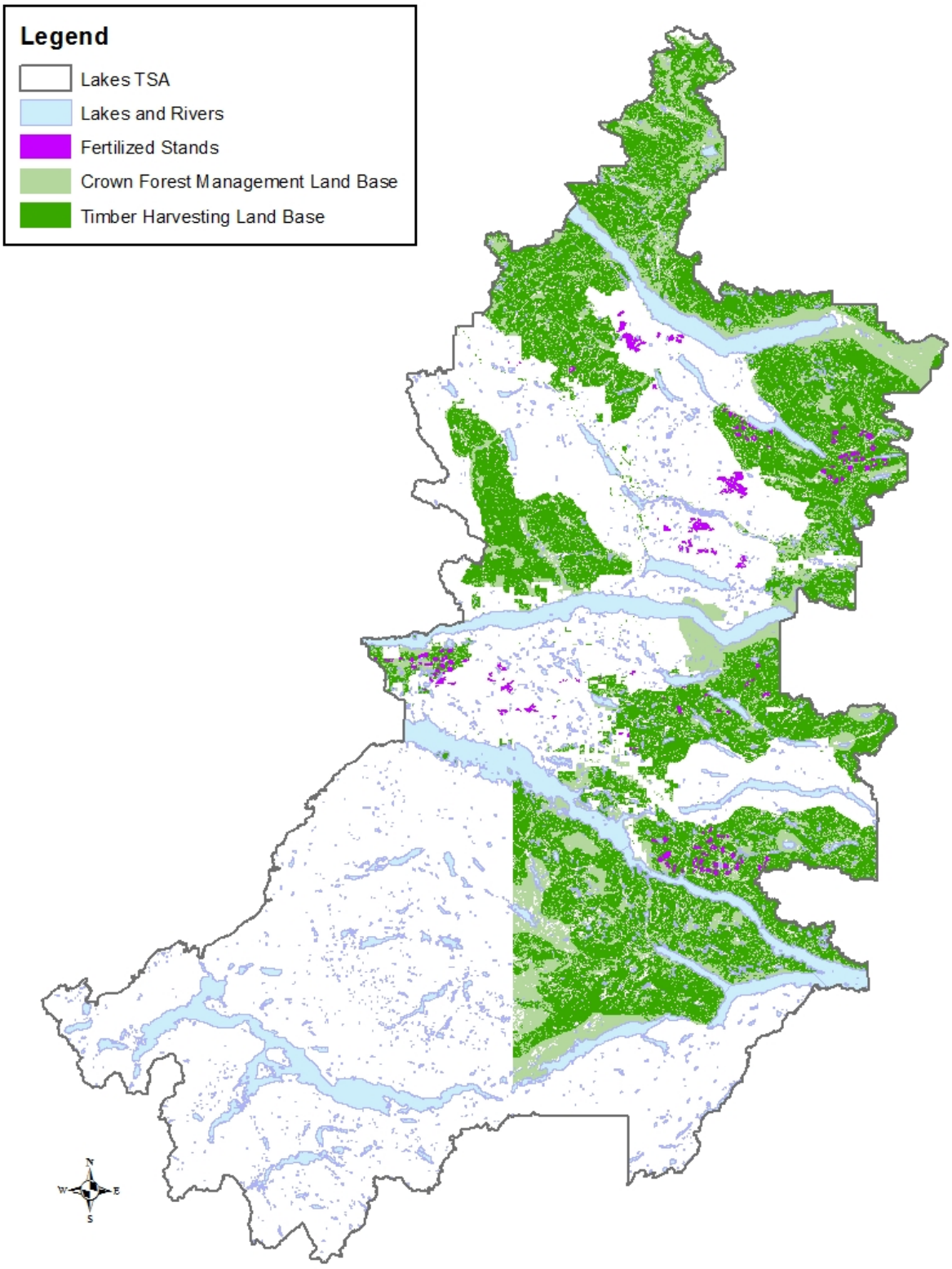

Figure 17. Fertilized stands within the Lakes TSA.

7.3.4 Forest health

Pests, diseases, fire, animals and human activities can all affect the health of forests. Both old and young forests are susceptible to damage from forest health factors. In Section 7.2 above, those forest health agents that result in endemic mortality of mature forests are modelled as non-recoverable losses.

In the Lakes TSA, pine stem rusts are ubiquitous and are considered the most serious disease within managed stands. Infections on young trees can affect survival rates, form and vigour which consequently impact merchantable volume yields. The risk they create to existing and future managed stands is considered separately.

Sampling done in the Lakes TSA since 1995 using forest health transect lines and stand development monitoring (SDM) thought the Forest and Range Evaluation Program (FREP) shows that 94 to 99 percent of the sampled stands had some level of rust. While the incidence level of individual rust is generally below 10 percent in affected stands (i.e., low), most stands contain more than one type of rust. Thus, when the incidence level of all rusts is considered, 36 to 43 percent of the sampled stands contain a high incidence of rust, with greater than 20 percent of the host trees affected. For example, as seen in Table 23, below, the incidence of western gall rust is in 61 percent (298 of 485)) of the sampled stands is ranked as low. However, when the incidence levels of all rusts are combined, only about 31 percent (150 of 485) of the sampled stands are ranked as having a low incidence.

Table 25, below, also indicates that forest health monitoring surveys found 1.4 times more western gall rust than what is reported in earlier free-to-grow surveys reported in RESULTS. The multiplier is 2.1 for comandra and stalactiform. The difference may be partially accounted for due to the timing of free-growing surveys, as rusts may not have been fully expressed at the time of the free-growing surveys and the forest health emphasis of the forest health monitoring surveys.

The impact of rusts in managed stands relative to growth and yield dynamics is being investigated by ministry growth and yield staff. To address the impact of rusts, a sub-model for the growth and yield model, TIPSY, has been created that uses incidence of stem rust as an input. In the base case, incidence rates based on forest health transect line surveys and stand development monitoring will be used to develop appropriate volume tables. Sensitivity analyses will investigate the impact of not applying rust considerations and the impact of applying lower incidences as found from the silviculture surveys as reported in RESULTS.

Table 25. A comparison of the rust rankings of 485 stands comparing RESULTS free-growing surveys to later forest health transect lines and stand development monitoring data

Rust incidence level ranking	Number of sampled stands by incidence level for all rusts incidence level combined		Number of samples stands by incidence level for gall rust (DSG) only		Number of samples stands by incidence level for comandra (DSC) and stalactiform (DSS)	
	RESULTS	Surveys	RESULTS	Surveys	RESULTS	Surveys
Low (<10%)	276	150	361	298	427	335
Moderate (10-20%)	99	148	73	132	37	81
High (>20%)	110	187	51	55	21	69

7.4 Resource management objectives

The overarching policy direction for the management of resource values within the Lakes TSA is described in the *Lakes District Land and Resource Management Plan (LRMP)*, which was approved by cabinet in January 2000. The operational direction for the implementation of the biodiversity direction of the LRMP is provided by the *Lakes South and Lakes North Sustainable Resource Management Plan (SRMP)* and important objectives are legally established under the *Land Act*. Resource management objectives for identified forest values are also legally established under the *Forest and Range Practices Act*. Intended results and strategies in relation to objectives established under the *Land Act* or FRPA are specified in forest stewardship plans prepared by forest tenure holders.

