Western Forest Products Limited

# Tree Farm Licence 19

# Timber Supply Analysis Information Package
## (DRAFT)

**In Preparation of**

## MANAGEMENT PLAN 9

**Submitted to the Ministry of Forests**
**Timber Supply Branch**
**Victoria, BC**

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# 1 INTRODUCTION

This Information Package provides a summary of data, assumptions, and modelling procedures to be used in the Timber Supply Analysis for Western Forest Product's (WFP) Tree Farm Licence (TFL) 19 Management Plan (MP) 9. The timber supply analysis will be completed using a spatial approach and the information in this package is presented accordingly.

The forest estate model Complan® will be used to complete the timber supply analysis. It is a spatially explicit harvest-scheduling model for forest management planning. This will allow the effects of adjacency to be modelled and incorporated in the timber supply analysis. Complan® allows for the inclusion of existing Forest Development Plans (FDP) and the 20–year plan for greater operational relevance in the results. The result is a detailed analysis that will guide operational planning and that can be checked and verified as planning proceeds.

WFP will complete the timber supply analysis to estimate timber harvest over a 200-year planning horizon as a function of the land base, timber volumes, and growth rates, after including constraints to protect and enhance non-timber resources. The harvest forecast will project the impacts of current management practices and operational requirements of the Forest Practices Code (FPC) and other current regulations and guidelines. Sensitivity analyses will be used to investigate the expected impacts of different management scenarios, and to examine the relative importance of variations in assumptions. Such as the removal of operable areas from the timber harvesting land base (THLB) by imposing forest-cover harvest constraints, or changes in growth & yield (G&Y) estimates.

The timber supply forecast will attempt to achieve the highest possible long-term harvest level, and minimize the rate of reduction during the transition from the current level of harvest to the mid- and long-term sustainable levels. In meeting these objectives WFP will continue to harvest to the timber inventory profile within the constraints set by cut control regulations, approved harvesting plans, market demand, objectives for other resources, and maintenance of long-term productivity. Due to the large proportion of area in older age classes on the TFL, we expect that the majority of the cut in the short- and medium-term can be concentrated in mature and over-mature stands without compromising the objectives stated above.

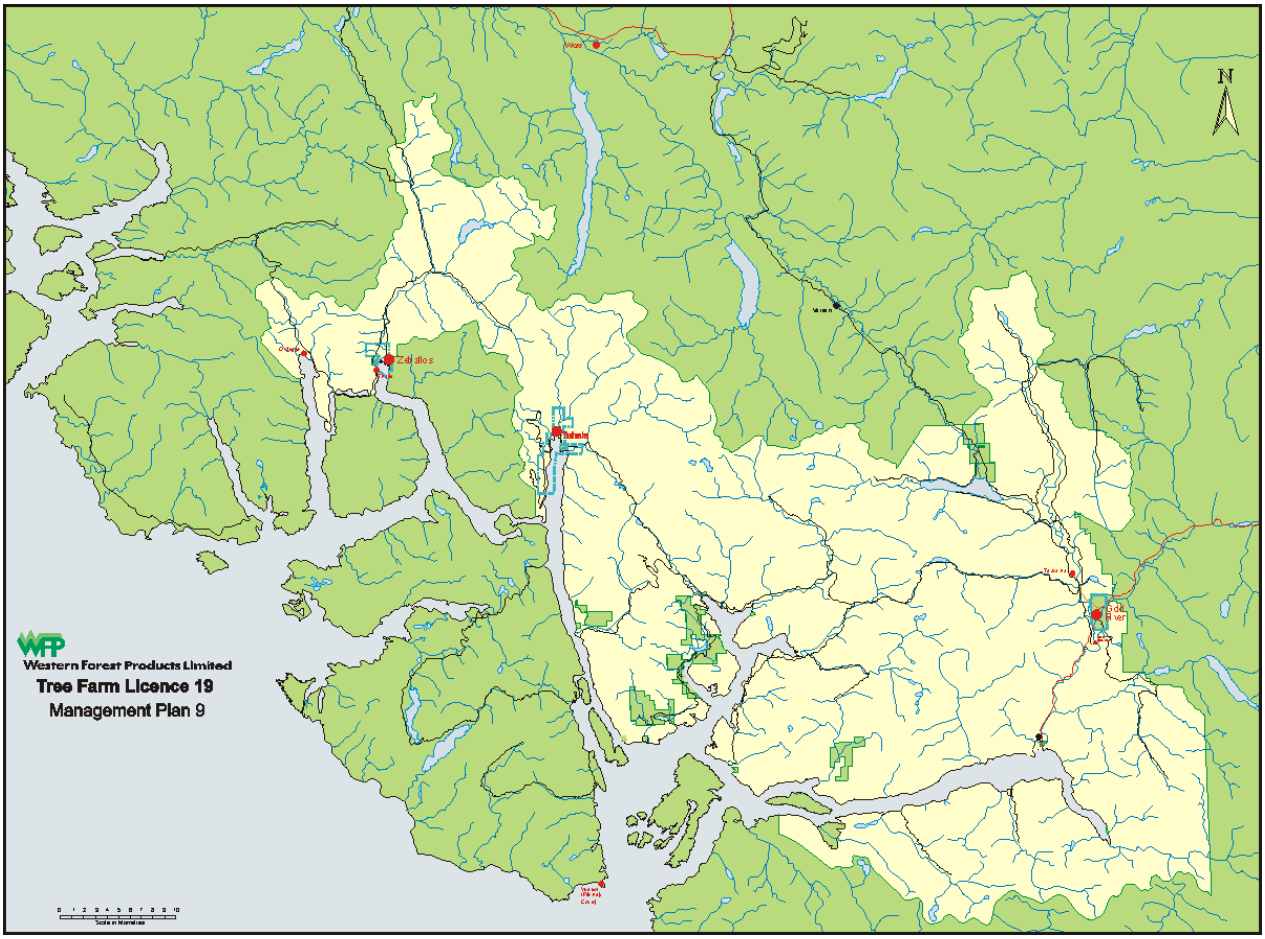


Figure 1 - TFL 19.

# 2 PROCESS

## 2.1 Overview

This information package was developed under the new provisions of the Ministry of Forests (MOF) without a Statement of Management Objectives, Options, and Procedures (SMOOP). This information package will be submitted for review and approval to the MOF Timber Supply Forester at Timber Supply Branch. The package will be revised accordingly and used to guide the timber supply analysis. The final draft will also be included as an appendix along with the timber supply analysis report in MP 9.

## 2.2 Growth and Yield

Yield tables for existing stands will be divided into three groups based on age class. Existing mature stands greater than age class 7 will have existing volumes estimated with VDYP. These generated volumes will remain static (flat line) throughout the analysis, as the assumption for these stands is that growth net decay is zero. Inventory that is less than age class 7 and greater than age class 2 will have existing and projected volumes estimated with VDYP. Existing stands less than age class 3 will have yields estimated and projected with TIPSY version 3.0. Yield projections using TIPSY will be assigned to NSR areas according to their expected regeneration.

# 3 TIMBER SUPPLY FORECASTS/OPTIONS/SENSITIVITY ANALYSES

## 3.1 Overview

This section describes the management scenarios to be included in the timber supply analysis. The details, assumptions, and sensitivities of each are also described.

## 3.2 Current Management Option

The MoF current management option represents the operational requirements and management practices on the TFL. The forecast of current management incorporates existing land use designations, including Special Management Zones,[1] and currently enforced regulations and guidelines including the FPC. This option is used as the basis for comparing sensitivity analyses of additional timber supply projections.

Current Management on TFL 19 includes:

- The operable land base includes forested areas accessible using conventional (Oc) and non-conventional (Oh) harvesting methods.
- Pure deciduous stands and mixed deciduous-coniferous stands are included in the THLB and any volume in these stands contributes to the analysis.
- Silviculture to meet free growing and forest practices code requirements is carried out on all regenerated stands. Virtually all harvested areas are planted.
- Additional (incremental) silviculture is conducted as a function of Forest Renewal B.C. funding and objectives.
- Tree Improvement gains will be applied to future regenerated stands as:
    - Fd, Hw, and Yc – 12% gain from 1997 onward and fro Fdc only 2% from 1972-1997
    - Cw and Ss – 12% gain for all plantations from 2000 onward.
- Visual quality objectives (VQO) are modelled based on known scenic areas with upper range denudation assumed.
- Wildlife Tree Patch retention is accounted for by volume net downs in the timber supply model.
- Biodiversity and Landscape Units – seral stage targets for only old seral will be applied to each landscape unit based on target proportions of 10/45/45, for high/intermediate/low.
- Ungulate Winter Ranges and Wildlife Habitat Areas are removed from the timber harvesting land base. Wildlife Management areas are accounted for by volume net downs in the timber supply model.
- Minimum harvest age is 60 years and the minimum harvestable volume is 350m3 per hectare. Both minimum age and minimum volume requirements must be met before a stand can be harvested.

[1] Although not approved by Government, the spirit and intent of the SMZs have been reflected in the current management of TFL 19 since they were recommended for designation.

The area available for timber production under Management Plan 9 is 95,195 ha (Table 1). The THLB under Management Plan 8 was 95,705 ha. There has been a decrease of 510 ha of forestland available for timber production since the last MP. This decrease is attributable to the addition of two new parks within the TFL, a Wildlife Habitat Area, revised operability classification and mapping refinements to the TFL boundary along various heights of land.

Table 1 - TFL 19 landbase comparison for MP 9 compared to MP 8.

| | MP 9 | MP 8 | Difference |
|---|---|---|---|
| **Total Area** | 191,992 | 192,551 | (559) |
| **THLB Area** | 95,195 | 95,705 | (510) |

### 3.3 Alternate Harvest Flow

The timber supply analysis attempt two approaches to harvest flows

1) Even flow from present at long term level.

2) Transition from current harvest level to long-term harvest level in increments of change not to exceed 10% per decade.

### 3.4 Sensitivity Analyses

Sensitivity analyses will be conducted for the current management scenario to examine the potential impact of uncertainty in several key attributes. These attributes will be examined either through the removal of area from the THLB or through the incorporation of temporal constraints on the harvest levels.

