Timber Supply Analysis Information Package
For Tree Farm Licence 38

International Forest Products Ltd.

Management Plan #9

Prepared by:

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INTERFOR

Timberline
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1 INTRODUCTION

This Information Package has been prepared as a source document prior to the completion of the Timber Supply Analysis Report for Management Plan (MP) #9 for Tree Farm Licence (TFL) 38. It serves as a summary of the inputs and assumptions made in preparing for the timber supply analysis. Included are inventory and landbase summaries, growth and yield information and management assumptions for timber and non-timber resources related to timber supply. It follows the suggested format outlined in the *Tree Farm Licence Management Plan Guidelines* (August, 1998). The Base Case documented here represents current management strategies. The results of this analysis will be reviewed and evaluated, and the licensee will submit a recommendation for an AAC for acceptance by the Chief Forester.

When completed, a copy of Management Plan #9, including the Information Package and Timber Supply Report appended documents will be provided to First Nations representatives.

2 PROCESS

Following acceptance, this report will be included as an appendix to the Timber Supply Analysis Report.

2.1 Growth and Yield

Yield tables have been developed by J. S. Thrower and Associates (JST). A report documenting this work and the results is included as Appendix 1 to this document.

1. Existing mature stands (> age 140) were assigned average volume lines (AVLs) based on a system of local inventory cruise plots, established in the late 1970s and 1992. These cruise plot timber volumes were audited in 1998 and found to be statistically acceptable. Average volumes/hectare were assigned to individual polygons, and stands are assumed to maintain these volumes until harvest.
2. Natural stand yield tables (NSYTs) for stands between ages 35 and 140 were developed using the provincial Variable Density Yield Prediction (VDYP) program (Batch Version 6.6d) and attributes extracted from the Forest Cover Inventory Database.
3. Managed stand yield tables (MSYTs) for existing stands < age 35, as well as all post-harvest regenerating (PHR) stands were developed using the provincial Table Interpolation Program for Stand Yield (TIPSY) (Batch Version 3.0a) and included:
    - Improved estimates of potential site index (PSI) for PHR stands using the results of the recently completed site index adjustment (SIA) and terrestrial ecosystem mapping projects for TFL 38;
    - Silviculture regimes for existing and future PHR stands developed by Interfor;
    - Impacts of planting improved stock in future PHR stands; and
    - Improved estimates of operational adjustment factors (OAFs) from the Terrestrial Ecosystem Mapping (TEM) project.

Yield tables were developed for all polygons on the Timber Harvesting Landbase, and then grouped into clusters (analysis units) for timber supply analysis purposes.

3 TIMBER SUPPLY FORECASTS/OPTIONS/SENSITIVITIES

3.1 Base Case

This option reflects current management performance based on the date of commencement for the preparation of Management Plan #9. The analysis will incorporate:

- Updated forest inventory database;
- Current management regimes;
- Current definition of operability;
- Updated recreation features inventory;
- Updated visual landscape inventory;
- Definition of biodiversity in accordance with Landscape Unit Planning Guide (LUPG);
- Draft Landscape Unit Plan including Old Growth Management Areas (OGMAs);
- Updated stream / riparian classifications;
- Definition of riparian reserves on TRIM-based streams consistent with the Riparian Management Area Guidebook, and with extended buffers on S5 and S6 classifications;
- Wildlife management strategies for grizzly bear, mountain goat, bald eagle, and moose;
- Slope stability mapping;
- New Terrestrial Ecosystem Mapping (TEM) of International Forest Product's Tree Farm Licence 38, B.A. Blackwell and Associates Ltd.;
- New Potential Site Index Estimates for the Main Commercial Species on TFL 38, J.S. Thrower & Associates Ltd.;
- Variable retention harvesting;
- Definition of merchantable stands and utilization standards;
- Definition of non-recoverable losses (NRLs);
- Minimum harvest ages;
- Silvicultural standards; and
- Forest health.

3.2 Sensitivity Analysis

Sensitivity analysis provides a measure of the upper and lower bounds of a "base case" harvest forecast that reflects the uncertainty of 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 given variable. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most affect results. To allow meaningful comparison of sensitivity analyses, they are usually performed using the base case option (i.e. current performance) and varying only the assumption being tested (i.e. all other assumptions remain the same as in the base case option). Each scenario will be fully documented with respect to the data and assumptions employed.

Table 3.1 summarizes the sensitivity issues to be addressed. The sensitivity levels included in this table are starting levels only, and may be altered based upon the results of the analyses.

Table 3.1 - Current management sensitivity analyses

Issue	Sensitivity Levels to be Tested
Landbase revisions	adjust timber harvesting landbase by +/- 10%
Growth and yield	adjust existing stand yields by +/- 10%
	adjust future managed stand yields by +/- 10%
	adjust managed stand harvest ages +/- 10 years
	increase and decrease regeneration delay
Management considerations & forest cover objectives	alter maximum disturbance constraints in IRM
	alter VQO disturbance constraints
	Alter disturbance constraint in mountain goat zone
	Alter retention constraint in mountain goat zone

3.3 Alternative Harvest Flows

In the base case analysis, the choice(s) of harvest flow will consider the following criteria:

- Maintain an initial harvest level of 217,500 cubic metres/year;
- Limit shifts in harvest level to less than 10% of the level prior to the shift; and
- Achieve a long term sustainable harvest level.

A number of different harvest flows will be explored, including a non-declining even-flow scenario. Alternatives will be based on tradeoffs between short and medium-term harvest levels. Forest cover constraints and biological capacity of the net operable landbase will dictate the harvest level. In addition, the proportions of the harvest coming from each operability class will be presented.

3.4 Licensee scenarios

At this point, no scenarios beyond the base case have been identified. If additional licensee considerations arise during the course of the analysis, they will be explored and fully documented.

4 FOREST ESTATE MODEL

The simulation model CASH6 (Critical Analysis by Simulation of Harvesting) will be used to develop harvest schedules integrating all resource management considerations, for all options and sensitivity analyses included in the MP #9 timber supply analysis. This proprietary software was developed by Timberline Forest Inventory Consultants. The model uses a geographic approach to landbase and inventory in order to adhere as closely as possible to the intent of forest cover requirements on harvesting. Maximum disturbance and minimum thermal and old growth retention forest cover requirements, as well as biodiversity seral stage requirements can be explicitly implemented if required.

A variable degree of spatial resolution is available depending on inventory formulation and resource emphasis area definitions. Forest stands in refuges such as environmentally sensitive and inoperable areas that do not contribute to the periodic harvest can be included to better model forest structure.

In their current implementation, forest cover objectives require a control area over which to operate. The control area for a constraint set should correspond to a realistic element in the landscape. For example, the requirements associated with visual quality objectives are designed to operate on the scene visible from discrete sets of viewpoints. Pseudo-geography may be employed to translate spatial constraints on harvesting into forest cover and static access constraints. The objective is to identify the "natural" constituency for forest cover constraints. CASH6 contains a hierarchical landbase organization to assist in implementing control areas. Numerous levels of land aggregation are used to define both geographically separate areas and areas of similar management regime. Forest cover constraints can be applied at up to 5 overlapping levels.

5 CURRENT FOREST COVER INVENTORY

All spatial information is controlled to the Terrain Resource Inventory Mapping (TRIM), North American Datum (NAD) 83 base.