The following sections describe the management objectives that have been established to manage, protect and conserve the forest values found within the Crown forests of the Lakes TSA. Objectives that result in the exclusion of harvesting are addressed in the previous sections of this document, whereas those which require the retention of different forest characteristics across the landscape, but do not fully exclude harvesting, are addressed below.

7.4.1 Seral stage distribution

The goal of seral stage distribution is to maintain the diversity of seral stages and disturbance regimes found within various ecosystems. This diversity is important since the composition of plant and animal communities change as forest stands develop through time after a disturbance. Various life-forms find their habitat requirements during different stages of forest development and most specialist species are associated with either the early herb/shrub stage or the mature to old seral stages.

Management objectives for seral stage distribution were legally established on July 17, 2003 for the portion of the TSA covered under the *Lakes South Sustainable Resource Management Plan* (SRMP) and on January 29, 2009 for the remainder of the TSA (Lakes North SRMP). These objectives apply to biogeoclimatic (BEC) zones within each landscape units and vary depending on the assigned biodiversity emphasis option. In the Lakes TSA, the dominant BEC are the Sub-Boreal Spruce (SBS) biogeoclimatic zone and the Engelmann Spruce Subalpine Fir (ESSF) biogeoclimatic zone. All seral stage requirements apply to the CMFLB.

To ensure stands do not age to infinity and in recognition of natural disturbances, stands located outside of the THLB in the SBS biogeoclimatic zone will have their age reset to 21 years once they reach 250 years of age. Stands outside of the THLB in the ESSF biogeoclimatic zone will have their ages set to 21 years once they reach 350 years of age. Resetting the age to 21 years, recognizes that these naturally disturbed stands will be considered to still contribute after disturbance to non-timber values such as visuals.

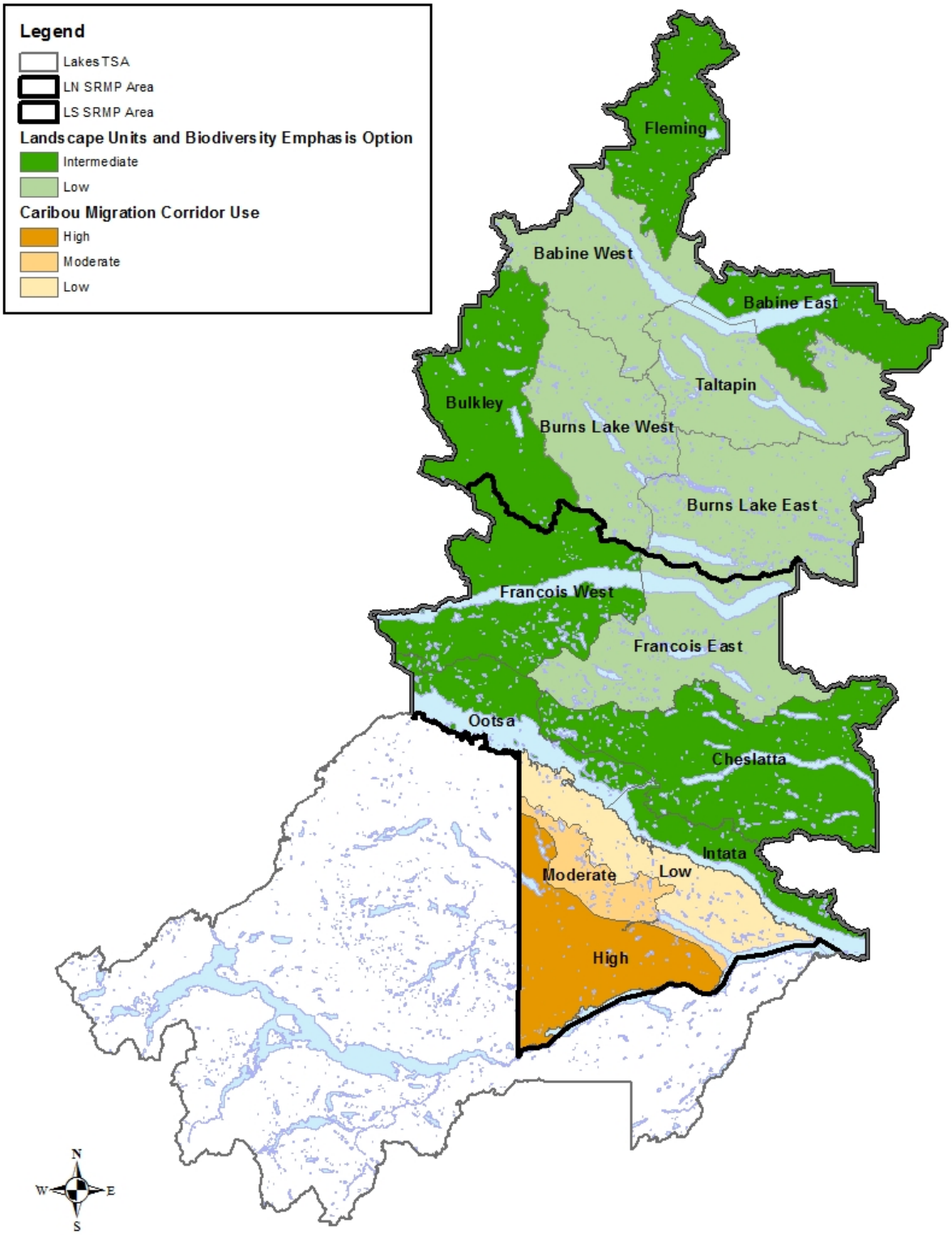

Figure 18. Landscape units and biodiversity emphasis option within the Lakes TSA.