Sensitivities for the base case will include:

1) Land Base: The TFL land base will be reduced by approximately 9% to determine how sensitive the harvest forecast is to a potential withdrawal of land. This will be done spatially by removing all Terrain Stability Class 4 areas located on slopes greater than 60% and all Terrain Stability Class 5 land.
2) Operability: Operability classes have been developed that reflect the harvesting system, timber quality, terrain stability, and include economic accessibility. The purpose of this sensitivity is to examine potential timber supply impacts on improved economic conditions by including operability classes that currently are not economic to harvest. The current management option includes areas that can be harvested:
   a) Conventionally with cable or ground-based equipment (Oc), and;
   b) Non-conventionally with helicopters (Oh),

   Therefore, those areas classified as:
   c) Physically inoperable (I), and;
   d) Operable only during favourable economic conditions (Oce and Ohe)
   are excluded from the THLB.

Sensitivity analyses will model the impacts of:

i) removing the non-conventional area (Oh), and;

ii) including areas that are considered economically marginal (Oce and Ohe).

3) Volume: The impact on harvest forecasts of adjusting the available timber supply for all stands, including both the mature (140+ years) and second growth components, by ±10% will be tested.

4) Site Productivity: Site indices for natural immature stands are assigned using the inventory database. For existing and future PHR stands, site indices are based on the inventory database with an adjustment to reflect the MoF SIBEC estimates. Site indices will be varied by ±10% from the current management assumptions for all stands. Site indices for natural immature stands only will be varied by +10%, or as inferred from plot or other data, to investigate the potential impact of improving yield estimates for these stands.

5) Nature Immature Stands: Site indices for nature immature stands appear to be low when compared to managed immature and existing stands. A closer examination into these site indices will be completed and any changes to the a sensitivity analysis will be

6) Harvest Age: The effect of rotation length will be tested by increasing the minimum harvest age by 10 years and the minimum volume by 100 $m^3$/ha.

7) Green-Up and Adjacency: The potential impact of green-up height will be tested by varying this height by ±2m. The current management green-up height will vary in accordance with the visual classification of the area.

8) Visual Quality Objectives: Current management incorporates constraints from VQOs assigned by the landscape inventory completed for the TFL in 1994. As a comparison to the current management option, two sensitivity analyses will be used to examine the impacts by varying the percentage of area below Visually Effective Green-up (VEG) to the mid range percent denudation limit recommended for the VQO class.

9) Biodiversity and Landscape Units: The current management option seral stage constraints for biodiversity will be expanded to include targets for early and mature plus old seral stages. This analysis will be used to determine the overall sensitivity of applying biodiversity guidebook seral stage targets.

10) Biodiversity Emphasis Options: Interim Biodiversity Emphasis Options (BEO) ratings have been assigned to the Landscape Units of TFL 19. The current management option does not consider interim BEO ratings. Interim BEO ratings on Landscape Units will be considered in a sensitivity analysis to study the implications of managing to maintain biodiversity at the landscape unit level. Old seral targets will be modelled within each Landscape Unit according to guidebook procedures for draw down in low emphasis units.

11) Silviculture Opportunities: The impacts of not fertilizing, not spacing and eliminating the use of genetically improved stock in the future will be assessed.

During preparation of the timber supply analysis, more issues that warrant sensitivity analyses may be identified. We may include additional sensitivity analyses in the final timber supply analyses for consideration by the Chief Forester if warranted.

### 3.5 Other Options

An unconstrained, current management option (operability the only constraint) will show the timber flow sacrificed for protection of non-timber values.

This option will be repeated by adding in full silviculture treatments (100% planting, all stock to be from improved seed and fertilized) to approximate the ultimate timber producing potential of TFL 19.

Table 2 - Current Management Option

| Issue Tested | Proposed Options / Sensitivity Analysis | |
|---|---|---|
| | **Title** | **Reason for Analysis and Range to be tested** |
| To project the timber supply based on current management practices, performance, operational requirements and currently enforced guidelines while meeting the objective of maintaining a timber supply which is not excessively variable over time and which maintains the long-term productivity of the TFL. | **Current Management Option** | Current Management Option includes the following:<br>• Conventional and non-conventional harvesting<br>• Visual Quality based on known scenic areas within the TFL inventory<br>• WTP – 3.25% volume net down to meet WTP requirements (current WTP retention is at 13%; however we are assuming that 75% of the WTP designated will be previously constrained areas)<br>• Riparian reserves based on FPC requirements<br>• Silviculture practices as described in Section 3.2<br>• Biodiversity Landscape Unit targets for old seral based on the 10/45/45, high intermediate, low proportions<br>• Parks excluded, major recreational sites excluded; UWR excluded; 50% net down on Wildlife Management Areas. |
| | (1) Land Base | The impact on reducing the land base by approximately 9% will be evaluated by removing all Terrain Stability Class 4 areas on slope greater than 80% and all Terrain Stability Class 5 areas from the THLB. |
| | (2) Operability | The impact on the harvest flow will be evaluated by including different operability classes in the THLB as follows (current management practices for all):<br>• Non-conventional areas removed.<br>• Economically marginal areas included. |
| | (3) Volumes | The impact on the harvest flow will be evaluated by varying stand yields as follows:<br>• ±10% mature volume and second growth volume |
| | (4) Site Productivity | Managed and future second growth site Indices (SI 50) will be varied by ±10% to model the uncertainties associated with assigned SI. Unmanaged second growth site indices will be varied by 10%, or as inferred from plot or other data. |
| | (5) Harvest Age | Increasing the minimum harvest age by 10 years and the minimum harvest volume for the stand by 100 m3/ha will assess the effect of rotation length. |
| | (6) Green-Up and Adjacency | The impact green-up periods have on harvest forecasts will be assessed by assuming green-up heights of ± 2m, with the base height used varying in accordance with the VQO classification of the area. |
| | (7) VQO | The effects on varying the percent-denudated limit to the mid range |
| | (8) Biodiversity | The implications on timber supply associated with managing to early seral and mature plus old seral stage targets as outlined in the biodiversity guidebook. |
| | (9) Interim BEO | The implications on timber supply associated with managing for biodiversity by individual landscape unit as dictated by the interim Biodiversity Emphasis Options (guidebook procedures for old seral targets requirements). |
| | (10) Silviculture Opportunities | The impact of not fertilizing, spacing or using genetically improved stock in the future will be assessed. |

Table 3 - Other Options

| Option | Issue to be Tested | Constraints |
|---|---|---|
| Unconstrained Run | To quantify timber flow sacrifices for sustaining non-timber values. | No constraints will be imposed upon this run with the exception of operability. |
| | | As above with full silviculture treatment activities being applied |

# 4 HARVEST MODEL

## 4.1 Complan®

This section presents a brief description of the analytical model used to produce harvest level and forest inventory projections. The proprietary forest estate simulation model Complan® will be employed in TFL 19 to determine the AAC based on spatially-explicit, volume-based cut control.

Complan® is a spatially explicit forest estate model that schedules harvests at the cutblock or stand level subject to adjacency (green-up) and non-timber resource constraints (cover constraints). The model's built-in flexibility makes it possible to evaluate many different scenarios with a large degree of realism.

Complan® software uses a hierarchical data structure that takes advantage of a compartment management approach to spatial data organization. Advantages of this approach include easy integration with GIS systems, adaptation to a wide variety of tenure administration structures and integration of both strategic and operational planning.

Tests have been completed which compare results of Complan® with those from the B.C. Ministry of Forests' model FSSIM. These tests, done in cooperation with the MoF showed that Complan® could produce results that are extremely similar to that of FSSIM. The differences are insignificant but the reasons for the differences are well understood and documented.

Key Features

Complan® offers a number of key features that make it ideally suited for both strategic and operational planning:

- Annual internal time increment allows accurate representation of growth, harvest, adjacency and constraint status.
- Yield table structures allow for many additional variables other than volume to be modelled.
- Initial inventory values for volume, height and other yield table columns are used and then trended with the yield tables allowing for polygon-specific values to be used.
- Constraints are localized to site-specific conditions (e.g. green-up time will be longer for cutblocks on poor sites compared with cutblocks on good sites).
- Cover constraints that address non-timber values can overlap so that it is not necessary to divide the area into management zones according to which constraint is most restrictive.
- All forested land base is retained in the simulation and contributes to cover requirements even if it is not part of the timber harvesting land base.
- Alternative silviculture systems such as retention, selection and shelterwood may be modelled.

- Commercial thinning is supported.
- Spatially explicit nature allows harvest schedules to be easily mapped and verified.
- Flexible yield table columns and the ability to shift yield tables at different ages allow for modelling of succession as well as alternative silvicultural strategies.
- Several different prioritization algorithms are available, including minimize growth loss, oldest first, geographic priority and analysis unit priority.
- Cutblock aggregation can be used.
- Several options exist for “harvesting the profile”.
- Revenues and costs can be tracked and reported.
- Road networks can be modelled.

There are no artificial limitations on numbers of polygons, yield tables, or other model inputs.

# 5 CURRENT FOREST COVER INVENTORY

## 5.1 Overview

The purpose of this section is to summarise:

1) History of the current forest-cover inventory.
2) Updates and changes to the inventory since the last timber supply analysis.
3) Area of the inventory.
4) Audits and reviews.
5) Plans for future updates.

## 5.2 History

The current TFL 19 inventory was completed in 1989 by Reid, Collins and Associates Ltd. This inventory was based on 1975 and 1980 photography (1:15,840 and 1:20,000) and mapped to 1:20,000. The inventory addressed all stands in age classes 4-9 with emphasis on old-growth (age class 7+). Stands in age class 1-3 were re-inventoried prior to this date for MP 7.

The 1989 inventory included new photo-typing and about 3,900 air calls, 90 ground calls, and 1,900 cruise plots. The cruise plots were located in age class 4-9 stands using stratified random sampling and located systematically along transects. Tree measurements were taken from a ratio of two count-plots for each measure plot. About 87% of the cruise plots were located in old-growth stands (87% of sampled area) and 13% in older second-growth stands (age class 4-6, 13% of sampled area). Volumes were estimated using the 1976 MoF taper equations and DWB factors. The utilization standard was 30 cm stump, 17.5 cm dbh, and 15 cm top. Volume estimates were computed as averages for each stratum (AVL method) and presented for each of 44 old-growth strata and 11 second-growth strata. The estimated overall precision was $\pm$3% (95% confidence) for the total volume.