5.1 Inventory History

The previous Tree Farm Licence holder, Weldwood of Canada Ltd, initially prepared forest cover inventories. The first inventory of TFL 38 was carried out in 1962 and 1963. The present inventory base was completed in 1981. In 1987 an inventory of second growth stands over 10 years of age was conducted and integrated into the mylar map base.

In 1993 the mylar map base was transferred to a 1988 orthographic photo map base made to photo control from the Ministry of the Environment, Lands and Parks (MoELP) TRIM format (NAD 83) by Timberline Forest Inventory Consultants Limited. Forest attributes were added to make the database compatible with current Ministry of Forest's (MoF) standards and the inventory was converted into a geographical information system (GIS) Arc/Info digital format.

The planimetric base, including forest cover, was also updated by Timberline to 1994 1:15,000 colour photography. This project updated altered geographic features, such as meandering rivers, and photo grammatically unverified harvest block boundaries. Indistinct areas in the original orthographic photography were also upgraded.

In 2001 a certified classifier from Timberline corrected some known forest cover attributes errors in the upper Elaho region. In addition, in 2001 several forest cover polygons with incorrect site index assignments were corrected.

The inventory and planimetric base has been maintained annually for harvesting, road construction, reforestation, silvicultural treatments, and TFL area amendments. The most recent updating of the inventory records occurred in 2001.

5.2 Inventory Audit

In 1998, the MoF conducted an inventory audit for TFL 38. Three components of the forest inventory were tested by the audit. The components tested were the mature forested areas (forest stands older than 60 years), the immature stands (younger than 60 years but older than the silvicultural classification of free growing), and the area classified as non-forest (lakes, gravel pits, alpine meadows, etc.). The audit made the following conclusions:

- The mature volume component of the inventory was found to be statistically acceptable.
- The assignment of site index estimates for young stands within the immature component of the inventory was found to be not accurate as it generally underestimates the site index in young stands. This portion of the inventory has since been improved significantly through the site index adjustment project completed by J.S. Thrower and Associates Ltd. and a reassessment of the young forest site index attributes by Interfor foresters.
- The non-forest inventory classification was not analysed due to government staffing constraints.

The forest cover inventory is updated for disturbance and projected to the year 2001. Inventory data has been prepared using ARC/INFO GIS. Use of GIS ensures that spatial relationships between the various inventory attributes are maintained throughout the analysis process. For example, existing roads and streams are buffered to provide specific area reductions from the net timber harvesting landbase (THLB).

The current inventory consists of timber in several land classes. Timber on the productive but inoperable landbase is not available for harvesting under the assumptions of the analysis. However, this forest land may contribute to forest cover and seral stage requirements for non-timber resources.

5.3 Terrestrial Ecosystem Mapping

Terrestrial ecosystem mapping to a site series level was conducted for TFL 38 and completed in 2001. This project was part of the overall growth and yield project aimed at developing reliable estimates of average site index for the major tree species on the forested land base of TFL 38 (B.A. Blackwell and Associates, 1999). The results were included in the report Terrestrial Ecosystem Mapping of International Forest Product's Tree Farm Licence 38. The TEM mapping was Quality Certified by Dr. Karel Klinka of the University of British Columbia.

5.4 Site Index Adjustment

In 2001 a site index - ecosystem correlations project was completed by J.S. Thrower and Associates Ltd. for TFL 38. New site indices were derived based on local forest productivity as expressed in TEM site series units. The results are outlined in the report entitled Site Index Adjustment of the Major Commercial Species in the Coastal Western Hemlock Biogeoclimatic Zone on Tree Farm Licence 38 (J.S. Thrower and Associates, 2001). All new inventories have been submitted to the appropriate agency for approval, and have been digitally captured and entered into a GIS database.

6 Description of Landbase

This section describes the TFL 38 landbase and the methodology used to determine the way in which land contributes to the analysis. Some portions of the productive landbase, while not contributing to harvest, may be available to meet other resource needs.

6.1 Timber Harvesting Landbase (THLB) Determination

Table 6.1 presents the results of the landbase classification process to identify the timber harvesting or net operable landbase. Individual areas may have several classification attributes. For example, stands within riparian 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 6.1 – Timber harvesting landbase determination

Classification	Total Area (ha)	Prod Area (ha)	Net Area (ha)			Coniferous Volume('000m^3)		
			Schedule A	Schedule B	Total	Schedule A	Schedule B	Total
Total Landbase	**189287**	**54357**	**251**	**189036**	**189287**	**37**	**19864**	**19901**
Non-productive	134930	0	51	134879	134930	0	0	0
Total Productive	**54357**	**54357**	**200**	**54157**	**54357**	**37**	**19864**	**19901**
Reductions								
Inoperable	146449	13122	5	13117	13122	2	4798	4800
Operable	**42838**	**41235**	**195**	**41040**	**41235**	**35**	**15066**	**15101**
Non-commercial	8	8	0	8	8	0	0	0
Existing Roads	449	409	0	404	404	0	54	54
Eagle Habitat	701	603	104	270	374	12	125	137
Moose Winter Range	312	278	0	250	250	0	79	79
Grizzly Bear Habitat	5384	2307	3	458	461	0	236	236
Goat Winter Range	11838	3742	0	1380	1380	0	669	669
OGMAs	6969	6168	1	1139	1140	0	667	667
Recreation	49036	1948	53	669	722	2	139	141
Riparian Reserves	9416	3232	1	1585	1586	0	484	484
Terrain Stability 5	6321	3927	10	2257	2267	7	1031	1038
Low Site Productivity	6407	6407	0	294	294	0	162	162
Operable Reductions			**172**	**8714**	**8886**	**21**	**3646**	**3667**
Reduced Landbase			**23**	**32326**	**32349**	**14**	**11420**	**11434**
Future Changes								
Roads, Trails, Landings			1	1111	1112			
Net Long-term			**22**	**31215**	**31237**			

6.2 Total Area

The total area of TFL 38 is 189,287 hectares, including 251 hectares of Schedule A lands (Table 6.2).

Table 6.2 - Total area

Schedule	Total Area (ha)	Productive Area (ha)
A	251	200
B	189036	54157
Total	**189287**	**54357**

6.3 Non-productive and Non-forest

All land classified as non-forest or non-productive (lakes, swamps, rock, alpine, *etc*.) or non-classified will be excluded from the THLB as shown in Table 6.3.

Table 6.3 - Non-productive & non-forest reductions

Classification	Description	Area removed (ha)
A	Alpine	120871
AF	Alpine Forest	5260
ICE	Icefield	8
L	Lake	917
NP	Non-productive	2844
NPBR	Non-productive brush	429
R	Rock	2799
RIV	River	1683
SWAMP	Swamp	56
U	Roads	63
Total		**134930**

6.4 Operability

The existing operability assessment was completed and approved in 1996. Minor revisions were undertaken in 2001, which resulted in a net reduction in operable area due to the removal of some marginal areas. The operability classification was based upon a number of factors including:

- Economics;
- Physical accessibility;
- Environmental concerns; and
- Currently available harvesting systems.

Some problem forest conditions were also removed in this classification. Four operability categories are included in the current operability mapping:

- Conventional;
- Helicopter;
- Marginal stands; and
- Inoperable.