Table 26. Seral stage distribution requirements outside of the Chelaslie Migration Corridor

Landscape unit (land base to which constraint apply)	Biodiversity emphasis option and BEC zone	Early seral		Mature plus old seral		Old seral	
		Maximum allowable disturbance area (%)	Age for disturbance allowable area (years)	Minimum retention area (%)	Age for retention (years)	Minimum retention area (%)	Age for retention (years)
Babine East (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Babine West (CMFLB)	SBS - Low ESSF - Low	N/A N/A	< 40 < 40	11 14	> 100 > 120	11 9	> 140 > 250
Bulkley (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Burns Lake East (CMFLB)	SBS - Low ESSF - Low	N/A N/A	< 40 < 40	11 14	> 100 > 120	11 9	> 140 > 250
Burns Lake West (CMFLB)	SBS - Low ESSF - Low	N/A N/A	< 40 < 40	11 14	> 100 > 120	11 9	> 140 > 250
Cheslatta (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Fleming (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Francois East (CMFLB)	SBS - Low ESSF - Low	N/A N/A	< 40 < 40	11 14	> 100 > 120	11 9	> 140 > 250
Francois West (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Intata and Ootsa (CMFLB)	SBS - Intermediate ESSF - Intermediate	54 36	< 40 < 40	23 28	> 100 > 120	11 9	> 140 > 250
Taltapin (CMFLB)	SBS - Low ESSF - Low	N/A N/A	< 40 < 40	11 14	> 100 > 120	11 9	> 140 > 250

Table 27. Seral stage distribution requirements for the Chelaslie Migration Corridor

Caribou migration zones	Seral stages			Land base to which constraint applies
	< 40 years	> 80 years	> 140 years	
High Use	< 25%	> 60%	> 40%	CMFLB
Moderate Use	< 32%	> 45%	> 30%	CMFLB
Low Use	< 54%	> 30%	> 20%	CMFLB

In the Lakes TSA, the main disturbance agents typically causing a rapid change in seral conditions are wildfire and timber harvesting. The recent mountain pine beetle epidemic has played a significant role in disturbance and will continue to play a significant role in forest structure. However, MPB and other bark beetles, insects and diseases do not typically kill trees in a forest stand in a way that swiftly converts the stand from one seral stage to another (e.g., from old to early).

Table 28, below, shows the current seral stage distribution within the Lakes TSA and the maximum disturbance and minimum retention area objectives as identified in Table 26.

Table 28. Current (2017) seral stage distribution - outside of the Chelaslie Caribou Migration Corridor

		Early seral		Mature plus old seral		Old seral	
Landscape unit	BEC zone and biodiversity emphasis option	Current condition (%)	Maximum allowable disturbance area (%)	Current condition (%)	Minimum retention area (%)	Current condition (%)	Minimum retention area (%)
Babine East	SBS - Intermediate	15	54	27	23	25	11
	ESSF - Intermediate	4	36	59	28	*1*	9
Babine West	SBS - Low	28	N/A	58	11	30	11
	ESSF - Low	7	N/A	87	14	*7*	9
Bulkley	SBS - Intermediate	29	54	48	23	16	11
	ESSF - Intermediate	10	36	66	28	*3*	9
Burns Lake East	SBS - Low	16	N/A	27	11	17	11
	ESSF - Low	7	N/A	26	14	*2*	9
Burns Lake West	SBS - Low	44	N/A	44	11	20	11
	ESSF - Low	10	N/A	81	14	*1*	9
Cheslatta	SBS - Intermediate	40	54	33	23	20	11
	ESSF - Intermediate	27	36	*15*	28	*0*	9
Fleming	SBS - Intermediate	35	54	52	23	*26*	11
	ESSF - Intermediate	4	36	82	28	*3*	9
François East	SBS - Low	45	N/A	41	11	27	11
	ESSF - Low	22	N/A	74	14	0	9

(continued)

Table 28. Current (2017) seral stage distribution - outside of the Chelaslie Caribou Migration Corridor (continued)

Landscape unit	BEC zone and biodiversity emphasis option	Early seral		Mature plus old seral		Old seral	
		Current condition (%)	Maximum allowable disturbance area (%)	Current condition (%)	Minimum retention area (%)	Current condition (%)	Minimum retention area (%)
François West	SBS - Intermediate	26	54	45	23	23	11
	ESSF - Intermediate	12	36	33	28	*1*	9
Intata and Ootsa	SBS - Intermediate	30	54	30	23	14	11
	ESSF - Intermediate	21	36	24	28	*0*	9
Taltapin	SBS - Low	38	N/A	54	11	44	11
	ESSF - Low	24	N/A	65	14	*2*	9

There is currently a deficit of forests older than 250 years old in the ESSF BEC zone within all landscape units. This deficit is primarily due to the existing natural seral conditions within this ecosystem zone rather than past harvesting. The ESSF BEC zone covers about 20% of the CMFLB. The minimal timber harvesting occurring in this zone and most stands are between 100 and 220 years of age.

Table 29. Current (2017) seral stage distribution within the Chelaslie Migration Corridor

Caribou migration zones	Seral stages					
	< 40 years		> 80 years		> 140 years	
	Current condition (%)	Maximum allowable area (%)	Current condition (%)	Minimum retention area (%)	Current condition (%)	Minimum retention area (%)
High use	48	25	49	60	21	40
Moderate use	35	32	54	45	23	30
Low use	36	54	48	30	27	20

The early seral requirements for the moderate use caribou migration corridor have been exceeded for the last decade due to previous harvesting activities. A very large wildfire in the summer of 2014 has drastically increased the early-seral stage conditions in the high use migration corridor.

In the past two years, harvesting and proposed harvesting activities have increased in the low use caribou migration corridor. Based on recent harvesting and currently submitted cutting permits, it is estimated that 48 percent of the CMFLB is now in the < 40 years seral stage condition.

7.4.2 Adjacency, green-up and patch size distribution

Cutblock adjacency and patch size distribution is used to ensure that the structural characteristics left after harvest is consistent with the temporal and spatial distribution of an opening that would result from a natural disturbance. This is an important consideration for values related to hydrology and landscape-level biodiversity.

Requirements for harvesting adjacent to an existing cutblock are set through the Lakes South SRMP and the Forest Planning and Practices Regulation (FPPR).

The Lakes South SRMP includes an objective that identifies the desired range of opening sizes (patch size distribution) to be attained by the end of a rotation. This patch size distribution, by natural disturbance type, is to be achieved within the Lakes South planning area and attempted to be met at the landscape level.

The FPPR, which applies in the Lakes North SRMP area, specifies that timber must not be harvested on a new cutblock unless the tallest trees on a minimum of 75 percent of the net area to be reforested on all existing adjacent cutblocks are at least three metres in height. The FPPR also specifies that the adjacency requirement does not apply to cut blocks larger than 60 hectares when timber harvesting is being carried out to recover timber damaged by fire, insect infestation, wind or for sanitation treatments, or is designed to be consistent with the structural characteristics and the temporal and spatial distribution of an opening that would result from a natural disturbance. Since 2000 about 70 percent of cutblocks harvested have been less than 60 hectares in size, which means that the adjacency requirements from the FPPR are applicable.

In the 2011 AAC determination rationale, the chief forester identified a concern around the hydrological impact of harvesting and the mountain pine beetle infestation. To aid understanding in this AAC determination, the chief forester requested that this timber supply analysis incorporate equivalent clearcut area (ECA) considerations.

In the base case, the adjacency green-up requirements from Table 30 below, will be incorporated in the base case and the ECA values reported. A sensitivity analysis will examine the use of requirements based on specific ECA levels.