## 5.3 Updates

The inventory for the Timber Supply Analysis has been updated for depletion (harvesting and natural) and reforestation to January 1, 2000. Volumes for the TFL19 inventory are based on cruise estimates of average volume lines.

The inventory is maintained by WFP in the Vancouver office in the PAMAP GIS system and is currently in UTM NAD 83. The inventory contains coverages for:

1) Forest cover
2) Operability class
3) Terrain and stability classification

4) Riparian Zones
5) Roads
6) Silviculture Activities
7) Biogeoclimatic classification to variant level
8) Landscape Units
9) Resource Management Zones
10) Elevation
11) Ungulate Winter Range and Wildlife Management Areas

### 5.4 Inventory Audits

A MoF inventory audit for TFL 19 is currently underway. The preliminary results from this audit are being compared to the existing inventory and will be incorporated in to Management Plan 9 as required.

# 6 DESCRIPTION OF LAND BASE

## 6.1 Overview

This section describes the TFL 19 land base and the methods used to determine the portion of the landbase that contributes to timber harvesting (THLB). Some portions of the productive land base, while not contributing to harvest, are crucial in meeting the demands for non-timber resource sustainability.

## 6.2 Timber Harvesting Land Base Determination

The THLB and the total long-term land base in TFL19 are presented in Table 4. Areas are reported for both Schedule A and Schedule B land classes. Areas and volumes have been compiled from a stand database constructed for the preparation of this information package. Appendix I shows detailed area and volume summaries for the timber harvesting land base. Mature and immature stand volumes have been derived from growth and yield projections.

The total area of reductions applied against the forest landbase for MP 8 in 1992 amounted to 52,807 ha, or 34% of the total productive forest at the time. For MP9 the total area of reductions is 52,982 ha., which is 36% of the productive forest.

The following sections show total area classified in each category noted in Table 4 and serve to summarise the area deducted from the timber harvesting land base including overlaps.

## 6.3 Total Area

The total area of the TFL is 191,992 ha. The total area in 1995 was 192,551 ha, a net decrease of 559 ha. As previously mentioned, this difference is due to the creation of two parks within the TFL and mapping refinements to the TFL boundary along heights of land.

Table 4 - Timber harvesting landbase for TFL 19

| Classification | Area (ha) | | | Mature Volume ($m^3$) | | |
|---|---|---|---|---|---|---|
| | Schedule A | Schedule B | Total | Schedule A | Schedule B | Total |
| **Total Area** | 6,674.4 | 185,317.3 | 191,991.7 | 2,120,821.2 | 48,949,951.3 | 51,070,772.5 |
| Less: Non-Forest | 350.8 | 35,845.8 | 36,196.6 | 0 | 0 | 0 |
| Less: Non-Productive Forest | 37.3 | 7,580.4 | 7,617.7 | 2,319.8 | 507,070.4 | 509,390.2 |
| **Total Productive Forest** | 6,286.3 | 141,891.1 | 148,177.4 | 2,118,501.4 | 48,442,880.9 | 50,561,382.3 |
| Less Reductions to Total Productive Forest: | | | | | | |
| Non-Commercial (NP Br) | 4.0 | 20.9 | 24.9 | 0 | 0 | 0 |
| Riparian Reserves | 309.0 | 3,663.2 | 3,972.2 | 142,089.2 | 1,310,022.2 | 1,452,111.4 |
| Inoperable / Inaccessible (I, Oce, Ohe) | 1,090.3 | 43,973.7 | 45,064.0 | 485,086.1 | 17,028,760.9 | 17,513,847 |
| Wildlife Habitat Reserves (e.g. UWR, WHA) | 260.8 | 2,174.5 | 2,435.3 | 225,700.4 | 1,505,040.2 | 1,730,740.6 |
| Unclassified Roads, Trails and Landings | 87.8 | 1,397.9 | 1,485.7 | 6,273.0 | 154,789.7 | 161,062.7 |
| **Total Reductions to Productive Forest** | 1,751.9 | 51,230.2 | 52,982.1 | 859,148.7 | 19,998,613.0 | 20,857,761.7 |
| Less: Volume Reductions | | | | | | |
| **Total Reduced Land Base** | 4,534.4 | 90,660.9 | 95,195.3 | 1,259,352.7 | 28,444,267.9 | 29,703,620.6 |
| Less: Not Sufficiently Restocked Areas | 151.1 | 3,094.0 | 3,245.1 | 0 | 0 | 0 |
| Add: Not Sufficiently Restocked Areas | 151.1 | 3,094.0 | 3,245.1 | 0 | 0 | 0 |
| **Timber Harvesting Land Base** | 4,534.4 | 90,660.9 | 95,195.3 | 1,259,352.7 | 28,444,267.9 | 29,703,620.6 |
| Less: Future Roads, Trails and Landings | 27.7 | 942.6 | 970.3 | 12,722.6 | 404,451.1 | 417,173.8 |
| **Total Long Term Land Base** | 4,506.7 | 89,718.3 | 94,225.0 | 1,246,630.1 | 28,039,816.8 | 29,286,446.9 |

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### 6.4 Non-Forest

The non-forest portion of TFL 19 includes area where merchantable tree species are largely absent. Most of this area is in alpine, rocks and slides, and wet areas (Table 5).

Table 5 - Non-forest area in TFL 19

| Type | Non-Forest Area (ha) |
|---|---|
| Alpine | 28,190.0 |
| Rock and Slides | 4,764.4 |
| Swamp, Marsh, Creek, River, Lake | 2,835.8 |
| Town | 299.5 |
| Dump, Camps and Sort | 53.5 |
| Islands | 40.9 |
| Classified Roads and Pits | 10.7 |
| Hydro and Telephone R-of-Way | 1.8 |
| **TOTAL** | **36,196.6** |

### 6.5 Non-Productive Forests

TFL 19 includes 7,618 ha of non-productive land (Table 6). These areas contain brush (shrubs) and grass.

Table 6 - Non-productive area in TFL 19

| Criteria | Total |
|---|---|
| Alpine forest | 7,266.2 |
| Brush | 193.8 |
| Non-productive forests | 157.7 |
| **Total** | **7,617.7** |

### 6.6 Non-commercial Cover

Approximately 25 ha of TFL 16 are classified as non-commercial cover (Table 7). Most of this area is occupied by brush.

Table 7 - Non-commercial area

| Non-Commercial | Total Area (ha) | Total Area Reduced |
|---|---|---|
| NCD | 24.9 | 24.9 |

### 6.7 Riparian Reserves – Streams

Although overview mapping is available, a comprehensive riparian inventory has not been completed for TFL 19. Operational stream inventories associated with development planning have been conducted since 1988 and a reconnaissance (1:20,000) fish and fish habitat inventory project to RIC standards will be completed by 2001. This inventory will provide information on fish distribution, fish habitat, and habitat restoration opportunities.

This detailed information in conjunction with GIS modelling helped to obtain an overall estimate of the riparian classes for watercourses and reserve areas for the TFL. The approach employed in the timber supply analysis was to utilise the available stream classification in the GIS to apply reserves to all known and predicted fish bearing streams, in accordance to specifications in the FPC's Riparian Management Area Guidebook.

Currently within the GIS streams are classed as S1 to S6 (as per FPC definitions), and Unclassified (which are streams of unknown fish presence and width).

Table 8 - Riparian Reserve Zones

| RIPARIAN FEATURE CLASS | FEATURE AREA (HA) OR LENGTH (KM) | | PROPORTION (%) OF CLASS RELATIVE TO TOTAL CLASSIFIED STREAMS | TOTAL RIPARIAN RESERVE WIDTH FROM FPC (M) | WEIGHTED AVERAGE RIPARIAN RESERVE ZONE UNCLASSIFIED STREAMS |
|---|---|---|---|---|---|
| | TOPOGRAPHY <30% GRADIENT | TOPOGRAPHY > 30% GRADIENT | | | |
| **DOUBLE LINE STREAMS (HA)** | | | | | |
| S1 | 592.5 | | 87% | 50 | |
| S2 | 88.1 | | 13% | 30 | |
| **SINGLE LINE STREAMS (KM)** | | | | | |
| S1 | 21.6 | 0 | 7% | 50 | 3.3 |
| S2 | 211.1 | 0 | 64% | 30 | 19.2 |
| S3 | 96.5 | 0 | 29% | 20 | 5.9 |
| S4 | 0.3 | 0 | 0% | 0 | 0.0 |
| S5 | 578.7 | 120.5 | | | |
| S6 | 776.1 | 795.4 | | | |
| UNCLASSIFIED | 945.5 | 487.5 | | | *28.4 (30)* |
| **LAKES AND WETLANDS (HA)** | | | | | |
| L1 (> 5 HA) | 1542.1 | | | 10 | |

Double line streams – Within the GIS all double-lined streams are assigned a riparian reserve based on their classification.

Unclassified single-line streams – a GIS analysis (terrain model) was used to separate, and class streams of less than 30% gradient as being potentially fish bearing. The 30% gradient parameter is more conservative than the normal assumption of <20% due to the coarse nature of the digital elevation model (TRIM) and because fish have been identified, in some cases, in streams of >20% gradient. Based on the 1684.3 km of known S1 to S6 classified single line streams identified as less than 30% gradient, it was determined that 20% of the unclassified single line streams are potentially fish bearing (329.4 km of fish bearing stream/1684.3 km of streams <30% gradient). A weighted average riparian width was then calculated for unclassified single line streams (28.4 metres). The 30m implied riparian zone width was applied sequentially to the lower gradient unclassified streams until 20% of the unclassified stream length was tagged with a reserve zone. This amounted to all of the unclassified streams on topography of less than 6% (20% potentially fish bearing / 30% slope). Due to limitation of the GIS each riparian reserve was rounded to the nearest ten meters; the rounding effect was conservative in that it increased the reserve area.

The reductions for all riparian classes have been applied to operable productive forested areas located within these buffers that have not already been deducted from the productive land base.

Table 9 - Riparian reserves in TFL 19

| | Total Area (ha) | Reduction Area (ha) |
|---|---|---|
| Riparian Reserves | 3972.2 | 3972.2 |

### 6.8 Inoperable/Inaccessible

Operability classes have been developed for TFL 19 that reflect the harvesting system, timber quality, terrain stability, and economic accessibility. APPENDIX II - OPERABILITY CLASSIFICATION details the methodology and assumptions used in completing the operability classification for TFL 19.