Conventional

These areas are both physically and economically accessible to ground-based and conventional harvesting systems. Minimum conventional volume is 350-400 cubic metres per hectare.

Helicopter

These are areas above the physical accessibility line which are available as heli-wood based on guidelines adopted by the Vancouver Region. They normally include areas with a minimum volume of 400 cubic metres per hectare. Areas with lower volumes can be included based on ground sampling to ensure viability.

Marginal

This classification includes stands with high decay factors, averaging 250 to 400 cubic metres/hectare.

Reductions for inoperable areas are summarized in Table 6.4.

Table 6.4 - Operability classification & reductions

Operability Category	Gross Area (ha)		Operability Reductions[1]		
	Total	Productive	% Reduction	Area (ha)	Volume ('000m^3)
Conventional	34741	33666	0	0	
Helicopter	7107	6617	0	0	
Marginal	990	952	0	0	
Subtotal operable	**42838**	**41235**		**0**	
Inoperable	146449	13122	100	13122	4800
Total	**189287**	**54357**		**13122**	**4800**

(1) Reductions for this stage of the netdown process, excluding productive areas removed in previous steps.

6.5 Non-commercial Brush

Land classified as NCBr will be excluded as shown in Table 6.5.

Table 6.5 - Non-commercial brush reductions

Classification	Description	Area removed (ha)
NCBR	Non-commercial brush	8

6.6 Roads, Trails and Landings

6.6.1 Reduction for Existing Roads, Trails and Landings

Forest operations create roads, trails and landings which can reduce the productivity of growing sites, and reduce the area available for growing trees. Existing roads, trails and landings are too small to be identified as polygons in the digital inventory files. In general, the timber for which roads, trails and landings have already been constructed has been logged. For this reason the areas of currently regenerating stands are adjusted. In addition, there are changes in available growing area and productivity for future stands due to road building disturbance.

6.6.2 Classified Roads, Trails and Landings

Existing roads for the TFL are in the GIS database for TFL 38 as line features. The area associated with mainline and branch roads is calculated by assigning a representative width of 10 metres to the 404 km of road measured on the TFL. This includes an allowance for trails and landings. The resulting area is removed from the operable landbase.

A summary of existing roads in the database is presented in Table 6.6. The total length of roads within the TFL is 450 km. The length if Table 6.6 represents the segments of roads passing through the harvestable TFL 38 polygons, while the width represents the expected permanent loss in productive growing space.

Table 6.6 - Existing classified road area summary

Road Description	Road Measurements (on net landbase)		
	Length (km)	Width (m)	Area Removed (ha)
Mainline and branch roads	404 km	10 m	404
Total			**404**

6.6.3 Unclassified Roads Trails and Landings

All existing roads have been classified using the above methodology.

6.6.4 Future Roads, Trails and Landings

Upon harvesting, a component of each stand is placed into a category that will remain in a disturbed state for perpetuity. If the area harvested is included in an area associated with forest cover constraints relating to integrated resource management, the road area will become part of the disturbance area permanently. Generally these stands will provide harvest volume on the first entry but not on further entries. The area contributing to the long term sustainable harvest is net of this amount.

The 404 hectares of existing road pass primarily through stands less than age 40, which comprise a net area of 10112 hectares. The existing roads therefore represent approximately 4% of this net area. However, results of recent surveys indicate that an allowance of 5% is more representative of current operations. To allow for future roads, a factor of 5% will be applied in CASH 6 to reduce the area of each forest class (currently greater than age 40) the first time it is harvested.

6.6.5 Site Degradation

There is no appreciable site degradation due to logging occurring on the TFL.

6.7 Management Zones (MZs) (formerly Environmentally Sensitive Areas (ESAs))

Management Zones replace designations formerly described as Environmentally Sensitive Areas (ESAs). The similarity exists in that these are mapped land units with special management requirements and modelling constraints. In the context of timber supply analysis, management constraints are assumed to reduce the area available for harvesting in designated Management Zones. In accordance with the spatial nature of this analysis, all Management Zones where some harvesting may take place have had restrictions applied through forest cover constraints.

Management Zones have been assessed for:

1. Wildlife;
2. Recreation; and
3. slope stability (Terrain).

In the following sections, summaries of areas classified as MZs on TFL 38 are presented. Tables include the net area in each category. This represents the residual area remaining in the THLB after the netdown process. In the previous Management Plan, a percentage of the total ESA area was removed from the landbase. In Management Plan #9, wherever possible, MZ netdowns have been applied in a manner designed to preserve the spatial model. Constraints were applied in a variety of ways, for example as a netdown, or as a forest cover constraint. Area removals applied to the operable landbase to account for operational constraints to harvesting in environmentally sensitive areas are also shown.

6.7.1 Wildlife

Staff of the Ministry of Water, Land and air Protection were involved in the input and review of the following wildlife strategies, and consider the data to be the best available at this time.

6.7.1.1 Grizzly Bear

A Grizzly Bear Habitat Management Strategy has been developed in consultation with biologists from the MoF and Ministry of Water, Land and Air Protection (MWLAP). Each ecosystem-based polygon delineated from Terrestrial Ecosystem Mapping (TEM) was rated for its capability for supporting the supply of Grizzly Bear forage during early spring, late spring, summer and fall. A 6-class rating scheme (1=high, 2=moderately high, 3=moderate, 4=low, 5=very low, 6=nil) was used to rate ecosystem units (habitats) by season for Grizzly Bear forage suitability only within the TFL. The strategy identified many

areas of moderate to high forage values which were removed from the THLB. Additional important forage areas not removed will be managed and/or protected during harvest planning.

6.7.1.2 Bald Eagles

An Overwintering Bald Eagle Habitat Management Strategy has been developed for TFL 38. It includes four zones. No harvesting is planned within eagle roosts, alternative roosts, and roost protection buffers. In addition, 100 metre ERMZ zones have also been identified. Operationally, a minimum of 30 percent of these latter areas will be reserved from harvesting. However, for modelling purposes, all four of these zones are excluded from the THLB.

6.7.1.3 Moose

The area defined as the Moose Winter Range Management Zone (MWRMZ) includes most of the Elaho River floodplain that extends south from the junction of Chadwick Creek and the Elaho River to the junction of Ponor Creek and the Elaho River. The current MWRMZ has been slightly modified from the 1989 version and it now excludes some sidehills with low winter range values and includes some additional floodplain areas with high winter range values. Interfor has identified a mosaic of mature and old seral forest stands distributed throughout the MWRMZ. These stands are being protected as Core Moose Winter Range [CMWR] and have been identified as having very high winter forage values and/or good snow interception properties. They include or are close to good forage value. No harvesting is permitted within CMWR areas. The strategy also calls for maintaining 150 hectares of area within the THLB in high forage production status. This will be accommodated through operational planning.

6.7.1.4 Mountain goat

All forest management and harvesting activities are to be planned and implemented with the objective of maintaining the value of Mountain Goat Winter Ranges (MGWR) and minimizing potential impacts on mountain goats and MGWR. Three strategies have been developed to address this objective.

STRATEGY A. MGWRs that are comprised entirely of critical winter habitat. There is limited productive forest within the polygon and what is there is critical habitat for the overwintering survival of the mountain goat. There should be no harvesting activities within the polygon boundaries.