Table 30. Cutblock adjacency constraint

Zone or group	Maximum allowable disturbance (% area)	Green-up height (metres)	Land base to which constraints apply
Cutblock adjacency	25%	3 m	THLB, by landscape unit

7.4.3 Landscape connectivity: landscape corridors and landscape connectivity matrix

Landscape corridors are established to link distinct patches of older forests and important ecosystems that facilitate the dispersal of plants and animal species from patch to patch. In the Lakes TSA, landscape corridors have been spatially identified and management objectives have been established through the Lakes North and Lakes South SRMPs.

7.4.3.1 Lakes South

Table 31. Forest cover requirements in the Lakes South SRMP landscape corridors

BEC zone	Analysis units	Minimum area retained (%)	Age for retention (years)	Land base to which constraint applies	Area (hectares)
SBS	Conifer leading	> 70	≥ 70	CMFLB, by legal feature	27 844
ESSF	Conifer leading	> 70	≥ 100	CMFLB, by legal feature	658

The objective set by government for connectivity in the Lakes South SRMP area is to "maintain, within a managed forest setting, landscape corridors dominated by mature tree cover and containing most of the structure and function associated with old forest by: (1) providing habitat connectivity within the landscape and (2) permitting movement and dispersal of plants and animal species". In approved FSPs and operationally, within the landscape corridors this objective is managed by:

- restricting cutblock size to an average of two hectares with opening size not exceeding three hectares. A four hectares average and maximum applies when a corridor is heavily impacted by insect disturbances and beetle control or salvage are the primary management objectives;
- avoiding new permanent access; and,
- maintaining over 70 percent of the CMFLB in the SBS in stands greater than 70 years old and in the ESSF in stands greater than 100 years old.

For the purposes of this timber supply review, a forest cover requirement proxy will be used to reflect the current management practice objective of maintaining 70 percent of the CMFLB in older stands. It will be assumed that cutblock size and new permanent access are to be met operationally without timber supply implications.

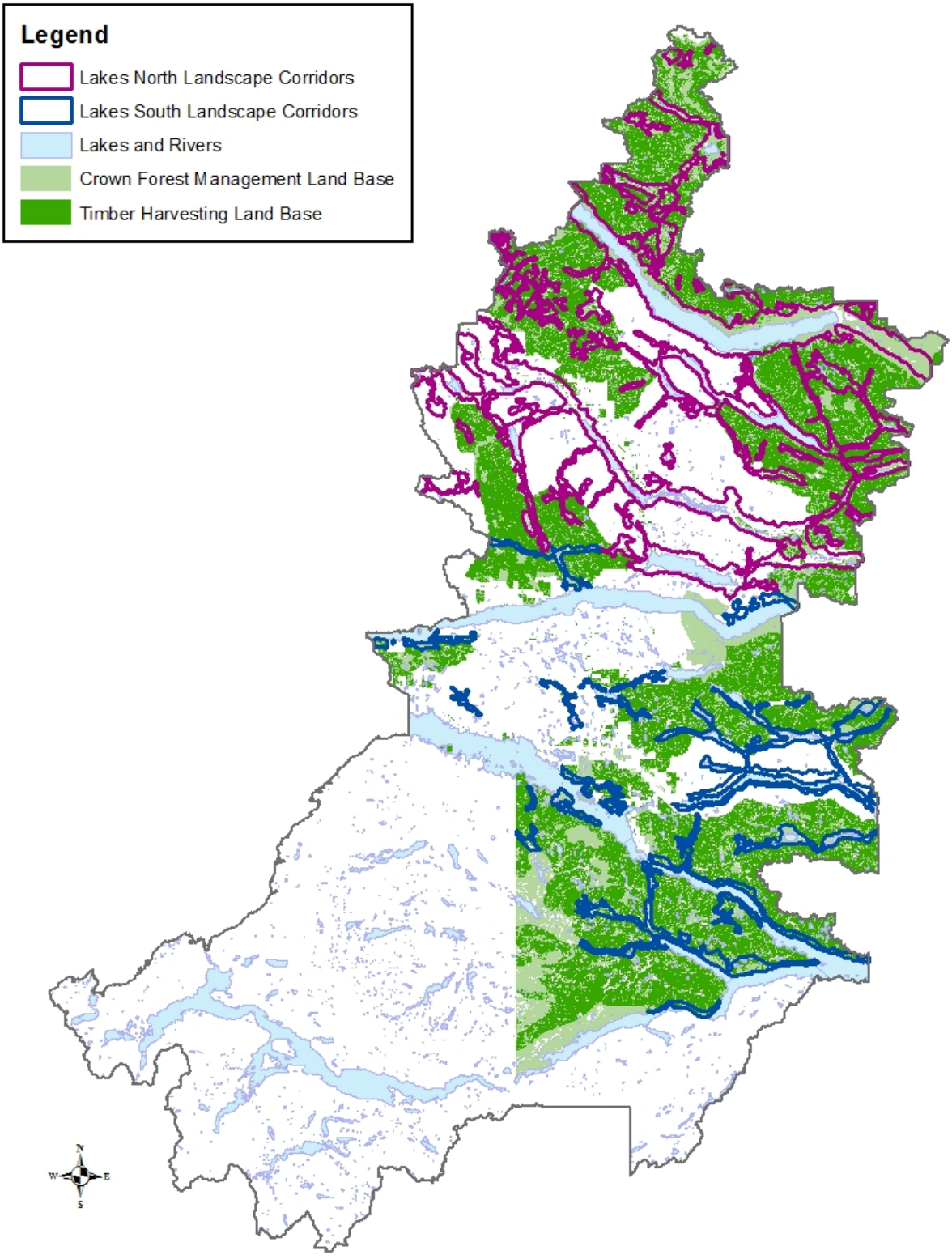

Figure 19. Landscape corridors within the Lakes TSA.

7.4.3.2 Lakes North

In the Lakes North, the objective set by government is, in part, to "maintain habitat connectivity within the landscape connectivity matrix (LCM)". A part of the objective relates to the retention of red- and blue-listed ecological communities and hydro-riparian ecosystems, which is addressed under Section 6.3.4 above. Another part of the objective relates to the maintenance of 70% of the forested area within each LCM feature in a contiguous mature and old forest condition. This requirement is described in Table 32, below.

Table 32. Forest cover requirements in the Lakes North SRMP landscape corridors

BEC zone	Minimum area retained (%)	Age for retention (years)	Land base to which constraint applies	Area (hectares)
SBS	≥ 70	> 100	CMFLB, by LCM feature	50 447
ESSF	≥ 70	> 120	CMFLB, by LCM feature	6 658

7.4.4. Wildlife habitat

The Lakes LRMP identifies areas for the winter survival of moose and deer and the survival of grizzly bear and the *FPPR* requires the conservation of sufficient habitat for these species. For the purpose of this timber supply review, wildlife habitat requirements will be addressed according to the criteria in Table 33, below. These criteria are consistent with the notices issued under Section 7 of the *FPPR* for species at risk in the Nadina Natural Resource District and ungulate species in the Lakes TSA.

