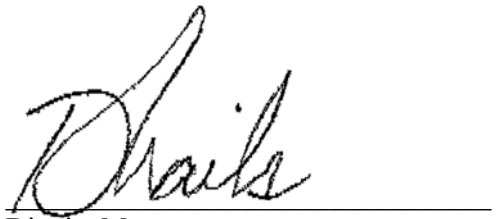
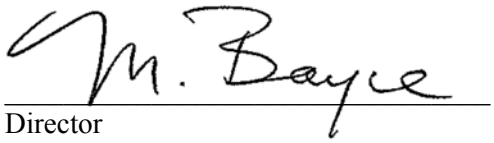
Soo Timber Supply Area
Timber Supply Review

Data Package

September 2008



District Manager
Squamish Forest District



Director
Forest Analysis and Inventory Branch

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1. Overview of the Soo TSA Timber Supply Review (TSR)

Under *Section 8* of the *Forests Act* the chief forester must review the timber supply for each Timber Supply Area (TSA) every five years. Under the same section the chief forester may extend the current allowable annual cut (AAC) up to 10 years if he considers that the AAC is unlikely to change with a new AAC determination. For more information about the AAC process please visit the following internet site: http://www.for.gov.bc.ca/hts/pubs/tsr/tsrbackgrounder.pdf.

In the fall of 2007 First Nations with asserted traditional territories and the forest sector with licensees within the Soo TSA were sent letters inviting comment to start the development of the data package. Interested members of these groups (or their consultants) have met periodically to provide input and review the development of the data package. This document summarizes the basic information and assumptions required for the Soo Timber Supply Area (TSA) timber supply analysis and will be available for public, First Nation and Industry review. The completed data package contains those inputs that represent current performance for the TSA. For the purpose of the timber supply review (TSR), "current performance" can be defined by:

- The Sea-to-Sky Land and Resource Management Plan (April 2008);
- 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;
- fully implemented land-use plans;
- land-use decisions approved by Cabinet;
- orders issued through the Government Actions Regulation of the *Forest and Range Practices Act (FRPA)* for ungulate management*;*
- the order establishing provincial non-spatial old growth objectives and landscape units pursuant to the *Forest Practices Code of British Columbia Act; and,*
- approved higher level plans under the *Forest Practices Code of British Columbia Act.*

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

Each section of this data package includes:

1) A short explanation of the data required;
2) A data table or lists of modelling assumptions;
3) A description of data sources and other comments.

The information in this data package represents the best available knowledge at the time of publication, but is subject to change. A First Nations consultation and public review period has been established to allow submission of comments and concerns about the data package to the Ministry of Forests and Range. Submissions and new information made available prior to the analysis may lead to changes in the data listed in this package. Until the timber harvesting land base (THLB) is determined, it is not possible to finalize the values shown in some of the tables in this document. Where the final value is not yet available, the applicable columns are shaded grey. In addition, should any major changes in management practices occur during the next few months, the timber supply analysis will attempt to capture them. The final timber supply analysis report will include a technical appendix that highlights any changes made to this data package.

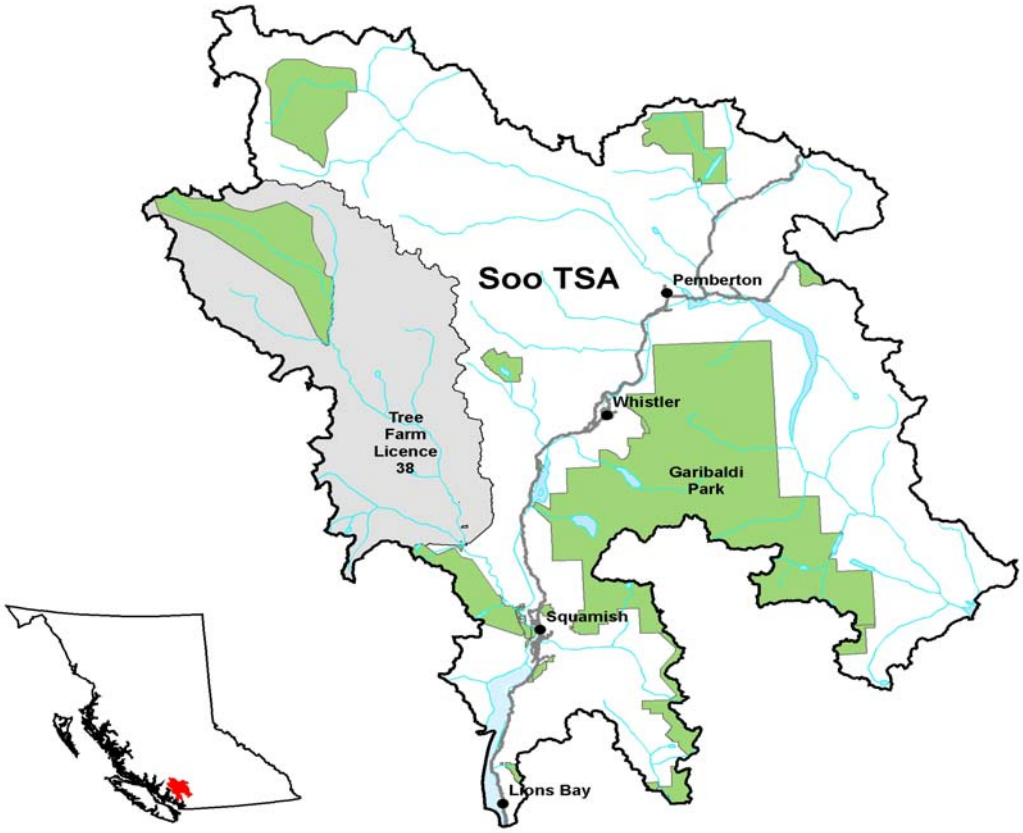

Figure 1. Location of Soo TSA and overview map

Introduction

1.1 Overview of the Soo Timber Supply Area (TSA)

The Soo TSA is located on the south coast of British Columbia, immediately north of the city of Vancouver. The Soo TSA is part of the Coast Forest Region and is administered by the Squamish Forest District in Squamish, which is also responsible for administering TFL 38 to the west of the TSA. In the last timber supply review the size of the Soo TSA was 826 000 hectares with approximately 299 000 (36%) considered productive forest land. The area considered available for timber harvesting was 123 000 hectares; this was 41% of the productive forest land or about 15% of the total area of the Soo TSA. The productive forest and timber harvesting land base is expected to be smaller in this timber supply review as a result of the implementation of the Sea-to-Sky Land and Resource Management Plan (LRMP) as well as land withdrawals resulting from other land use decisions and urban uses.

The Soo TSA closely corresponds to the drainages of the lower Squamish and Cheakamus Rivers, which flow into Howe Sound, and the Lillooet River, which flows into Harrison Lake. The Soo TSA is bounded on the west by TFL 38 and the Sunshine Coast TSA; on the north and northwest by the Lillooet TSA; and on the south by the Fraser TSA. The communities of Lions Bay, Squamish, Whistler, and Pemberton, as well as many smaller communities are located in this TSA.

The Soo TSA has a wide range in climate (from coastal to interior) and elevation (from sea level to 2700 metres). The TSA is ecologically diverse including five biogeoclimatic zones: coastal western hemlock, mountain hemlock, Engelmann spruce-subalpine fir, interior Douglas-fir and alpine tundra. The major commercial tree species within the timber harvesting land base, in order of magnitude are: Douglas-fir, balsam, hemlock, cedar, spruce, cottonwood and pine. After harvest, most stands are expected to be regenerated to the same species, except the better hemlock and balsam sites, which will be mostly regenerated to fir, cedar and spruce.

The mature forests of this TSA support about 130 wildlife species that depend on the characteristics of older forests. These include four species of amphibians, five species of reptiles, 93 species of birds and 28 species of mammals (excluding big game species). Big game species found in the Soo TSA include grizzly and black bears, moose, mule and black-tailed deer, mountain goat, cougar and gray wolf.
Forested areas are home to bird species such as the northern spotted owl, northern flicker, hairy woodpecker and various songbirds. The spotted owl is designated as an endangered species in Canada and is known to occur within the Soo TSA. Clearcut areas provide habitat for blue grouse, hairy woodpecker, cedar waxwings, and songbirds. The nutrient-rich, protected waters of the Squamish estuary provide shelter for various ducks, swans, geese and gulls. In addition, the many fish-bearing waters support a range of predators including the common merganser, Barrow's goldeneye and bald eagle. Portions of the Soo TSA are also within the range of the marbled murrelet.