STRATEGY B. MGMRs that are comprised of critical winter habitat with productive forest between the core areas. The areas of productive forest provide thermal cover and forage for wintering mountain goats. Some level of harvest can occur within these winter forage areas as long as timing restrictions and road construction guidelines are adhered to. The following rules apply:

- no harvesting activities within core habitat area;
- retain 50% of the productive forest within the winter forage portions in age class 5 or greater;
- within the winter forage areas, green-up for goat habitat is defined as age 40 or greater

Areas defined as critical winter habitat (classes A and B) were removed from the THLB. The balance of the winter forage areas in habitat class B were not removed.

A summary of wildlife management zones is provided in Table 6.7. The net area figures represent the residual area left in the timber producing landbase at the end of the netdown process, while the removed figures represent the area actually removed for MZs. The latter therefore exclude operable MZ already removed in earlier netdown steps.

Table 6.7 - Distribution of area by Wildlife Management Zone

Landscape Unit	Species	Management	Productive Area (ha)				
			Total	Inoperable	Operable	Removed	Net
Elaho	GRIZZLY	FORAGE	1185	530	656	437	0
	MOOSE	WINTER RANGE	278	26	252	250	0
	GOAT	WINTER FORAGE-A	129	46	83	83	0
	GOAT	WINTER FORAGE-B	90	42	47	0	40
	GOAT	WINTER HABITAT-A	1299	1005	294	291	0
	GOAT	WINTER HABITAT-B	270	123	147	147	0
Upper Squamish	EAGLE	100m roost protection	30	4	26	0	0
	EAGLE	100 m ERMZ	161	22	139	138	0
	EAGLE	ALTERNATE ROOST	245	156	89	89	0
	EAGLE	ROOST	197	50	148	148	0
	GRIZZLY	FORAGE	1122	894	228	23	0
	GOAT	WINTER FORAGE-A	131	19	112	112	0
	GOAT	WINTER FORAGE-B	221	62	159	0	136
	GOAT	WINTER HABITAT-A	1308	794	513	508	0
	GOAT	WINTER HABITAT-B	606	367	239	239	0

6.7.2 Recreation

6.7.2.1 Recreation Features Inventory

Table 6.8 describes the recreation netdowns used in this analysis. The matrix was developed by MoF staff, in consultation with recreation specialists. Although these percentages are not regulation, they are generally accepted for strategic analysis. Area removals are listed in Table 6.9. In practice, recreation features and polygons will be assessed individually, and may be arranged in a variety of ways, which could include netdowns, forest cover constraints, harvest pattern planning, timing of harvest, etc.

Table 6.8 - Recreation Feature netdown factors

Significance	Sensitivity		
	High	Medium	Low
High and very high	100	50	0
Medium	50	0	0
Low	0	0	0

Table 6.9 - Distribution of area by Recreation Feature

	Significance	Sensitivity	Netdown factor (%)	Productive Area (ha)				
				Total	Inoperable	Operable	Removed	Net
Elaho	H	H	100	488	113	376	242	0
	H	L	0	10	9	1	0	1
	H	M	50	104	99	5	2	2
	L	L	0	17591	4398	13192	0	10818
	L	M	0	26	0	26	0	24
	M	H	50	112	88	24	2	2
	M	L	0	1310	391	920	0	835
	M	M	0	4909	1264	3645	0	2670
	VH	H	100	41	4	36	5	0
Sub-total				**24591**	**6366**	**18225**	**251**	**14352**
U. Squamish	H	H	100	406	78	328	192	0
	H	L	0	17	11	6	0	5
	H	M	50	459	290	169	68	26
	L	L	0	12701	3148	9553	0	7703
	L	M	0	154	2	152	0	125
	M	H	50	300	126	175	64	42
	M	L	0	12373	1822	10551	0	8908
	M	M	0	2791	994	1796	0	1184
	VH	H	100	484	250	234	142	0
	VH	M	50	81	35	46	5	4
Subtotal				**29766**	**6756**	**23010**	**471**	**17997**
Total				**54357**	**13122**	**41235**	**722**	**32349**

6.7.3 Slope stability

All terrain class 5 areas were removed from the THLB (Table 10).

Table 6.10 - Distribution of area by Terrain Classification

Landscape Unit	Stability	Productive Area (ha)				
		Total	Inoperable	Operable	Removed	Net
Elaho	4	6743	1001	5742	0	5037
	5	1675	454	1221	1015	0
Subtotal		**8418**	**1455**	**6963**	**1015**	**5037**
Upper Squamish	4	9194	1633	7560	0	6506
	5	2252	605	1648	1252	0
Subtotal		**11446**	**2238**	**9208**	**1252**	**6506**
Grand Total		**19864**	**3693**	**16171**	**2267**	**11543**

6.8 Riparian Allowances

Riparian allowances are designed to exclude harvesting from areas immediately adjacent to waterbodies, including streams, lakes, swamps and wetlands. All TRIM streams within the TFL were classified using

- Riparian Management Area Guidebook (MoF and MoELP 1995); and

- Operational Planning Regulations of the Forest Practices Code (FPC).

All unclassified TRIM streams were assigned and S5 designation. S6 streams were assigned an S5 buffer, which was done to compensate for unmapped streams. For strategic purposes, a 10 metre buffer was applied to all wetlands and lakes larger than 0.5 hectares. The classifications and associated stream buffer widths are summarized in Table 6.11.

Table 6.11 - Stream buffer widths (each side)

Classification	Length (km)	Reserve zone buffer (m)	Mgmt zone buffer (m)	Mgmt zone retention (%)	Buffer (m)	Prod (ha)	Area removed (ha)
S1	115.0	50	20	50	60	1380	392
S2	38.4	30	20	50	40	307	168
S3	30.5	20	20	50	30	183	132
S4	25.0	0	30	33	10	50	24
S5	240.0	0	30	33	10	480	319
S6	409.0	0	20	50	10	818	544
Subtotal streams							**1579**
Lakes and wetlands > 0.5 m					10	15	7
Lakes and wetlands < 0.5 m					0	0	0
Total							**1586**

6.9 Old Growth Management Areas (OGMAs)

The Squamish Forest District has completed draft landscape unit (LU) boundaries and established draft Biodiversity Emphasis Options (BEO) in accordance with the direction provided by government. There are 20 LUs within this district. Two of these (Elaho and Upper Squamish) fall within the boundaries of TFL 38. Through a ranking process the Elaho LU was rated as an Intermediate BEO, and the Upper Squamish was rated as low BEO. Current government direction requires that priority biodiversity provisions, including the delineation of Old Growth Management Areas (OGMA) and wildlife tree retention (WTR), be undertaken immediately. This work was undertaken by International Forest Products Ltd, in co-operation with the Ministry of Sustainable Resource Management (MSRM), Ministry of Forests (MoF) and Ministry of Water, Land and Air Protection (MWLAP) staff.

OGMA selection was based on the area's suitability to provide representative old-growth characteristics to meet specified ecological characteristics. Wildlife habitat was also a factor since seven species of Identified Wildlife may exist within the TFL: mountain goats, grizzly bear, rubber boa, tailed frog, bull trout, marbled murrelet and the Northern goshawk. Spotted owl and black-tailed deer were also considered in making this selection. Areas that provided a variety of habitat for Identified Wildlife and other species were also commonly selected as OGMAs. OGMAs are summarized in Table 6.12.

The designation of OGMAs will have to be re-examined during the development of TFL 38 Management and Working Plan #10. Natural events such as disease, fire and windstorms may alter the suitability of certain OGMAs to provide old-growth characteristics. Over time, some OGMAs may have to be replaced and new recruitment areas sought to meet the targets set at the landscape level.

Table 6.12- Old Growth Management Areas

Landscape Unit	Productive Area (ha)				
	Total	Inoperable	Operable	Removed	Net
Elaho	2704	1734	970	362	0
Upper Squamish	3464	2029	1435	778	0
Total	**6168**	**3763**	**2405**	**1140**	**0**

6.10 Low site

Sites may have low productivity either because of inherent site factors (nutrient availability, exposure, excessive moisture, *etc.*), or because they are incompletely occupied by commercial tree species. In the case of TFL 38, the majority of these areas are included in the Inoperable category. However, in addition, area may remain which is considered below minimum productivity levels. A partial netdown of 20% was applied to stands within the MHmm2 subzone with an inventory site index ≤ 10 (Table 6.13).

Table 6.13- Low site removals

Landscape Unit	Inventory type Group	Productive Area (ha)				
		Total	Inoperable	Operable	Removed	Net
Elaho	12	270	245	25	5	20
	14	37	37	0	0	0
	15	1276	1109	167	30	121
	18	275	253	22	4	17
	19	2231	1172	1059	174	698
Subtotal		**4089**	**2815**	**1273**	**214**	**855**
Upper Squamish	11	**14**	**14**	**0**	**0**	**0**
	12	56	56	0	0	0
	13	3	3	0	0	0
	14	167	147	20	3	12
	15	803	696	106	17	68
	18	208	165	43	6	24
	19	1068	695	374	55	219
Subtotal		**2319**	**1775**	**543**	**81**	**323**
Grand Total		**6407**	**4591**	**1817**	**294**	**1178**

6.11 Deciduous Volumes

As indicated in Table 6.14, deciduous leading stands were not removed from the THLB. However, as part of the J. S. Thrower yield curve development process, in preparing natural stand yield tables, deciduous volumes were removed from each forest cover polygon according to the percentage indicated by the forest cover label. Deciduous volumes were also removed from the managed stand yield tables according to the percentages indicated by the associated Silviculture regime.

Table 6.14- Deciduous classifications

Landscape Unit	Inventory type Group	Productive Area (ha)				
		Total	Inoperable	Operable	Removed	Net
Elaho	35	78	12	66	0	13
	36	188	38	151	0	32
	37	32	0	32	0	20
	38	83	1	82	0	29
	39	4	0	4	0	3
Subtotal		**385**	**51**	**335**	**0**	**97**
Upper Squamish	35	61	3	58	0	14
	36	404	199	205	0	19
	37	81	25	56	0	39
	38	444	180	264	0	82
	39	61	39	22	0	9
	40	37	10	27	0	18
Subtotal		**1088**	**456**	**632**	**0**	**181**
Grand Total		**1473**	**507**	**967**	**0**	**278**

6.12 Not Satisfactorily Restocked Areas

In the timber supply analysis, the current not satisfactorily restocked (NSR) area listed in Table 6.15 will be assigned an age of -1 years, as it is assumed that it will be regenerated within 1 years.

Table 6.15 - NSR classifications

Landscape Unit	Type ID	Productive Area (ha)				
		Total	Inoperable	Operable	Removed	Net
Elaho	4	38	1	37	0	29
	9	16	0	16	0	16
Subtotal		**54**	**1**	**53**	**0**	**45**
Upper Squamish	4	41	1	39	0	19
Subtotal		**41**	**1**	**39**	**0**	**19**
Grand Total		**95**	**3**	**92**	**0**	**64**

Interfor records indicate that actual NSR at the end of 2001 was 272 hectares. The forest cover used in this analysis does not therefore fully reflect 2001 harvest depletions. To compensate for this, the first decadal harvest target in the timber supply analysis will be increased by 10% to approximate these depletions.

6.13 Stand-level Biodiversity (Wildlife Tree Patches)

The only stand level biodiversity requirement modelled is the practice of leaving wildlife tree patches (WTPs). In this analysis, WTPs are modelled by reducing the average volume per hectare that is harvested. By accounting for WTPs in this way, these small patches of timber are not considered to be contributing to any landscape level biodiversity requirements within the model. In actuality, WTPs contribute to landscape level forest structure, and some contribute to old growth targets. Landscape level biodiversity objectives are set as indicated in Section 10.2.2 (Landscape Level Biodiversity – Rationale).

The lands comprising today's TFL 38 were awarded in 1961, and harvesting began in 1962. The silviculture history of the license indicates that forest stand management began in 1966. Retention of wildlife tree patches started on the TFL in 1996, and since it's inception the retention level targeted on the TFL is 10% per cutblock. In 2001, 31% of the net landbase is between 5 and 40 years of age, and assumed to have been harvested without wildlife tree retention.

Stand-level biodiversity will be modelled based on the Landscape Unit Planning Guide (March 2000).

Two Landscape Units cover TFL 38. Table 6.16 shows the wildlife tree retention (WTR) requirements at the subzone level per draft landscape unit, calculated in accordance with Section 3.1 of the Landscape Unit Planning Guide (LUPG). The resulting total wildlife tree retention requirement of 6% is drawn from Table A3.1 of Appendix 3 of the LUPG. Assuming that 50% of this requirement will be met outside of the THLB, the remaining 3% will be applied in the analysis as a reduction to the volume per hectare that is harvested.

Table 6.16 Minimum wildlife tree retention (WTR) requirements

Landscape Unit	BEC Variant	Area (ha)		THLB Harvested		Available	WTP
		Prod	Net	ha	%	%	%
Elaho	CWHds1	511	363	205	57	71	10
	CWHms1	13299	9319	2598	28	70	7
	MHmm2	10781	4670	7	0	43	1
Upper Squamish	CWHdm	938	374	96	26	40	4
	CWHds1	3990	2402	1266	53	60	8
	CWHms1	13933	10351	5123	49	74	9
	CWHvm1	475	320	126	39	67	8
	CWHvm2	210	100	31	31	48	5
	MHmm1	240	33	0	0	14	0
	MHmm2	9980	4417	660	15	44	3
		54357	**32349**	**10112**	**31**	**60**	**6**

In practice, the WTR objectives determined above are established for each subzone within a landscape unit, and will be applied to each cutblock within the subzone. Although not explicitly modelled, an estimated 5% average impact of variable retention (VR) harvesting is accounted for in the base case through a 5% arbitrary increase in WTR requirements specified in Table A3.1 of the LUPG. Experience on the TFL shows that WTR can be successfully implemented to meet VR objectives. To date, this experience demonstrates that due to the spatial constraints inherent in the definition and intention of variable retention, some retention patches must be located in operable and merchantable timber that is not otherwise constrained for riparian, visual, wildlife, or soils reasons. Efforts are made to be minimize the amount of timber unduly constrained by variable retention. Overall, a volume reduction of 8% (3%+5%) will be applied to all yield curves to account for the combined effects of wildlife tree patches and variable retention harvesting.