Table 33. Forest cover requirements for wildlife habitat

Species	Maximum allowable disturbance (% area)	Minimum green-up age (years)	Minimum retained area (%)	Minimum age for retention (years)	Land base to which constraint apply	Area (hectares)
Deer	≤ 33%	< 17 years			THLB	347
			≥ 50%	> 101 years	CMFLB	1 920
Moose	≤ 33%	< 17 years			THLB	17 234
			≥ 30%	> 101 years	CMFLB	33 818
Grizzly	≤ 33%	< 28 years			THLB	979
	≤ 50%			< 121 years	CMFLB	11 355

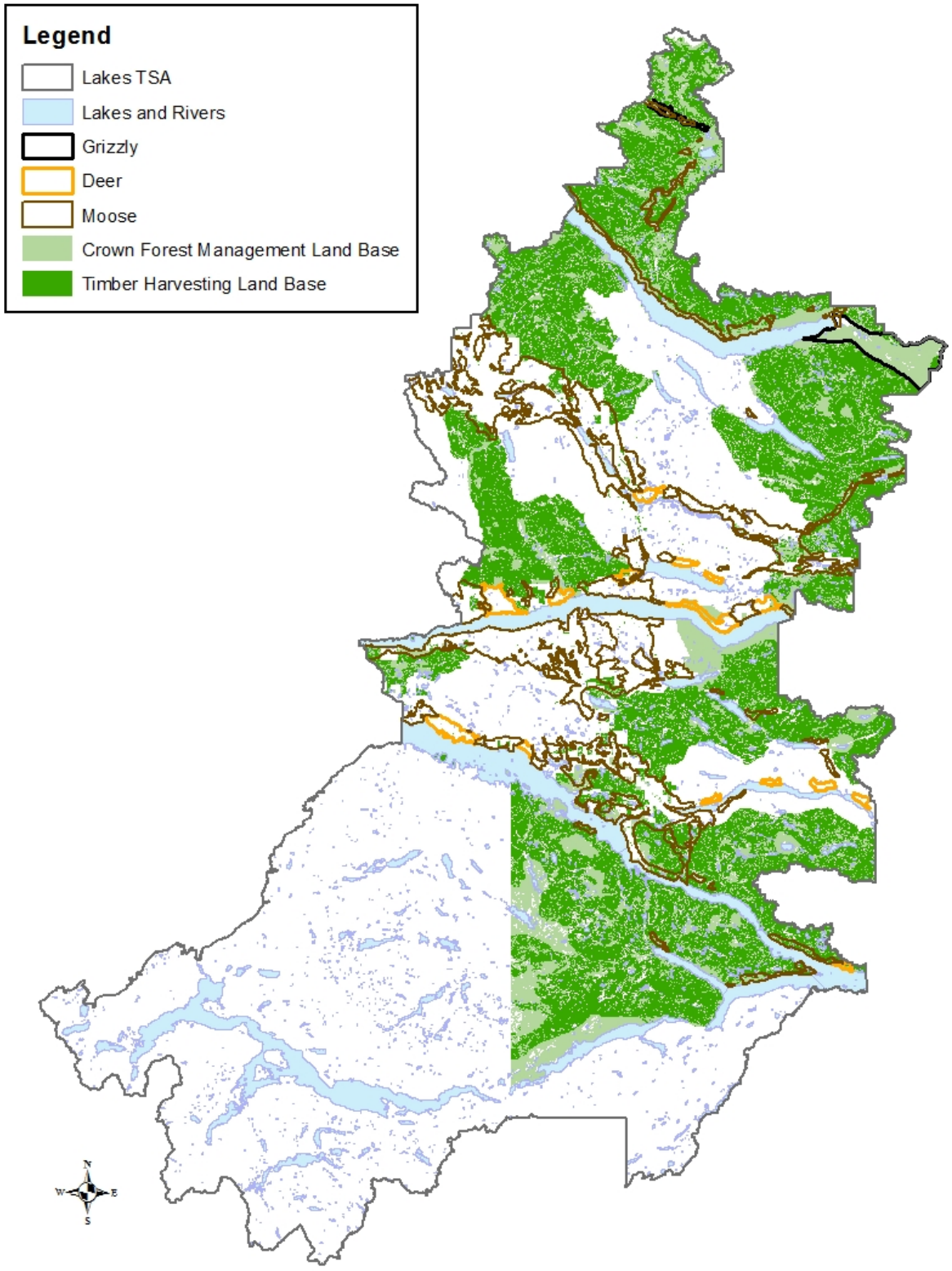

Figure 20. Identified wildlife habitat for deer, moose and grizzly bear within the Lakes TSA.

7.4.5. Visual quality

The spectacular natural beauty of British Columbia is valued by the public and the tourism industry and the Government of British Columbia is entrusted with ensuring that the scenic quality expectations are met.

In the Lakes TSA, a number of valued areas have been designated for visual quality management. Within these areas, visual quality objectives (VQOs) have been established based on physical attributes such as topography and social attributes such as viewer expectations. VQOs ensure that forestry activities are managed so that the size, shape, and location of cutblocks and roads fit with the landscape's natural character.

Established scenic areas in the Lakes TSA, including areas not administered by FLNRO for the purpose of timber supply (e.g., community forests or woodlots), are listed in Table 34 below.

Table 34. Established scenic areas in the Lakes TSA

Scenic areas – Lakes TSA			
Augier Lake	Fleming Lake	Knapp Lake	Sather Lake
Babine Lake	Francois Lake	Knapp Lake East (Trout Lk)	Starr Lake Cluster
Binta Lake	Gale Lake	Knapp Lake NE (Bob Lake)	Sunset Lake
Bird Lake	Gestzuni Lake	Lucas Lake	Takysie Lake
Bulkley Lake	Gullwing Lake	Lund Lake	Taltapin Lake
Camsell Lake	Guyishton Lake	Mackenzie Lake	Tchesinkut Lake
Chaoborus Lake	Haney Lake	Maxan Lake	Tetachuck Lake
Cheslatta Lake	Hannay Lake	Middle River/Takla Lake	Tochcha Lake
Cheslatta Trail	Helene Lake	Ootsa Lake	Uduk Lake
Chief Louis Lake	Henrietta Lake	Ootsanee Lake	Uncha Lake
Day Lake	Highway 16	Pinkut Lake	Whitefish Lake
Eastern Lake	Isaac Lake	Rum Cache Lake	

Note: Burns Lake, Decker Lake, Conrad Lake, Rose Lake, Maud Lake, Crystal Lake are all mapped as part of the Highway 16 Corridor visual quality inventory.

Within a scenic area one or more visual quality objective may apply. A VQO represents the prescribed extent of forest alteration resulting from the size, shape and location of cutblocks and roads. Table 35, below describes the categories of visually altered landscapes that may apply.