Four major river systems support salmon species (sockeye, coho, chum, pink and chinook), other salmonids (such as steelhead, cutthroat trout, kokanee, rainbow trout, bull trout, mountain whitefish and Dolly Varden char) and non-salmonids (such as sculpin and stickleback). Valuable fish streams are present in the Soo TSA; however, in some instances, fisheries potential is limited by rapid stream flow, extreme flow variation, and low temperatures and nutrients that are a function of the climate and rugged terrain in the area.

The region has experienced one of the highest population growth rate in the province. Larger communities located in the Soo TSA include Squamish, Pemberton, Whistler, and Lions Bay. Tourism is by far the largest employer in the Soo TSA. Other important economic sectors include the construction, forestry and the public sector.

One of the most significant change to the Soo TSA since the last timber supply review is Cabinet approval (May 2008) of the Sea-to-Sky Land and Resource Management Plan (LRMP). The LRMP provides current and future direction and guidance for the development of the entire Squamish Forest District. It is important to note that the timber supply review follows the direction of the LRMP.

The current AAC for the Soo TSA, which came into effect October 1, 2000, is 503 000 cubic metres. A partition of at least 90 000 cubic metres (17.9%) was specified as attributable to helicopter-operable land base. In

March of 2004 the chief forester postponed the next AAC determination to no later than September 30, 2010 under Section 8(3.1) of the *Forests Act*.

1.2 Sea-to-Sky Land and Resource Management Plan (LRMP)

The Sea-to-Sky Land and Resource Management Plan (LRMP) is a sub-regional land use plan covering approximately 1 091 000 hectares to the north of Greater Vancouver and east of the Sunshine Coast. The area coincides with the boundaries of the Squamish Forest District and includes the Soo TSA and TFL38. The LRMP provides direction for future planning and management of natural resources, and a framework to resolve land use issues. The Sea-to-Sky LRMP process is consistent with provincial government policy for land-use planning. The LRMP is built upon the outcomes of government-to-government discussions between the Province and First Nations, and on recommendations put forward by a public planning forum representing a range of resource sectors.

The Minister of Agriculture and Lands approved the Sea-to-Sky LRMP in April 2008. Copies of the LRMP can be obtained from the Surrey office of the Integrated Land Management Bureau or online at: http://ilmbwww.gov.bc.ca/lup/.

1.2.1 Overview of management direction

The LRMP contains two levels of management direction that, taken together, reflect an overall vision for land use and resource management in the plan area:

- General management direction which applies to the land and resource values throughout the plan area; and
- Area-specific direction to address the values for particular land use zones.

1.2.2 General management direction

The LRMP provides general management direction under sixteen headings (access, cultural heritage values, forest health, recreation, riparian and aquatic habitats, water, wildfire management, wildlife and biodiversity, bald eagle, deer, moose, mountain goat, grizzly bear, marbled murrelet, spotted owl, and visual quality). These categories are intended to reflect the interests, needs and values of all users and are intended to complement each other.

The general management direction applies to all resources and activities throughout the plan area, within the context of other legislation, policies, processes, operational guidelines, and land use agreements with First Nations.

1.2.3 Land use zones

Land use zones in the Sea-to-Sky plan area include:

- The All Resource Uses Permitted Zone, which includes the Frontcountry Area and Cultural Management Areas;
- Wildland (Mining/Tourism Permitted) Zones; and
- Protected Areas, which include existing Parks and new Conservancies.

All Resource Uses Permitted Zone

The All Resource Uses Permitted Zone is the largest land use zone in the Plan Area. Within this zone a range of resource uses and activities may be considered, subject to existing legislation, policy, and land use agreements with First Nations.

There are two specific sub-areas within the All Resource Uses Permitted Zone:

- The Frontcountry Area follows the major transportation corridors in the Plan Area. The Frontcountry Area is recognized as the gateway through which all visitors to the region pass and where the majority of residents make their home. The Frontcountry Area has intensive public and commercial recreational use. Visual quality and recreation are the primary values managed in the Frontcountry Area.
- Cultural Management Areas are the outcomes of government-to-government discussions between the Province and First Nations. Cultural Management Areas have high First Nations cultural values, and

development and use of these areas must be conducted in a manner that protects First Nations cultural values and ecological integrity, and must be consistent with the management direction contained in the land-use agreements with First Nations.

Wildland (Mining/Tourism Permitted) Zones

Wildland (Mining/Tourism Permitted) Zones ("Wildland Zones") have been identified in recognition of their First Nations cultural values, high wildlife habitat values, backcountry recreation values, and remote, natural, wilderness characteristics. Wildland Zones are intended to permit tourism and subsurface resource development while maintaining these values. Commercial timber harvesting is not allowed, nor is the infrastructure of independent power projects (IPPs), including but not limited to commercial run-of-river hydroelectric power generation (waterpower IPPs).

One of four emphases has been assigned to individual Wildland Zones to reflect their primary resource value(s):

- Cultural: First Nations spiritual, cultural, and traditional renewable resource harvesting activities.
- Recreation: Non-commercial (public) recreational activities.
- Tourism: Commercial recreational (guided adventure tourism) activities.
- Wildlife: Functional habitat for wildlife.

Area-specific management direction may be provided for individual Wildland Zones. Management direction for Cultural Wildland Zones is an outcome of government-to-government discussions between the Province and First Nations.

Protected Areas (Parks and Conservancies)

Existing Parks*:* Existing provincial parks were identified prior to the initiation of the LRMP development process, and were not discussed as part of the public planning process or government-to-government discussions with First Nations.

Conservancies*:* There are eight Conservancies in the LRMP area. In order to protect the high value of these areas to First Nations and the public, industrial resource development activities such as commercial logging, mining, hydroelectric development, and new roads are not permitted. Government-to-government agreements with First Nations specify interim strategic management direction for individual Conservancies and this management direction is included in the LRMP. More detailed management direction will be defined through collaborative Conservancy management planning between the Province and First Nations, and may identify certain other uses and activities as acceptable.

The creation of the Qwalímak / Upper Birkenhead Conservancy resulted in isolated pockets of Crown land between the Conservancy and the existing Birkenhead Lake Provincial Park. The boundary of Birkenhead Lake Provincial Park was extended to fill these small gaps.

1.3 First Nations

Seven First Nations have asserted traditional territories in the Soo TSA. The Squamish, In-SHUCK-ch, which consists of 3 bands, the Douglas, Samahquam and Skateen, the Lil'wat (Mount Currie) and the N'Quatqua (Anderson Lake Band) all have well-established communities within the TSA. The Tsleil-Waututh has reserve land in the Soo TSA. The Musqueam and Sto:lo, while not resident, have also historically asserted interest in the Soo TSA.

Five of the seven First Nations have Forest and Range Agreements which contain offers of a forest tenure within the TSA. In addition, the Squamish, In-SHUCK-ch Lil'wat and Tsleil-Waututh have also purchased tenure from licensees.

First Nations currently control 36% of the AAC in the Soo TSA. Additionally some First Nations are employed in forestry activities, such as timber harvesting, processing and silviculture. Through increased involvement in the forest sector, First Nations have greater involvement in both forest management and management of cultural heritage resources.

Government to Government discussions in the Sea-to-Sky area resulted in the following agreements between the Province and individual First Nations:

In-SHUCK-ch Nation

The In-SHUCK-ch Nation and the Province signed a Strategic Land Use Planning Agreement on July 6, 2007. The In-SHUCK-ch Nation and the Province will continue to work collaboratively on a government-to-government basis on matters related to the implementation of the Agreement and the LRMP.

The In-SHUCK-ch Nation was at Stage 5 of the Treaty process at the time that the Sea-to-Sky LRMP was approved.

Lil'wat Nation

The Lil'wat Nation and the Province signed an Agreement on Land Use Planning in April 2008. The Agreement includes new strategic zoning and management direction to harmonize Lil'wat cultural, economic, and conservation interests with the LRMP. The Agreement also includes provisions for processes and projects, such as a small-scale forestry program, added protection for old growth and sensitive ecosystems, and commercial recreation development opportunities. The Lil'wat Nation and the Province will continue to work together on matters related to the implementation of the Agreement and the LRMP.

The Agreement identifies A7x7ūlḿecw (Spirited Ground) Areas, which are places of high cultural value. When a developer/proponent encounters an A7x7ūlḿecw (Spirited Ground) Area, the Lil'wat Nation requests that the developer/proponent contact the Lil'wat Lands and Resources Department to gain knowledge of the specific interests associated with the area.

The Agreement did not resolve land use zoning and management direction for the Mkwal'ts / Ure Creek Area at the time of LRMP approval. The Lil'wat Nation and the Province will continue to seek a resolution on this area. While these discussions continue, resource management will be guided by existing direction as defined in the LRMP. If a resolution is reached, the LRMP will be amended to reflect the new management direction.