The first category relates to the area being physically inaccessible and not available for timber harvesting (I). The second category uses economic criteria to determine operability (Oce/Ohe). In this case, timber harvesting under normal market conditions is not justified given costs of harvesting and the expected value of the timber. Physical inoperability relates to the presence of a physical barrier or terrain constraint leaving access virtually impossible. Classifying areas as operable with an economic constraint relates to the inability to harvest stands in a cost-effective manner given the value of the timber. Two classes are recognised in this analysis: (1) Oce for areas that could be logged profitably by conventional harvesting systems should markets improve sufficiently and (2) Ohe for areas that could be heli-logged profitably should markets improve sufficiently.

Of the net inoperable land base, 5,389 ha are currently classified as Oce/Ohe and 39,675 ha are currently classified as I. The total area classified as inoperable and therefore deducted from the productive forest land base is 45,064 ha.

Table 10 - Inoperable area (ha) by class

| Criteria | Total Area (ha) | Reduction Area (ha) |
|---|---|---|
| I – Physically Inoperable | 40,507.6 | 39,675.2 |
| Oce – Operable for conventional logging with economic constraints removed | 373.7 | 356.9 |
| Ohe – Operable for heli-logging with economic constraints removed | 5,149.1 | 5,031.9 |
| **Total** | **46,030.4** | **45,064.0** |

### 6.9 Environmentally Sensitive Areas (ESAs)

Areas assessed as sensitive or valuable for other resource values have been defined by inventories completed before and after MP 8. Land base reductions reflecting the presence of these areas are captured in other sections of the Information Package. These include terrain stability and soil sensitivity, which have been included in the definition of operability classes (Section 6.8), and wildlife habitat (Section 6.10). Productive area net downs for riparian reserves (Section 6.7) and forest cover constraints are applied to capture the reservation of future Wildlife Tree Patches (WTP) designed to protect non-timber resources. There is no requirement to apply further reductions for these reasons.

### 6.10 Wildlife Habitat

A number of wildlife inventories have been undertaken or broadened since MP 8 in an effort to identify and classify potential wildlife habitat areas suitable for deer and other species.

Areas previously identified in MP 8 as Ew1 have now been grandfathered and reserved under the Forest Practices Code as Ungulate Winter Ranges (UWR). These areas have under gone some minor revisions

during the Forest Development Plan process and now encompass 3,722 ha of productive forest, of which 1,315 ha are inoperable or constrained by riparian reserves.

Recently within the TFL one of the first Wildlife Habitat Areas in the province has been designated. This area, which is 27.7 ha in size, has established to protect one of two know caves used for maternity roosts by the Keen's long-eared Myotis

Future WTPs will be handled through a volume reduction in the timber supply analysis as described in Section 10.3.1.5. It should be noted that at least 75% of the WTPs will be incorporated in riparian reserves or other constrained areas.

A total of 2,435.3 ha of the productive land base has been specifically reserved for wildlife habitat. This compares to about 4,035 ha of wildlife habitat areas identified in MP 8. Table 11 summarises the operable and total productive forest areas reserved for wildlife habitat.

Table 11 - Wildlife management areas

| | Total Area (ha) | Total Area Reduction (ha) |
|---|---|---|
| **Ungulate Winter Range Area** | 3,722.3 | 2,407.6 |
| **Wildlife Habitat Area** | 27.7 | 27.7 |

### 6.11 Recreation Reserve Areas

A new coverage for recreation areas reserved from the timber harvesting land base is currently being prepared. It will be included in the inventory database for the TFL and appropriate areas will be removed, if required, from the timber harvesting land base for the timber supply analysis.

### 6.12 Cultural Heritage Resource Reductions

An archeological overview assessment for the Nootka and Kyuquot Sound areas including TFL 19 was completed in 1998. This overview deals with archeological sites and resources and indicates where past human activities are likely to have occurred. This assessment is used in planning. Areas of high potential are subject to field reconnaissance and inventory. No explicit reductions for cultural heritage resources have been made to the inventory file although the most common features such as culturally modified trees are commonly included in already-accounted-for reserves for riparian protection or wildlife tree patches.

### 6.13 Deciduous Stands

Table 12 shows the area of stands defined as deciduous leading in the inventory. This represents about 0.44% of the long term harvestable land base. These are included in the THLB and any deciduous volume harvested will be included in modelled timber flows.

Table 12 - Area of Deciduous forest types

| Inventory Type Group | Total Area (ha) By Age | | | | | Total |
|---|---|---|---|---|---|---|
| | 0-20 | 21-40 | 41-60 | 61-80 | 80-100 | |
| Pure Deciduous | 0 | 4.3 | 0.6 | 0 | 0.5 | 5.4 |
| Deciduous-Leading | 10.5 | 43.8 | 188.5 | 94.0 | 81.0 | 421.1 |
| **Total** | **10.5** | **48.1** | **189.1** | **94.0** | **81.5** | **423.2** |

### 6.14 Roads, Trails and Landings

#### 6.14.1 Classified Roads, Trails and Landings

Classified roads, trails and landings are those that are mapped as polygons distinctly separate from adjacent polygons. Only the mainline roads have been identified as separate polygons on the forest cover maps. Table 13 summarizes the areas of classified roads in the TFL.

Table 13 - Classified roads, trails and landings

| | Total Area of Road (ha) in Productive Forest Land | Total Area Reduction (ha) |
|---|---|---|
| Existing Roads | 10.7 | 10.7 |

#### 6.14.2 Unclassified Roads, Trails and Landings

Unclassified roads on the TFL have been mapped as lineal features. For the purposes of determining the total area of unclassified roads, all are assumed to occupy a 10 metre wide unproductive width. As with classified trails and landings, all trails and the majority of the landings are rehabilitated and restocked immediately following logging and consequently there is no associated area reduction. Table 14 indicates the area of unclassified roads in the TFL that is excluded from the timber harvesting land base.

Table 14 - Unclassified roads, trails and landings

| | Road Length (km) in Productive Forest Land | Total Area Reduction (ha) |
|---|---|---|
| Existing Roads | 148.6 | 1,485.7 |

### 6.14.3 Future Roads, Trails and Landings

A projected road system was developed as part of the operability classification for TFL 6. This road system was digitized into the GIS in conjunction with operability loading which allowed for the same approach used with unclassified roads to predict area summaries. Table 15 indicates the area of future roads in the TFL that have yet to be developed.

Table 15 - Future roads, trails and landings

| | Total Road Length (km) in Productive Forest Land | Total Area Reduction (ha) |
|---|---|---|
| Roads | 93.3 | 932.8 |

# 7 INVENTORY AGGREGATION

## 7.1 Overview

This section describes the delineation of the TFL landbase and definition of stand types needed to complete the timber supply analysis. The TFL area is defined by different management zones to allow for a variety of forest cover constraints (e.g., for wildlife habitat, VQOs, biodiversity, etc.). Stand types are grouped in analysis units based on similar leading species, history and productivity.

## 7.2 Management Zones

The net operable and available land base is subject to normal management where the focus is timber production. Unique forest cover objectives will be modelled through the different management zones. Landscape Units, Special Management Zone (SMZ) and Resource Management Zone (RMZ) are delineated in the data and may be used to report seral stage distributions and other ecological parameters for selected sensitivity analyses (Table 16 and Table 17).

Table 16 - Management zones and landscape units

| Mgmt Zone | Mgmt Unit | Landscape Unit | Productive Forest (ha) | Management Considerations |
|---|---|---|---|---|
| EMZ 24 | Burman | Burman | 21,949 | ***Enhanced Forestry Zone*** suited for enhanced silviculture, as well as limited enhanced timber harvesting; due consideration and integration of riparian and wildlife values associated with Burman River corridor into Strathcona Park; integration of biodiversity, recreation and scenic values as described. |
| EMZ 18 | Eliza | Eliza | 5,499 | ***Enhanced Forestry Zone,*** particularly suited for enhanced timber harvesting in suitable areas (e.g. areas which are not visually sensitive), as well as enhanced silviculture on most productive sites; emphasis on scenic values along coast, and integration of associated recreation/tourism opportunities; objectives for biodiversity are to be integrated at the basic stewardship level in accordance with FPC requirements; adaptive road engineering/deactivation efforts are indicated to maintain terrain and watershed integrity. |
| GMZ 22 | Gold | Gold | 38,154 | ***General Management Zone***, with high fish, wildlife and biodiversity values, as well as significant timber values; landscape level development of riparian recovery plan for the Gold-Muchalat-Oktwanch-Nimpkish riparian corridor recommended. |
| EMZ 23 | Kleeptee | Kleeptee | 12,608 | ***Enhanced Forestry Zone***, suited for enhanced timber harvesting and silviculture, while maintaining fish and wildlife, as well as watershed integrity; basic level of biodiversity conservation; integration of coastal scenic and recreation values. |

| Mgmt Zone | Mgmt Unit | Landscape Unit | Productive Forest (ha) | Management Considerations |
|---|---|---|---|---|
| SMZ 11 | Schoen-Strathcona | Gold | 2,238 | ***Special Management Zone***, the focus should be on maintenance of old growth biodiversity and habitat values, as well as backcountry recreation potential and maintenance of viewsheds around Victoria and Warden Peaks; this SMZ should become a focal area for old growth retention at the landscape level. |
| EMZ 19 | Tahsis | Tahsis | 19,840 | ***Enhanced Forestry Zone****,* with opportunity for enhanced timber harvesting, as well as enhanced silviculture on most productive sites; emphasis on integration of visual values along coastline; objectives for biodiversity are to be integrated at the basic stewardship level in accordance with FPC requirements; adaptive road engineering/ deactivation efforts are indicated to maintain terrain and watershed integrity. |
| EMZ 21 | Tlupana | Tlupana | 34,118 | ***Enhanced Forestry Zone***, with significant opportunity for enhanced timber harvesting and silviculture, while maintaining high fish, wildlife and intermediate biodiversity values; integration of scenic/recreation/tourism values along coastline. |
| SMZ 6 | Woss-Zabellos | Zebellos | 2,442 | This ***Special Management Zone*** should become a focal area for old growth biodiversity conservation; focus should also be on maintenance of recreation opportunities associated with lakes and alpine/subalpine, and maintenance of scenic values associated with recreation sites and access corridors. |
| GMZ 16 | Zeballos | Zeballos | 11,329 | ***General Management Zone***, with lower biodiversity conservation objectives; sensitive development of timber values on unstable terrain |
| **Total** | | | **148,177** | |