Table 35. Categories of visually altered forest landscape

Categories of visually altered forest landscape	Definition
Preservation	Altered forest landscape in which the alteration is: (i) very small in scale, and (ii) not easily distinguishable from the pre-harvest landscape.
Retention	Altered forest landscape in which the alteration, is: (i) difficult to see, (ii) small in scale, and (iii) natural in appearance.
Partial retention	Altered forest landscape in which the alteration is: (i) easy to see, (ii) small to medium in scale, and (iii) natural and not rectilinear or geometric in shape.
Modification	Altered forest landscape in which the alteration is: (i) very easy to see, and (ii) is (A) large in scale and natural in its appearance, or (B) small to medium in scale but with some angular characteristics.
Maximum modification	Altered forest landscape in which the alteration (i) is very easy to see, and (ii) is (A) very large in scale, (B) rectilinear and geometric in shape, or (C) both.

Operationally, the management of visual quality objectives for a scenic area is based on meeting requirements from specific viewpoints (i.e., a perspective view). However, for a strategic modelling, such as timber supply analysis, these objectives must be translated to a planimetric ("plan") view. To model in a plan view visual management specialists in the ministry have developed procedures that are described in the *Procedures for Factoring Visual Resources into Timber Supply Analyses*, and the update bulletin, *Modelling Visuals in TSR III*.

The procedures to translate requirements from a perspective to a plan view make several assumptions. First it is assumed that the height at which a stand is in an acceptable visual condition is dependent on the slope on which the stand is found; the greater the slope the less a tree blocks the view of the stand behind it. Secondly, that given the slope there is a relationship between the perspective and plan views (i.e., a P2P ratio).

For the base case scenario, visually effective green-up (VEG) heights and plan-to-perspective (P2P) ratios will be used to translate visual quality objectives (VQO) to a plan view. These heights and ratios are applied by VQO polygons and weighed by slope classes. Table 36 shows the VEG heights and P2P ratios by slope class that will be used to determine the maximum disturbance requirements within a scenic area.

Table 36. Predicted P2P ratios (with 95% confidence limits) and VEG height by slope classes

Slope	0%	10%	20%	30%	40%	50%	60%	70%
P2P	4.68	3.77	3.04	2.45	1.98	1.60	1.29	1.04
VEG height (metres)	3.0	3.75	4.75	5.75	6.5	7.25	8.25	8.5

Table 37shows the area of each slope class in each VQO polygon within the Lakes TSA (including areas not administered by FLNRO for the purpose of timber supply). Table 38 shows the resulting area-weighted values by VQO.

Table 37. Area of slope classes within VQO classes

VQO	Area (hectare) by slope classes								
	0-5	6-15	16-25	26-35	36-45	46-55	56-65	65+	Total
Preservation	0	0	0	0	0	0	0	0	0
Retention	7 415	24 372	15 151	7 188	3 325	1 583	704	572	60 314
Partial retention	22 640	85 299	44 954	16 732	6 096	2 300	767	425	179 212
Modification	3 224	14 445	6 810	2 628	1 096	435	167	178	28 984
Maximum modification	0	0	0	0	0	0	0	0	0
Total	33 280	124 116	66 916	26 548	10 518	4 318	1 638	1 176	268 510

Table 38. Area-weighed P2P and VEG height by VQO category for the Lakes TSA

VQO	Area-weighted P2P	Area-weighted VEG height (metres)
Retention	3.33	4.49
Partial retention	3.47	4.26
Modification	3.45	4.29

The area-weighed P2P are used to convert the permissible percent alteration in perspective view to permissible percent alteration in planimetric view. Within a VQO there are a range of maximum percent alterations that are dependent on the visual absorption capability of the scenic area. As such, the maximum percent of alteration in planimetric view can also vary depending on which value is used from the permissible percent of alteration in perspective view (Table 39).

Table 39. Maximum percent planimetric alteration by VQO category

VQO	Permissible percent alteration in perspective view	P2P	Maximum percent alteration in planimetric view using minimum percent alteration in perspective view	Maximum percent alteration in planimetric view using mid-point percent alteration in perspective view	Maximum percent alteration in planimetric view using maximum percent alteration in perspective view
Retention	0-1.5	3.33	0	2.50	5.0
Partial retention	1.6-7.0	3.47	5.55	14.92	24.29
Modification	7.1-18.0	3.45	24.50	43.3	62.1

In the base case scenario of the current timber supply review, the maximum percent alteration using the mid-point percent alteration (see Table 39) will be used. The impact of using the minimum or maximum alteration value will be examined under a sensitivity analysis.

Table 40. Forest cover requirements for visual quality in the CMFLB

VQO	Maximum allowable disturbance (% of area)	Minimum visually effective green-up height (metres)	Land base to which constraint applies	CMFLB area (hectare)
Retention	≤ 2.50%	< 4.5 m	CMFLB by VQO polygon	21 281
Partial retention	≤ 14.92%	< 4.3 m	CMFLB by VQO polygon	100 984
Modification	≤ 43.3%	< 4.3 m	CMFLB by VQO polygon	20 122