Squamish Nation

The Squamish Nation and the Province signed an Agreement on Land Use Planning on July 26, 2007. The Agreement outlines jointly agreed management direction for those portions of the Squamish Nation territory within the Sea-to-Sky Plan Area. The Agreement contains management direction for Kwékwayex Kwelháynexw ta Skwxwú7mesh Temíxw (Squamish Nation Wild Spirit Places) which did not become conservatories, Síiyamin Síiyamin ta Skwxwú7mesh (cultural sites), Úxwumixw (village sites) and Skwxwú7mesh-úhl Snewáyelh (cultural training areas). It also provides recommendations for commercial recreation zoning.

The Squamish Nation and the Province will continue to work collaboratively on a government-to-government basis on matters related to the implementation of the land use agreement and the LRMP.

Tsleil-Waututh Nation

The Tsleil-Waututh Nation and the Province signed a Partnership Agreement to develop an Integrated Land and Resource Management Plan for the Indian River Watershed on December 9, 2005. The Indian River Watershed Integrated Land and Resource Management Plan will be guided by the Tsleil-Waututh Nation's vision for the watershed and the Province's general framework for strategic land use plans. The plan will address the interests of the Nation, the Province, and other stakeholders in the Indian River

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

These assumptions reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and is used as a reference to which other development scenarios are compared. While there may be uncertainty associated with the assumptions used to develop the base case, these assumptions are qualitatively examined by conducting sensitivity analysis (see Section 7).

2.2 Statement of major forest management considerations and issues

The following table lists major forest management issues and considerations. Where possible, the issues will be assessed directly in the timber supply analysis. If the issue does not fall within the definition of current management as described in Section 1, the related timber supply impacts will be assessed in a sensitivity analysis. There may be significant uncertainties in defining some current management issues. In such cases, sensitivity analysis can assist in assessing the potential timber supply implications and assigning degrees of risk to timber supply during the allowable annual cut determination.

Table 1. Major forest management considerations

Issue	Description
Landscape Level Biodiversity	Legal landscape unit (LU) boundaries and biodiversity emphasis objectives (BEO) have been determined.
Old Growth Management Areas (OGMAs)	Most landscape units have approved OGMAs. MFR notes reasonable certainty in the draft OGMAs. Both approved and draft OGMAs will be used in the base case.
Spotted Owl Management Plan	In May 1997 government approved the Spotted Owl Management Plan (SOMP) for the Chilliwack and Squamish Forest Districts. The Operational Guidelines Component outlines the attributes, amount and distribution for spotted owl areas. Resource Management Plans (RMPs) have been approved for Special Resource Management Zones (SRMZs) 14 (Douglas), 15 (Glacier and Tuwasus), 17 (Lilooet Lake) 18 (Birkenhead) and 21 (Squamish). The 1997 plan did not require RMPs to be completed for SRMZ 19 ((Wedge/Green) and SRMZ 20 (Cheakamus). In 2004, the Ministry of Environment issued notices to licensees requiring them to incorporate Results or Strategies consistent with the RMPs into their Forest Stewardship Plans. The management strategies contained in the RMPs will be incorporated into the base case. As part of the SOMP, two matrix activity centres outside of SRMZs were also established in the Soo TSA. These matrix activity centers follow a 50-year phase-out strategy. This is to ensure that some suitable owl habitat remains in the areas while the younger stands in the adjacent SRMZ's, 15 and 17, develop into suitable habitat. While no special forest practices are required within these matrix activity centres, they must be harvested in a manner that attempts to maintain spotted owls for as long as possible. This includes prioritizing forests located in the periphery of the activity centre before harvesting closer to the nest site and minimizing forest fragmentation. The rate of cut at which matrix activity centres are phased out closely resembles the rate at which suitable habitat will be restored within SRMZs. Currently the 2006 Recovery Action Plan is reviewing habitat strategies. Should this result in change, impacts will be reported to chief forester at the time of his AAC determination.
Ungulate Winter Range	In 2003, order Ungulate Winter Range (UWR) # U-2-002 was established for goat. In 2005, order UWR U-2-005 was established for moose and black tailed deer. Prescribed management practices will be included in the base case

(continued)

Table 1. Major forest management considerations

Issue	Description
Grizzly Bear Habitat	Wildlife Habitat Areas (WHAs) have been approved for WHAs 2-172 to 2-175, 2-177 to 2-193, 2-204, and 2-254 to 2-270. Grizzly Bear Recovery Plans are being developed, however results will not be available for use in this timber supply analysis.
Over-Wintering Bald Eagle Habitat	The Sea-to-Sky Land and Resource Management Plan requires best management practices to meet the objectives for maintenance of key bald eagle over-wintering habitat elements, including forage and roosting attributes, as well as functional areas of bald eagle habitat within the plan area. The habitat tends to be located in riparian reserve areas and therefore have no impact on timber supply.
Coastal Tailed Frog	Coastal tailed frog habitat has been identified and Section 7 notice is in effect where the current practice is to exclude these areas from harvest.
Marbled Murrelet	The Marbled Murrelet Recovery Plan is being updated. Draft (2008) WHAs have been identified and the current practice to exclude these areas from harvest.
Riparian Management	A predictive geographic classification model has been used to assign stream classifications which have prescribed management regimes. Lakes and wetlands already have assigned classifications with prescribed management regimes.
Community Watershed	For the purpose of defining riparian management areas all streams within community watersheds are assumed to be fish bearing. There are 23 community watersheds within the Soo TSA. The Sea-to-Sky LRMP provides management direction within specific community watersheds and community water supply areas In the analysis the operational practices will be modelled as a forest cover constraint as recommended in *Community Watershed Guidebook*.
Visual Landscape Management	Grandfathered scenic areas and VQO management pursuant to FRPA will be used in the base case. The grandfathered areas are covered by the Sea-to-Sky LRMP and 3-corridors landscape inventories. These inventories reasonably correspond to the approved areas in the LRMP. Revised visual resource management strategies are being developed for the Front Country zone and the In-SHUCK-ch territory areas. When they are approved these areas will be included in the base case.
Sea-to-Sky LRMP	The Sea-to-Sky LRMP was approved April 2008 and is a sub regional land use plan covering the crown land within the Squamish Forest District. The plan provides direction for planning and management of natural resources. The base case follows the directions set out in the LRMP. Strategic Land Use Planning Agreements (SLUPA) are in place for the In-SHUCK-ch, Lil'wat and Squamish Nations. The SLUPAs provided direction for land use zoning within the LRMP area. A Partnership Agreement to develop a Sustainable Resource Management Plan (SRMP) has been signed with the Tsleil-Waututh-Nation.

(continued)

Table 1. Major forest management considerations (concluded)

Issue	Description
Operability	Operability consists of two distinct zones; conventional and helicopter logging zones. The criteria to develop the operability mapping was defined in the last timber supply review (TSR 2).
Archaeological Sites	Archaeological Overview Assessment (AOA) are used to identify potential archaeological sites which include cultural, habitat and historic sites. When field verified the areas are excluded from logging.
Site Index Adjustments (SIA)	Results from a Douglas-fir and hemlock SIA project will be applied to applicable post-harvest stands. Results from the cedar component of the project-may not be available for use in the base case but impacts will be evaluated via a sensitivity analysis. A Terrestrial Ecosystem Mapping project is underway and results will be ready for the next timber supply review.
Vegetation Resource Inventory	A phase I and phase II inventory is currently underway. Results will be ready for the next timber supply review.
Urbanization of the Soo TSA	The Soo TSA provides many cultural, ecological, economic and social opportunities. The LRMP was developed to provide long-term sustainability of these values. The LRMP process includes monitoring and making amendments to incorporate mandated projects (e.g., grizzly bear recovery plan) and future direction from government or it's agencies. Changes or updates will be reflected in future timber supply reviews.

3. Inventories

3.1 Background information

The following are the major data sources that have been consulted during this timber supply review.

Table 2. Inventory information

Data	Source	Date of compilation or last update	Scale
Forest cover (Rollover to VRI format)	MFR	2001 (Projected to 2007)	1:20,000
Ownership	MFR	TFL/Timber Licenses/Woodlots/Parks – Other areas – 1997 2007 Update MFR 2008	1:20,000
TSA Administrative Boundary	LRDW	2008	
Inventory disturbance Update – Non standard Overlay	MFR	2008	1:20,000
Updated Visual Quality Classes	LRDW	2008	1:20,000
Landscape Unit Boundaries	LRDW	2008	1:20,000
Biogeoclimatic Classification	LRDW	2008	1:250,000
Operability mapping	MFR	2001	1:20,000
Archeological Data — Known sites only	MFR	2001	1:50,000
Community Watershed	LRDW	2008	1:20,000
Spotted Owl SRMZ and Matrix Areas	ILMB	2008	1:20,000
Wildlife Habitat Areas (WHAs)	LRDW	2008	1:20,000
Proposed WHA – Tailed Frog	Terminal Forest Products	2007	1:20,000
Proposed WHA – Marbled Murrelet	ILMB	2008	1:20,000
Proposed WHA – Grizzly Bear	ILMB	2008	1:20,000
Ungulate Winter Range	LRDW	2008	1:20,000
Riparian Management	ILMB/MFR	2008	1:50,000

(continued)

Table 2. Inventory information (concluded)

Data	Source	Date of compilation or last update	Scale
Roads and Transmission Lines	LRDW	2008	1:20,000
Wildlife Tree Patches	FSP	Yearly	1:20,000
Old-Growth Management Areas (OGMAs)	ILMB	2008	1:20,000
Proposed OGMAs	ILMB	2008	1:20,000
Botanical Forest Products	BCTS	2008	1:20,000
Sea-to-Sky LRMP Land Use Zones	ILMB	2008	1:20,000
Recreation Features	ILMP - FIP	2001	1:20,000
Woodlots	LRDW	2008	1:20,000
Timber Licenses	LRDW	2008	1:20:000

Data source and comments:

Many GIS layers or themes go into the development of the land base and management zones for the timber supply analysis. The above table shows the major layers. A more comprehensive table is available from the Forest Analysis and Inventory Branch, MFR.

4. Division of the Area into Management Zones

4.1 Management zones and tracking of multiple objectives (grouping)

The concept of management zones is used to differentiate areas with different management objectives. For example, a zone may be defined as an area which has a common harvesting system, silviculture system, or visual quality objective. The computer simulation model enables the tracking of multiple objectives on the forested land base. In addition, the non-contributing forest (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives. Further information on the forest cover requirements to be applied to these areas can be found in Section 6.4.

Table 3. Objectives to be tracked

Objectives	Inventory definition
Cutblock adjacency	Non-visual areas modelled by cutblock size distribution by landscape unit.
Visuals	Visual polygons modelled by visual sensitivity classes (VSC) and assigned visual absorption capacities (VAC). VSC include preservation, retention, partial retention, modification and maximum modification. VAC include low, medium and high.
Deer, moose and goat winter range	Deer, moose and goat winter ranges are designated as retention or rotation management zones. Retention zones excludes timber harvesting and is applicable to all three species. Deer have rotation zones where modified harvesting practices are permitted. Moose have areas that are designated as forage zones and there are some restrictions on harvesting activities but have no further impact on modelling timber supply.
Botanical forest products	Mapped as an unique management zone in the Blackwater Pine Management Area. Modified harvesting practices are permitted.
Spotted Owl Special Resource Management Zones (SRMZs) and matrix areas	A key component of SOMP is the retention of 67% mature and old forest in each of the Long-Term Activity Centers (LTACs). Within each of the LTACs a minimum of 67% of the gross forested area is managed as Long-Term Owl Habitat Areas (LTOHAs). Outside the LTOHA a maximum 33% of the gross forested area in each LTAC is managed as Forest Management Areas (FMA). The FMAs are further subdivided into Heavy Volume Removal (HVR) and Replacement (RP) areas. Modified harvesting is now permitted in the HVR areas and over the next 50 years, in the RP areas. Practices are discussed in more detail in Section 6.4.3, Wildlife Forest Objectives. Outside of the SRMZ areas are two matrix areas which follow a 50-year phase-out period.. A modified rate of cut is permitted and discussed in more detail in Section 6.4.3, Wildlife Forest Objectives.

(continued)

Table 3. Objectives to be tracked (concluded)

Objectives	Inventory Definition
Community watersheds	Community watersheds have been identified and modified harvesting practices are permitted.
Landscape units, biodiversity emphasis options (BEOs) and biogeoclimatic (BEC) inventory.	Provincial BEC inventory and established landscape units and BEOs. Approved and Draft OGMA will be used in the base case.
Heli-logging	Operability code 'H'. Additional area identified as per survey through previous harvesting practices.

4.2 Analysis units

Existing natural stands yields will be modelled for each stand polygon based on the stand attributes (e.g. age, height and site index). After the natural stands have been harvested they are grouped into analysis units by similar stand attributes (e.g. species, site index). Using the average stands attributes one yield table is created for each analysis unit.

A site index adjustment project has been completed for Douglas-fir- and hemlock-leading stands. Post-harvest site indices have been assigned to these stands which will be used to develop managed stand yield tables.

Yield tables for existing natural stands are derived using the Variable Density Yield Projection (VDYP) model. Recent plantations and future stands have their yield tables derived using the Table Interpolation Program for Stand Yields (TIPSY) model.

Table 4. Definition of analysis units

Analysis unit	Inventory type groups	Site index range (metres)
Douglas-fir (Fd) – Good	1 –- 8	≥ 26
Douglas-fir (Fd) – Medium	1 – 8	20.0 to 25.9
Douglas-fir (Fd) – Poor	1 – 8	< 20
Cedar/Spruce (Cw/Sw) – Good/Medium	9 – 11, 21-25	≥ 20
Cedar/Spruce (Cw/Sw) – Poor	9 – 11, 21-25	< 20
Hemlock/Balsam (Hw/Ba) - Good	12 – 20	≥ 25
Hemlock/Balsam (HwSw) – Medium	12 – 20	20.0 to 24.9
Hemlock/Balsam (Hw/Sw) – Poor	12 – 20	< 20

Data source and comments:

All site index ranges are draft and will be finalized once the data set for the analysis has been produced.

The site index refers to the height of the tree in metres when its breast height age is 50 years.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

This section outlines the steps used to identify the timber harvesting land base (THLB) (i.e., the productive forest expected to support timber harvesting) within the Soo timber supply area. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the Forest Service for timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes (e.g. non-forested areas); or
- it is unavailable for timber harvesting (e.g. recreation areas).

Land may also be added to the timber harvesting land base:

- by management activities which improve productivity or operability (e.g., areas classified as non-commercial brush that are re-habilitated); or
- by the acquisition of productive forest land (e.g., timber license reversions).

The timber harvesting land base for the Soo TSA is determined by separating out the following areas, which do not contribute to timber harvesting in the area:

- land not administered by the forest service for the purpose of timber supply.
- non-forest types.
- environmentally sensitive areas (ESA).
- inoperable forest.
- sites with low timber growing potential.
- unmerchantable forest types or problem forest types.
- roads, trails and landings.
- specific known cultural heritage resources which result in areas being unavailable for timber harvesting.
- riparian management areas. These include riparian reserve and management zone considerations.
- specific wildlife habitat or ungulate winter range areas considered unavailable for timber harvesting.
- sites with adequate productivity but possessing low projected volume.
- specific old-growth management areas. See Section 5.2.14.
- wildlife tree retention.

The above categories apply to land where no harvesting is anticipated to occur. Forest cover requirements are used in cases where some level of harvesting is permitted.

After all the areas that do not contribute to the timber harvesting land base have been identified the resulting area is defined as the current timber harvesting land base for the TSA.

5.2 Details on land base classification

5.2.1 Land not administered by the BCFS for timber supply purposes

A spatial ownership/tenure coverage for the entire TSA has been developed. Excluded from the timber supply analysis are land not administered by the BCFS for timber productions which include areas that are not provincial Crown land and provincial Crown land not used for timber production. Examples of these areas are community forest agreement areas, Indian reserves, municipal land, parks, conservancies, private land and woodlots. Parks and conservancies are listed in Appendix I.

Although they are not part of the Crown forest timber harvesting land base; conservancies, parks and areas constrained for wildlife habitat purposes contribute towards meeting biodiversity forest cover objectives.

5.2.3 Land classified as non-forest

Areas classified as "non-treed and vegetated" (VN) as well as alpine, wetland, lakes, rocks, shrubs etc. are removed from the land base considered available for timber supply. The exceptions are harvested areas that have little or no trees which are scheduled to be regenerated in the near future.

5.2.4 Land classified as Crown forest

Crown provincial forest designated as 62-C (forest management unit), 69-C (forest reserves) and 70-N (Timber Licence areas reverted back to 62-C). The timber harvesting land base is determined after accounting for the areas not available for timber harvesting.

5.2.5 Exclusion of geographically defined areas

Two areas where management excludes timber harvesting activities and not accounted for in the inventory are:

- East Howe Sound (region 9, compartment 86) has limited harvesting chances and would most likely require helicopter logging. This type of harvesting would require timber to be flown over highways and railroads and for public safety reason, are excluded from the timber harvesting land base.
- Whistler Local Resource Use Plan (LRUP) excludes timber harvesting activities within the old Whistler municipal boundary. This area is likely to become a community forest in the future.

5.2.6 Roads and transportation

Most major roads and transportation corridors (e.g. hydro lines) are represented as polygons in the inventory file and already removed as non-forest. To account for adjacent right-of-way an additional 10-buffer was applied to both sides of the polygon.