Table 17 - Area by landscape unit and BGC variant

| Landscape Unit | BEC | Seral Stage | Productive Forest (ha) | Non Contributing Area | | THLB Area | |
|---|---|---|---|---|---|---|---|
| | | | | ha | % | ha | % |
| Burman | CWH vm 1 | Early | 2953.0 | 238.5 | 2% | 2714.6 | 20% |
| | | Mid | 2057.5 | 467.3 | 4% | 1590.1 | 12% |
| | | Mature | 1959.8 | 794.7 | 6% | 1165.1 | 9% |
| | | Old | 6278.3 | 2464.4 | 19% | 3813.9 | 29% |
| | CWH vm 1 Total | | 13248.5 | 3964.9 | 30% | 9283.6 | 70% |
| | CWH vm 2 | Early | 634.5 | 30.7 | 0% | 603.8 | 9% |
| | | Mid | 397.2 | 140.0 | 2% | 257.2 | 4% |
| | | Mature | 528.4 | 380.8 | 6% | 147.6 | 2% |
| | | Old | 4885.2 | 2603.7 | 40% | 2281.5 | 35% |
| | CWH vm 2 Total | | 6445.2 | 3155.1 | 49% | 3290.1 | 51% |
| | CWH xm 2 | Mid | 15.7 | 5.1 | 32% | 10.6 | 68% |
| | CWH xm 2 Total | | 15.7 | 5.1 | 32% | 10.6 | 68% |
| | MH mm 1 | Early | 86.1 | 2.9 | 0% | 83.1 | 4% |
| | | Mid | 254.1 | 88.1 | 4% | 166.0 | 7% |
| | | Mature | 113.3 | 74.2 | 3% | 39.1 | 2% |
| | | Old | 1779.3 | 1062.8 | 48% | 716.5 | 32% |
| | MH mm 1 Total | | 2232.7 | 1228.1 | 55% | 1004.7 | 45% |
| | MH mmp1 | Old | 6.7 | 6.7 | 100% | 0.0 | 0% |
| | MH mmp1 Total | | 6.7 | 6.7 | 100% | 0.0 | 0% |
| Burman Total | | | 21948.9 | 8359.9 | 38% | 13589.0 | 62% |
| Eliza | CWH vm 1 | Early | 1943.8 | 271.9 | 6% | 1671.9 | 36% |
| | | Mid | 235.4 | 14.3 | 0% | 221.1 | 5% |
| | | Mature | 836.3 | 404.9 | 9% | 431.4 | 9% |
| | | Old | 1597.8 | 623.7 | 14% | 974.2 | 21% |
| | CWH vm 1 Total | | 4613.3 | 1314.7 | 28% | 3298.6 | 72% |
| | CWH vm 2 | Early | 88.7 | 2.8 | 0% | 85.9 | 10% |
| | | Mature | 65.5 | 44.2 | 5% | 21.4 | 3% |
| | | Old | 672.5 | 324.7 | 39% | 347.8 | 42% |
| | CWH vm 2 Total | | 826.7 | 371.6 | 45% | 455.0 | 55% |
| | MH mm 1 | Old | 59.0 | 54.6 | 92% | 4.4 | 8% |
| | MH mm 1 Total | | 59.0 | 54.6 | 92% | 4.4 | 8% |
| Eliza Total | | | 5499.0 | 1740.9 | 32% | 3758.1 | 68% |

| Landscape Unit | BEC | Seral Stage | Productive Forest (ha) | Non Contributing Area | | THLB Area | |
|---|---|---|---|---|---|---|---|
| | | | | ha | % | ha | % |
| Gold | CWH vm 1 | Early | 8677.0 | 882.9 | 6% | 7794.1 | 52% |
| | | Mid | 1050.5 | 379.0 | 3% | 671.5 | 4% |
| | | Mature | 767.4 | 169.2 | 1% | 598.3 | 4% |
| | | Old | 4555.5 | 2294.1 | 15% | 2261.3 | 15% |
| | CWH vm 1 Total | | 15050.4 | 3725.2 | 25% | 11325.2 | 75% |
| | CWH vm 2 | Early | 2579.6 | 201.6 | 2% | 2378.0 | 18% |
| | | Mid | 681.6 | 424.4 | 3% | 257.2 | 2% |
| | | Mature | 504.0 | 199.2 | 2% | 304.8 | 2% |
| | | Old | 9232.4 | 4175.8 | 32% | 5056.6 | 39% |
| | CWH vm 2 Total | | 12997.5 | 5001.0 | 38% | 7996.6 | 62% |
| | CWH xm 2 | Early | 2517.5 | 306.5 | 5% | 2211.0 | 38% |
| | | Mid | 1922.2 | 794.8 | 14% | 1127.4 | 20% |
| | | Mature | 714.1 | 297.5 | 5% | 416.6 | 7% |
| | | Old | 614.1 | 274.8 | 5% | 339.3 | 6% |
| | CWH xm 2 Total | | 5767.9 | 1673.6 | 29% | 4094.3 | 71% |
| | MH mm 1 | Early | 231.6 | 33.9 | 1% | 197.7 | 3% |
| | | Mid | 101.7 | 43.0 | 1% | 58.7 | 1% |
| | | Mature | 248.6 | 106.0 | 2% | 142.6 | 2% |
| | | Old | 5955.9 | 3510.8 | 54% | 2445.1 | 37% |
| | MH mm 1 Total | | 6537.8 | 3693.7 | 56% | 2844.1 | 44% |
| | MH mmp1 | Mid | 0.9 | 0.9 | 2% | 0.0 | 0% |
| | | Mature | 1.1 | 1.1 | 3% | 0.0 | 0% |
| | | Old | 36.5 | 35.1 | 91% | 1.4 | 4% |
| | MH mmp1 Total | | 38.4 | 37.1 | 96% | 1.4 | 4% |
| Gold Total | | | 40392.1 | 14130.5 | 35% | 26261.6 | 65% |
| Kleeptee | CWH vm 1 | Early | 1963.2 | 160.2 | 2% | 1803.0 | 27% |
| | | Mid | 462.3 | 188.4 | 3% | 273.9 | 4% |
| | | Mature | 576.8 | 249.0 | 4% | 327.9 | 5% |
| | | Old | 3601.3 | 1121.5 | 17% | 2479.9 | 38% |
| | CWH vm 1 Total | | 6603.7 | 1719.1 | 26% | 4884.6 | 74% |
| | CWH vm 2 | Early | 509.2 | 26.8 | 1% | 482.4 | 11% |
| | | Mid | 157.9 | 69.6 | 2% | 88.3 | 2% |
| | | Mature | 185.9 | 127.2 | 3% | 58.7 | 1% |
| | | Old | 3619.3 | 1828.1 | 41% | 1791.2 | 40% |
| | CWH vm 2 Total | | 4472.3 | 2051.8 | 46% | 2420.5 | 54% |
| | CWH xm 2 | Early | 111.3 | 16.3 | 3% | 95.0 | 18% |
| | | Mid | 264.1 | 88.4 | 17% | 175.7 | 33% |
| | | Mature | 73.1 | 47.3 | 9% | 25.7 | 5% |
| | | Old | 82.9 | 31.2 | 6% | 51.8 | 10% |
| | CWH xm 2 Total | | 531.3 | 183.1 | 34% | 348.2 | 66% |
| | MH mm 1 | Early | 11.8 | 1.5 | 0% | 10.4 | 1% |
| | | Mid | 0.8 | 0.8 | 0% | 0.0 | 0% |
| | | Mature | 2.9 | 2.9 | 0% | 0.0 | 0% |
| | | Old | 985.5 | 830.5 | 83% | 155.1 | 15% |
| | MH mm 1 Total | | 1001.0 | 835.6 | 83% | 165.4 | 17% |
| Kleeptee Total | | | 12608.3 | 4789.5 | 38% | 7818.8 | 62% |

| Landscape Unit | BEC | Seral Stage | Productive Forest (ha) | Non Contributing Area | | THLB Area | |
|---|---|---|---|---|---|---|---|
| | | | | ha | % | ha | % |
| Tahsis | CWH vm 1 | Early | 4031.7 | 215.4 | 2% | 3816.2 | 29% |
| | | Mid | 2695.8 | 608.1 | 5% | 2087.7 | 16% |
| | | Mature | 1571.7 | 425.8 | 3% | 1145.9 | 9% |
| | | Old | 4644.8 | 1888.6 | 15% | 2756.3 | 21% |
| | CWH vm 1 Total | | 12944.0 | 3137.9 | 24% | 9806.1 | 76% |
| | CWH vm 2 | Early | 930.0 | 35.0 | 1% | 895.0 | 16% |
| | | Mid | 96.1 | 45.5 | 1% | 50.6 | 1% |
| | | Mature | 429.4 | 228.1 | 4% | 201.3 | 4% |
| | | Old | 4047.7 | 2537.0 | 46% | 1510.7 | 27% |
| | CWH vm 2 Total | | 5503.1 | 2845.5 | 52% | 2657.6 | 48% |
| | MH mm 1 | Early | 50.7 | 1.2 | 0% | 49.5 | 4% |
| | | Mid | 1.8 | 1.8 | 0% | 0.0 | 0% |
| | | Mature | 3.7 | 3.2 | 0% | 0.5 | 0% |
| | | Old | 1327.1 | 1143.9 | 83% | 183.3 | 13% |
| | MH mm 1 Total | | 1383.3 | 1150.1 | 83% | 233.2 | 17% |
| | MH mmp1 | Old | 9.6 | 9.6 | 100% | 0.0 | 0% |
| | MH mmp1 Total | | 9.6 | 9.6 | 100% | 0.0 | 0% |
| Tahsis Total | | | 19840.0 | 7143.1 | 36% | 12696.9 | 64% |
| Tlupana | CWH vm 1 | Early | 7610.8 | 671.7 | 3% | 6939.1 | 30% |
| | | Mid | 2340.4 | 711.4 | 3% | 1629.0 | 7% |
| | | Mature | 8023.5 | 2354.7 | 10% | 5668.8 | 24% |
| | | Old | 5208.6 | 1511.3 | 7% | 3697.3 | 16% |
| | CWH vm 1 Total | | 23183.3 | 5249.1 | 23% | 17934.3 | 77% |
| | CWH vm 2 | Early | 749.9 | 41.1 | 0% | 708.9 | 8% |
| | | Mid | 205.1 | 139.1 | 2% | 66.0 | 1% |
| | | Mature | 1892.8 | 1215.7 | 13% | 677.1 | 7% |
| | | Old | 6343.4 | 3170.2 | 34% | 3173.2 | 35% |
| | CWH vm 2 Total | | 9191.2 | 4566.0 | 50% | 4625.2 | 50% |
| | MH mm 1 | Early | 3.8 | 3.2 | 0% | 0.6 | 0% |
| | | Mid | 20.1 | 17.4 | 1% | 2.7 | 0% |
| | | Mature | 177.3 | 167.0 | 10% | 10.3 | 1% |
| | | Old | 1536.6 | 1335.8 | 77% | 200.8 | 12% |
| | MH mm 1 Total | | 1737.8 | 1523.5 | 88% | 214.4 | 12% |
| | MH mmp1 | Old | 5.8 | 5.8 | 100% | 0.0 | 0% |
| | MH mmp1 Total | | 5.8 | 5.8 | 100% | 0.0 | 0% |
| Tlupana Total | | | 34118.1 | 11344.3 | 33% | 22773.8 | 67% |

| Landscape Unit | BEC | Seral Stage | Productive Forest (ha) | Non Contributing Area | | THLB Area | |
|---|---|---|---|---|---|---|---|
| | | | | ha | % | ha | % |
| Zeballos | CWH vm 1 | Early | 2154.2 | 149.5 | 2% | 2004.8 | 28% |
| | | Mid | 1325.9 | 154.0 | 2% | 1171.9 | 16% |
| | | Mature | 393.3 | 165.9 | 2% | 227.5 | 3% |
| | | Old | 3397.5 | 1354.0 | 19% | 2043.5 | 28% |
| | CWH vm 1 Total | | 7270.9 | 1823.3 | 25% | 5447.6 | 75% |
| | CWH vm 2 | Early | 574.3 | 29.0 | 1% | 545.3 | 11% |
| | | Mid | 24.1 | 10.4 | 0% | 13.7 | 0% |
| | | Mature | 248.3 | 215.2 | 4% | 33.1 | 1% |
| | | Old | 4077.0 | 2241.4 | 46% | 1835.6 | 37% |
| | CWH vm 2 Total | | 4923.7 | 2495.9 | 51% | 2427.7 | 49% |
| | MH mm 1 | Early | 2.7 | 2.2 | 0% | 0.5 | 0% |
| | | Mid | 13.9 | 13.9 | 1% | 0.0 | 0% |
| | | Mature | 11.5 | 9.5 | 1% | 2.0 | 0% |
| | | Old | 1526.6 | 1109.4 | 71% | 417.2 | 27% |
| | MH mm 1 Total | | 1554.7 | 1134.9 | 73% | 419.8 | 27% |
| | MH mmp1 | Mid | 0.4 | 0.4 | 2% | 0.0 | 0% |
| | | Old | 21.4 | 19.3 | 89% | 2.1 | 10% |
| | MH mmp1 Total | | 21.7 | 19.6 | 90% | 2.1 | 10% |
| Zeballos Total | | | 13771.0 | 5473.8 | 40% | 8297.2 | 60% |
| ***Total*** | | | ***148177.4*** | ***52982.2*** | ***36%*** | ***95195.3*** | ***64%*** |

### 7.3 Analysis Units

The forest area in the THLB is aggregated into groups of similar stands to help better portray the necessary growth and yield information needed to model timber supply. For conifer leading stands, analysis units were based on biogeoclimatic subzone, site class and age class. Pure deciduous stands and deciduous-leading stands have separate analysis units.

Table 18 - Analysis units for existing stands

| Analysis Unit | Subzone | Site Class | Age Class | Stand Type | Model | Area (ha) | % THLB |
|---|---|---|---|---|---|---|---|
| 1-1 | CWHxm2 | Good | 1-2 | Conifer leading | Tipsy | 291 | 0.3% |
| 1-2 | CWHxm2 | Good | 3-6 | Conifer leading | VDYP | 138 | 0.1% |
| 1-3 | CWHxm2 | Good | 7-9 | Conifer leading | Flat line | 256 | 0.3% |
| 2-1 | CWHxm2 | Medium | 1-2 | Conifer leading | Tipsy | 1,919 | 2.0% |
| 2-2 | CWHxm2 | Medium | 3-6 | Conifer leading | VDYP | 873 | 0.9% |
| 2-3 | CWHxm2 | Medium | 7-9 | Conifer leading | Flat line | 245 | 0.3% |
| 3-1 | CWHxm2 | Poor/Low | 1-2 | Conifer leading | Tipsy | 208 | 0.2% |
| 3-2 | CWHxm2 | Poor/Low | 3-6 | Conifer leading | VDYP | 397 | 0.4% |
| 3-3 | CWHxm2 | Poor/Low | 7-9 | Conifer leading | Flat line | 8 | 0.0% |
| 4-1 | CWHvm1 | Good | 1-2 | Conifer leading | Tipsy | 4,853 | 5.1% |
| 4-2 | CWHvm1 | Good | 3-6 | Conifer leading | VDYP | 2,817 | 3.0% |
| 4-3 | CWHvm1 | Good | 7-9 | Conifer leading | Flat line | 3,362 | 3.5% |
| 5-1 | CWHvm1 | Medium | 1-2 | Conifer leading | Tipsy | 18,893 | 19.8% |
| 5-2 | CWHvm1 | Medium | 3-6 | Conifer leading | VDYP | 4,934 | 5.2% |
| 5-3 | CWHvm1 | Medium | 7-9 | Conifer leading | Flat line | 15,315 | 16.1% |
| 6-1 | CWHvm1 | Poor/Low | 1-2 | Conifer leading | Tipsy | 2,058 | 2.2% |
| 6-2 | CWHvm1 | Poor/Low | 3-6 | Conifer leading | VDYP | 2,375 | 2.5% |
| 6-3 | CWHvm1 | Poor/Low | 7-9 | Conifer leading | Flat line | 5,851 | 6.1% |
| 7-1 | CWHvm2 | Good | 1-2 | Conifer leading | Tipsy | 515 | 0.5% |
| 7-2 | CWHvm2 | Good | 3-6 | Conifer leading | VDYP | 39 | 0.0% |
| 7-3 | CWHvm2 | Good | 7-9 | Conifer leading | Flat line | 632 | 0.7% |
| 8-1 | CWHvm2 | Medium | 1-2 | Conifer leading | Tipsy | 3,786 | 4.0% |
| 8-2 | CWHvm2 | Medium | 3-6 | Conifer leading | VDYP | 447 | 0.5% |
| 8-3 | CWHvm2 | Medium | 7-9 | Conifer leading | Flat line | 10,935 | 11.5% |
| 9-1 | CWHvm2 | Poor/Low | 1-2 | Conifer leading | Tipsy | 675 | 0.7% |
| 9-2 | CWHvm2 | Poor/Low | 3-6 | Conifer leading | VDYP | 583 | 0.6% |
| 9-3 | CWHvm2 | Poor/Low | 7-9 | Conifer leading | Flat line | 5,521 | 5.8% |
| 10-1 | MHmm1/MHmmp1 | Good | 1-2 | Conifer leading | Tipsy | 33 | 0.0% |
| 10-2 | MHmm1/MHmmp1 | Good | 3-6 | Conifer leading | VDYP | 6 | 0.0% |
| 10-3 | MHmm1/MHmmp1 | Good | 7-9 | Conifer leading | Flat line | 29 | 0.0% |
| 11-1 | MHmm1/MHmmp1 | Medium | 1-2 | Conifer leading | Tipsy | 218 | 0.2% |
| 11-2 | MHmm1/MHmmp1 | Medium | 3-6 | Conifer leading | VDYP | 81 | 0.1% |
| 11-3 | MHmm1/MHmmp1 | Medium | 7-9 | Conifer leading | Flat line | 2,315 | 2.4% |
| 12-1 | MHmm1/MHmmp1 | Poor/Low | 1-2 | Conifer leading | Tipsy | 76 | 0.1% |
| 12-2 | MHmm1/MHmmp1 | Poor/Low | 3-6 | Conifer leading | VDYP | 140 | 0.1% |
| 12-3 | MHmm1/MHmmp1 | Poor/Low | 7-9 | Conifer leading | Flat line | 1,976 | 2.1% |
| 13-1 | All | All | 1-2 | Pure deciduous | Tipsy | 4 | 0.0% |
| 13-2 | All | All | 3-6 | Pure deciduous | VDYP | 1 | 0.0% |
| 14-1 | All | All | 1-2 | Deciduous leading | Tipsy | 52 | 0.1% |
| 14-2 | All | All | 3-6 | Deciduous leading | VDYP | 366 | 0.4% |

Analysis units for existing post-harvest regenerated (PHR) and future stands were based on subzone and site class. There were a total of 12 analysis units for future stands (four subzones and three site classes). All yield tables were generated with Tipsy 3.0. The residual density in spaced stands was 950 stems/ha in the CWHvm1 and 1,000 stems/ha in other subzones.

Table 19 - Analysis units for future stands

| Analysis Unit | Subzone | Site Class | Treatments (% of AU) | PHR Area (ha) | % THLB |
|---|---|---|---|---|---|
| 101 | CWHxm2 | Good | Spaced (25%) | 39 | 0.0% |
| 102 | CWHxm2 | Medium | Fertilized (40%)<br>Fertilized and spaced (30%) | 66 | 0.0% |
| 103 | CWHxm2 | Poor/Low | Fertilized (30%) | 4 | 0.0% |
| 104 | CWHvm1 | Good | Spaced (10%) | 173 | 0.2% |
| 105 | CWHvm1 | Medium | Spaced (10%) | 779 | 0.8% |
| 106 | CWHvm1 | Poor/Low | | 165 | 0.2% |
| 107 | CWHvm2 | Good | Spaced (20%) | 108 | 0.1% |
| 108 | CWHvm2 | Medium | Spaced (20%) | 552 | 0.6% |
| 109 | CWHvm2 | Poor/Low | | 76 | 0.1% |
| 110 | MHmm1/MHmmp1 | Good | | 11 | 0.0% |
| 111 | MHmm1/MHmmp1 | Medium | | 4 | 0.0% |
| 112 | MHmm1/MHmmp1 | Poor/Low | | 0 | 0.0% |

# 8 GROWTH AND YIELD

## 8.1 Overview

This section describes the approach to developing the yield tables for managed and natural stands. This will describe the approach in adequate detail for review and approval by the MOF. The general approach is to develop yield tables for existing and future stands, thus separate yield tables are developed for:

1) Existing natural immature stands.
2) Existing natural mature stands.
3) Existing post-harvest regenerated stands.
4) Future regenerated stands.

Table 20 describes the different input parameters for the four different yield tables. It also summarizes the main output results. The average culmination MAI for future PHR stands will be about twice as much as the average for existing immature natural stands even though MAI is reached at about 85 years for both stand types. Although based on the inventory database acquired from the predecessor Licensee, the volume at culmination for existing immature natural stands seems underestimated and will be the focus of further investigation.

Table 20 - Modelling overview

| | Existing Immature Natural Stands | Existing Mature Natural Stands | Existing Immature Managed Stands | Future Stands (Exisiting PHR) |
|---|---|---|---|---|
| **Inputs** | | | | |
| Model | Batch VDYP (6.4d) | Flat Line | Batch TIPSY (3.0) | Batch TIPSY (3.0) |
| Age Class | 3-6 | 7-9 | 1-2 | All |
| Area | 13,196 | 46,444 | 33,580 | 1,975 |
| Proportion of THLB | 14% | 49% | 35% | 2% |
| **Outputs** | | | | |
| Average Culm MAI | 5.6 $m^3$/ha/yr | N/A | 10.6 $m^3$/ha/yr | 11.3 $m^3$/ha/yr |
| Average Culm Age | 85 years | N/A | 79 years | 84 years |
| Average Volume at Culm Age | 444 $m^3$/ha | N/A | 818 $m^3$/ha | 880 $m^3$/ha |

## 8.2 Site Index

Site index estimates for existing immature natural stands were taken from the inventory database. Site index estimates for future PHR stands were based on both the inventory site index and the MoF SIBEC database. First, the average inventory site index by subzone and site class was calculated. This average was then adjusted so that the overall average for the subzone corresponds to the SIBEC estimate for the zonal site within the subzone. Future PHR stands were then assigned the adjusted average site index for their subzone and site class. Site index for existing PHR stands were assigned the same site index as future PHR stands for subzones and site classes for which an adjusted site index was available. If no site

index was available, but a site index conversion equation could be used, the site index was derived from the conversion equation. If no adjusted site index estimates or site index conversion equation existed, the site index from the inventory was used.

### 8.3 Utilization Levels

The utilization level is 12.5 cm for all existing stands less than 41 years old and for future stands. Stump height for these stands was 30 cm and top diameter inside bark (DIB) was 10 cm. Utilization level for immature and mature conifer stands is 17.5 cm, with stump height of 30 cm and top DIB of 15 cm (Table 21).

Table 21 - Utilization levels

| Species Group | Utilization | | | Firmwood Standard |
|---|---|---|---|---|
| | Minimum DBH (cm) | Stump Height (cm) | Top DIB (cm) | |
| Managed Conifers (0 - 40 yrs) | 12.5 | 30.0 | 10.0 | 50% |
| Immature Conifers (41 - 140 yrs) | 17.5 | 30.0 | 15.0 | 50% |
| Mature Conifer (141+ yrs) | 17.5 | 30.0 | 15.0 | 50% |
| Older Mature Deciduous > 41 yrs old | 17.5 | 30.0 | 15.0 | 50% |
| Younger Mature Deciduous 0 - 40 yrs | 12.5 | 30.0 | 10.0 | 50% |

### 8.4 Decay, Waste, and Breakage

The default decay, waste, and breakage factors for TFL19 within VDYP 6.4 were used for existing natural stands.

### 8.5 Operational Adjustment Factors

An OAF1 of 15% and OAF2 of 5% were used for yield tables generated with TIPSY.

### 8.6 Volume Deductions

Deciduous volumes existing in pure or mixed stands have been assigned a specific analysis unit (Analysis unit 13 is pure deciduous, analysis unit 14 is deciduous-leading stands).

### 8.7 Yield Tables For Unmanaged Stands

#### 8.7.1 Natural Immature Stand Volumes

For existing natural immature stands, an analysis unit was assigned to every forest cover polygon based on criteria defined in Section 7.3. The inventory site index was used to generate the yield tables. Yield tables were first calculated for each individual polygon using VDYP 6.4d. An area-based weighted average yield table was then calculated for the analysis unit. Average VDYP input for existing natural

immature stands is given in Table 22. Stocking class is the stocking class with the most area within the analysis unit. The average yield curves are shown in Figure 2.

Table 22 - Average VDYP inputs for existing natural immature stands

| Analysis Unit | Site Index | Crown Closure | Spc 1 | % | Spc 2 | % | Spc 3 | % | Spc 4 | % | Spc 5 | % | Spc 6 | % | Spc 7 | % | Stocking Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-2 | 30.4 | 74 | Hw | 51 | Fd | 36 | Dr | 7 | Cw | 5 | Ss | 1 | | 0 | | 0 | 0 |
| 2-2 | 25.3 | 68 | Fd | 46 | Hw | 34 | Pl | 11 | Cw | 7 | Pw | 2 | Dr | 0 | | 0 | 0 |
| 3-2 | 16.3 | 75 | Fd | 45 | Hw | 24 | Pl | 17 | Cw | 11 | Pw | 3 | Yc | 0 | | 0 | 0 |
| 4-2 | 29.9 | 52 | Hw | 48 | Fd | 28 | Cw | 17 | Ba | 5 | Dr | 1 | Pl | 1 | Ss | 0 | 0 |
| 5-2 | 23.5 | 61 | Hw | 46 | Fd | 27 | Cw | 20 | Ba | 5 | Dr | 2 | Pl | 0 | Ss | 0 | 0 |
| 6-2 | 14.9 | 66 | Hw | 32 | Fd | 30 | Cw | 25 | Pl | 11 | Yc | 1 | Ba | 1 | Pw | 0 | 0 |
| 7-2 | 28.4 | 78 | Hw | 40 | Fd | 36 | Ba | 13 | Cw | 11 | | 0 | | 0 | | 0 | 0 |
| 8-2 | 23.2 | 78 | Hw | 45 | Fd | 26 | Ba | 16 | Cw | 12 | Yc | 1 | Pl | 0 | Dr | 0 | 0 |
| 9-2 | 15.1 | 71 | Hw | 34 | Fd | 28 | Cw | 20 | Pl | 8 | Yc | 6 | Ba | 4 | | 0 | 0 |
| 10-2 | 31.3 | 70 | Hw | 46 | Fd | 26 | Ba | 24 | Cw | 4 | | 0 | | 0 | | 0 | 0 |
| 11-2 | 22.9 | 77 | Hw | 43 | Ba | 29 | Fd | 16 | Cw | 7 | Yc | 5 | | 0 | | 0 | 0 |
| 12-2 | 13.9 | 72 | Hw | 42 | Ba | 23 | Fd | 17 | Yc | 12 | Cw | 6 | Pl | 0 | | 0 | 0 |
| 13-2 | 28.0 | 72 | Dr | 100 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | 0 |
| 14-2 | 26.7 | 54 | Dr | 61 | Hw | 33 | Fd | 3 | Cw | 2 | Ss | 1 | Ba | 0 | | 0 | 0 |

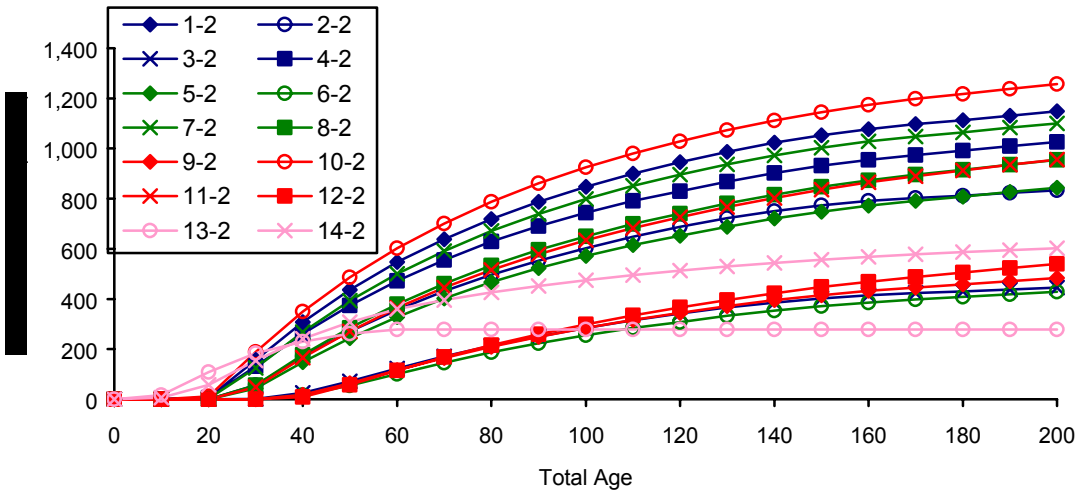


Figure 2 - Yield curves for all existing analysis units, between age class 3 and 6

### 8.7.2 Existing Mature Stand Volumes

The timber volume in existing mature stands (those ≥ 140 years) was determined for each analysis unit by using area weighted average volumes as calculated from VDYP for these stands (Table 23).