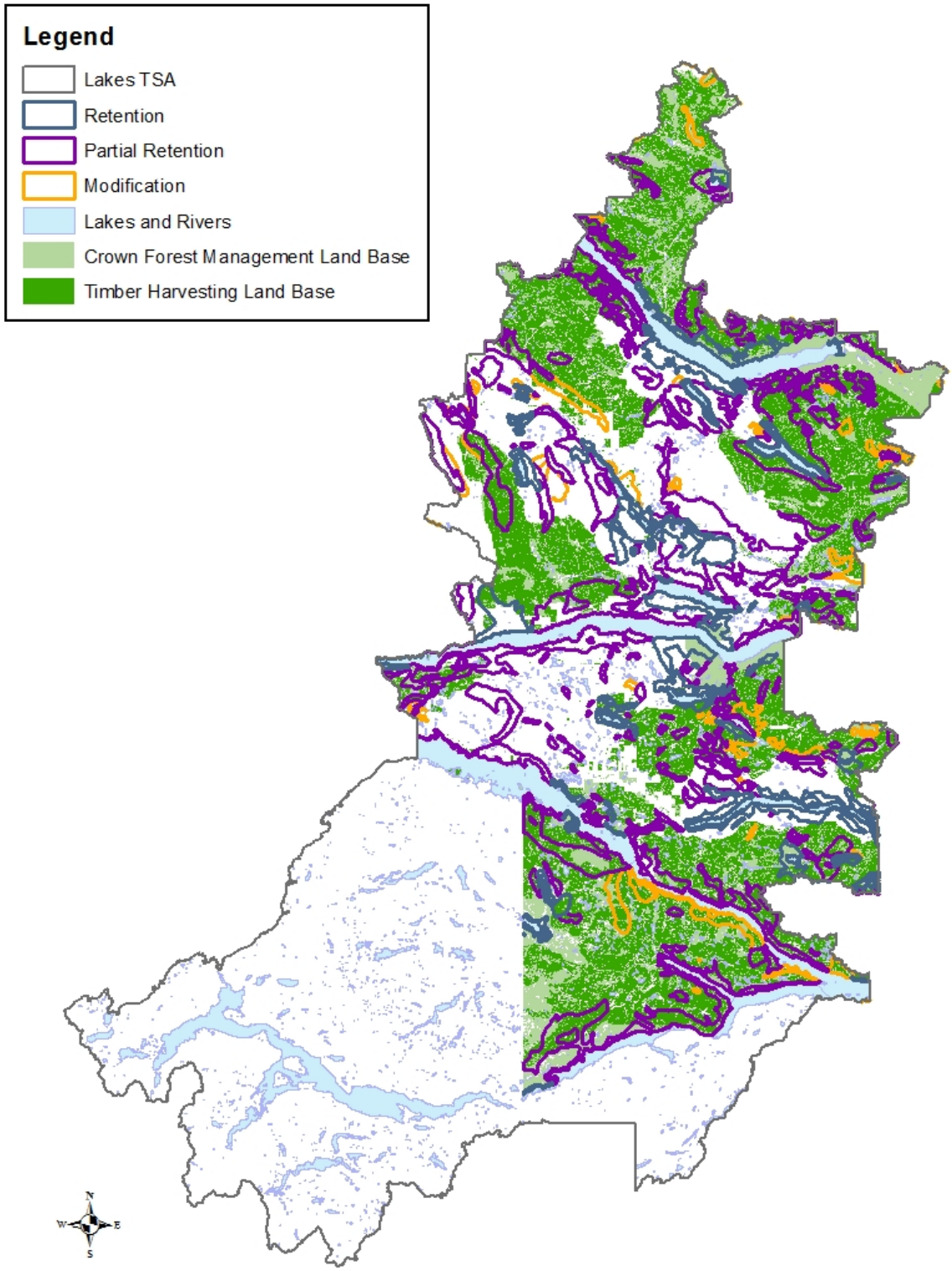

Figure 21. Visual quality objectives within the Lakes TSA.

8. Growth and Yield

Knowledge of the volume available from a forest stand over time is a critical input for timber supply modelling. Growth and yield models are used to generate the volume estimates based on the characteristics of the forest stand.

British Columbia has a strong history in growth and yield modelling. The various models have been important to improving strategic decision making and understanding of the management of British Columbia's forest resources.

For the current analysis, two of the Ministry's growth and yield models will be used. The model VDYP7 was specifically developed to project the mature forest inventory. The model TIPSY, on the other hand, is suitable for projection based on known regeneration characteristics.

To enable modelling of the volume available from a forest stand over time, volume tables are created based on common forest stand inputs, growth characteristics, and the most suitable growth and yield model. Volume tables where detailed input information is available may be based on information at a forest polygon or silvicultural opening level; however, where detailed information is not available (e.g., for future stands) a volume table may reflect an aggregation of stands representing current practice.

8.1 Growth and yield models

8.1.1 Variable density yield prediction model (VDYP7)

The Variable Density Yield Prediction (VDYP7) model, developed by the FLNRO, is an empirical growth model that has been parameterized based on a large temporary (52,000 plots) and permanent (9,300 plots) sample plot database collected from mature natural forests in British Columbia. Decay, waste and breakage estimates are incorporated within VDYP7 and are based on BEC loss factors using a decay sample tree database which consists of over 82,000 trees

VDYP7 is the base model for projecting British Columbia's forest inventory estimates. Input information for the VDYP7 model is based on VRI attributes, typically at the individual forest polygon level.

Information on VDYP is available at http://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/variable-density-yield-projection-vdyp.

8.1.2 Table interpolation program for stand yields (TIPSY)

The Table Interpolation Program for Stand Yields (TIPSY) provides yield tables for single species and even-aged stands based upon the interpolation of yield tables generated by the individual tree growth model Tree and Stand Simulator (TASS). Mixed species yield tables generated by TIPSY are weighted averages of single-species yields and do not directly consider inter-species interactions.

Input information for TIPSY is based on stand initiation characteristics including species, initial density, regeneration method (planted or natural), genetic gain, and potential site index. TIPSY also enables consideration for various silviculture treatments, forest health, and general operational adjustment factors.

Information on TIPSY is available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/table-interpolation-program-for-stand-yields-tipsy.

The Tree and Stand Simulator, version TASS II, developed by FLNRO, is an individual tree level model for commercial species of British Columbia. TASS predicts the potential growth and yield of even-aged and single species stands by modelling individual tree crown dynamics and the crown relationship to bole growth and wood quality. The individual tree and crown focus makes TASS well suited for predicting the response to many silviculture treatments and the exploration of stand dynamics. TASS III is a recently released version that extends TASS into more complex stand structures including multiple-species and multi-age cohorts. However, the currently parameterized species are limited.

Information on TASS is available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/growth-and-yield-modelling/tree-and-stand-simulator-tass.

In the analysis, TIPSY version 4.4 is used. This version uses a database of TASS II generated yield tables.

8.2 Volume table types

Volume tables are an important data input for modelling timber supply forecasts with a forest estate model. Volume tables provide the projection of current forest conditions into the future. These tables may be derived for specific or aggregated forest polygons.

For the Lakes TSA TSR, we are proposing a more traditional aggregation of forest polygons into a smaller number of analysis units.

Existing natural stand analysis units are defined in Table 4. The volume tables for these unharvested analysis units will be a weighted average of individual VDYP7-based volume tables generated for each forest polygon based on its existing forest inventory attributes.

Managed stand analysis units are defined in Table 5 for stands that have been harvested since 1967. These analysis units will use inputs based on an aggregation of RESULTS planting records and associated information to generate TIPSY-based volume tables for the current stands. As the expected forest estate model to be used is Woodstock, an analysis unit can be assigned multiple volume tables that have an associated weight. For example, in Table 5 with the analysis unit MSG, 85% of the stands will have the volume table based on species composition S50P50, 12% S70P30, 2% S50P40B10, and 1% S100.

Table 4 and Table 5 also identify the regeneration input to derive the future volume tables for each analysis unit. This input is based on an aggregation of the RESULTS planting records for managed stands regenerated from 2008 to 2017.

Details about the modelled regeneration assumptions are outlined in Section 7.3.

8.3 Site index

Site index, for a reference age of 50 years, is the most common measure of forest site productivity used in British Columbia. The growth and yield models TASS and TIPSY require potential site index as a required input to develop volume tables.

The Ministry has developed formalized standards for deriving site index for the potential productivity of a site. Site indices based on simpler methods (e.g., age and height relationships for forest inventory photo classification) often have biases that result in difference from the potential site index.

For the base case scenario, potential site indices based on the FLNRO provincial layer of site productivity are used. In the Lakes TSA, the provincial layer is based upon SIBEC-based site index estimates tied to site series from predictive ecosystem mapping (PEM). In the Lakes TSA, a PEM had been completed and approved by the ministry for timber supply analysis. This PEM was completed by licensees under the Innovative Forestry Practices Agreement program.