7 Forest Inventory Organization

In order to reduce the complexity of the forest description for the purposes of timber supply analysis simulation, aggregation of individual forest stands is necessary. However, it is critical that this aggregation does not obscure either the biological differences in forest stand productivity or differences in management objectives and prescriptions. It is important to note that aggregation of the landbase will be consistent in all options and sensitivity analyses. This is to ensure that differences in results reflect differences in management decisions and not inventory aggregation.

Grouping stands into analysis units (clusters) on the basis of similar species composition, site productivity and silviculture regime captures similarities in growth and response to silvicultural treatments.

Biodiversity planning is done in accordance with the Landscape Unit Planning Guide, and the definition of "priority biodiversity" planning described within. This priority biodiversity planning is the current focus of landscape unit planning and consists of two objectives: "retention of old growth forest; and stand structure through WTR."

Unique management characteristics can be modelled in CASH6 by grouping areas into two forest cover groups:

1. As described in Section 6.9, OGMAs have been established for TFL 38. These are designed to explicitly account for old growth retention requirements on the TFL, by removing area from the THLB. In order to track these requirements in the timber supply analysis, old growth retention requirements (based on biodiversity emphasis assignments) from the Landscape Unit Planning Guide (LUPG) will also be assigned to each LU-BEC/NDT. Landscape level biodiversity is described in greater detail in Section 10.2.2 (Landscape Level Biodiversity – Rationale).
2. Resource emphasis areas (REAs) are aggregates of area with similar non-timber resource concerns. These include visual sensitivity, wildlife habitat, and timber emphasis (IRM) areas. Maximum disturbance (based on green-up height requirements), minimum mature and old growth forest cover objectives will be assigned to each REA forest cover group to address needs of the resource. REAs are either modelled at the polygon level, as in the case of VQOs, or aggregated within each landscape unit to reflect operational management of the resource. Where REA classifications overlap, areas must meet all overlapping forest cover objectives before harvesting.

7.1 Landscape Units

The two landscape units covering the TFL are the Elaho and Upper Squamish. Biogeoclimatic Ecosystem Classification / Natural Disturbance Types (BEC/NDT) is based on the updated Terrestrial Ecosystem Mapping (TEM). In general, seral stage objectives applied at the LU-BEC variant level are intended to address biodiversity (seral stage) representation and ensure that an acceptable distribution of age classes is maintained. Biodiversity representation through old-growth seral stage distribution is being modelled in the base case, both through explicit delineation of OGMAs, and by tracking seral stage status. Other seral stage requirements may be included in this timber supply analysis only in specific situations such as described in Section 6.7 (Management Zones).

Table 7.1 summarizes the distribution of LU-BEC variants on TFL 38. Note that a small amount of productive area was not classified in the TEM mapping process. All of this area is found at the higher elevations, and was not surveyed as it falls beyond the extent of the continuous forest cover. For modelling purposes, this area has been grouped with the MHmm2 variant. The old growth retention constraints which will be applied to these areas are summarized in Section 10.2.2.

Table 7.1 - LU - BEC/NDTs

Landscape Unit	BEC Variant	NDT	Productive Area (ha)		
			Productive	Operable	Net
Elaho	CWHds1	2	511	478	363
	CWHms1	2	13299	11805	9319
	MHmm2	1	10781	5941	4670
Upper Squamish	CWHdm	2	938	752	374
	CWHds1	2	3990	3488	2402
	CWHms1	2	13933	12765	10351
	CWHvm1	1	475	455	320
	CWHvm2	1	210	150	100
	MHmm1	1	240	65	33
	MHmm2	1	9980	5336	4417
			54357	**41235**	**32349**

7.2 Resource Emphasis Areas

The landbase has also been segregated into zones to facilitate the application of management criteria. Visual quality objectives (VQO) zones are defined on the basis of visual quality objectives determined through a full landscape inventory approved by the MoF in Management Plan #8, and revised in 2002. 5 metre greenup constraints will be applied to individual VQO polygons. Critical wildlife habitat zones have also been identified. Forest cover constraints for wildlife habitat will be applied separately within each landscape unit/zone combination. The remaining area is classified as Integrated Management with conventional cover class constraints applied. An area summary of these resource emphasis areas is provided in Table 7.2.

Table 7.2 . Resource emphasis areas – productive (and net)

Landscape Unit	Zone	Productive Area (ha)	Operable (ha)	Net (ha)
Elaho	VQO-R	89	2	1
	VQO-PR	478	306	199
	VQO-M	3910	2705	2020
	Goat	90	47	40
	Integrated	20114	15211	12131
Upper Squamish	VQO-R	4	1	1
	VQO-PR	404	317	249
	VQO-M	4381	3294	2121
	Goat	221	159	136
	Integrated	24977	19399	15627

These zones are created to address concerns not accounted for through landbase withdrawals in the netdown process. The actual forest cover constraints which will be applied to these zones are summarized in Section 10.2.1.

7.3 Analysis Unit Definitions

Analysis unit definitions (clusters) have be developed as part of the yield curve development process. This work has been completed by J. S. Thrower and Associates. A report documenting this work and the results is included as Appendix 1 to this document.

7.4 Age Class Distributions

Tables 7.3 and 7.4 summarize the distribution of area and volume by age class for both the operable and inoperable components of the TFL 38 inventory. Only forested area and coniferous volume above age 35 is reported.

Table 7.3 - Area by age class

Age Range	Productive Area (ha)			Net Current Landbase (ha)
	Productive	Inoperable	Operable	
0 (1)	95	3	92	64
1-20	7709	42	7667	6642
21-40	4101	68	4032	3406
41-60	2611	412	2200	1741
61-80	634	224	410	280
81-100	496	297	199	137
101-120	310	97	213	104
121-140	486	189	297	162
141-250	1951	652	1299	875
251+	35964	11138	24826	18938
Total	**54357**	**13122**	**41235**	**32349**

(1) Current NSR

Table 7.4 - Coniferous volume by age class

Age Range	Coniferous Volume ('000 m^3)			Net Operable Coniferous Volume ('000m^3)
	Total	Inoperable	Operable	
0	0	0	0	0
1-20	0	0	0	0
21-40(1)	174	1	174	149
41-60	352	3	348	299
61-80	66	21	45	37
81-100	31	6	25	16
101-120	78	23	55	31
121-140	138	33	105	68
141-250	839	202	637	474
251+	18223	4511	13712	10360
Total	**19901**	**4800**	**15101**	**11434**

(1) Volumes computed for stands > age 35 only

8 GROWTH AND YIELD

For the analysis of TFL 38, the development of growth and yield relationships was undertaken by J. S. Thrower and Associates. A report documenting this work and the results is included as Appendix 1 to this document.

8.1 Silviculture History

8.1.1 Immature Managed Stands

All stands with a current age less than 35 are assigned to managed stand yield curves, reflecting the silviculture history of the licence. Stands between 35 and 140 years are assigned to VDYP curves, while stands older than 140 years are assigned average volumes.

8.1.2 Current and Backlog Not Satisfactorily Restocked Areas (NSR)

Not satisfactorily stocked areas (NSR) originally contained operable timber, were harvested and have not yet regenerated to commercial species. For every stand scheduled for harvest there is a target period for regeneration following harvest. Land that fails to regenerate during this period is considered backlog. Under the Silviculture Regulations, land is not allowed to become backlog. It must be planted within the regeneration delay period if it has not regenerated naturally before that. Land that has been harvested recently, for which the regeneration delay period has not yet expired, is current NSR. Current NSR is part of the working forest and is expected to be regenerated on schedule. In the case of TFL 38, all NSR is considered to be current and will be regenerated in the first decade of the analysis.

8.1.3 Area Rehabilitation

At the present time, no specific areas have been identified for rehabilitation

9 NON-RECOVERABLE LOSSES

Fire, insects, disease and other natural factors can cause catastrophic losses of whole stands of trees. Over the long term the probability of losses to natural causes can be predicted. Where losses occur in merchantable stands some of the dead or dying timber may be salvageable. When modelling the timber supply, the unsalvaged losses are added to the desired harvest forecast and then subtracted from the forecast upon completion of the modelling exercise. In the case of TFL 38, 25 year fire history records indicate an annual average unsalvaged burned area of 23 hectares over the entire TFL. This can be converted to a volume reduction as follows:

Gross burned area	Total productive area	Net area	Net/Total ratio	Net area loss	Average mature vol/ha	Net loss
23	189287	32349	.171	3.93	530	2084

No figures on losses to insects are available for TFL 38. figures for the Soo TSA (TSR#2) indicate an annual expected loss of 4000 cubic metres on a net landbase of 123,392 hectares (.0325 m3/ha). This translates to 1071 cubic metres for the TFL 38 net landbase. The total expected loss for fire and insects is therefore 3155 cubic metres (rounded to 3200).

10 INTEGRATED RESOURCE MANAGEMENT

This section provides details on how modelling methodology will address non-timber resource requirements.

10.1 Forest Resource Inventories

This section documents the status of all non-timber resource inventories. Approximate dates of completion and approvals are presented in Table 10.1.

Table 10.1 - Non-timber resource inventory status

Inventory Category	Data Source	Mapping Scale	Date of Completion	Date of Acceptance	Authority
Recreation Feature Inventory	Recreation Resource Consultants	1:50000	Nov/2001	MP#9	MoF
Visual Landscape Inventory	Recreation Resource Consultants	1:20000	Jan/2002	MP#9	MoF
Operability	Interfor	1:20000	2001	MP#9	MoF
Stream / Riparian Classifications	TRIM	1:20000	2001	MP#9	MoF
Grizzly Bear Habitat	Ecologic Consulting	1:20000	Jan/2002	MP#9	MWLAP
Moose Habitat	Intefor	1:20000	Mar/2002	MP#9	MoF/ MWLAP
Mountain Goat Habitat	Ecologic Consulting	1:20000	May/2002	MP#9	MWLAP
Eagle Roosting Sites	Merkens/Booth/Interfor	1:20000	Feb/2002	MP#9	MoF/ MSRM/ MWLAP
Terrestrial Ecosystem Mapping	B.A. Blackwell and Associates	1:20000	Mar/2001	2001	MoF
Potential Site Index Estimates	J.S. Thrower and Associates	1:20000	Apr/2002	MP#9	MoF
Terrain Stability	June Ryder and Associates	1:20000	1995	1996	MoF

10.2 Forest Cover Requirements

The analysis will apply forest cover objectives to model wildlife habitat guidelines, biodiversity, visual green-up and silvicultural greenup. Forest cover objectives place maximum and minimum limits on the amount of young second growth and/or old growth found in landbase aggregates (LU-BEC/NDTs and REAs).

Timberline's proprietary simulation model CASH6 has the option of using a pseudo-geographic or full spatial approach to modelling timber availability, giving considerable flexibility depending on data structure and analysis objectives. This allows the analysis to mirror, as closely as possible, the intent of forest cover objectives on harvesting in operations.

Maximum depletion and minimum old growth objectives on forest cover are explicitly implemented. Productive forest stands such as inoperable and uneconomic forest types which have been excluded from the THLB may be included to better model forest structure and disturbance levels. These non-harvesting areas are referred to as non-contributing forest.

Any number of forest cover groups may be used to aggregate forest stands for the purpose of modelling forest cover objectives. For example, a forest cover group will be created to model ungulate winter range

habitat within a specific region of the TFL and this will be overlapped with landscape level biodiversity requirements for Landscape Unit-BEC/NDT combinations.

There are three forest cover constraint classes available for modelling within each forest cover group:

1. Disturbance - the maximum area that can be younger than a specified age or shorter than a specified height. This is intended to model cutblock adjacency and green-up requirements.
2. Mature Retention - the minimum proportion of area that must be retained over a lower retention age. This is intended to model thermal cover for wildlife or mature biodiversity requirements. Mature and old growth retention forest cover objectives overlap and area that qualifies for both is counted in both.
3. Old growth Retention - the minimum area that must be older than, or as old as, a specified age. This is intended to model both retention of cover and retention of old growth.

The use of forest cover objectives as described above improves forest management modelling by ensuring that non-timber resources are given appropriate consideration. Forest cover objectives to be applied to the forest cover groups representing REAs and seral stages are presented in Table 10.5 and 10.6.

10.2.1 Forest Cover Objectives - Rationale

Forest cover requirements for REAs are based on the following sources:

10.2.1.1 Disturbance Requirements - VQOs

Visual quality constraints in this analysis will be modelled at the polygonal level, based on visual quality objective (VQO) and visual absorption capacity (VAC). These areas are not removed from the THLB, but will be subjected to visual greenup disturbance constraints. Areas are listed in Table 10.2.

Table 10.2 - Distribution of area by VQO Zone

Landscape Unit	VQO	VAC	Productive area (ha)			
			Total	Inoperable	Operable	Net
Elaho.	None		20114	4903	15211	12131
	M	H	1063	267	795	591
	M	M	2847	937	1910	1430
	PR	H	151	13	138	77
	PR	M	327	159	168	122
	R	H	23	23	1	0
	R	M	66	64	1	0
Subtotal			**24591**	**6366**	**18224**	**14351**
Upper Squamish	None		24977	5578	19399	15627
	M	H	1	0	1	1
	M	L	292	22	270	8
	M	M	4088	1065	3023	2112
	PR	M	404	88	317	249
	R	H	2	1	1	1
	R	M	2	2	0	0
Subtotal			**29766**	**6756**	**23010**	**17998**
Grand Total			**54357**	**13122**	**41235**	**32349**

10.2.1.2 Wildlife Requirements

Forest cover constraints for mountain goat management areas will be established to meet the habitat and forage objectives established for these species.

CASH6 functionality includes the capability to model either age or height-based green-up. Green-up height requirements will be modelled based on height/age relationships developed for each analysis unit using TIPSY. Green-up height requirements of 3 meters in the Integrated Resource Management (IRM) zones, and 5 meters in the Visual Quality Objective (VQO) zones will be employed in the base case.

A summary of forest cover constraints is provided in Table 10.3.

Table 10.3 - Forest cover requirements - base case

REA		Disturbance Class			Old-growth Retention	
		Maximum Age	Minimum Ht (m)	Maximum %	Minimum Age	Minimum %
VQO-M	VAC = H		5	25		
	VAC = M		5	20		
	VAC = L		5	16		
VQO-PR	VAC = H		5	15		
	VAC = M		5	10		
	VAC = L		5	6		
VQO-R	VAC = H		5	5		
	VAC = M		5	3		
	VAC = L		5	1		
Goat Forage B	All	40		25	81	50
IRM	All		3	33		

10.2.2 Landscape level Biodiversity - Rationale

Biodiversity planning is modelled as described in Section 7.1, through the explicit deliniation of OGMAs, and by tracking seral status. Two landscape units have been recommended for TFL 38. The Elaho landscape unit has been designated as Intermediate biodiversity emphasis, and the Upper Squamish has been designated as Low. Old growth (> age 250) seral stage requirements are established within each landscape unit at the BEC variant level. All of the productive forest within each LU/BEC contributes to the old growth seral stage requirement. The forest cover requirements used to model landscape biodiversity are based on the Landscape Unit Planning Guide, March 2000. Requirements are based on low and intermediate emphasis.