Highway 99 and railroads are defined by linear lines. On both sides of the lines, a 20-metre and 15-metre buffer has been applied for highways and railroads, respectively. These buffers also account for right-of-ways and are removed from the potential timber harvesting land base.

The existing primary and secondary road inventory has been updated. Roads are represented as linear features and a 10-metre buffer has been applied to all roads. The buffers are removed from the potential timber harvesting land base.

Futures roads have yet to be determined. A roading program will generate future access during the running of the timber supply harvesting program.

The amount of area removed for existing and future roads will be reported in the timber supply analysis report.

5.2.7 Riparian reserve and management zones

Detailed stream inventories are not available for most of the Soo TSA, therefore streams were classified as per the *Riparian Management Guidebook* using a combination of available stream inventories and Terrain Resource Information Management (TRIM) maps. The no-harvest areas have been mapped as a non-standard geographic information system (GIS) file. Table 5 notes below outline the stream categories and the buffer widths that have been applied to each side of the rivers and streams.

Table 5. Riparian reserve and management zone buffer widths for river and streams

River/stream class	Reserve width (metres)	Management zone width[a] (metres)	GIS buffer width (metres)
S1 large rivers	0	100	50
S1 fish streams	50	20	60
S2 fish streams	30	20	40
S3 fish streams	20	20	30
S4 fish streams	0	30	15
S5 non-fish streams	0	30	15
S6 non-fish streams	0	20	10

a) Fifty per cent of the management zone is removed from the timber harvesting land base.

Lakes and wetlands were classified using the *Riparian Management Guidebook* and Table 6 outlines the reserve and management zone buffers that have been applied to the features on the river/stream GIS file.

Table 6. Riparian reserve and management zone buffer widths for lakes and wetlands

Feature class	Reserve zone width (metres)	Management zone width[a] (metres)	GIS buffer width (metres)
L1[b]	10	0	10
L2	10	20	20
L3	0	30	15
L4	0	30	15
W1	10	40	30
W2	10	20	20
W3	0	30	15
W4	0	30	15
W5	10	40	30

a) Fifty per cent of the management zone is removed from the timber harvesting land base.

b) L1 lakes < 1000 hectares gave a 10 metre reserve zone and the management zone is determined by the district manager. L1 lakes > 1000 hectares only have a management zone determined by the district manager.

5.2.8 Environmentally sensitive areas (ESAs)

An environmentally sensitive area (ESA) is an area that is susceptible to disturbance (e.g., unstable terrain and areas that are difficult to reforest). ESA values are used to exclude areas from the timber harvesting land base where more specific and detailed information is not available about a particular forest resource. Areas can be identified as either very sensitive (E1) or moderately sensitive (E2) to disturbance, and are entirely or partially removed from the timber harvesting land base.

Table 7. Description of environmentally sensitive areas

ESA category	ESA description	Field reduction (%)
S1	Soils – highly sensitive	90
S2	Soils – moderately sensitive	20
A1	Avalanche hazard	60
P1	Severe regeneration problems	90

Since it is unknown which part of the polygon to remove for the ESA, all or none of it is removed in this analysis. Model reductions: Soils ESA 1 = 100% , Soils ESA 2 = 0%, Avalanche 1 = 100% and Regeneration ESA 1 = 100%.

Reasons for this are:

- Soils – After reviewing the amount of S1 and S2 it was determined that removing 100% of S1 is equivalent to removing 90% of S1 and 20% of S2.
- Avalanche – Overall area of A1 is not large. Minor impact on the THLB.
- Regeneration – Regeneration P2 not considered so remove all P1 area from the THLB.

5.2.9 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors (e.g., poor nutrient availability, exposure, excessive moisture, etc.), or because they are not fully occupied by commercial tree species. Typically, these stands are intermixed with other stands within the forested land base. As these stands are not considered to be harvestable, they need to be identified and removed from the timber harvesting land base. This will be done as outlined in Table 8.

Table 8. Description of sites with low timber growing potential

Leading species	Characteristics	Reduction (%)
Fir	Existing volume less than 350 m³/hectare and sites projected not capable of producing 350 m³/hectare by age 140. In heli-log areas volume criteria will be 400 m³/hectare.	100
Cedar	Existing volume less than 300 m³/hectare and sites projected not capable of producing 350 m³/hectare by age 140. In heli-log areas volume criteria will be 400 m³/hectare.	100
Hemlock/balsam	Existing volume less than 350 m³/hectare and sites projected not capable of producing 350 m³/hectare by age 140. In heli-log areas volume criteria will be 400 m³/hectare.	100
Spruce	Existing volume less than 300m³/hectare and sites projected not capable of producing 300 m³/hectare by age 140.	100
Pine	Existing volume less than 300 m³/hectare and sites projected not capable of producing 300 m³/hectare by age 140.	100

Regardless of site productivity, areas that have been previously logged are not removed from the timber harvesting land base as these sites once supported merchantable timber.

5.2.10 Operability

Operability codes are generally used to describe the presence or absence of physical and economic barriers that limit harvesting. Since physical and economic conditions are highly variable throughout British Columbia, interpretation and mapping may vary between management units. Definitions of operability may also change over time as technologies evolve and markets change.

In the 1994 timber supply analysis (TSR1) most of the higher elevation stands were inventoried as inoperable as very little helicopter logging was being done. By the 1999 timber supply analysis (TSR II – current AAC) there had been demonstrated helicopter logging in the higher elevation stands and these stands were re-assessed for inclusion into the timber harvesting land base. Approximately 20% of the area was assessed by aerial surveys and the remaining area was assessed by selecting heli-log from the inventory database using minimum stand criteria (e.g. by species minimum site index, height and volume). The results of the re-assessment increased the TSR 2 timber harvesting land base by 26 500 hectares (21.5% of total THLB). Since the last review the operability has been mapped as its own GIS layer. The coding of the layer is shown in the table below.

Table 9. Description of operable areas

Inventory description	Code	Reduction (%)
Operable areas — conventional	A	0
Operable areas — helicopter	H	0
Inoperable	I	100

Inoperable areas with a logging history are considered to be operable.

In the chief forester's 2000 AAC determination rationale he noted that the base case limited the helicopter harvest to a maximum area of 135 hectares per year for the first 20 years and 160 hectares per year thereafter. When harvesting constraints were removed the initial harvest could increase to 514 000 cubic metres per year.

The chief forester also identified the inclusion predominantly hemlock and balsam stands as a source of uncertainty due to poor logging chance. These stands are approximately 30% of the helicopter land base. In the final decision hemlock and balsam were not excluded to encourage the district to find markets for these species. Notwithstanding, the chief forester asked the district staff to review the harvest performance for the next timber supply review.

From the 1999 to 2007 the district staff tracked areas that were helicopter harvested. The results show that a total area of 1140 hectares were harvested of which 407 hectares (35.7%) were from the helicopter land base, 474 hectares (41.6) from the conventional land base and 259 hectares (22.7%) from the inoperable land base. The 407 hectares of helicopter harvesting only represents 41.2% achievement of the helicopter partition. The review did not indicate whether the inoperable harvest came from the helicopter or conventional land base.

The district also reviewed the helicopter harvest by leading-stand species. Results show that 71% of the area harvested by helicopters were Douglas-fir/cedar-leading stands. Eighteen percent of the area harvested were hemlock/balsam leading stands with a minimum of 30% fir and/or cedar cypress component. Only 11% of the area harvested by helicopters were predominantly hemlock/balsam-leading stands with minor components of the higher valued species. The lack of performance in the hemlock/balsam stands is probably a reflection of current market conditions.

For this review the licensee group submitted harvest plans that outline broad areas where helicopter logging may occur. Additional database search based on minimum stand attributes would be required to include this work in the current analysis. Given that this has been done already for the MFR dataset, district staff conclude that the current operability mapping is the best available information for this analysis.

The major conclusions from the historical review of helicopter logging are:

- During the last nine years, the area harvested from the helicopter land base averaged about 45 hectares—well below of the target of 135 hectares/year. It is expected that the helicopter land base will be increasingly important in the near future to maintain harvest levels. Sensitivity analysis will be performed to examine various levels of harvest and their contribution to timber supply and meeting the current AAC;
- Species harvested. During the 2000 to 2007 period licensees failed to harvest the profile of stands which contribute to the helicopter land base. Over the period only stands with a significant component of Douglas-fir/cedar were harvested. Hemlock/balsam stands with less than a 40% Douglas-fir/cedar component were avoided. Sensitivity analysis will examine the various harvest profiles e.g. based on the species composition of the historical profile and the species profile of the land base.
- Given the uncertainty of the size and type of the helicopter land base, separate harvest flows will be developed for the conventional and helicopter land bases. This separation will enable the chief forester to decide whether an AAC partition is required for the Soo TSA.