8.4 Tree improvement

Licensees are obliged to use the best available seed source when regenerating sites with planted stock. As such planted stock may have faster growth than natural trees that may regenerate on the site. The faster growth may be due to either use of high-quality genetically improved seed (Class A seed) obtained through traditional tree breeding within seed orchards or use of seed harvested from superior wild trees (Class B+).

Information on the use of select seed in the TSA and the associated genetic gains are available from the Seed Planning and Registry Application (SPAR) of the Forest Improvement and Research Management Branch (see https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/seed-planning-use/spar). RESULTS information provides a seed source for individual plantations and thus enables linkage to the genetic gain database.

Genetic worth is used as input into the growth and yield model TIPSY for stands. The applicable genetic worth will be calculated based on the aggregation assigned to the volume table. No modelling considerations are made for expected future improvements in genetic worth.

In the Lakes TSA seedlings from genetically improved seeds are planted regularly. Since 2007, 100 percent of the spruce seedlings planted are from class A seeds with an estimated average gain of 20 percent. The planting of genetically improved pine seedlings began in 2009 and about 64 percent of the pine seedlings currently planted are from genetically improved seed with an estimated weighted average gain of nine percent. The average gain for spruce and pine applied to future managed stands was determined by extrapolating orders from planting years 2007 to 2016.

8.5 Operational adjustment factors

Yield projections in TIPSY are based upon potential yields where a site is fully occupied. As 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 dynamic reduction that increases over time and, for example, may reflect a forest health issue that increases as a stand ages. Standard OAF values of 15% for OAF 1 and 5% for OAF 2 are utilized unless localized OAFs have been developed.

In the previous TSR the chief forester accepted a higher OAF 2 value in pine-leading stands to account for higher incidence of rusts.

9. Forest Estate Modelling

9.1 Forest estate model

The forest estate model Remsoft Spatial Woodstock™ will be used for this analysis. Woodstock has been used for the timber supply analysis for multiple management units in British Columbia.

9.2 Base case scenario

The objective of the base case scenario is to provide a baseline harvest flow from which the chief forester can understand the dynamics of timber supply in the management unit given current forest management assumptions. In most TSRs the base case scenario has reflected a harvest flow that initiates from the current AAC and transitions to a mid-term level before moving to a stable long-term level.

Although the AAC had been lowered in the previous AAC determination to address the declining mountain pine beetle infestation, there is no expectation that the current AAC level will be maintained. Several alternative harvest flows based on different initial harvest levels are likely possible given current forest management assumptions. From these alternatives, a base case scenario is selected to represent timber supply dynamics and provide a base for understanding of the timber supply dynamics based on the modelled information. While the base case scenario is a reference point, it needs to be recognized that the AAC determination is an informed decision by the chief forester that considers multiple sources of information.

9.3 Sensitivity analysis

Sensitivity analysis can help to understand the implications of uncertainty around data and management assumptions and can be used to determine which variables have the greatest influence on harvest forecasts. Specific issues can also be investigated to enhance understanding of possible impacts on timber supply. Table 41 lists initial sensitivity analyses that were proposed. As the analysis is an on going process until the determination is finalized, further sensitivity analyses will be completed as needs are identified.

Table 41. Proposed sensitivity analyses

Issue to be tested	Sensitivity levels
General THLB	± 5% of the THLB.
THLB – steep slopes	Include all slopes in THLB; include slopes ≤ 50%
THLB – stream	Assume following stream classes: 2% S2; 16% S3; 13% S4; 3% S5; 38% S6; 28% NCD
THLB – deciduous	Include deciduous-leading stands with site index >5 in the THLB and the deciduous component of mixed stands
THLB – deciduous	Include the deciduous component of mixed stands
Marginally economic stands	Include all low productivity sites with a site index >5
Marginally economic stands	Include stands with < 140 m^3/ha, ≥ 70% pine content and ≥ 90% mortality. Vary criteria to include < 140 m^3/ha, ≥ 70% pine content and ≥ 50% mortality.
Minimum harvestable volume	Increase minimum harvestable volume requirement from 140 m^3/ha to 170 m^3/ha and decrease from 140 m^3/ha to 100 m^3/ha.
Minimum harvestable volume	Remove the requirement for regenerating stands to be at least 80 years of age.
Equivalent clearcut area	Limit the equivalent clearcut area by watershed to 20%, 30% and 50%
Natural disturbance	Set non-THLB to age 21 when it reaches 250 years in SBS and 350 years in ESSF; Set non-THLB age to zero when stands reach 250 years in the SBS and 350 in the ESSF.
Visual quality objective	Use the minimum and maximum point of the permissible percent of alteration in perspective view.

10. Associate Analysis and Reporting

The primary focus of the TSR will be to develop a timber supply analysis of the current TSA land base and forest management practices. The data package is an initial document that describes available information and the direction for future analysis and information collection.

10.1 Timber supply analysis discussion paper

To summarize the results of the timber supply analysis, a discussion paper will be released for public review. Information used in the analysis is described in the data package and updated based on information identified during the consultation, public review and the analysis process.

The timber supply analysis should be viewed as a "work in progress". As such, following the release of the public discussion paper, further analysis may be needed to complete, refine existing analysis, or address issues identified during the consultation and review process.

10.2 First Nations consultation and public review

Information collected through First Nations consultation and public review processes provide important information for the AAC determination. Information received through written and oral presentations are collated and presented to the chief forester. Relevant information received early in the process may be incorporated into timber supply analysis.

10.3 Allowable annual cut determination rationale

The chief forester's AAC determination will be documented through the public release of a written AAC determination rationale. This rationale identifies reasons for the decision and discusses specific considerations; further the rationale provides recommendations where the chief forester has identified deficiencies in information or a need for improved stewardship.

This document, as is the data package and discussion paper, is available on the Government of British Columbia web site at www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut.

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12. Your Input is Needed

Public input is a vital part of establishing the allowable annual cut. Feedback is welcomed on any aspect of this data package or any other issue related to the timber supply review for the Lakes TSA. Comments on the June 2018 draft data package were accepted until August 20, 2018.

A further comment period will be made available following the release of a *Discussion Paper* that outlines the results of the timber supply analysis.

Ministry staff would be pleased to answer questions to help you prepare your response in respect of the Discussion Paper review process.. Please send your comments to the local resource district office at the address below.

You may identify yourself on the response if you wish. If you do, you are reminded that responses will be subject to the *Freedom of Information and Protection of Privacy Act* and may be made public. If the responses are made public, personal identifiers will be removed before the responses are released.

For more information or to send your comments, contact:

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For information on the Timber Supply Review visit the Timber Supply Review & Allowable Annual Cut web site at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut

Further information regarding the technical details of the timber supply review process and timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca