Tree Farm Licence 47

Management Plan #4

TimberWest

Timber Supply Analysis

Information Package

June 2012

TECO Natural Resource Group Limited

Table of Contents

List of Figures

List of Tables

1 Introduction

This document provides a summary of the inputs and assumptions made in preparing the timber supply analysis data set and model for the Bonanza Lake (Block 17) and Johnstone Strait Management Units (Blocks 1-12) of Tree Farm Licence (TFL) 47. Included are inventory and land base summaries, growth and yield information and management assumptions for timber and non-timber resources as they relate to timber supply.

The Information Package allows the reader to consider the inputs and assumptions to be used in the timber supply analysis. These include:

- The documentation of inventory data and sources;
- Classification of the land base according to each hectare's contribution to management (harvest, resource management for wildlife, etc.);
- Land productivity estimates and prediction of stand growth and timber yield;
- Silviculture and harvesting regimes;
- Action taken to model multi-resource requirements; and
- Timber supply scenarios and sensitivity analyses to be evaluated.

The document has been prepared to identify management issues on TFL 47 that are relevant in determining a sustainable harvest level, and in accordance with the guidelines set out in the document "Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licences". In addition to describing the scope and broad objectives of the timber supply analysis, this report will serve as a communication instrument in dealing with people and organizations who have an interest in the project, but who will not be involved at a technical level. Upon acceptance by the Ministry of Forests and Range (MFML) Timber Supply Analyst, the assumptions and methodology provided in the Information Package will be used to prepare and submit a timber supply analysis to the MFML.

This Information Package has been prepared in support of the Timber Supply Analysis for Management Plan (MP) No. 4 for TFL 47 and will be provided as an Appendix to the Timber Supply Analysis Report. Figure 1 shows the location of TFL 47.

TFL 47 comprises two[1] management units (MU) located on northern Vancouver Island near Port McNeill (Bonanza Lake MU) and parts of the coastal mainland and islands in the Johnstone Strait (Johnstone Strait MU) (Figure 1). The total TFL (and TL) area is 125,004 hectares. The total productive area of the TFL is 115,444 hectares.

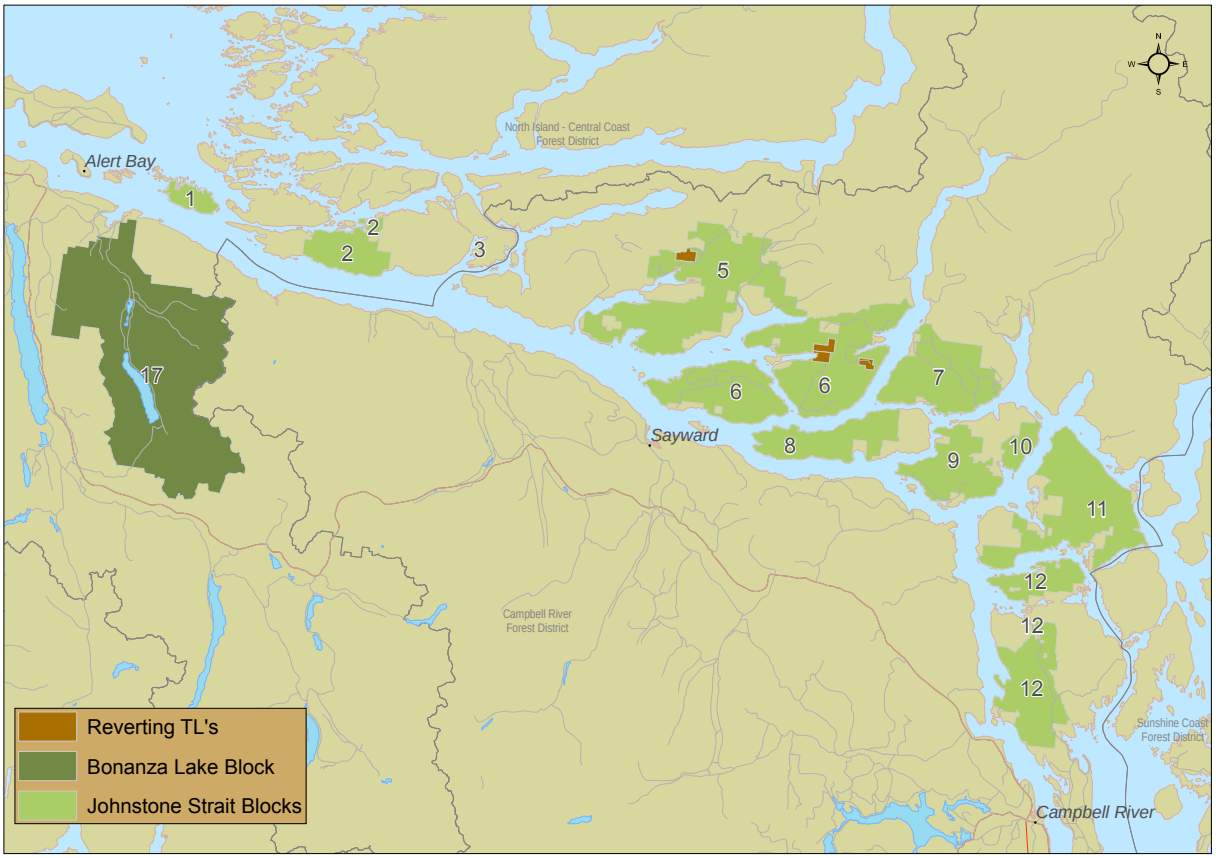

Figure 1. Location of TFL 47

[1] A third unit (Moresby Island MU) has been removed from TFL 47 since the submission of the last Management Plan.

2 Process

2.1 Overview

The data summarized in this document is the most current available. Any assumptions made for modelling and forecasting purposes are consistent with current forest management practices on the TFL.

The contents of this document will be reviewed with staff from MFML Forest Analysis and Inventory Branch (FAIB) before starting any forest estate modelling.

This report will be included as Appendix I of the Timber Supply Analysis Report.

2.2 Growth and Yield

This section describes the issues, information sources, assumptions, methods, and any relevant processing or adjustments related to growth and yield estimates for existing and future stands. Yield tables for natural stands were developed with the MFML program Variable Density Yield Predictor (VDYP7). Managed stands used the MFML Table Interpolation Program for Stand Yields (TIPSY 4.1) growth and yield model.

Copies of the existing and future managed stand yield tables (MSYT) can be found in Appendix I and II respectively. Natural stand yield tables were prepared for each stand and are too numerous to be included with this document. They will be submitted for MFML review in a digital format.

2.2.1 Site index

Site index estimates based from the recently completed VRI are problematic. The Phase 2 adjustment process resulted in productivity estimates significantly lower than the Phase 1 estimate; they are also lower than those in TimberWest's previous forest inventory. These new estimates are low based on operational experience as well. Yield curves generated using these site indices would result in future stand volumes that are lower than those used to complete the timber supply analysis for MP#3. An alternative estimate of site productivity is needed.

A site index adjustment (SIA) program was completed on TFL 47 following MP #3 to provide improved site index estimates for managed stands, based on a field data collection program together with a Terrestrial Ecosystem Mapping (TEM). These estimates of site productivity will be used to develop yield curves for existing and future managed stands. In addition, yield curves based on adjusted site index will be used for one of the sensitivity analysis runs. This issue is discussed further in Section 8.1. The report describing the site index adjustment process can be found in Appendix III.

3 Timber Supply Forecasts

This section summarizes the harvest forecasts that will be provided. The assumptions pertaining to each option and sensitivity analysis are detailed in later sections.

3.1 Base Case

The base case analysis uses the best available information and assumes that current management practices will be carried on throughout the entire 250 year planning horizon. It is intended to model 'What is?' rather than 'What if?'. Major forest management considerations and issues incorporated into this base case analysis are:

- new Vegetation Resources Inventory (VRI), including the Phase II / NVAF adjustment;
- minimum harvest ages based on volume and piece size criteria, and on the culmination of merchantable volume;
- exclusion of harvesting within Ungulate Winter Range (UWR), Riparian Reserves Zones (RRZ) and other areas with high habitat or recreational values;
- implementation of Ecosystem-based management in the area covered by the SCCO
- buffering of all unreclaimed roads in the road inventory to accurately reflect the loss of productive area;
- constraints on harvest rates in order to protect biodiversity and visual values at the landscape level;
- retention of trees to meet stand level biodiversity and riparian requirements; and
- regeneration and silvicultural assumptions that reflect current practices.

It is based on current performance and so provides a reference timber supply forecast against which timber supply implications of different future management options may be measured. The objective of the base case will be to:

- Maintain the current harvest for as long as possible;
- Increase harvest levels at the earliest time that it can be done sustainably;
- Subject to limiting changes in harvest level to less than 10% per decade.

3.2 Sensitivity Analyses

Sensitivity analysis provides a measure of the upper and lower bounds of the base case harvest forecast that reflects the uncertainty in the data and/or the management assumptions made in the base case. The magnitude of the increase and decrease in the sensitivity variable reflects the degree of uncertainty

surrounding the assumption associated with that specific variable. This provides a way to gauge the extent to which the base case harvest level and other statistic might change with changes to input data and assumptions.

Table 1 summarizes the sensitivity analyses that will be performed for this analysis.

Table 1. List of Sensitivity Analyses

Issue	Sensitivity Analysis	Level to be Tested
Land Base Uncertainty		
Impact of roads on productive land base is overestimated	Reclassify roads and recalculate buffer widths	+/- 10%
Stand G/Y Uncertainty		
Inventory volumes not realized at harvest	Existing Stand Volume	+/- 10%
Future stands do not perform as forecast	Future Stand Volume	+/- 10%
Utilization is better than yield estimates due to lower stump heights with mechanical harvesting	Stand Volume	TBD[2]
Stands become economical to harvest sooner or later than predicted	Minimum Harvest Age	+/-10, +20 years,
Disturbance Limit Uncertainty		
Visual Constraints	Green-up Height	+/- 1 metre
Integrated Resource Management (IRM)	Disturbance Limit	+/- 5%
Integrated Resource Management (IRM)	Green-up Height	+/- 1 metre
Regeneration Uncertainty		
TEM SI does not accurately reflect future site productivity	Use SIBEC Site Index to build yield curves	n/a
Stocking in regenerated stands is better than TIPSY assumptions	Reduce OAF1 for Managed Stand Yield Tables	-5%

[2] To be determined based on a reassessment of waste survey plots in blocks that were mechanically harvested to measure stump heights.

3.3 Alternative Harvest Flows

It is anticipated that the harvest flow will be constant over the entire planning horizon. This was the case for the last timber supply analysis that was conducted. The age class distribution is fairly evenly distributed, so no obvious and severe pinch point in timber supply was found. As an alternative to even flow, an effort will be made to find the highest initial harvest level that can be achieved without impacting long-term harvest levels – and subject to the constraint that the harvest level cannot fall more than 10% between consecutive decades.

Currently on the TFL, average harvest age is well above culmination age. An accelerated harvest flow scenario that move harvest age closer to culmination age over a shorter period than in the base case will be explored.

3.4 Other Options

No other analysis scenarios are anticipated.

4 Forest Estate Model

4.1 Model Description

Patchworks is a spatially explicit harvest scheduling optimization model developed by Spatial Planning Systems in Ontario. It has been used to develop spatially explicit harvest allocations to explore the trade off between a broad range of conflicting management and harvest goals. Patchworks is a multiple-objective goal-programming model and can be described as consisting of two components:

1. A GIS interface with map viewer and viewer functions; and

2. A harvest scheduler that runs continuously in the background - searching for improvements in the allocation to improve the value of the objective function. The model seeks a solution that maximizes the value of the total objective function. The objective function will be made up of both the traditional (management plan) objectives and the additional requirements and indicators. In areas of timber management, the harvest schedule will be optimized (both the current and future forecasted land base) for timber flow requirements and to minimize the environmental risk, as measured by the established indicators.

4.2 Timber Supply Modelling

Timber supply analysis for the full two hundred and fifty (250) year planning horizon will be carried out using *Patchworks*.

5 Current Forest Cover Inventory

Three separate forest inventory data sources have been combined to create the forest cover database for this analysis. As Table 2 shows, the vast majority of the TFL is covered by the recently completed TFL 47 VRI.

Table 2. Forest Inventory Data Sources.

Source Inventory	Area(Ha)
TFL 47 VRI	124,160
No Forest Cover	28
LRDW VRI	481
Old TimberWest Inventory	335

5.1 TFL 47 VRI

TimberWest initiated a VRI program for TFL 47 in 2006 to upgrade and adjust their existing inventory[3]. The TFL 47 Phase I inventory is based on photo-interpreted inventory attribute estimates using the current VRI procedures, and was completed in March 2007 using 2006 1:15,000 aerial photos. The VRI Phase II project implementation plan (VPIP)[4] was prepared in 2007, with ground sampling carried out in 2007, 2008 and 2010. NVAF sampling was completed in March 2010. An adjustment of the Phase I was completed in 2010 using VDYP7. The results of the adjustment are summarized here. The complete adjustment report can be found in Appendix IV.

[3] TimberWest Forest Corp. 2006. TFL 47 Bonanza Lake and Johnstone Straits Management Units VRI Strategic Inventory Plan. Prepared by Warren Nimchuk, RPF and Doug Reeve, RFT, on behalf of TimberWest Forest Corp.

[4] Timberline Natural Resource Group Ltd. 2007. *TimberWest Forest Corp. Tree Farm License 47 Vegetation Resources Inventory Phase II Project Implementation Plan.* Unpublished Report, July 2007, amended February 15, 2008 and October 29, 2009. 28 pp.

For the Phase II adjustment, the target population was stratified by age and species using two age groups (30-100 years vs. 101+ years) and two species groups (Hw+Hm, vs. all others). This stratification also reflects the two different MU's since Johnstone Strait is mainly composed of second-growth stands while Bonanza includes a larger component of mature stands.

While the leading species is dominated by Hw, both Hw and Hm were combined into one species group for consistency, separated from all other species. Each stratum was further sub-stratified into volume classes (<=400m3/ha, and >400m3/ha) to ensure appropriate distribution of the ground samples across the range of possible values. Table 3 shows how productive area is distributed by these strata and substrata.

Table 3. Stratum and Substratum Areas.

Sub-stratum Area (ha)	Stratum Area (ha)				
	H ≤ 100yrs	Other ≤ 100yrs	H > 100yrs	Other > 100yrs	Total (ha)
Low volume (<= 400m^3/ha)	21,107	11,270	5,048	6,596	44,021
High volume (> 400m^3/ha)	19,536	6,025	12,015	6,681	44,257
Total	*40,643*	*17,295*	*17,063*	*13,277*	*88,278*

VDYP7 has been used to project stand volumes to 2010, and to generate yield tables for natural stands. Required input parameters for VDYP include species composition, age, height, density and basal area. The Phase II process adjusts most of these input parameter (not species composition) based on field observations so that more accurate estimates of stand volume can be computed. The statistic computed for each attribute is the 'ratio of means' (ROM): the ratio of the field-measured attribute value to the interpreter-called value for each of the input variables. It is compiled for each stand in the Phase II field sample. Average ROM for each of the input variables for each stratum is presented in Table 4.

Table 4. VRI Phase II Adjustment Ratios – VDYP Input Attributes.

Stratum	Area (ha)	Stems Per Ha (ROM)	Height (ROM)	Lorey Height (ROM)	Basal Area (ROM)	Age (ROM)
H ≤ 100yrs	40,643	2.320	0.969	0.987	1.286	1.201
Other ≤ 100yrs	17,295	1.664	0.910	1.078	1.161	1.488
H > 100yrs	17,063	1.996	0.989	1.004	1.328	1.272
Other > 100yrs	13,277	2.130	1.130	0.974	1.580	1.671
Total	*88,278*	*2.137*	*0.987*	*1.004*	*1.312*	*1.392*

One of the impacts of adjusting the estimates of stand height and stand age is that calculated site index will change. Table 5 shows the magnitude of this change, averaged by stratum.

Table 5. Average Site Index – Adjusted and Unadjusted

Stratum	Area (ha)	Phase I SI (m)	Adjusted SI (m)	Difference	
				(m)	(%)
H ≤ 100yrs	40,643	26.3	22.4	-3.9	-14.7%
Other ≤ 100yrs	17,295	25.1	18.7	-6.4	-25.5%
H > 100yrs	17,063	14.0	12.4	-1.6	-11.6%
Other > 100yrs	13,277	14.6	14.0	-0.5	-3.8%
		21.9	*18.5*	*-3.4*	*-15.6%*

VDYP is run using the adjusted input attributes to generate stand volumes for the sampled stands. This is compared to the volumes compiled from the sample plots, and a ROM for volumes is calculated. This is shown in Table 6.

Table 6. VRI Phase II Volume Adjustment Ratios.

Stratum	Area (ha)	12.5 cm+ Volume (ROM)	17.5 cm+ Volume (ROM)
H ≤ 100yrs	40,643	0.965	0.953
Other ≤ 100yrs	17,295	1.029	1.007
H > 100yrs	17,063	1.114	1.111
Other > 100yrs	13,277	1.076	1.080
Total	*88,278*	*1.027*	*1.021*

Using the information in Table 4, adjusted height, age, basal area and density were calculated for every stand in the inventory. These adjusted values were used to derive the inventory site index, and also used to generate stand volumes projected to 2010. Finally, the volume ROM's are applied to calculate the adjusted volumes and compile the starting inventory volumes.

5.2 Other Forest Cover Data

The TL areas that will be added to the TFL, and a small portion of the TFL itself, were not covered by the recently completed VRI. For a part of this area, forest cover information (in VRI format) was available on the LRDW and was downloaded. TimberWest's old inventory covered some additional area that was missed by both VRI's.

For areas where forest cover species information is missing, species will be assigned as the more common leading species for the BEC subzone and variant. For the small area where stand age is missing, it will be set to zero.

5.3 Updates

The inventory has been updated for depletions up to January 2010; growth has been projected to the same date.

6 Description of Land Base

This section describes the methodology used to define the productive forest considered to contribute to, and be available for, long-term timber supply from within the total land base of TFL 47.

The total TFL area for Management Plan #3 was 139,867 hectares. This included the Johnstone Strait and Bonanza Lake blocks, but not the Moresby block. A separate timber supply analysis was completed for the Moresby block, and it was not included in MP#3. It was officially removed from the TFL under Instrument 19.

The area of the TFL has been further reduced by the take-back that occurred under Instrument 16, Bill 24 (2007) and subsequent Forestry Revitalization Act removals. The total area of the TFL for this analysis is 125,004 hectares.

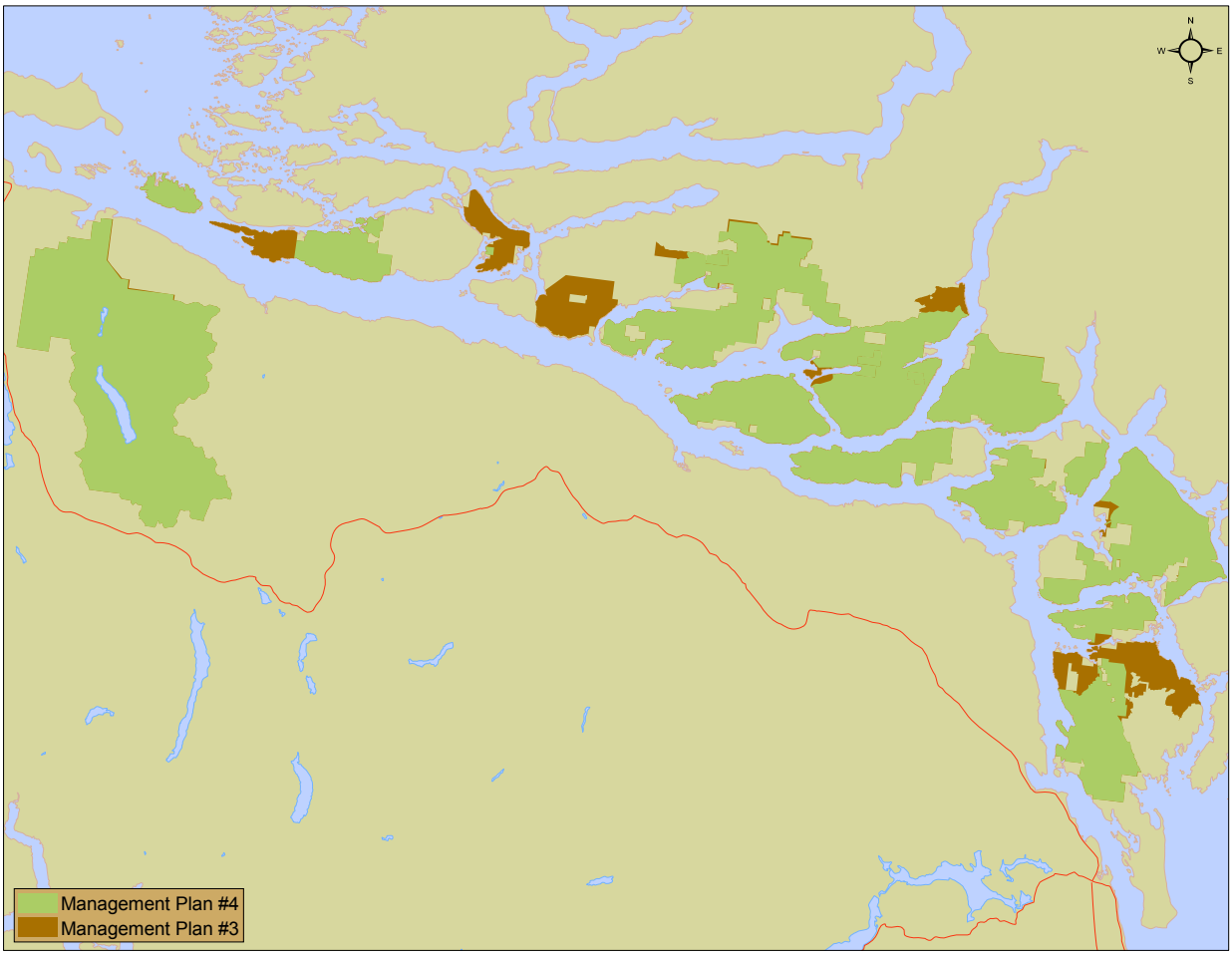

Figure 2. TFL 47 Land Base Changes Since MP #3.

Table 7. TFL Area Change Summary – MP#3 to MP#4.

Management Plan #3 Area			**139,867**
minus:			
Bill 24	Boat Bay	-606	
	Forward Harbour	-297	
	Thurston Bay	-251	
Bill 24 Total		*-1,154*	
FRA	East Craycroft	-2,341	
	Loughborough Inlet	-1,063	
	Quadra	-1,236	
	West Craycroft	-1,026	
FRA Total		*-5,666*	
Instrument 16	Boughey Bay	-3,888	
	Fulmore Lake	-318	
	Quadra	-1,438	
Instrument 16 Total		*-5,644*	
Unknown	Main Lake Park	-1,660	
	Octopus Islands Marine Park	-228	
	Small Inlet Marine Park	-573	
	Surge Narrows Park	-40	
Unknown Total		*-2,502*	
Total Reductions			-14,966
plus:			
Timber Licence Reversions			
	T0168	177	
	T0417	41	
	T0426 Blk 2	121	
	T0995	172	
Timber Licence Total		511	
Total Additions			511
Boundary Adjustment / Mapping Error			-408
Management Plan #4 Area			**125,004**

Additional area has also been added to TFL 47 - four Timber Licences will revert to the TFL. They are currently the subject of negotiations between the provincial government and TimberWest. Those negotiations are expected to be complete either prior to or during the term of MP#4. These areas have been incorporated into the spatial dataset for this analysis. The initial harvest level for the base case will be adjusted to account for the additional area. Table 8 shows the contribution of these TL's to the total landbase area.

Table 8. TFL and Timber Licence Areas.

Parcel	Area (Ha)
TFL 47	124,086
T0168	216
T0417	270
T0426 Block 2	259
T0995	172
Total	125,004

The location of these TL's is shown in Figure 3.

6.1 Timber Harvesting Land Base

This Information Package includes a description of issues, information sources, assumptions, and criteria used to estimate the land base available for timber harvesting, including any relevant data processing or adjustments. Land is classified as either 'Productive' or 'Non-Productive'; the productive landbase is then netted down to determine the Timber Harvesting Land Base (THLB).

6.1.1 Timber Harvesting Land Base Determination

The starting landbase for the analysis will be all land within the TFL 47 boundary, and the four TL's that will revert to the TFL during the term of MP#4. All Timber Licenses that revert will have second growth or old growth stands on them. If forest cover information is unavailable, the minimum necessary stand information will be developed based on other available data and local knowledge.

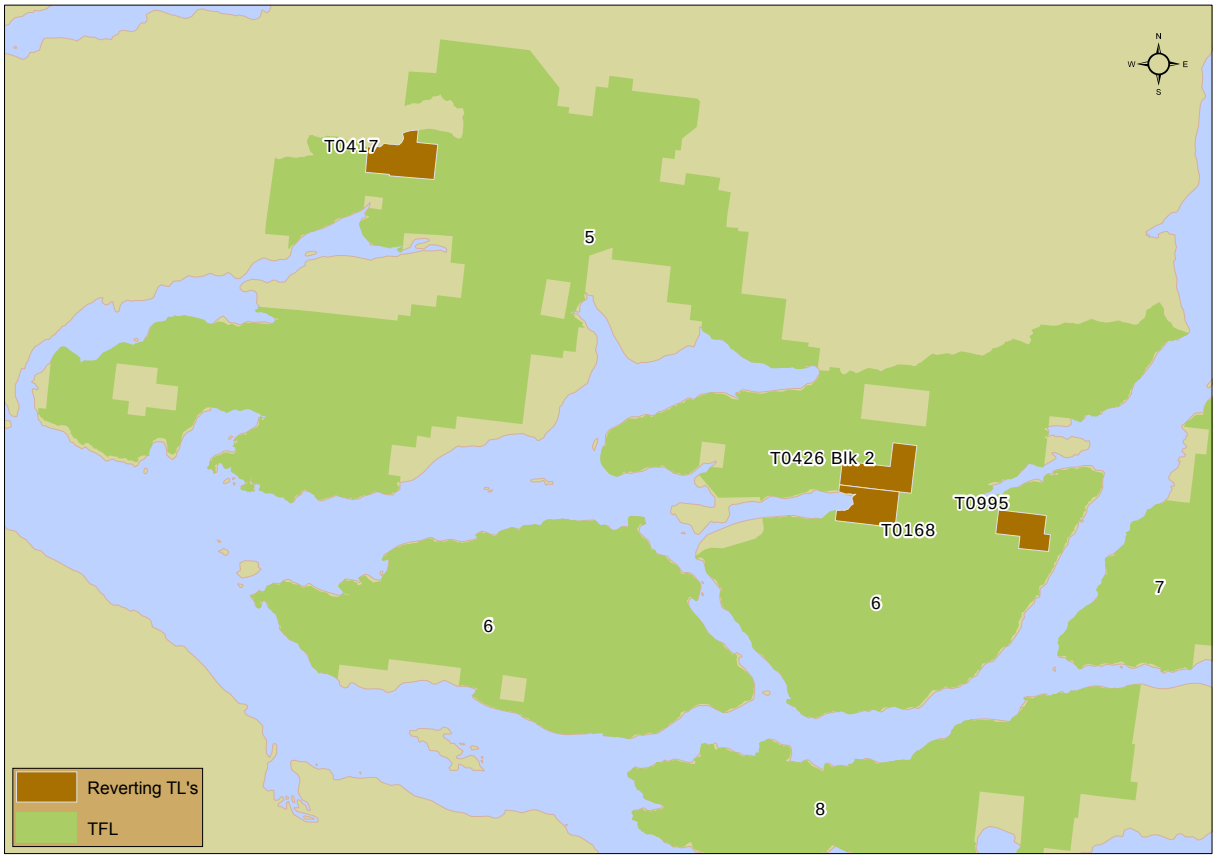

Figure 3. Timber Licences Reverting to TFL 47.

Parks were netted out of the THLB for MP#3. They are no longer in the TFL, but no Instrument documenting their removal exists on the MFML website.

In some cases individual areas may have several classification attributes. For example, stands within riparian reserve boundaries might also be classified as non-commercial. These areas would have been classified on the basis of this latter attribute, prior to the riparian classification. Therefore, in most cases the net reduction will be less than the total area in the classification. Table 9 shows the netdown process through which the timber harvesting landbase has been determined. The order of the entries in the table corresponds to the sequence in which the land base classifications were applied.

Table 9. Timber Harvesting Land Base Determination

	Total Area (Ha)	Productive Area (Ha)	Area Removed (Ha)
TFL Area	**125,004**	**115,444**	
Hanson Island	1,385		1,385
Non Forest	6,281	-	6,264
Roads	2,465	-	1,876
Landslides	n/a	-	34
Inoperable	12,734	10,300	10,299
Unstable Terrain	16,349	15,833	3,840
Problem Forest Type	1,261	1,253	802
Low Site	5,024	4,659	3,822
Recreation	4,442	2,535	1,100
Wildlife Habitat	2,647	2,512	2,187
Red/Blue Listed Ecosystems	4,010	3,977	2,062
ESAs	12,350	9,538	903
Marine Buffer	1,253	1,104	714
Riparian	18,496	17,691	4,427
Wildlife Tree Patches	1,512	1,475	602
Cultural Retention	n/a		85
Timber Harvesting Landbase			84,601

The productive area of the TFL is 115,444 hectares and the THLB area is 84,601 hectares.

6.1.2 Age Class, Leading Species and Ecological Distribution

The age class distributions of the productive forest and THLB landbases are shown in Figure 4.

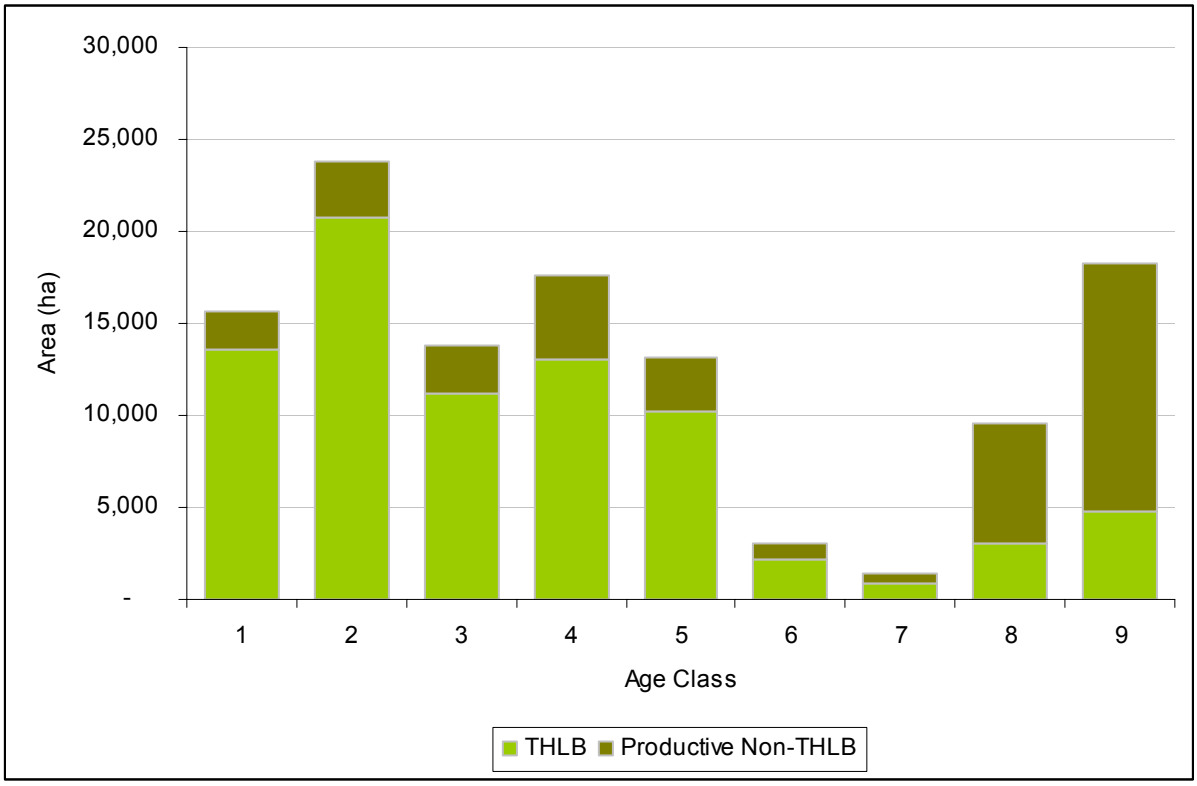

Figure 4. Age Class Distribution.

The age class distribution is well balanced, with significant area between 60 and 100 years of age (age classes 4 and 5). However, much of the old second growth (age class 8, older than 140 years) and the old growth area have been netted out of the THLB.

Figure 5 shows that TFL 47 is comprised primarily of hemlock leading stands. However, this is based on the forest cover label and is somewhat misleading. Many younger stands have been typed as Hw-leading based on the high number of naturally regeneration hemlock stems. However, these are often shorter than the Douglas-fir (planted) crop trees that they outnumber. The majority of harvested volume will, in most cases, be Douglas-fir. While the harvested species distinction in not important for strategic timber supply assessment, the fact that these sites will be assigned a lower productivity because they are classified as hemlock stands is of concern.

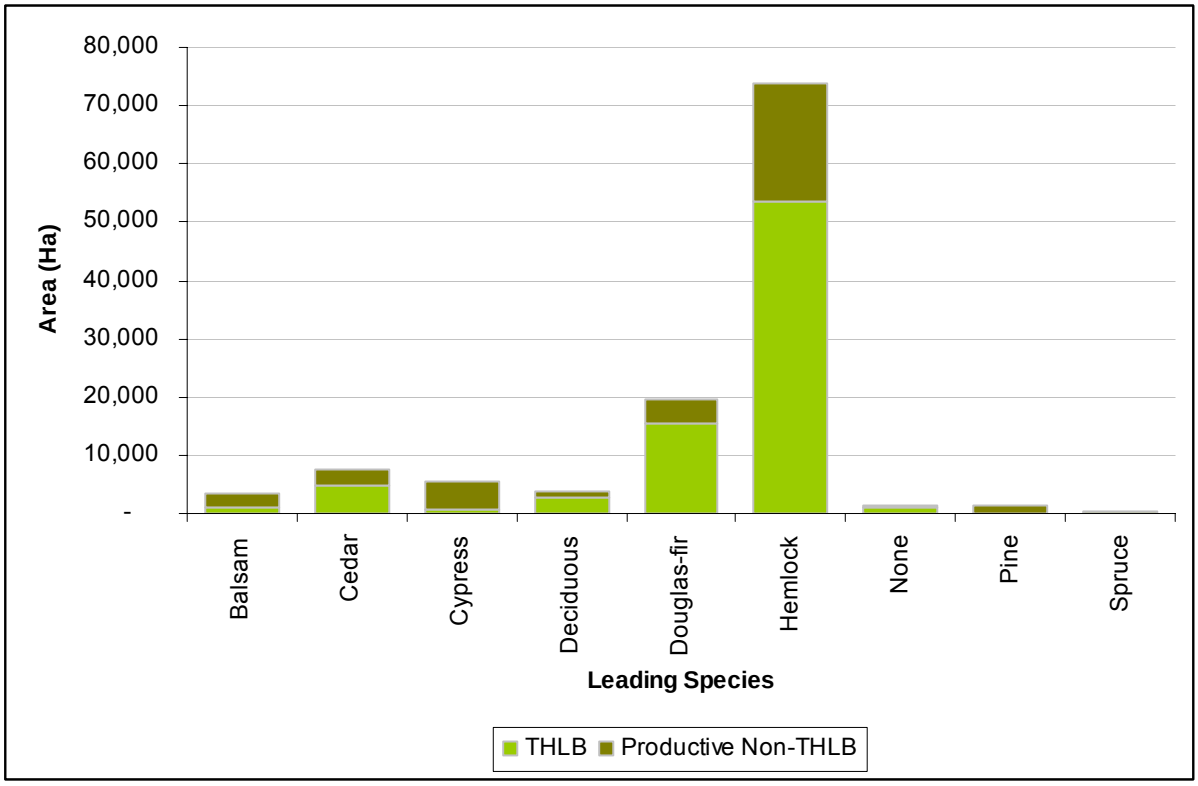

Figure 5. Leading Species Distribution

To correct the mis-assignment of leading species for younger, managed stands, yield curves will be based on typical planting prescriptions and amounts of natural ingress determined from silvicultural records. Stands establish after 1974 are considered to be managed. The silviculture prescription is based on the ecology of the site, which is known from the BEC classification (Figure 6) and site series designation – both of which are contained in the spatial data being used for this project.

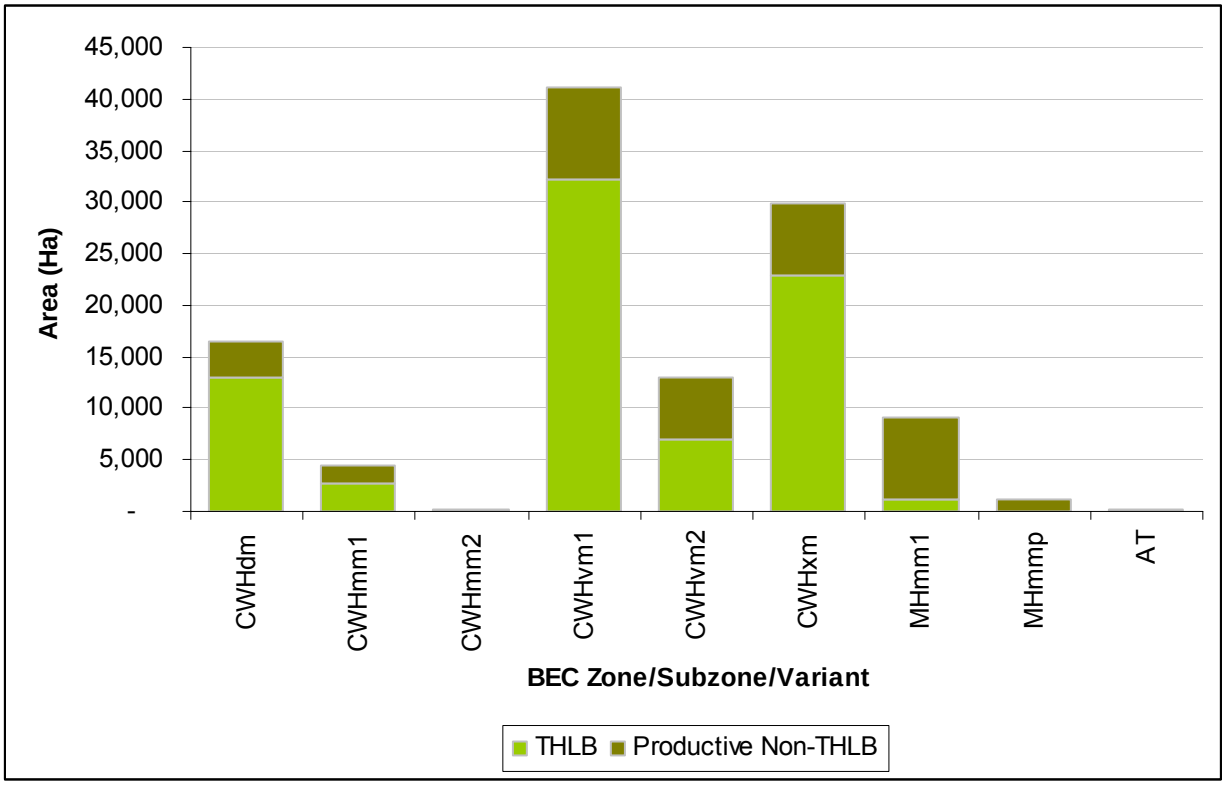

Figure 6. Biogeoclimatic Class Distribution

6.2 Total Area

The total area of TFL 47 is 125,004 hectares. However, Hanson Island was established as a protection area under the Environment and Land Use Act in May 2002. In July 2003 a Management Agreement was signed between the Province and the Hanson Island First Nations that gave them management over Land Act tenures for Hanson Island through a head lease on behalf of the provincial government. Although the area of the head lease, which is subject to the Hanson Island Management Agreement, remains within TFL 47 it no longer contributes to the TFL timber supply and has been excluded from the timber harvesting land base. Since it will not contribute to the LU-based forest cover objectives for other resource values, the productive area of the Island for the purpose of this analysis is consider to by zero.

6.3 Non-Forest Area

Non-forest land includes areas in the forest cover that are either non-vegetated (such as lakes, rocks, shrubs that occupy less than 5% of the land, etc.), or are unreported. Non-forest land also includes vegetated areas where less than 10% of the area is occupied by trees. With the exception of recently logged areas classified as bare ground or having little tree cover, all these non-forest areas are considered non-contributing to timber supply and are excluded. Non-forest land has been identified from

the VRI based on BC Land Classification System codes and estimated site index. The old forest cover data explicitly classifies non-forest land. These exclusions are shown in Table 10.

Table 10. Non-Forest Area.

Non Forest Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
TFL VRI (not 'Vegetated, Treed and Estimated SI = 0)	6,169	-	6,169
LRDW VRI (not 'Vegetated, Treed and Estimated SI = 0)	80	-	63
TimberWest NP Code in (AF,AL,CL,GPIT,LA,NP,RI,RK,RR,SW,TL)	32	-	32

6.4 Non-Productive Area

Non-productive forest areas are portions of the land base that are capable of supporting vegetation, but are considered unsuitable for growing commercial tree species. They have not been explicitly netted out of the THLB. Instead, they are accounted for through the 'Low Productivity' and 'Problem Forest Type' netdowns below. These area won't contribute to old seral constraint that is used to model biodiversity requirements.

6.5 Existing Roads, Trails and Landings

6.5.1 Classified Roads, Trails and Landings

Classified roads, trails and landing are those for which a polygon has been typed out in the forest inventory data. The VRI land classification system has categories for roads and landings. However, using them for netdown purposes is problematic for two reasons:

- Most road R/W and landing polygons are too small in size to be captured by the VRI; and
- The classification often applies to only a portion of the polygon, making it difficult to reconcile with other fully spatial netdowns.

No netdown has been applied for classified roads, trails and landings, on the basis that these areas are adequately identified by the road buffering exercise described in the next section.

6.5.2 Unclassified Roads

Unclassified roads are based on the spatial road database maintained by TimberWest. It is continuously updated as roads are built in support of harvesting operations. For the last timber supply analysis, roads were

spatially netted out of the landbase using a 10 metre buffer width. This buffer width has been reviewed and amended based on current operational practice. A total road width of 9.88 metres has been used for Johnstone Straits, and 10.33 metres has been used for Bonanza Lake. These widths are based on actual measured widths over the past five years, and summarized in Table 11.

Table 11. Constructed Road Widths – 2005 to 2009.

			Slope Class (%)				
	Forest Type	Disturbance Type	0-15	16-30	31-50	50+	Average
Blocks 2-12	all	roads only	9.37	9.83	10.13	12.98	9.75
Blocks 2-12	all	all PAS	9.56	10.04	10.38	12.23	9.88
Block 17	all	roads only	8.4	9.98	12.06	11.68	10.18
Block 17	all	all PAS	8.52	10.12	12.23	11.84	10.33
Block 17	2G	roads only	8.15	9.88	N/A	N/A	8.22
Block 17	2G	all PAS	8.32	10.09	N/A	N/A	8.34
Block 17	OG	roads only	8.63	9.99	12.06	11.68	10.86
Block 17	OG	all PAS	8.73	10.1	12.2	11.81	10.98

The area falling within the GIS buffers has been removed from the THLB (Table 12). It is also considered to be non-productive.

Table 12. Area in Unclassified Roads.

	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Existing Roads	2,465	-	1,876

The area removed is slightly smaller than the total area because some roads pass through non-productive areas previously netted out of the THLB.

These road widths are ditch line to ditch-line measurements. As such, they will overestimate the area that no longer supports forest growth. In fact, trees will establish roots within the ditch areas, and tree crown will grow to cover most (or – in many cases – all) of the road right-of-way. TimberWest is considering a field program that will quantify the actual impact of roads on future timber supply. These results will be presented in a sensitivity analysis.

6.6 Landslides

No net down is proposed for landslides in blocks 2 to 12. Blocks 2 to 12 do not have a history of landslides. A netdown of 0.1% is proposed for block 17. This results in a 34 hectare aspatial deletion from the THLB. The Bonanza Lake area, following the completion of backlog road deactivation work, has experienced very few landslide events and these have been very limited in scope.

6.7 Inoperable / Inaccessible

The current operability map for the TFL was completed prior to the last Management Plan, and reviewed by TimberWest staff for this project. It identifies large, contiguous areas that are uneconomical to harvest based on a combination of accessibility and timber value, and is considered to be accurate and suitable for strategic planning purposes. Stands that were primarily pulp, isolated, or old growth less than 250 m^3/ha were classified as inoperable. The landbase was also classified by yarding system (conventional and helicopter.) The total area that is considered inoperable or inaccessible is shown in Table 13.

Table 13. Inoperable Area.

	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Inoperable Area	12,734	10,300	10,299

Areas with an 'Inoperable' designation that have been previously logged are considered to be operable. The remaining operable landbase has been further classified according to yarding system. This breakdown is shown in Table 14.

A further reduction to the operable land base was made; areas of 'Unstable' or 'Potentially Ustable' terrain were mapped, and a netdown has been applied. For 'Unstable Terrain', two categories were excluded: 'Unstable' terrain and slope stability class 5. A 90% netdown was applied to these areas. Reductions have also been applied for 'Potentially unstable' and slope stability class 4; 20% of these areas were netted out of the THLB. Table 15 shows the total and productive area involved, and the impact on THLB.

Table 14. Area by Yarding Method.

Operability Class	Mapped Area (Ha)	Productive Area (Ha)	THLB Area (Ha)
[C]onventional	109,752	102,138	83,237
[H]elicopter	2,250	2,230	1,179
[I]noperable	11,892	9,925	-
[N]ot Classified	842	375	-
<blank>	268	250	185

Table 15. Unstable Terrain.

Stability Class	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
P	9,936	9,859	1,591
4	2,331	2,278	382
U	1,391	1,353	443
5	2,690	2,343	1,424

This netdown is based on TimberWest consolidated terrain stability database which they maintain for operational planning purposes. The mapping for the Johnstone Strait portion of the TFL was completed in 1993 to a terrain survey intensity level (TSIL) 'E'. Terrain stability mapping for the Bonanza Lake block was completed in the late 1970's and early 1980's, but was review and updated to TSIL 'E' standards in 1993 in conjunction with the completion of a Management Working Plan for the TFL. Part of the Bonanza Lake block were completed to TSIL 'C' standards under two separate projects completed in 1998 and 2000.

6.8 Problem Forest Types

Problem forest types are physically operable and exceed low site criteria, but are not currently utilized due to poor merchantability. Within TFL 47, only lodgepole pine leading stand fall into this category.

Table 16. Problem Forest Types.

PFT	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Pine-leading	1,261	1,253	802

Although classified as productive land, these stands will not contribute to old seral constraints.

6.9 Low Site

Low site stands are not likely to achieve a harvestable volume over a reasonable time horizon. Sites may fall into this category in two ways: they are inherently unproductive due to soil moisture and nutrient regimes (i.e. low site index); or the sites might not be fully occupied with commercial tree species. At this stage, the following stand types are netted out of the THLB:

- Immature coniferous stands incapable of achieving 150 m^3/ha at 150 years of age on slopes less than 30%;
- Immature coniferous stands incapable of achieving 250 m^3/ha at 150 years of age on slopes of 30% or more; and
- Immature deciduous stands incapable of achieving 150 m^3/ha have been netted out of the landbase.

This reduction is applied after Pl-leading stands have been netted out of the land base as being non-commercial. In order to apply this reduction, stand volume at 150 years of age was forecast using Variable Density Yield Predictor (VDYP). The area that was netted out due to low growing potential is shown in Table 17 broken down by leading species.

Table 17. Areas With Low Site – By Leading Species.

Leading Species	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
BA	309	194	120
CW	380	373	331
DR	51	46	46
FD	716	691	571
HM	435	434	224
HW	2,684	2,624	2,403
PL	32	29	-

Leading Species	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
SS	18	17	17
YC	339	204	82
<blank>	58	47	28
Total	5,024	4,659	3,822

A lower volume threshold has been used on has been used on slopes less than 30%. These areas can be economically harvested using less expensive ground-based systems. Also, road construction costs tend to be lower.

Although classified as productive land, these stands will not contribute to old seral constraints.

6.10 Recreation Reductions

Protection of recreation values on the TFL does not fit into any of the foregoing categories. Two types of netdowns have been applied to protect recreation resources:

- Features in the Recreation Inventory that were categorized has having 'High' or 'Very High' significance have been removed from the landbase. The exception to this rule is karst features. The Recreation Inventory drew broad polygons around karst features; however TimberWest staff feel that harvesting operations can be managed in a way that will protect these features without any negative impact on strategic timber supply.

- Identified recreation sites and trails have been netted out of the THLB.

Forest Service recreation sites and trails have been netted out of the THLB. In addition, the Recreation Resources Inventory identifies additional areas to be removed. Any feature with a Significance of 'A' or 'B' and a Management Class of '0' has been removed. A partial netdown has been applied for features with a Significance of 'B' and a Management Class of '1' – 50% of the area has been removed from the THLB. Any karst areas not excluded by the recreation netdown will be managed operationally – no additional netdowns have been applied. These areas tend to be small and can be protected within the WTP's that are retained to meet stand level biodiversity requirements.

Table 18 shows the total and productive area covered by recreation features, and the THLB impacts of protecting them.

Table 18. Recreation Resources.

Recreation Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Recreation Sites	2	1	1
Recreation Trails	299	281	249
Rec Inv Significance in VH or H , Sensitivity is H (100% netdown)	1,395	449	324
Rec Inv Significance in VH or H , Sensitivity is M (100% netdown)	2,746	1,804	526
	4,442	2,535	1,100

6.11 Habitat Reductions

No WHA's are currently established on Quadra or in Johnstone Strait. However, grizzly bear habitat has been identified (based on Schedule 2 of the SCCO) and has been netted out of the THLB. The Bonanza Lake block has WHA's for MAMU and UWRs for deer and elk. Reductions for wildlife habitat are summarized in Table 19.

Table 19. Wildlife Habitat Areas

Habitat Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
UWR	1,520	1,461	1,247
MAMU	160	160	58
Grizzly Bear	967	891	882
	2,647	2,512	2,187

6.12 Red and Blue-Listed Ecosystems

Red and blue-listed plant communities have been identified based on TEM mapping. Red-listed communities in old growth has been completely netted out of the THLB, and blue-listed communities in old growth has been partially (70%) netted out. Reductions for red- and blue-listed ecosystems are summarized in Table 20.

Table 20. Red- and Blue-Listed Ecosystems

Ecosystem Type	Mapped Area(Ha)	Productive Area(Ha)	Net Area Removed(Ha)
Red-Listed Ecosystems	772	767	615
Blue-Listed Ecosystems	3,238	3,211	1,447
Total	4,010	3,977	2,062

6.13 Environmentally Sensitive Areas

Some productive land is classified as environmentally sensitive and/or significantly valuable for other resources. For timber supply analysis purposes, Environmentally Sensitive Areas (ESA's) are identified and delineated through forest cover polygons in the old forest cover data, and are applied as reductions to the THLB. Two categories of ESA's are considered: sites with suspected regeneration problems, and avalanche areas. Two ESA classes are recognized within each category: highly sensitive (1) and moderately sensitive (2). The ESA categories that occur on the TFL, and the netdown factors applied to them, are shown in Table 21.

Table 21. ESA Netdown Factors.

ESA Category	Code	% Reduction
Regeneration	Ep1	90%
	Ep2	20%
Avalanche	Ea1	20%

Reductions to the THLB due to these ESA's are shown in Table 22.

Table 22. ESA Areas – By ESA Category.

ESA Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Regeneration (Ep1)	3,454	1,747	423
Regeneration (Ep2)	7,748	7,295	473
Avalanche (Ea1)	1,149	496	7
Total	12,350	9,538	903

For MP#3, ESA mapping was used to identify and exclude environmentally sensitive areas for soils and wildlife from the THLB. That will not be done for this analysis. Instead, terrain mapping has been used to net out unstable areas (see Section 6.7).

6.14 Marine Foreshore

For MP#3 a marine foreshore buffer of 30 metres was generated. Within this buffer a 90% netdown was applied. The same approach has been taken for this analysis. The area removed is shown in Table 23.

Table 23. Marine Foreshore Buffer.

	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
Marine Foreshore Buffer	1,253	1,104	714

6.15 Riparian Reserve and Management Zones – Streams

The FSP states that FPPR regulations will be followed with respect to riparian buffers. These are listed (for streams) in Table 24. Streams have been buffered according to their riparian class and the resulting area has been netted out of the THLB.

For EBM areas, the South Central Coast Order specifies a riparian buffer of 1.5 tree lengths. However, the tables below (from FPPR) are considered to amount to similar retention levels, and can be modelled in a more straight forward fashion. Therefore, FPPR regulations will be followed with respect to riparian buffers. This FPPR riparian buffer guidance will also be applied to classified stream in the non-EBM parts of the TFL.

Not all streams and other water bodies are classified. Depending on the number of unclassified steams, two possible approaches to generating buffers are being considered. These were treated as S2 or S5, depending on the presence or absence of fish.

No fluvial units (fans, alluvial streams) exist within the plan area. Terrain is relatively gentle. Watersheds tend to be small and are usually regulated by lakes or wetlands.

Other than estuaries and marine interface areas, which are already netted out of the THLB, TFL 47 does not have 'high-value fish habitat' – as that term is defined in the South Central Coast Order. The definition that it provides is:

> *[…] critical spawning and rearing for anadromous and nonanadromous fish including:*

(a) estuaries (including eel grass beds, and salmonid and eulachon rearing areas);

(b) wet flood plains (including main channel salmonid and eulachon spawning habitats, and off channel habitat used for rearing and spawning); and

(c) marine interface areas (including, shallow intertidal areas, kelp beds, herring spawning areas, and other nearshore habitats used by marine invertebrates for reproduction and rearing).

Streams within the plan area are generally uniform in nature and non alluvial, lacking what is defined as critical fish habitat.

Table 24. FPPR Riparian Zone for Streams.

			VILUP Area		SCCO Area	
Category	RRZ[3] Buffer (m)	RMZ Buffer (m)	RMZ Retention (%)	Effective Buffer Width[1,4]	RMA Retention (%)	Effective Buffer Width[1,4]
S1	50	20	75	65	100	70
S2	30	20	75	45	100	50
S3	20	20	75	35	100	40
S4	0	30	20	6	50	15
S5	0	30	10	3	10	3
S6	0	20	0	0	0	0
Unclassified - Fish Present[2] (S2)	30	20	75	45	100	50
Unclassified - No Fish Present (S5)	0	30	10	3	10	3

Notes:

[1] For comparison purposes only - will not be applied to the spatial data

[2] fish_ind is populated for every stream

[3] FPPR buffer rules have be used instead of the SCCO '1.5 tree length' rule

[4] Effective buffer width is calculated as RRZ + (RMZ x Retention %)

Table 25 shows the Riparian Reserve Zones (RRZ) and Riparian Management Zones (RMZ) that result when these rules are applied to the mapped streams in TFL 47. RRZ's are entirely netted out of the THLB, but only 25% of the area in RMZ's is removed.

Table 25. Riparian Reserve and Management Zones – Streams

RMA Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
RMA-S1-SCCO	58	56	53
RMA-S1-VILUP	169	162	80
RMA-S2-SCCO	407	394	335
RMA-S2-VILUP	124	120	68
RMA-S3-SCCO	704	682	628
RMA-S3-VILUP	164	157	84
RMA-S4-SCCO	342	333	152
RMA-S4-VILUP	33	31	4
RMA-S5-SCCO	3,501	3,380	288
RMA-S5-VILUP	6,532	6,167	405
RMA-S6-SCCO	1,765	1,714	-
RMA-S6-VILUP	1,418	1,350	-
Total	15,217	14,546	2,097

6.16 Riparian Reserve Zones – Lakes and Wetlands

Lakes and wetlands are less common on the TFL than are streams, but the management of riparian areas around these features does have a small impact on the THLB. The FRPA guidelines for riparian management of lakes are shown in Table 26, and the resulting riparian zones and THLB impacts are shown in Table 27.

Table 26. FPPR Riparian Zone for Lakes.

			VILUP Area		SCCO Area	
Category	RRZ Buffer (m)	RMZ Buffer (m)	RMZ Retention (%)	Effective Buffer Width	RMA Retention (%)	Effective Buffer Width
L1	10			10	100	10
L2	10	20	50	20	100	30
L3		30	50	15	100	30
L4		30	50	15	100	30
Unclassified (5ha <= area < 1000ha) -- L1	10			10	100	10
Unclassified (1ha <= area < 5ha), CWHdm, xm -- L2	10	20	50	20	100	30
Unclassified (1ha <= area < 5ha), other BEC -- L3		30	50	15	100	30
Unclassified (0.25ha <= area < 1ha), CWHdm, xm -- L4		30	50	15	100	30

Table 27. Riparian Reserve and Management Zones – Lakes.

RMA Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
RMA-L0-SCCO	21	20	15
RMA-L0-VILUP	51	48	19
RMA-L1-VILUP	7	7	2
RMA-L2-SCCO	3	2	2
RMA-L3-SCCO	25	23	20
RMA-L3-VILUP	37	31	6
RMA-L4-SCCO	19	18	11
RMA-L4-VILUP	17	15	0
Total	180	164	75

The FRPA guidelines for riparian management of wetlands are shown in Table 28, and the resulting riparian zones and THLB impacts are shown in

Table 29.

Table 28. FPPR Riparian Zone for Wetlands.

Category	RRZ Buffer (m)	RMZ Buffer (m)	VILUP Area		SCCO Area	
			RMZ Retention (%)	Effective Buffer Width	RMA Retention (%)	Effective Buffer Width
W1	10	40	50	30	100	50
W2	10	20	50	20	100	30
W3	0	30	50	15	100	30
W4	0	30	50	15	100	30
Unclassified (area>=5ha) --W1	10	40	50	30	100	50
Unclassified (1ha<=area<5ha), CWHdm, xm--W2	10	20	50	20	100	30
Unclassified (1ha<=area<5ha),other BEC--W3	0	30	50	15	100	30
Unclassified (0.25ha<=area<1ha),CWHdm, xm--W4	0	30	50	15	100	30
Unclassified (0.5ha<=area<1ha) ,other BEC--W4	0	30	50	15	100	30

Table 29. Riparian Reserve and Management Zones – Wetlands.

RMA Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
RMA-W1-SCCO	111	103	78
RMA-W1-VILUP	57	50	9

RMA Type	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
RMA-W2-SCCO	55	52	38
RMA-W2-VILUP	59	56	23
RMA-W3-SCCO	34	32	26
RMA-W3-VILUP	32	30	11
RMA-W4-SCCO	25	24	20
RMA-W4-VILUP	36	34	14
Total	409	380	219

No netdown is proposed for forested swamps. Forested swamps are infrequent within the plan area. Timber deferrals required for forested swamps will be handled operationally, within WTPs.

6.17 Wildlife Tree Patches

Existing WTP's have been mapped and are excluded from the THLB.

Table 30. Wildlife Tree Patches.

	Mapped Area (Ha)	Productive Area (Ha)	Net Area Removed (Ha)
WTP's	1,512	1,475	602

6.18 Cultural Heritage Resource Reductions

Cultural heritage resources are localized to small areas. An analysis conducted for MP#3 concluded that these areas could be effectively managed through the operational planning process and would have negligible strategic timber supply impacts. No netdowns or cover constraint restrictions were applied. For this analysis, a netdown of 0.1% has been used to model the impact that cultural heritage resources (including monumental cedar) would have on strategic timber supply. The results in 90 hectares being (aspatially) removed from the THLB. The vast majority of timber deferrals due to these objectives will be handled operationally – through the siting of WTP's and other reserve areas.

6.19 Future Roads

The road density on the developed landbase has been calculated, and the resulting percentage reduction factor (2.5%) will be applied to the undeveloped landbase as a yield curve netdown (on future stands

only) in order to account for the area that will be lost to future roads. No future road allowance will be made for areas identified as 'Helicopter Yarding' in the operability coverage

These calculations are summarized in Table 31.

Table 31. Future Road Requirements.

	Area (ha)
THLB Area, Roaded	75,500
Area in Roads	1,876
Road %	2.5%
THLB Area, Unroaded	9,101
Road Area Required	226

6.20 Exclusion of Specific Geographically Defined Areas

No other specific geographically defined areas have been excluded from this analysis.

6.20.1 Wildlife Tree Patches

Existing WTP's are mapped, and have been excluded from the THLB. Future WTP requirements will be dealt with partial netdowns in stands above a threshold age of 80 years. Where sufficient non-THLB forest exists within 250 metres of a THLB stand, no future WTP netdown will be applied to that stand.

6.21 Area Additions

This section normally addresses TL's for other types of tenure that will become part of the TFL within the planning horizon of the forest estate model. Although four TL's will become part of the TFL, it is expected that this will occur before MP#4 come into effect. Consequently, they have been added to the spatial data set, and will be considered to be part of the TFL for this analysis.

7 Inventory Aggregation

7.1 Management Zones and Multi-Level Objectives

Inventory aggregation allows stands with similar mensurational characteristics and ecological values to be modeled as a single unit, which significantly increases modelling efficiency. This does not preclude the tracking of individual stands for harvest scheduling.

Most TFL 47 resource values other than timber are protected by removing land from the THLB. However, it is still necessary to manage the timing and distribution of harvest within the THLB to adequately address some non-timber resource values. To accomplish this, several management zones have been established (solely for timber supply modelling purposes). These are shown in Table 32.

Table 32. Modelling Zones.

Resource Concern	Landbase
Visual Quality	Productive forest within VQO polygons
Biodiversity	Productive forest by LU and Site Series Surrogate
Adjacency / Rate of Cut	THLB outside of VQO polygons (IRM)

7.2 Analysis Units

Stands are grouped into analysis units so that individual stand yield curves can be aggregated for modelling purposes. This grouping has been done for existing and future managed stands only; individual yield curves for each existing natural stand will be tracked within the forest estate model. Aggregation for managed stand yield tables is based on TFL Block (Bonanza Lake or Johnstone Strait) BEC zone/subzone/variant and site series, and genetic gain era. Table 33 shows the THLB area for each of the resulting Analysis Units. There are 50 AU's for existing managed stands.

Table 33. THLB Area by Analysis Unit – Existing Managed Stands

			Genetic Gain Era			
TFL Block	BGC Zone	Site Series	GG0	GG1	GG2	Total
Bonanza Lake	CWHvm1	01	4,075	181	169	4,426
Bonanza Lake	CWHvm1	02,03,04	1,320	16	3	1,338
Bonanza Lake	CWHvm1	05,07,08	1,636	24	121	1,782
Bonanza Lake	CWHvm1	06,13,14	402	3	2	407

			Genetic Gain Era			
TFL Block	BGC Zone	Site Series	GG0	GG1	GG2	Total
Bonanza Lake	CWHvm2	01	3,524	188	523	4,234
Bonanza Lake	CWHvm2	02,03,04	263	11	0	274
Bonanza Lake	CWHvm2	05,07,08	162	5	8	175
Bonanza Lake	CWHvm2	06	47		6	53
Bonanza Lake	CWHvm2	09,10,11	46	1	5	52
Bonanza Lake	MHmm1	All	465	136	180	781
Johnstone Strait	CWHvm2	All	575	11	21	607
Johnstone Strait	CWHxm	01	5,621	781	2,070	8,473
Johnstone Strait	CWHxm	03,02	4,704	263	635	5,602
Johnstone Strait	CWHxm	05,04	1,122	619	705	2,446
Johnstone Strait	CWHxm	06	616	38	249	903
Johnstone Strait	CWHxm	07,08	755	193	400	1,348
Johnstone Strait	CWHxm	12,14	93	25	7	126
Total			25,428	2,494	5,104	33,026

All stands in the THLB will eventually become managed stands. The areas for these future managed stand analysis units are shown in Table 34. There are 17 AU's for future managed stands.

Table 34. THLB Area by Analysis Unit – Future Managed Stands

TFL Block	BGC Zone	Site Series	Total
Bonanza Lake	CWHvm1	01	7,642
Bonanza Lake	CWHvm1	02,03,04	2,759
Bonanza Lake	CWHvm1	05,07,08	3,517
Bonanza Lake	CWHvm1	06,13,14	718
Bonanza Lake	CWHvm2	01	6,451
Bonanza Lake	CWHvm2	02,03,04	507

TFL Block	BGC Zone	Site Series	Total
Bonanza Lake	CWHvm2	05,07,08	293
Bonanza Lake	CWHvm2	06	119
Bonanza Lake	CWHvm2	09,10,11	172
Bonanza Lake	MHmm1	All	3,866
Johnstone Strait	CWHvm2	All	2,930
Johnstone Strait	CWHxm	01	21,735
Johnstone Strait	CWHxm	03,02	24,653
Johnstone Strait	CWHxm	05,04	5,399
Johnstone Strait	CWHxm	06	2,048
Johnstone Strait	CWHxm	07,08	2,914
Johnstone Strait	CWHxm	12,14	549
Total			86,274

7.3 Detailed Land Base Information Requirements

All resultant spatial datasets, stand and analysis unit yield curves, and forest estate model input files will be made available to the Ministry of Forests and Range upon request.

8 Growth and Yield

8.1 Site Index Assignments

Site Index (SI) is a measure of productivity used during yield analysis. It is an estimate of potential height growth on a site over a fixed period of time, normally 50 years. The productivity of a site largely determines how quickly trees grow and when rotation age and minimum harvest age (MHA), are reached.

Two approaches to estimating site index are possible:

- Height / age based on the new (Phase II-adjusted) VRI data
- Site Index Adjustment Project (TEM-based) developed by J.S. Thrower (2002)

The inventory site index from the VRI has been used to develop yield tables for all existing stands. However, an ecologically-based site index estimate (adjusted site index) was used for stands that regenerated after 1974. Although the Terrestrial Ecosystem Mapping upon which the adjusted site index

estimates were based has not yet been independently assessed for accuracy, it is still considered to be the best source of site productivity data for the purpose of forecasting the yield for future managed stands. To gauge the impact on timber supply of uncertainty about site productivity, a sensitivity analysis using SIBEC site index estimates will be conducted.

Figure 7 shows the site index distribution of the THLB, by leading species.

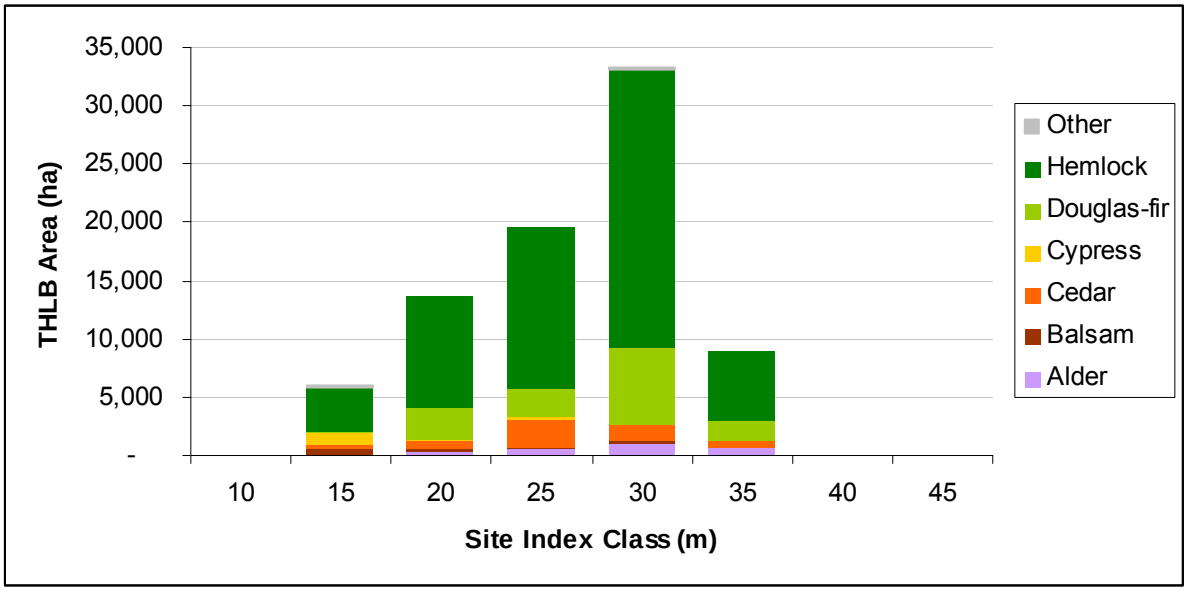

Figure 7. Site Index Distribution of the THLB.

8.2 Utilization Level

The utilization level defines the maximum height of stumps that may be left on harvested areas and the minimum top diameter (inside bark) and minimum diameter (dbh) of stems 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. Utilization standards will be:

- Stands older than 120 years: 30cm stump, 17.5cm dbh, 15cm top
- Stands younger than 121 years: 30cm stump, 12.5cm dbh, 10cm top

8.3 Decay, Waste and Breakage for Unmanaged Stands

Decay, waste and breakage (DWB) factors that are applied to unmanaged stand yield tables to obtain net volume per hectare. These factors are assigned to natural stand volumes automatically in VDYP based on the Public Sustained Yield Unit (PSYU) location. For volume estimates at the 12.5 cm utilization level,

net volume cannot be produced directly by VDYP. Gross volume can be output, so these are prorated using the net volume / gross volume ratio taken from the 17.5 cm utilization yield tables.

8.4 Operational Adjustment Factors for Managed Stands

OAF1 is used to represent reduced yield due to gaps in stocking; and OAF2 is used to represent decay and losses due to disease and pest when they are present in large magnitudes. OAF1 is a constant reduction factor that shifts the yield curve down whereas the influence of OAF2 increases with age and therefore alters the shape of the curve. For MP#3, an OAF1 of 15% and an OAF2 of 5% were used. The same OAF values will be used for the base case run in this analysis.

Operational experience indicates that that OAF1 is significantly less than 15% in managed stands, and may in fact be below 10%. This estimate is based on local experience and professional judgment. However, it is difficult to apply existing survey information and spatial data to an analysis of operational adjustment factors. Additional survey work may be undertaken so that yield curves based on more realistic OAF1 values can be presented in a sensitivity analysis.

8.5 Volume Deductions

No other volume deductions have been applied to the yield curves for biological reasons. However, for timber supply modelling purposes, yield reductions will be applied to account for wildlife tree retention and future roads.

Root rot is not an issue, with minor occurrences on Quadra only. It is dealt with through stumping and/or planting white pine. It does not have an impact on timber supply at the strategic level and will not be modelled for this analysis.

8.6 Yield Table Development

Yield tables are used to forecast the development over time of existing stands, and of future stands that will be established following harvesting.

8.6.1 Base Yield Tables

Separate yield tables have been compiled for each stand identified in the VRI. One of three approaches was taken, depending on the age of the stand:

- For stands established before 1975 VDYP7 has been used.
- For stands established since 1975, TIPSY has been used.
- VDYP7 will be used to forecast the yield from all alder stands – natural and managed.

8.6.2 Aggregated Yield Tables

Yield tables have not been aggregated for existing stands. For both immature and mature existing stands, a unique yield curve has been created based on the productivity and species composition of the individual stand.

8.7 Yield Tables for Unmanaged Stands

8.7.1 Existing Mature Timber Volumes

The Phase II and NVAF adjustment to the VRI has been completed and have been applied when compiling natural stand yield tables.

8.7.2 Yield Tables for Unmanaged Immature Stands

VDYP7 was used to derive yield curves for each stand established before 1975.

8.8 Yield Tables for Managed Stands

Any stand established since 1975 is deemed to be a managed stand and will have a yield table developed using TIPSY.

8.8.1 Silviculture Regimes

While a separate yield curve was developed for each existing natural stand, existing and future managed stand yield curves will be developed for each Analysis Unit (AU). Existing and future managed stands will have the same planting prescription applied, and similar assumptions will be made about the composition and amount of natural ingress. Future managed stands will have different genetic gain assumptions applied (see Table 38). In total, the are 50 AU's for existing managed stands, and 17 AU's for future managed stands. All regeneration assumptions are listed in Table 35 and Table 36 for Johnstone Strait and Bonanza Lake respectively.

Each analysis unit has three lines in the table:

1) the planted component of the stand

2) the natural component of the stand; and

3) the proportion (by species) the each of the planted and natural component of the stand will contribute to the eventual volume harvested.

All existing natural stands will regenerate to one of these analysis units based on its BEC zone/subzone/variant and site series. Existing old growth and existing second growth stands will be

treated in the same fashion – they will have the same silviculture prescriptions and regeneration assumptions applied.

The site index used to drive the yield forecast for each AU is the area-weighted average SI for all of the stands that will regenerate to the AU.

Operational adjustment factors of 15% and 5% will be applied to for all stands for OAF1 and OAF2. A more realistic OAF1 value will be derived from survey data and used to generate managed stand yield tables for a sensitivity analysis.

Table 35. Silviculture Regimes – Johnstone Strait

BGC Zone	Site Series		F	H	C	Ba	Yc	Bg	Ss	Dr	Total
CWHvm2	All	P T/ha	0	0	150	150	400	0	0	0	700
		N T/Ha	0	1700	0	1600	700	0	0	0	4000
		Crop %	0	44	8	28	20	0	0	0	
CWHxm	01	P T/ha	840	0	140	10	0	10	0	0	1000
		N T/Ha	0	2200	50	16	0	0	3	31	2300
		Crop %	62	29	7	1	0	1	0	0	100
CWHxm	03,02	P T/ha	900	0	100	0	0	0	0	0	1000
		N T/Ha	0	2300	400	0	0	0	30	70	2800
		Crop %	53	27	19	0	0	0	1	0	100
CWHxm	05,04	P T/ha	800	0	190	0	0	10	0	0	1000
		N T/Ha	0	1600	0	10	0	0	10	80	1700
		Crop %	67	19	13	0	0	1	0	0	100
CWHxm	06	P T/ha	500	0	500	0	0	0	0	0	1000
		N T/Ha	0	2590	50	50	0	0	30	80	2800
		Crop %	32	41	26	1	0	0	0	0	100
CWHxm	07,08	P T/ha	500	0	460	20	0	20	0	0	1000
		N T/Ha	0	1900	0	0	0	0	0	100	2000
		Crop %	48	26	22	1	0	2	0	1	100

BGC Zone	Site Series		F	H	C	Ba	Yc	Bg	Ss	Dr	Total
CWHxm	12,14	P T/ha	60	0	940	0	0	0	0	0	1000
		N T/Ha	0	1700	100	0	0	0	90	110	2000
		Crop %	6	47	45	0	0	0	2	0	100

Table 36. Silviculture Regimes – Bonanza Lake

BGC Zone	Site Series		F	H	C	Ba	Yc	Ss	Hm	Total
CWHvm1	01	P T/ha	50	0	900	50	0	10	0	1010
		N T/Ha	0	3000	100	400	50	20	0	3570
		Crop %	5	49	40	5	0	1	0	100
CWHvm1	02,03,04	P T/ha	100	0	900	0	0	0	0	1000
		N T/Ha	0	3000	100	300	50	0	0	3450
		Crop %	10	48	40	2	0	0	0	100
CWHvm1	05,07,08	P T/ha	0	0	800	200	0	20	0	1020
		N T/Ha	0	1500	100	100	0	40	0	1740
		Crop %	0	35	49	15	0	1	0	100
CWHvm1	06,13,14	P T/ha	0	0	900	90	0	10	0	1000
		N T/Ha	0	4000	300	300	0	20	0	4620
		Crop %	0	60	34	5	0	1	0	100
CWHvm2	01	P T/ha	23	0	226	91	520	0	0	860
		N T/Ha	3	2040	0	1266	815	0	507	4631
		Crop %	0.8	41.3	3.1	24.2	23.6	0	7	100
CWHvm2	02,03,04	P T/ha	23	0	226	91	520	0	0	860
		N T/Ha	18	2303	0	1135	551	0	256	4263
		Crop %	1.3	34.8	5.9	24.1	29.2	0	4.7	100
CWHvm2	05,07,08	P T/ha	0	0	226	91	543	0	0	860
		N T/Ha	0	1191	178	1339	83	0	98	2889

BGC Zone	Site Series		F	H	C	Ba	Yc	Ss	Hm	Total
		Crop %	0	37.1	11.5	40.2	11.2	0	0	100
CWHvm2	06	P T/ha	0	0	226	91	543	0	0	860
		N T/Ha	0	1698	0	1311	687	0	134	3830
		Crop %	0	37.5	1.2	33.5	25.8	0	2	100
CWHvm2	09,10,11	P T/ha	0	0	226	91	543	0	0	860
		N T/Ha	27	546	0	148	1260	0	600	2581
		Crop %	0	14.5	0	7	57	0	21.5	100
MHmm1	All	P T/ha	0	0	0	91	769	0	0	860
		N T/Ha	0	369	0	1543	1331	0	560	3803
		Crop %	0	6.8	0	38.2	44.8	0	10.2	100

8.8.2 Regeneration Delay

Planting occurs promptly on all harvested areas; a regeneration delay of zero years will be assumed for the planted component of each stand. Fill in with naturals occurs over a few years so a regeneration delay of two years will be assumed for the natural component of each stand. These regeneration delays will be built into the yield curves that are input to the forest estate model.

8.8.3 Years to Breast Height

Silviculture survey data indicates that many plantations are reaching breast height in less time than is predicted by TIPSY. Analysis unit yield curves generated using TIPSY will be shifted leftward on the age-axis to compensate for this effect and better predict actual managed stand yields. Reliable data is available for Douglas-fir and is presented in Table 37. Block 12 has been separated from Blocks 1-11 due to a much higher incidence of browsing in Block 12. Similar information may be compiled for western hemlock is sufficient data is available and can be compiled. The results would be reviewed with MFLNRO staff before being applied in the forest estate model.

Having already accounted for the one-year old planting stock age in the regeneration delay calculations, the years to breast height listed in Table 37 will be increased by one year for application in the forest estate model.

Table 37. Average Number of Year to Breast Height for Douglas-fir.

TFL Blocks	Site Series	Average Measured YTBH
Blocks 1 to 11	CWHxm01	3.5
Blocks 1 to 11	CWHxm03	4.5
Blocks 1 to 11	CWHxm05	3.5
Blocks 1 to 11	CWHxm07	3.2
Blocks 1 to 11	CWHdm05	3.0
Blocks 1 to 11	CWHvm105	3.2
Block 12	CWHxm01	5.0
Block 12	CWHxm05	3.7

8.8.4 Fertilization

Existing managed stands are too young to have been fertilized. However, gains for fertilization on some existing natural stands will need to be accounted for. Since VDYP has no facility to model this, TIPSY will be used to estimate fertilization response (volume gain at rotation age) for a typical stand (Fd70Hw30) across a range of site indexes. These percentage increases will then be applied to the yield curves for the specific stands that have received a fertilizer treatment.

8.8.5 Stand Rehabilitation

No active stand rehabilitation is currently undertaken. A proportion of harvested alder stands will regenerate to alder, and the remainder will regenerate to fir-cedar stands. SIBEC will be used for inter-species site index conversion.

8.8.6 Tree Improvement

Improvements in growth due to the use of genetically improved seed will be modeled during yield curve construction. Genetic gains will be applied to any stands established after 1999. For MP#3, 8% and 5% were used for all post-1999 Fd and Cw stands respectively. These gains will be used for stands established between 1999 and 2004 for this analysis. New calculations have been made, based on seedlot information contained in planting records, to set new Fd, Cw and Ba genetic gain factors for stands established between 2005 and 2009. Factors for all future stand yield curves are based on 2010 sowing requests. These are summarized in Table 38.

Table 38. Genetic Gain Factors by Species and Silvicultural Era.

Era	Fd	Cw	Ba
2000 to 2004	8.0%	5.0%	0.0%
2005 to 2009	6.3%	5.1%	0.9%
Future	11.3%	15.0%	0.7%

If source data permits, genetic gain factors might also be compiled for periods prior to 2000. Any genetic gain assumptions beyond those listed in Table 38 will be reviewed with MFLNRO staff before being used for yield curve development and forest estate modelling.

8.9 Silviculture History

8.9.1 Existing Managed Immature

Any stand regenerated since 1975 is assumed to be managed. Yield estimates are derived using TIPSY. Operational adjustment factors have been used to account for stand openings and for factors that cause sub-optimum growth. These factors are discussed in Section 8.4.

8.9.2 Backlog and Current Non-Stocked Areas

NSR areas originally contained operable timber, were harvested, and have not yet regenerated to commercial species. Current NSR is part of the working forest and is expected to be regenerated on schedule. No backlog NSR exists on TFL 47.

All NSR in the forest inventory will be assumed to be “rolling” NSR – it will have regeneration delays applied in the forest estate model, and will be grown using the appropriate AU yield curve.

8.10 Unsalvaged Losses

Non-recoverable losses (NRL) of 1% were applied for the timber supply analysis that was completed in conjunction with MP#3. However, no allowance for NRL’s will be made for this analysis. Managed stand yield tables already take small openings due to windthrow (and other causes) into account through the application of an operational adjustment factor (OAF). Modelling NRL’s during forest estate modelling would result in ‘double-counting’ these losses.

9 Integrated Resource Management

9.1 Forest Resource Inventories

The following inventories (Table 39) are maintained by the licencee, and along with administrative and ecological boundary information obtained from both TimberWest and the MFML, form the foundation of the spatial database that has been built for this timber supply analysis.

Table 39. Resource Inventories.

Data Description	Use
TFL boundary (current)	Resource analysis extent – and distinguish Schedule A and B lands
TFL boundary (MP#3)	Resource analysis extent – and distinguish Schedule A and B lands
TL boundaries	Identify TL's that will revert to the TFL
Forest cover - VRI	Primary source of forest cover inventory. Used to define sites with low timber growing potential, unmerchantable forest types, environmentally sensitive areas where terrain stability mapping does not exist.
Forest cover - old	Identify environmentally sensitive areas for regen and avalanche hazard; Also identify Es where terrain stability mapping does not exist.
Forest cover – reverting TL's	
Logged blocks	Forest cover updating
Fertilization - historical	Managed stand yield tables
Operability	Land base accessibility
Terrain stability mapping	Identify unstable terrain (Class V)
Slope class	Netdown for low productivity
Stream class mapping	Base mapping data (roads, riparian). Used to define road and riparian reserve and management buffers.
Double line water	
Watershed boundaries	Application of ECA constraints
"Important fisheries watersheds"	
Road class mapping	Buffer roads for removal from THLB

Data Description	Use
Landscape units	Harvest control zone definition. Used to define landscape-level biodiversity.
Biogeoclimatic ecosystem classification	Harvest control zone definition. Used to define landscape-level biodiversity.
Terrestrial Ecosystem Mapping	Site Productivity
Visually sensitive areas	Harvest control zone definition. Used to define “known” and visual areas identified in the visual landscape inventory
Recreation Feature Inventory	Used to define areas with high recreational value.
Recreation sites (MFR)	Netdown
Trails	Netdown
WHA’s	Used to net out wildlife habitat.
SCCO	Define landbase for EBM constraints
VILUP Zones	Used to identify SMZ’s
Planned blocks and roads	Input to blocking procedure and source of future roads from existing forest development plans or forest stewardship plans.
WTP	Netdown
Red/blue listed ecosystems	Netdown
Grizzly bear	Netdown
Site series deficit	Cover constraint model for seral stage targets

9.2 Non-Timber Forest Resource Management

The document to this point has been primarily focused on approaches to modelling the timber resource. This section describes the methods that will be used to forecast the future availability of non-timber resources.

9.2.1 Forest Cover Requirements

The rate of harvesting can be limited in order to achieve an age class distribution target by applying forest cover constraints when the forest estate model is run. Cover constraints typically work by capping the amount of area that can be moved to a young age class (i.e. harvested), or by insisting that a minimum

amount of old timber exist at all times. Each has the effect of limiting the rate of harvest within the area to which it is applied. Many cover constraints can be enforced within a given model run, and each may apply to all or only to a specified portion of the landbase. Cover constraints will be applied in this analysis to model visual resources, watersheds and landscape level biodiversity. A cover constraint will also be applied at the landscape unit level as an alternative to modelling strict spatial adjacency rules.

9.2.2 Visual Resources

Visual Quality Objectives have been established in known scenic areas in TFL 47.

Cover constraints to protect visual resources will be applied to all areas with an established VQO . VEG heights will be calculated according to the guidance provided by "Procedures for Factoring Visual Resources into Timber Supply Analysis".

Visually sensitive areas are summarized by Visual Quality Objective (VQO) in Table 40. Visual quality will be maintained by limiting the rate of cut for each visually sensitive polygon according to the limits in "*Procedures for Factoring Visual Resources into Timber Supply Analyses*".

Table 40. Area Managed for Visual Quality

VQO	Total Area	Productive Area	THLB Area
M	14,711	14,473	12,252
PR	21,786	21,306	17,181
R	3,277	3,211	1,945
P	61	61	12
Total	39,835	39,051	31,390

Cover constraints will be applied to individual VQO polygons. Height growth will be based on TIPSY outputs, adjusted for the early achievement of breast height noted in Section 8.8.3. VEG height will be calculated based on average slope by landscape unit and VQO class.

Maximum percent denudation for each visual polygon will be taken from Table 41.

Table 41. Maximum Percent Denudation by VQC and VAC

	Visual Absorption Capacity		
Visual Quality Class	Low	Medium	High
Preservation	0	0.5	1
Retention	1.1	3	5
Partial Retention	5.1	10	15
Modification	15.1	20	25
Maximum Modification	25.1	32.5	4

9.2.3 Recreation Resources

Important recreational resources have been netted out of the THLB. Any remaining recreational values will be managed through the operational planning process. No cover constraints are required.

9.2.4 Wildlife

Most wildlife habitat is managed through a system of reserves and netdowns, so no forest cover constraints are required.

9.2.5 Adjacent Cutblock Green-Up

Integrated resource management (IRM) constraints will be applied to the remainder of the landbase without established VQO's , and modelled at the Landscape Unit level. Cut block adjacency will not be modelled spatially. The THLB area to which this constraint will be applied Table 42.

Table 42. Integrated Resource Management Zone (IRM)

	Total Area	Productive Area	THLB Area
IRM Zone	79,436	74,800	57,986

Within each landscape unit, no more than 25% of the THLB can be less than three metres in height.

9.2.6 Biodiversity

9.2.6.1 Landscape Level Biodiversity

The SCCO specifies 15% stand level retention, at least half of which must fall within the block for blocks greater than 15 hectares in size. TimberWest has analyzed existing EBM blocks[5] and determined the percentage of otherwise unconstrained timber that is being retained at the stand level to be 3.8%. The yield curves for all existing and future stands in the EBM area will be reduced by this amount.

Since no OGMA's are in place, a 10% stand-level retention target (FSP commitment) is in place for all harvesting that occurs outside of the EBM area (Quadra and Bonanza) in areas where the old seral requirement is in deficit. This will also serve to meet the landscape-level biodiversity requirements in these areas. This retention target will be adjusted to account for retention in riparian and other productive, non-contributing areas, and an aspatial netdown (either volume or area) will be applied.

The FPPR mandates a target of 3.5% be applied to each cutblock; this will not be modelled at the strategic level, and this requirement will be met by other stand-level retention netdowns and/or yield curve reductions.

The old seral constraints listed in Table 43 will be applied for Bonanza and Quadra (the non-EBM areas of the TFL) in the base case.. Where these targets are currently in deficit, 10% of volume will be retained at the stand level, as noted above. No drawdown of old seral areas will be permitted.

Seral stage requirements are established at the BEC variant level. All of the productive forest within each LU/BEC contributes to the old growth seral stage requirement.

Table 43. Non-EBM Old Seral Retention Requirements

Natural Disturbance Type	Biogeo-climatic Zone	Age of Old Forest	Percent Old Forest Retention in Low and Intermediate Biodiversity Emphasis
1	CWH	>250 years	>13
1	MH	>250 years	>19
2	CWH	>250 years	>9

[5] 26 settings at Knox Bay

9.2.6.2 Wildlife Tree Retention

Wildlife tree retention will be dealt with as a yield curve reduction (see Section 6.20.1). No cover constraint is required.

9.2.6.3 Course Woody Debris

There is no need to model future supplies of course woody debris

9.2.6.4 Objectives for Patch Size Distribution

No patch size modelling will be conducted.

9.2.6.5 Objectives for Connectivity

No effort has been made to model connectivity between old seral patches and high value habitat areas.

9.2.6.6 Watersheds

No fisheries-sensitive watersheds occur in the TFL. However, several “important fisheries watersheds” do overlap the TFL. A watershed assessment must be completed in these areas whenever the ECA approaches 20%. Where these assessments have been completed in the past, ECA levels above 35% have been found to be acceptable. For this analysis, an ECA constraint of 35% will be applied to the forested area of each watershed, and an additional disturbance cover constraint may be applied to the upland areas. Full hydrologic green-up will be reached at a stand height of 12 metres.

Other than estuaries, which are already netted out of the THLB, TFL 47 does not have ‘high-value fish habitat’ as the term is defined in the SCCO. Streams within the plan area are generally uniform in nature and non alluvial, lacking what is defined as critical fish habitat.

9.2.6.7 Riparian Management Zones

Riparian areas – both reserve zones and management zones – have been netted out of the THLB. RRZ’s have been entirely removed, and RMZ’s have been partially removed in the VILUP area and entirely removed in the SCCO area. No additional constraints are necessary.

9.2.6.8 Higher Level Plans

VILUP and SCCO are the Higher Level Plans in force. They will be reviewed to ensure that timber supply modelling is consistent with their objectives.

Within the Quadra SMZ a 10% netdown will be applied (to the yield tables) to comply with the VILUP rules for the SMZ. This yield curve reduction will be applied in addition to any other yield reductions that are required for stands in the zone in order to meet other non-timber objectives.

9.2.6.9 Any Other Resource Emphasis

No other resource issues apply to TFL 47.

9.3 Timber Harvesting

9.3.1 Minimum Harvest Age

The minimum harvestable age (MHA) is the criterion that forest stands within an analysis unit must meet to be eligible for harvest. In most cases, economic factors will dictate the threshold beyond which stands are available for harvest. For the purpose of timber supply modelling, these characteristics are often expressed in terms of volume per hectare and/or average diameter. Culmination age, the age at which mean annual increment (MAI) reaches a maximum, or some proportion thereof can also be used as the threshold for minimum harvestable age. In timber supply modelling the age at which the minimum threshold is attained is called the “minimum harvestable age” (MHA). These are minimum criteria – not rotation ages or the actual ages at which the stands will be harvested. Some stands may be harvested at the minimum thresholds to meet forest-level objectives; however, other stands may not be harvested until well past the age for “optimal” timber production due to management objectives for other resource values

MHA is established for each analysis unit. An AU is first harvestable when it meets the following criteria:

- 90% of culmination age; or
- 300 m^3/ha and 30 cm QMD.

This was the MHA approach used for MP#3. Alternative MHA limits will be examined in sensitivity analyses.

The MHA that results when these criteria are applied to each analysis unit are shown in Table 44 for all managed stands. Existing natural stands will be modelled on stand-by-stand yield tables, and are too numerous to present in tabular format. The same rules used to establish MHA for managed stands will be applied to existing stands.

9.3.2 Operability

Inoperable area has been netted out of the THLB. The remaining area is considered to be more or less equally available over the entire planning horizon, so no additional harvest scheduling constraints or quotas are needed.

9.3.3 Initial Harvest Rate

For the base case, the initial harvest rate will be set at the current administratively adjusted AAC. This represents the AAC level set at the last determination, prorated for area that has since been removed from the TFL. The initial harvest level for the base case will be adjusted upwards to account for the four incoming TL's.

Table 44. Minimum Harvest Age (MHA) for Managed Stands.

			Genetic Gain Era			
TFL Block	BGC Zone	Site Series	GG0	GG1	GG2	Future
Bonanza Lake	CWHvm1	01	36	35	35	35
Bonanza Lake	CWHvm1	02,03,04	49	49	49	47
Bonanza Lake	CWHvm1	05,07,08	34	33	33	32
Bonanza Lake	CWHvm1	06,13,14	44	34	57	43
Bonanza Lake	CWHvm2	01	74	85	104	78
Bonanza Lake	CWHvm2	02,03,04	72	87	89	72
Bonanza Lake	CWHvm2	05,07,08	50	107	84	52
Bonanza Lake	CWHvm2	06	78		90	79
Bonanza Lake	CWHvm2	09,10,11	80	95	82	80
Bonanza Lake	MHmm1	All	81	104	111	92
Johnstone Strait	CWHvm2	All	49	57	57	49
Johnstone Strait	CWHxm	01	42	40	40	39
Johnstone Strait	CWHxm	03,02	61	64	59	58
Johnstone Strait	CWHxm	05,04	40	37	37	37
Johnstone Strait	CWHxm	06	36	35	34	34
Johnstone Strait	CWHxm	07,08	35	34	34	33
Johnstone Strait	CWHxm	12,14	60	59	59	57

9.3.4 Harvest Rules

Harvest rules are used by the simulation model to rank stands for harvest. A common approach is to harvest oldest first. With this rule, older stands are queued for harvest ahead of younger stands. Harvest rules interact with forest cover constraints to determine the actual order of harvesting within the model. If a higher ranked stand is in a constrained zone and cannot be harvested, then the model will choose the next highest ranked stand that can be harvested. 'Relative oldest first' harvests those stands that are farthest past their rotation age (culmination MAI), and would be the best rule to use for TFL 47, which has a significant component of second growth timber on a range of sites.

9.3.5 Harvest Profile

A harvest rule that applies a 20% percent quota to old growth will be used. This is consistent with current practice and will be applied over the entire planning horizon to existing old growth on the timber harvesting landbase. This is not a requirement that 20% old growth be harvested in each period, but rather a limit on the maximum amount of old growth that can be harvested in any period. Old growth outside of the THLB will, of course, not be scheduled for harvest.

Alternative harvest sequencing will be examined in through sensitivity analyses.

9.3.6 Silviculture Systems

Silvicultural practices in TFL 47 need to be considered as a prelude to developing yield curves. Clearcutting is the silvicultural system most commonly employed in the TFL.

Although the last Management Plan made reference to Variable Retention (VR), this is no longer current practice. All harvesting will be clearcut, subject to EBM constraints and the protection of other resource values. VR will not be modelled. Retention (through yield curve reductions) will still be applied to account for WTP's, RMZ's and EBM requirements.

Trees are retained when necessary to meet riparian or wildlife habitat objectives. Reductions to account for wildlife tree and other retention will be applied when the forest estate model is run, rather than directly on the yield curves. All yield curves have been built assuming even-aged management of all stands. Any retention that is left is assumed to be permanently lost to harvesting; no second pass volume is taken.

9.3.7 Harvest Flow Objectives

The harvest flow objectives for this analysis will be:

- To find the highest even flow timber harvest level that can be achieved while meeting all other resource objectives.
- If the current harvest level cannot be sustained, to maintain the current level for as long as possible and then step down to the long term level in a series of orderly steps that do not exceed 10% of the initial harvest level in each decade.
- To provide a balanced flow of old growth and second growth timber in each decade until the available old growth timber has been exhausted.

At MP#3, the projected harvest flow was flat. However, alternative initial, mid-term and long-term harvest levels will also be considered in sensitivity analyses. In particular, if a step-up to a higher long-term harvest level is possible (while maintaining stable growing stocks levels), it will be implemented.

9.4 Other

All forest management issues – for both timber and non-timber resources – have been dealt with in the preceding sections. No other concerns exist.

10 Ecosystem Based Management

For the portion of the TFL that is subject to the SCCO, this section summarizes the steps that will be taken to model ecosystem-based management in a manner consistent with the SCCO. Much of this material was discussed above; it is consolidated here for ease of review and reference.

10.1 Objectives for First Nations' traditional forest resources (3)

This is primarily managed operationally and has minimal impact on strategic timber supply. A 0.1% aspatial netdown will be applied to account for objectives (3) through (7). This netdown is meant to account for the small impact that implementing operational measures to meet First Nations objectives will have on strategic timber supply. The netdown level is based on local experience and professional judgment. Also, recent timber supply analyses for the Kingcome and Midcoast TSA's were reviewed. Relative to those management units, TFL 47 has considerably less old growth timber (cedar in particular). TimberWest will continue to address any site specific concerns raised through the FSP review and operational planning process.

10.2 Objectives for First Nations' traditional heritage features (4)

This is primarily managed operationally and has minimal impact on strategic timber supply. A 0.1% aspatial netdown will be applied to account for objectives (3) through (7).

10.3 Objectives for culturally modified trees (5)

This is primarily managed operationally and has minimal impact on strategic timber supply. A 0.1% aspatial netdown will be applied to account for objectives (3) through (7).

10.4 Objectives for monumental cedar (6)

This is primarily managed operationally and has minimal impact on strategic timber supply. A 0.1% aspatial netdown will be applied to account for objectives (3) through (7).

10.5 Objectives for stand-level retention of western red and yellow cedar (7)

This is primarily managed operationally and has minimal impact on strategic timber supply. A 0.1% aspatial netdown will be applied to account for objectives (3) through (7).

10.6 Objectives for important fisheries watersheds (8)

An ECA limit of 35% will be enforced in these watersheds.

10.7 Objectives for high value fish habitat (9)

The TFL does not have 'high value fish habitat' (as the term is defined in the SCCO) outside of estuaries and marine interface areas. These will be netted out of the landbase by the 30-metre foreshore buffer. An additional small netdown may be applied to account for HVFH outside of the marine foreshore zone.

10.8 Objectives for aquatic habitat that is not high value fish habitat (10)

S1 to S3 streams and all lakes/wetlands > 0.25 hectares will be buffered according to the FPPR-specified riparian reserve zones widths. Within this buffer 100% of the productive forest will be spatially netted out of the THLB.

10.9 Objectives for forested swamps (11)

No netdown is proposed for forested swamps. Forested swamps are infrequent within the plan area. Timber deferrals required for forested swamps will be handled operationally, within WTPs.

10.10 Objectives for upland streams (12)

In important fisheries watersheds, no more than 35% of the area will be less than 9 metres tall. This level has been selected based on operational experience. Once half of the SCCO-specified ECA limit of 30% has been reached in a watershed, an adaptive planning process is implemented and a professional review is undertaken. In watersheds where this has happened, higher ECA limits have been justified. On this basis, a 35% ECA limit is considered reasonable for strategic planning purposes.

10.11 Objectives for active fluvial units (13)

No fluvial units (fans, alluvial streams) exist within the TFL. Terrain is relatively gentle. Watersheds tend to be small and are usually regulated by lakes or wetlands.

10.12 Objectives for landscape-level biodiversity (14)

Old seral representation targets (i.e. stands older than 250 years) will be applied by landscape unit and site series surrogate The targets are specified and a percentage of RONV within each LU in Schedule 4 of the SCCO. The allowable groupings of site series surrogates are listed in Schedule 4(b). Based on the numbers in these two tables, the actual old growth target will be calculated for each LU/site series. The proportion of each category in a mid-seral stage condition will be tracked in the forest estate model, but no constraint will be applied.

Old seral representation targets (i.e. for stands older than 250 years) will be applied by landscape unit and site series surrogate. Old growth within site series surrogates identified by Government as being in a deficit position will be spatially netted out of the THLB.

10.13 Objectives for red and blue-listed plant communities (15)

Red-listed plan communities will be netted out of the THLB. A partial netdown will be applied to blue-list communities. The red- and blue-listed communities will be taken from Schedule 5 and Schedule 6 of the SCCO.

10.14 Objectives for stand-level retention (16)

TimberWest has compiled average retention from silvicultural records for blocks harvested over the past few years to determine the level of retention required from both the contributing and non-contributing landbase.

10.15 Objectives for grizzly bear habitat (17)

Mapped Class 1 grizzly bear habitat, as identified in Schedule 2 of the SCCO, will be netted out of THLB.

11 Glossary

AAC	Allowable Annual Cut
BEC	Biogeoclimatic Ecosystem Classification
SCCO	Central Coast Land and Resource Management Plan
ESA	Environmentally Sensitive Area
FPPR	Forest Planning and Practices Regulation
FSP	Forest Stewardship Plan
GIS	Geographic Information System
IP	Information Package
IRM	Integrated Resource Management
LU	Landscape Unit
MHA	Minimum Harvestable Age
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MP	Management Plan
NSR	Not Satisfactory Restocked
OAF	Operational Adjustment Factor
OGMA	Old Growth management Area
PSYU	Public Sustained Yield Unit
QMD	Quadratic Mean Diameter
RFI	Recreation Features Inventory
RMA	Riparian Management Area
RMZ	Riparian Management Zone

RRZ	Riparian Reserve Zone
RVQC	Recommended Visual Quality Class
SCCO	South Central Coast Order
SI	Site Index
SRMZ	Special Resource Management Zone
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation Program for Stand Yields ver. 4.1
TL	Timber Licence
UWR	Ungulate Winter Range
VDYP	Variable Density Yield Prediction ver. 7
VILUP	Vancouver Island Land Use Plan
VLI	Visual Landscape Inventory
VQO	Visual Quality Objective
VRI	Vegetative Resources Inventory
WHA	Wildlife Habitat Area

12 References

Guide for Tree Farm Licence Management Plans (20-month) and Calendar Year Reports (March 2001)

Supplemental Guide for Preparing Timber Supply Analysis Data Packages (June 2003)

Interim Standards for Information Package Preparation and Timber Supply Analysis (March 2004)

Tree Farm License 47 – Duncan Bay Tree Farm Licence (March 1, 2010)

Tree Farm License 47 – Management Plan No. 3 (January 3, 2002)

Timber Supply Analysis – Appendix III of MP No. 3 (October 2001)

Tree Farm License 47 – Rationale for Allowable Annual Cut (AAC) Determination (August 1, 2003)

Section 173 Order (September 28, 2006)

Forest Planning and Practices Regulation (January 2010)

Order Establishing Provincial Non-Spatial Old Growth Objectives (June 2004)

Vancouver Island Summary Land Use Plan (February 2000)

Central Coast LRMP- South Central Coast Order

Forest Stewardship Plans for Bonanza, Quadra-Quinsam and Johnstone Straits

Kingcome TSA Timber Supply Review – Data Package, Analysis Report and Rationale

Strathcona TSA Timber Supply Review – Data Package and Analysis Report

TFL 47 VRI Phase II – Preliminary Analysis 2 (Internal Memo)

TFL 47 Licence document

TFL 47 Licence – Instrument 16

TFL 47 Licence – Instrument 19

Tree Farm Licence Management Plan Regulation

Abbott, George. 2004. Order Establishing Provincial Non-Spatial Old Growth Objectives. Ministry of Sustainable Resource Management.

B.C. Ministry of Forests. 2001. Guide for Tree Farm Licence Management Plans (20-month) and Calendar Year Reports. Resource Tenures and Engineering Branch / Timber Supply Branch

B.C. Ministry of Forests. 2003. Supplemental Guide for Preparing Timber Supply Analysis Data Packages. Forest Analysis Branch

B.C. Ministry of Forests. 2004. Interim Standards for Data Package Preparation and Timber Supply Analysis - Defined Forest Area Management Initiative. Forest Analysis Branch

Dryburgh, Jack. 2005. Order to Establish Visual Quality Objectives for the South Island Forest District. Ministry of Forests and Range.

Government of British Columbia. 2001. Vancouver Island Summary Land Use Plan.

Government of British Columbia. 2006. Website. Forest Planning and Practices Regulation. (http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm)

J. S. Thrower & Associates Consulting Foresters Ltd. 2002. Site Index Adjustment of Douglas-fir and Western Hemlock in the Low Elevation Biogeoclimatic Subzones on TFL 47.

TECO Natural Resource Group Ltd. 2010. Tree Farm Licence 47 – Vegetation Resources Inventory Statistical Adjustment Ver. 1.0.

13 Appendix I

Existing Managed Yield Curves

14 Appendix II

Future Yield Curves

15 Appendix III

Site Index Adjustment Report

16 Appendix IV

VRI Phase II Adjustment Report