5.2.11 Unmerchantable forest types

Unmerchantable forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized. These types can be wholly or partially excluded from the timber harvesting land base.

Table 10. Unmerchantable forest types criteria

Leading species	Inventory type group	Reduction (%)
Yellow Pine[1], Larch[1], Alder, Birch, Cottonwood and Maple	32-36, 39-42	100

[1.] Few stands exist in TSA.

5.2.12 Cultural heritage resource reductions

Archaeological Overview Assessments (AOA) are used to identify potential archaeological sites which include cultural, habitat and historic sites as well as Culturally Modified Trees (CMTs). Where subsequent field investigations confirm the presence of culturally important sites they are mapped as a non-standard geographic information system (GIS) file and will be excluded from the timber harvesting land base.

In addition to the above, a number of culturally important sites made known to the government by the various First Nations through the LRMP process have also been excluded from the timber harvesting land base.

A minimum of one hectare has been used to identify known archaeological features on the GIS file.

5.2.13 Timber license reversions

Timber Licenses are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the license area and do not contribute to the TSA allowable annual cut. Once these areas have been harvested, regenerated and attain free-growing status, the timber license area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after the first harvest and contribute to the TSA harvests in mid- to long-term timber supply.

In the last TSR, it was determined from the forest inventory file that there were a total of 15 806 hectares of timber licence in the Soo TSA of which 2444 hectares are currently considered timber harvesting land base. After updating for the last seven years of harvest there are 1881 hectares remaining to be harvested. The remaining area is expected to be harvested as per the schedule shown in the table below.

Table 11. Timber licence reversion schedule

Schedule of timber licence (TL) area reverting back to the Soo TSA Years from 2007		
Year 1-5	**Year 6-10**	**Year 11-20**
100 hectares per year Total = 500 hectares	92 hectares per year Total = 460 hectares	92.05 hectares per year Total = 920.5 hectares

5.2.14 Old growth management areas (OGMAs) – landscape-level biodiversity

An Old Growth Management Area (OGMA) is defined in the BCFPC Operational Planning Regulation as an area established under a higher level plan which contains or is managed to replace structural old growth attributes. OGMAs have been approved for 12 of 20 landscape units. OMGAs have been identified on the remaining landscape units and current practice for the licensee's is to treat the areas as no-harvest zones. Given the no-harvest status, the identified OMGAs will be used in the base case. Should the OMGA land base change after the analysis is completed the impact will be reported to the chief forester so it may be incorporated into his AAC determination.

Table 12. Status of OGMAs by landscape unit – July 2008

LU identifier	Landscape unit name	BEO	Area (ha)	Status	Effective date
356	East Howe (311)	low	31 892	approved	Aug. 20/03
595	Indian (312)	low	22 097	approved	Aug. 20/03
796	Lower Squamish (307)	intermediate	34 923	approved	Aug. 20/03
819	Mamquam (309)	low	50 835	draft	N/A
172	Callaghan (312)	low	45 777	draft	N/A
1419	Whistler (314)	low	71 440	draft	N/A
1184	Soo (313)	low	62 515	approved	Sept. 6/04
1092	Ryan (306)	low	59 304	approved	Sept. 6/04
844	Meager (302)	intermediate	50 990	approved	Sept. 6/04
1361	Upper Lillooet (317)	intermediate	71 817	approved	Sept. 6/04
1063	Railroad (318)	high	32 936	approved	Sept. 6/04
104	Birkenhead (319)	high	68 008	approved	May 9/05
450	Gates (320)	intermediate	35 162	approved	May 9/05
755	Lizzie (321)	intermediate	43 098	draft	N/A
103	Billygoat (308)	intermediate	60 933	approved	Sept. 6/04
1325	Tuwasus (310)	intermediate	44 510	draft	N/A
1168	Sloquet	intermediate	11 145	draft	N/A
1170	Sloquet	intermediate	15 018	draft	N/A
1167	Sloquet (316) - high	high	12 780	draft	N/A
1087	Rogers (301)	intermediate	54 978	approved	Apr. 14/04
Total			880 158		

5.2.15 Wildlife trees (WTs)and wildlife tree patches (WTPs)

Using principles from the *Forest Practices Code Landscape Unit Planning Guide*, Forest District staff reviewed the amount, location and type of wildlife trees and patches in current and past harvest areas. After accounting for other land base removals (e.g. riparian reserves) staff estimated the requirements for WTs and WTPs in areas other spotted owl SRMZs to be 1.6%.

In addition to the WTP's, trees are often retained dispersed throughout a setting in order to address other forest management issues such as visual management constraints. The district analyzed the tree retention levels on non-spotted owl areas harvested over the past 3 years and found that , on average, 1.6 % of the volume is being retained as dispersed retention. This retention will be added to the WTP retention levels noted above. Total retention will therefore be 3.2%.

In spotted owl areas where harvesting is permitted there is an increased need for WTPs and in-stand retentions. Current owl management guidelines require a minimum of 10% WTP retention. Approximately 5% of this retention is estimated to come from already constrained areas such as riparian management areas. In addition to the WTP retention requirements it is estimated that a further 10 % of the volume in coastal SRMZs (21) and 20% of the volume in non-coastal SRMZs (14, 15, 17 and 18) is retained as dispersed tree retention. The retention estimates are a proxy for actual field requirements (e.g. in non-coastal zones the actual requirement is to leave 40 of the largest 80 trees).

Retention WTs and WTPs will be modelled as volume reductions to the yield curves.

5.2.16 Wildlife habitat area reductions

Wildlife habitat areas for grizzly bears, marbled murrelet, coastal tailed frog, ungulate winter range for black tailed deer (retention zone), moose and mountain goat have been mapped as a non-standard geographic information system (GIS) layer. These areas will be excluded from the timber harvesting land base.

The specific wildlife orders and wildlife habitat areas are listed in the table below.

Table 13. Description of wildlife orders and WHAs for the Soo TSA

Type	Number	Species	Management activity
Order	#U2-002	Mountain Goat	No harvesting within the specified mountain goat winter ranges
	#U2-005	Black-tailed deer	Retention Range - No harvesting within designated ungulate winter ranges
			Rotation Range – A minimum of 20% of the total rotation polygon must be maintained as winter range. As long as the minimum range is maintained, 20% of the remaining area may be harvested every 20 years
		Moose	Core Areas – No harvesting
			Forage – forage areas not be more than 200 meters from security cover
WHA	2-172 to 2-175 2-177 to 2-193 2-254 to 2-270 2-204	Grizzly Bear	No harvesting within the WHA
WHA	Draft	Coastal Tailed Frog	Current practice is not to harvest within the draft WHA
WHA	Draft	Marbled Murrelet	Current practice is not to harvest within the draft WHA

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels

The utilization level defines the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height that must be removed from harvested areas. These factors are needed to calculate merchantable stand volume for use in the analysis. The levels used in the analysis reflect current operational practice.

Table 14. Utilization levels

Leading species	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine	12.5	30	10
All others – < 121 years	12.5	30	10
All others > 121 years	17.5	30	15

6.1.2 Volume exclusions for mixed-species stands

One or more species may be unmerchantable in mixed-species stands. For example, deciduous species may not be harvested in a predominantly coniferous stand. The unharvested portion should not contribute to estimated stand volume. In the Soo TSA all deciduous species will be excluded from the estimation of stand volume. This reflects current utilization standards, licence requirements and current performance.

6.1.3 Minimum harvestable age

Minimum harvestable age is, as the term implies, the minimum age at which harvesting is expected to be feasible. While harvesting may occur in stands at the minimum requirements in order to meet harvest objectives (e.g. during short periods when just recently merchantable trees are harvested to maintain a harvest level), most stands will not be harvested until well past the minimum ages because other resource values take precedence (e.g. requirements for the retention of older timber).

The criteria used to define minimum harvestable ages for this analysis are a specified volume based on species and harvesting method (e.g., conventional *versus* helicopter logging).

Table 15. Minimum harvestable age criteria for both existing and managed analysis units

Analysis unit			Minimum harvestable volume existing yield tables	
	Inventory type groups	Site index range (m)	Conventional land base	Helicopter land base
1. Fir, good	1 –- 8	≥ 26	350	400
2. Fir, medium	1 – 8	20.0 to 25.9	350	400
3. Fir, poor	1 – 8	< 20	350	400
4. Cedar/spruce, good/medium	9 – 11, 21-25	≥ 20	350	400
5. Cedar/spruce, poor	9 – 11, 21-25	< 20	350	400
6. Hemlock/balsam, good	12 – 20	≥ 25	350	400
7. Hemlock/balsam, medium	12 – 20	20.0 to 24.9	350	400
8. Hemlock/balsam, poor	12 – 20	< 20	350	400
9. Pine, all	27 – 31	≥ 20	300	350

6.1.4 Logging method

Conventional logging methods (i.e., cable, grapple and skidder) are the dominant harvesting systems within the Soo Timber Supply Area. Heli-logging is employed but at this time and will be monitored separately during this timber supply review.

6.2 Unsalvaged losses

Table 16 shows the estimated average annual unsalvaged volume loss due to catastrophic events such as insect epidemics, fires, wind damage or other agents. The unsalvaged loss column only reflects those areas in which the volume will not be recovered.

Table 16. Unsalvaged losses

Cause of loss	Annual unsalvaged loss (m^3/year)
Fire	30 000
Insects	4000
Total	34 000

Data source and comments:

Insects: Current and projected volume losses can be expected in Douglas-fir stands due to western spruce budworm and Douglas-fir bark beetle. The volume loss estimate was derived by applying a loss factor to the volume of stands currently under attack. Estimates of losses in pine stands attributable to the mountain pine beetle are unknown, but pine comprises only a very small portion of the Soo TSA. Losses to pine types are negligible as this species is not harvested within the TSA.

Fire: The unsalvaged loss estimate due to fire is based on 10 years of district fire reports. The total losses were reduced so that only volume loss that occurred in the timber harvesting land base is included in the estimate.

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the Forest Service TIPSY growth and yield model. The table below contains the inputs required to produce MSYTs for this analysis. A MSYT may be built from a number of tables if more than one regeneration method is used within an analysis unit. When this is the case, tables are produced for the different regeneration methods (each method x species combination) are then aggregated into one table.

Table 17. Regeneration regimes for managed stands

Analysis	Planted			Natural	Total			Ave.Site	Regen
Unit	Stems/ha	Species	%	Stems/ha	Stems/ha	Species	%	Index	Delay
FD	1200	FDC	80	250	1450	FDC	65	30	1
Good		CW	20			CW	20	30	1
						HW	15	30	1
FD	1000	FDC	80	216	1216	FDC	67	23	1
Medium		CW	20			CW	17	23	1
						HW	9	23	1
						BA	7	23	1
FD	1000	FDC	86	866	1866	FDC	85	16	1
Poor		CW	14			CW	9	16	1
						HW	6	16	1
Cw/SX	600	CW	50	1200	1802	CW	37	26	1
Good/									
Medium		FDC	20			FDC	22	26	1
		BA	9			BA	21	26	1
						HW	20	26	1
		SX	21					26	1
Cw/Sx	600	SX	84	1913	2913	SX	46	16	1
Poor						BA	41	16	1
		CW	7			CW	8	16	1
						HW	5	16	1
		YC	5					16	1
		FDC	4					16	1
Hw/Ba	350	BA	70	2707	3057	BA	28	29	1
Good						HW	28	29	1
		FDC	5			FDC	21	29	1
		CW/YC	25			CW/YC	23	29	1
Hw/Ba	400	BA	76	1938	2338	BA	50	21	1
Medium		YC/CW	7			YC	20	21	1
		FDC	8			FDC	15	21	1
		SX	9			SX/HW	15	21	1
Hw/Ba	600	BA	79	2396	2996	BA	61	16	2
Poor		SX	6			SX	18	16	2
		YC	15			YC	11	16	2
						HM/HW	10	16	2

The common planting stock for all stands is 1+0.

6.3.2 Stand fertilization

The Squamish Forest District has fertilized Douglas-fir stands for many years. Much of the program has been dependant on special program funding (e.g., Forest Investment Account). Therefore, fertilization has not occurred every year for the last 25 years. The goal (target) is to fertilize 800 hectares each year.

As part of the provincial government strategy for the coast, fertilization is a key component. Therefore, this treatment will be incorporated into managed Douglas-fir plantations with a site index less than 30 metres (there is no response in the more productive stands).

Once Douglas-fir stands reach an age of 30 they will be treated with 400 Urea at 435 kilograms per hectare. The growth of these stands and will be projected using TIPSY fertilized stand yield curves.

6.3.3 Immature plantation history

This section identifies areas of existing immature forest where the density (i.e., stems per hectare) is controlled and therefore should be assigned to a managed stand yield table curve (MSYT). All NSR and stands harvested in the future will be managed under MSYTs.

District review of plantations indicates that Douglas-fir stand less than 35 years old have had some form of density control (natural or man-induced by spacing). These stands will be modelled as managed stands using the TIPSY model. For other leading species plantations (hemlock, balsam, cedar and spruce) there is a great variation in whether a stand can be considered in a managed state. For example, stands with natural hemlock are typically very dense in stocking and would initial grow as a natural stands. In order not to overestimate past performance in these stands they will be modelled as natural stands. All future harvested hemlock, balsam, cedar and spruce stands will be modelled using the silvicultural regimes outlined in Table 17.

6.3.4 Not satisfactorily restocked (NSR) areas

The inventory file for the analysis is a Forest Inventory Planning (FIP) file converted into Vegetation Resource Inventory (VRI) format. For the most part NSR will be defined by the original FIP format by which NSR is identified as type identity (projected) 4 or 9. These type identities indicate old cutblocks which have not yet reached free-growing status.

Openings where there are no type identity will be assessed as NSR if there is a logging history, stand attributes or a record in the RESULTS database. Finally, recent cutovers will be updated through satellite imagery techniques.

6.3.5 Genetic gain through tree improvement

Data from the Tree Improvement Branch of the Ministry of Forests and Range indicate that Class A seed will be used for Cedar, Fir and Spruce stands. The data is currently being collected and will be available for the analysis and reported in the final analysis report.

6.4 Integrated resource management

6.4.1 Objectives which require forest cover requirement

As noted in Section 4.1, the discussion on multiple objectives and forest cover requirements may be examined at a number of different levels. These may be considered as layers in GIS terminology. One possible layer may be landscape units, another may be wildlife areas, while another may be associated with a different resource emphasis. With the requirement to retain different forest characteristics across the landscape, it is important to identify how non-contributing forest (productive forest which does not contribute to the timber harvesting land base) may be considered in the forest cover requirements (i.e., maximum allowable disturbance or minimum area retention).

6.4.2 Areas with only timber management constraints and visual quality objectives

Table 18 details the constraints for areas without other management zones (IRM) and the visual quality objective groups to be tracked during this timber supply review.

Table 18. Forest cover requirements

Group	Maximum allowable disturbance (%)	Green-up height (metres)	Area of application
IRM	Cut block size distribution	3 m	THLB within an LU outside of visual areas
RVQC= R	3	5 m	Forested area in a visual polygon
RVQC=PR_L	15	5 m	Forested area in a visual polygon
RVQC=PR_M	10	5 m	Forested area in a visual polygon
RVQC=PR_H	6	5 m	Forested area in a visual polygon
RVQC=M	20	5 m	Forested area in a Visual polygon

The maximum opening size for a harvest area is 40 hectares. The individual blocks average 10 to 15 hectares in size. The timber supply analysis will utilize a block size distribution pattern based on the maximum opening size. Harvesting is limited when adjacent openings have not reached a 3 metre green-up height.

6.4.3 Wildlife forest cover objectives

Many of the wildlife habitats are managed by retention management (no harvesting). Section 5.2.16 outlined the management regimes for marbled murrelet, mountain goat, black tailed deer, moose, coastal tailed frog and grizzly bear. This section will discuss the management regimes for northern spotted owl.

In May 1997 the provincial government approved the Spotted Owl Management Plan (SOMP). The SOMP is comprised of a summary report and a strategic and an operational guidelines component. A Section 7 notices applies to SRMZ 14, 15, 17, 18 and 21 as well as Billygoat and Tuwasus Matrix Activity Centers.

The SOMP relies on 21 Special Resource Management Zones (SRMZs) distributed throughout the range of spotted owls within the Chilliwack and Squamish Forest Districts. Within the 21 SRMZs, 16 are identified to be managed for spotted owl habitat of which 7 are within the Soo TSA. Note: three management areas are found exclusively within parks and two management areas are found within Greater Vancouver Watersheds.

Resource Management Plans (RMP), which provide strategies and best management practices for forest management activities within the SRMZs were completed in May 1999 for the following SRMZs in the Squamish Forest District: 14 (Douglas), 15 (Glacier and Tuwasus), 17 (Lillooet Lake), 18 (Birkenhead) and 21 (Squmish). There are no requirement for RMPs to be developed for the Cheakamus (SRMZ 20) and Wedge/Green (SRMZ 19)). The RMP subdivided each SRMZ into long-term activity centres (LTAC), typically 5 to 7 each approximately 3000 hectares in size. Each LTAC is further subdivided into Long-Term Owl Habitat (LTOH) areas and Forest Management Areas (FMAs). The following are the management directions for each area in the RMP.