Table 10.6 - BEC/NDT mature+old and old growth seral stage requirements

Emphasis	NDT	CWH			MH		
		Mat+old(2)	Old start(1)	Old end(1)	Mat+old(2)	Old start(1)	Old end(1)
Low(1)	1	18	4	13	19	6	19
	2	17	3	9			
Intermediate	1	36	13	13	36	19	19
	2	34	9	9			
High	1	54	19	19	54	28	28
	2	51	13	13			

(1) Old growth seral requirements in low emphasis areas to be met over three 80 year rotations

(2) Only old growth seral requirements will be modelled in the base case. A sensitivity analysis may be employed to test the impact of the mature+old requirements.

10.2.3 Stand Level Biodiversity – Rationale

The practice of leaving wildlife tree patches (WTPs) will be modelled in the current management option. WTPs will be modelled by reducing the average volume per hectare that is harvested, to account for trees

which must be left within cutblocks. The methodology for determining this allowance has been described in Section 6.12.

10.3 Cultural Heritage Resources

TFL 38 lies within the traditional territories identified by the Squamish Nation and Lil'wat Nation (Mt. Currie Band). Planning and operations in TFL38 are conducted in consultation with First Nations and government. A cultural heritage resource means an object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance in British Columbia, a community or an aboriginal people. Tools such as Archaeological Overview Assessments, Archaeological Field Reconnaissances and Archaeological Impact Assessments are used to identify and manage or protect cultural heritage resources. To date, any identified cultural heritage resources have been operationally managed and/or protected with no significant timber harvest impacts (*ie*. Impacts were within existing stand level limits for factors such as WTPs or Riparian netdowns). As such, cultural heritage resources or their impacts are not modelled as part of the timber supply analysis for Management Plan #9.

10.4 Timber Harvesting

10.4.1 Minimum Merchantability Standards

Minimum merchantability will be assessed for each yield curve, based on the age at which culmination of mean annual increment (MAI) is reached.

Culmination age was determined at the point when MAI maximized to one decimal place (i.e. further increases in MAI would be less than 0.05 cubic metres/hectare/year). This is a reasonable approach to avoid excessively high culmination ages resulting from small increases in MAI. Culmination MAI is then determined at this age, based on volume per hectare including waste and breakage.

It should also be recognised that the application of cover constraints in particular zones may delay stand entry well beyond these minimum ages. This will result in realized long-term harvest levels which will be lower than the theoretical Long Run Sustained Yield (LRSY), which is based on harvesting all stands at MAI culmination age.

Various harvest methods will be employed across TFL 38 in consideration of both harvesting and silvicultural systems. Harvesting systems will primarily involve cable equipment to remove most of the operable timber. The areas currently identified for helicopter logging represent approximately 16% of the operable area, though this percentage is likely to increase as a result of additional constraints being placed on the conventional harvest. The use of different silvicultural systems is evolving from previous large-scale clearcuts to current prescriptions that include a range of variable retention prescriptions. Cutblock size will vary on a site-specific basis, with the average opening to be approximately 20 hectares in size.

10.4.2 Initial Harvest Rate

The initial harvest rate for the analysis is 217,500 cubic metres/year. In addition, an allowance must be made for the estimate for non-recoverable losses (NRLs). In this case, based on the information presented in Section 9, the estimate of NRLs is 3,200 cubic metres/year. As discussed in Section 6.11, an additional harvest of 21,750 cubic metres (10%) will be made for additional harvesting in decade 1 to account for incomplete updating of harvest depletion records for 2001.

This harvest level will provide a starting point for the analysis. However, as a result of changes in the initial operable landbase, combined with the effect of currently defined cover constraints, this level may subsequently be adjusted to achieve harvest flow objectives over the entire planning horizon.

10.4.3 Harvest Rules

Harvest rules are used by the simulation model to rank stands for harvest. The standard rule is 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.

10.4.4 Harvest Flow Objectives

In the base case analysis, the choice(s) of harvest flow will consider the following criteria:

- Maintain an initial harvest level of 217,500 cubic metres/year;
- Limit shifts in harvest level to less than 10% of the level prior to the shift; and
- Achieve a long term sustainable harvest level.

A number of different harvest flows will be explored, including a non-declining even-flow scenario.

Forest cover constraints and biological capacity of the net operable landbase will dictate the harvest level. If opportunities exist to increase the harvest at given points during the 250 year planning horizon, these opportunities may be taken.

10.4.5 Initial volume check

The timber supply analysis employs stand level yield curves to project the inventory on the net timber harvesting landbase over time, as stands age and are harvested. A comparison of the starting inventory in the analysis and the initial standing inventory (Table 7.4) is presented below. The results show a very close agreement.

Starting Inventory from Analysis (before application of VR and WTP allowances)	Standing Inventory (Table 7.4)	Difference
11,438,000 cubic metres	11,434,000 cubic metres	4,000 cubic metres

11 SENSITIVITY ANALYSES

This section describes the sensitivity analyses that will be performed on the Current Management Option. The sensitivities reflect the stability of the base case in the face of uncertainty surrounding specific analysis assumptions. They also reflect the impact of alternative management or potential changes in forest practices.

11.1 Landbase Revisions

11.1.1 Adjust timber harvesting landbase by +/- 10%

Are will be shifted between the inoperable and net landbase components to simulate changes in the operable landbase definition.

11.2 Growth and yield Inputs

11.2.1 Adjust VDYP stand yields by +/- 10%

All VDYP yield curves will be adjusted to measure the impacts on timber supply.

11.2.2 Adjust TIPSY stand yields by +/- 10%

All TIPSY yield curves will be adjusted to measure the impacts on timber supply.

11.2.3 Adjust managed stand harvest ages +/- 10 years

Stand minimum harvest ages will be altered to measure timber supply impact.

11.2.4 Increase and decrease regeneration delay

Regeneration delay will be altered by +/- 1 year.

11.3 Forest Cover Objectives

11.3.1 Alter maximum disturbance constraints in IRM

IRM disturbance constraints will be altered by +/- 5%.

11.3.2 Alter VQO disturbance constraints

VQO disturbance percentages will be altered to the minimum and maximums specified in Table 10.3.

11.3.3 Alter disturbance constraints in wildlife zones

Forest cover constraints in the mountain goat zone will be systematically altered by +/- 5%.

11.3.4 Alter retention constraints in wildlife zones

Old growth retention minimum percentages will be systematically altered by +/- 10%.

12 Licensee Options

No additional licensee options have been identified at this point.

Appendix 1. Yield Curve Development Report

This appendix contains the report *Yield Tables for Natural and Managed Stands: Management Plan 9 on TFL 38 April 15, 2002*, prepared by J. S. Thrower and Associates.