Long-term owl habitat area (LTOH): A minimum of 67% suitable owl habitat (forest more than 100 years old) must be maintained within the LTAC over the long term. The RMPs make provisions to enhance, create or maintain owl habitat using partial harvesting systems (i.e. removal of up to one-third of the basal area from each 10 cm. stand diameter class distributed evenly across the treatment area). However, this has proven to be operationally difficult. Since the establishment of the RMPs in 1999 approximately 9300 m^3 has been harvested from the LTOH.

Recruitment areas (RCAs): Are areas within LTOH that are currently non-suitable for the purpose of owl habitat. Typically they are productive forest areas that are less than 100 years of age. While harvesting within the

LTOH is permitted, based on current performance, the LTOH zone will be considered a no-harvest zone for the purpose of the timber supply analysis.

Forest management area (FMA): The remaining 33% of each LTAC makes up the FMA. The FMA is further subdivided into 'Heavy Volume Removal' (HVR) and Replacement Area (RPA). In the HVR area partial harvesting is permitted where a minimum of the largest 15 of the largest 30 stems/hectare on coastal sites, and 40 of the largest 80 stems/hectare on transitional/interior sites, are maintained dispersed across the opening For the timber supply analysis a maximum of 33% of the area may be harvested if the remaining area in the LTOH is greater than 100 years old.

Replacement areas (RPAs): Are areas within the FMA that are temporarily constrained from harvest in order to meet the overall LTOH target of 67% suitable owl habitat. The RPA revert to HVR when the LTOH target is achieved.

In addition to SRMZs, there are two *matrix activity centers, Billygoat and Tuwasus,* in the Soo TSA. As part of SOMP, these two matrix activity centers follow a 50-year phase-out strategy. Each has 3 consecutive rings with the outer ring identified for phase-out first. Harvesting is restricted to 59 hectares every 5 years in the Billygoat matrix and 52 hectares ever 5 years in the Tuwasus.

6.4.4 Community watersheds

There are 23 community watersheds within the Soo TSA. The Sea-to-Sky LRMP provides management direction within specific community watersheds and community water supply areas. A generalized forest cover constraint will be modelled in the base case based on the recommendations from the *Community Watershed Guidebook* for timber supply analyses. The assumption is no more than 5% of the area can be less than 5 metres tall. This equates to a 1% harvest every year.

Appendix II lists the community watersheds in the Soo TSA.

7. Sensitivity Analyses to be Performed

Sensitivity analysis can provide a measure of the timber supply impact if uncertainty in management assumptions and/or data integrity exists. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. For instance, minimum harvestable age may be developed based on some minimum stand attributes which currently appear to dictate the earliest time stands are eligible for harvest. Sensitivity analysis may indicate that a small reduction in these attributes may alleviate anticipated harvest level reductions in the future. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most affect results. Table 19 lists the sensitivity analyses to be undertaken as part of this timber supply review.

Table 19. Sensitivity issues

Issue to be tested	Sensitivity levels	Data source
Minimum harvestable age	Increase minimum volume to 400 m³/hectare	Recent shift by licensees from low volume HB stands
Site index estimate for older stands	Adjust SI for species other than Fd and Hw by equation provided by Research Branch	Provincial SIBEC for other species
Size of the area before forest provides “old” forest characteristics	Extrapolate the size characteristics from the nine completed LUs	MSRM guidance for polygon selection in landscape unit planning
Harvest flow alternatives	Even-flow	Alternative harvest flows
Examine the implications of restricting the harvest of isolated timber	Land base reduction	District review of minimum block size and isolated stands
Examine spatial adjacency guidelines	Vary cutblock distribution size	District review of cutblock size and spatial influence
Helicopter land base	a) Alternative harvest levels b) Vary contribution of hemlock stands	Existing Inventory file

Appendix I Parks and Conservancies within the Soo TSA

Parks within the Soo TSA

Park name	Area
Park area (hectares)	
Alice Lake Park	404
Baynes Island Ecological Reserve	45
Birkenhead Lake Park	10 053
Blackcomb Glacier Park	244
Brackendale Eagles Park	710
Brandywine Falls Park	146
Callaghan Lake Park	2693
Cypress Park (portion)	838
Garibaldi Park (portion)	144 093
Golden Ears Park (portion)	2079
Indian Arm Park (portion)	2934
Joffre Lakes Park	1480
Murrin Park	24
Nairn Falls Park	180
Pinecone-Burke Park (portion)	6520
Porteau Cove Park	17
Porteau Cover Recreation Area	1
Shannon Falls Park	88
Stawamus Chief Park	522
Tantalus Park	10 935
Upper Lillooet Park	19 996
Total	203 781

Conservancies

Conservancies are designated under the *Park (Conservancy Enabling) Act* 2006. According to *Section 5(3.1)* of the Act, Conservancies are designated:

- for the protection and maintenance of biological diversity and natural environments;
- for the preservation and maintenance of social, ceremonial and cultural uses of First Nations;
- for protection and maintenance of recreational values; and
- to ensure that development or use of natural resources occurs in a sustainable manner consistent with the above purposes.

Conservancies are areas where industrial resource development activities are prohibited in order to protect the high values of these areas to First Nations and the public. Commercial logging, mining, hydroelectric developments,

new roads, and commercial development are not permitted within conservancies. The areas are managed collaboratively between First Nations and the province.

There are eight Conservancies in the Sea-to-Sky Plan Area. At the time of LRMP approval, discussions were ongoing regarding the naming of Conservancies and other Land Use Zones that fall within the territories of both the Lil'wat and Squamish Nations. Interim names for these Conservancies (Upper Soo1, Upper Elaho2, and Callaghan3) are presented in the following table and used throughout the LRMP, pending the outcomes of these discussions. These names may be revised by agreement of interested First Nations and the Province.

Conservancy approximate area (hectares)

Conservancy name	Area (hectares)
Callaghan	8223
Estétiwilh / Sigurd Creek	1082
I7loqaw7 / 100 Lakes	1028
K'zuzált / Twin Two	2127
Qwalímak / Upper Birkenhead	4806
Upper Elaho	10 128
Upper Rogers Kólii7	3898
Upper Soo	9993
Total	44 887

The creation of the Qwalímak / Upper Birkenhead Conservancy resulted in isolated pockets of Crown land between the Conservancy and the existing Birkenhead Lake Provincial Park. The boundary of Birkenhead Lake Provincial Park was extended to include these areas.

Appendix II Recognized Community Watershed Supply Areas

Recognized community water supply areas

Community watershed	Number	Purveyor	Designated FPC	LRMP	Comment
D'Arcy Creek	100.059	Township of D'Arcy	Yes	No	
Spruce Creek	100.079	Devine	Yes	No	
Jason & Mungye Creeks		Ivey Lake Estates	Yes	No	
Pemberton Creek	119.004	Village of Pemberton	Yes	Yes	
Peq Creek	119.005	Xit'olacw Village	Yes	No	
Rideau Brook	119.006	Emerald Estates	Yes	No	
Agnew Creek	119.001	Alpine Meadows	Yes	No	
Twentyone Mile Creek	119.007	Resort Municipality of Whistler	Yes	Yes	
Blackcomb Creek	119.002	Resort Municipality of Whistler	Yes	No	
Whistler Creek		Resort Municipality of Whistler	Yes	No	abondoned
Alpha Creek	900.005	Resort Municipality of Whistler	Yes	No	
Van West		Resort Municipality of Whistler	Yes	No	deleted
Brew Creek	900.074	Black Tusk subdivision	Yes	Yes	
Retta Lake		Pinecreat Estates subdivision	No	Yes	includes Ransom & Evelyn Creeks
Stawamus River	900.062	District of Squamish	Yes	Yes	
Mashiter Creek	900.040	District of Squamish	Yes	Yes	
Lower Mamquam (groundwater)		District of Squamish	No	Yes	
Britannia Creek	unavailable	Community of Britannia Beach	No	No	
Mineral Creek	900.045	Community of Britannia Beach	Yes	No	
Magnesia Creek	900.037	Brunswick Beach	Yes	Yes	
Alberta Creek	900.003	Village of Lions Bay	Yes	No	

(continued)

Recognized community water supply areas (concluded)

Community watershed	Number	Purveyor	Designated FPC	LRMP	Comment
Harvey Creek	900.037	Village of Lions Bay	Yes	Yes	
Rundle Creek	900.057	Village of Lions Bay	Yes	No	
Charles Creek		Strachan Point	Yes	No	
Regowski Creek		Birkenhead Lake Estates	Yes	No	
Cataline Creek		HJ Develpments Ltd. (Heather Jean Properties)	No	No	
McCullock Creek		HJ Develpments Ltd. (Heather Jean Properties)	No	No	
Twin One Creek		Twin Creek residents	Yes	No	
Franks Creek		Skatin Nation	No	Yes	