Table 23 - Existing mature volume verification.

| Analysis Unit | THLB Area | Average Age | Weighted Average Volume | Weighted Avg. Total Volume |
|---|---|---|---|---|
| 1-3 | 256 | 295 | 1,1139 | 291,481 |
| 2-3 | 245 | 268 | 636 | 155,647 |
| 3-3 | 8 | 209 | 360 | 2,709 |
| 4-3 | 3,362 | 286 | 1,040 | 3,496,141 |
| 5-3 | 15,315 | 278 | 690 | 10,571,525 |
| 6-3 | 5,851 | 269 | 385 | 2,251,961 |
| 7-3 | 632 | 286 | 1,058 | 668,006 |
| 8-3 | 10,935 | 290 | 683 | 7,471,110 |
| 9-3 | 5,521 | 288 | 427 | 2,356,606 |
| 10-3 | 29 | 272 | 1,075 | 31,473 |
| 11-3 | 2,315 | 282 | 657 | 1,520,037 |
| 12-3 | 1,976 | 279 | 449 | 886,925 |

## 8.8 Yield Tables for Managed Stands

### 8.8.1 Existing Managed Stand Volumes

For existing managed stands, all stands were assumed to be plantations, species composition was taken from the inventory database, establishment density was assumed to be 10% higher than free-to-grow density, and the adjusted inventory site index was used when possible. Yield tables were first calculated for each individual polygon using Batch Tipsy 3.0. An area-based weighted average yield table was then calculated for the analysis unit. Average Tipsy inputs for existing managed stands are given in Table 24. Site index was estimated using the method described in section 8.2. Average site index by subzone and species is shown in Table 25. Free-to-grow density was derived by subzone, site class, and age class from historical records and local knowledge of the TFL. Genetic gain of 2% was assumed for Fdc in age class 1. The proportion of each age class within analysis units, and the proportion of genetically-improved Fd is given in Table 26. No other treatment was used in existing managed stands.

Table 24 - TIPSY inputs for existing managed stands

| Analysis Unit | Site Index | Establish. Density | Spc1 | % | Spc 2 | % | Spc 3 | % | Spc 4 | % | Spc 5 | % | Spc 6 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 33.0 | 1,983 | Fd | 52 | Hw | 41 | Cw | 5 | Pl | 2 | Ba | 0 | | 0 |
| 2-1 | 32.9 | 1,680 | Fd | 73 | Hw | 25 | Ss | 1 | Cw | 1 | Dr | 0 | Pl | 0 |
| 3-1 | 21.5 | 1,100 | Fd | 67 | Hw | 29 | Pl | 2 | Cw | 2 | Ba | 0 | | 0 |
| 4-1 | 35.9 | 3,381 | Hw | 48 | Fd | 24 | Cw | 13 | Ba | 13 | Ss | 2 | Yc | 0 |
| 5-1 | 27.9 | 3,310 | Hw | 46 | Fd | 27 | Cw | 15 | Ba | 10 | Ss | 1 | Yc | 1 |
| 6-1 | 18.7 | 1,875 | Hw | 48 | Fd | 25 | Cw | 16 | Ba | 9 | Yc | 1 | Ss | 1 |
| 7-1 | 35.2 | 3,300 | Hw | 45 | Ba | 36 | Cw | 6 | Yc | 6 | Fd | 5 | Ss | 2 |
| 8-1 | 28.6 | 3,300 | Hw | 44 | Ba | 31 | Cw | 10 | Fd | 8 | Yc | 7 | Hm | 0 |
| 9-1 | 21.5 | 2,200 | Hw | 47 | Ba | 26 | Cw | 12 | Fd | 8 | Yc | 7 | Hm | 0 |
| 10-1 | 13.5 | 4,400 | Ba | 50 | Yc | 30 | Fd | 20 | Hw | 0 | Cw | 0 | | 0 |
| 11-1 | 16.3 | 4,400 | Ba | 36 | Hw | 31 | Yc | 21 | Cw | 6 | Fd | 4 | Bl | 2 |
| 12-1 | 14.0 | 4,400 | Hw | 50 | Cw | 24 | Ba | 21 | Fd | 3 | Yc | 2 | | 0 |
| 13-1 | 22.5 | 2,200 | Dr | 100 | | 0 | | 0 | | 0 | | 0 | | 0 |
| 14-1 | 22.8 | 2,518 | Dr | 59 | Hw | 23 | Cw | 8 | Fd | 7 | Ss | 2 | Bg | 1 |

Table 25 - Average site index for existing managed stands

| Spp | CWHxm2 | | CWHvm1 | | CWHvm 2 | | MHmm1 | |
|---|---|---|---|---|---|---|---|---|
| | Area (ha) | SI (m) | Area (ha) | SI (m) | Area (ha) | SI (m) | Area (ha) | SI (m) |
| Ba | 10 | 31.8 | 985 | 22.2 | 1,220 | 22.7 | 139 | 13.1 |
| Cw | | | 1,653 | 22.9 | 127 | 22.1 | 2 | 22.0 |
| Dr | 8 | 20.2 | 62 | 23.0 | | | | |
| Fd | 2,132 | 32.2 | 6,259 | 31.6 | 307 | 34.9 | 1 | 31.2 |
| Hm | | | | | 0 | 31.1 | | |
| Hw | 194 | 29.6 | 15,991 | 28.4 | 2,990 | 30.2 | 111 | 16.3 |
| Pl | 9 | 24.7 | | | | | | |
| Ss | | | 49 | 38.6 | 7 | 45.8 | | |
| Yc | | | 15 | 14.0 | 77 | 20.3 | 28 | 23.0 |

Table 26 - Proportion of age class 1, age class 2, and genetically improved Fd by analysis unit

| AU | Area (ha) | Age Class 1 (%) | Age Class 2 (%) | Fd Pct |
|---|---|---|---|---|
| 1-1 | 229 | 20.2% | 79.8% | 11.6% |
| 2-1 | 1,902 | 2.7% | 97.3% | 1.5% |
| 3-1 | 190 | 0.3% | 99.7% | 0.1% |
| 4-1 | 4,511 | 59.7% | 40.3% | 8.4% |
| 5-1 | 18,363 | 56.0% | 44.0% | 8.1% |
| 6-1 | 2,009 | 40.9% | 59.1% | 7.7% |
| 7-1 | 440 | 97.4% | 2.6% | 3.2% |
| 8-1 | 3,606 | 88.1% | 11.9% | 3.7% |
| 9-1 | 672 | 71.0% | 29.0% | 3.3% |
| 10-1 | 23 | 100.0% | 0.0% | 19.8% |
| 11-1 | 185 | 99.3% | 0.7% | 3.9% |
| 12-1 | 72 | 6.3% | 93.7% | 0.0% |
| 13-1 | 4 | 0.0% | 100.0% | 0.0% |
| 14-1 | 52 | 20.1% | 79.9% | 0.6% |

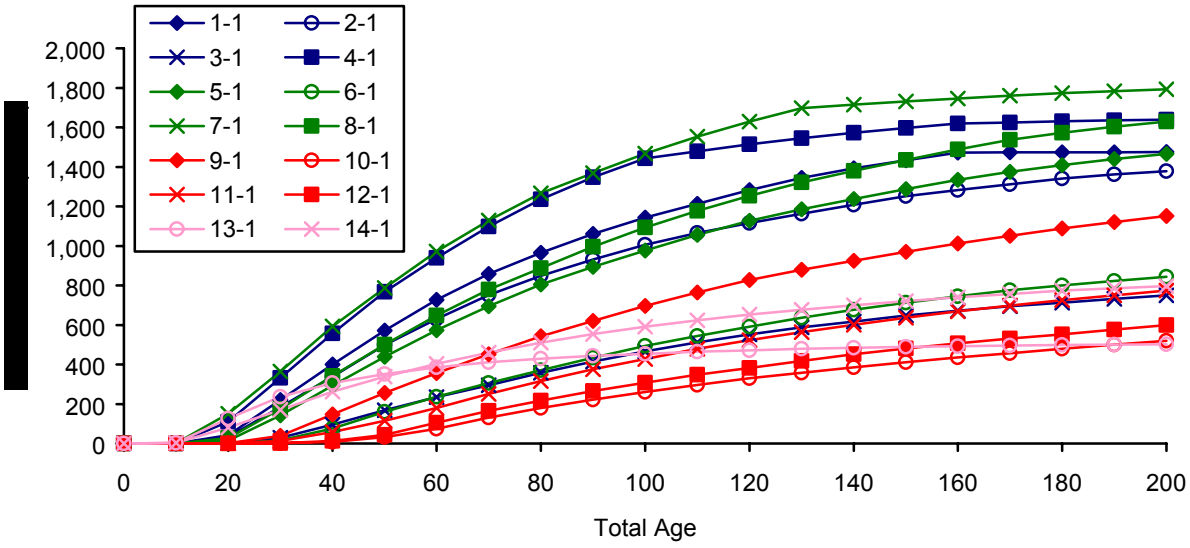


Figure 3 - Yield curves for all existing analysis units, between age class 1and 2

### 8.8.2 Future Stand Volumes

For future stands, a series of silviculture strategies were derived based on what is currently being done on the TFL and what Western Forest Products intends to do in the future. These silviculture strategies were based on ecological units. Input information is given in Table 27. OAF1 was 15%, OAF2 was 5%, utilization limit was 12.5 cm, and there was no regeneration delay.

Fertilization consists of two applications of 435 kg/ha urea pellets at ages 20 and 60. Since fertilization response is only applicable to Douglas-fir two runs per treated analysis unit were done. First, the Douglas-fir component was run as a pure fir stand with the fertilization applications using custom runs of TASS. Second, the remainder of stand composition was run using Tipsy with its composition adjusted without the fir component. Finally, the runs were re-combined for the analysis unit proportionally to the original stand composition. Fertilization runs were provided by Ken Polsson of the Ministry of Forests, Research Branch since double fertilization applications is not yet available in Tipsy.

Table 27 - Silviculture strategies for future stands

| AUs | Subzone | Site Class | Establish. density | Spc1 | % | Spc 2 | % | Spc 3 | % | Spc 4 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | CWHxm2 | Good | 3600 | Fd | 70 | Cw | 20 | Hw | 10 | | |
| 102 | CWHxm2 | Medium | 3000 | Fd | 60 | Cw | 20 | Hw | 20 | | |
| 102 (spaced) | CWHxm2 | Medium | 3000 | Fd | 70 | Cw | 20 | Hw | 10 | | |
| 103 | CWHxm2 | Poor | 3000 | Fd | 50 | Cw | 40 | Hw | 10 | | |
| 104 | CWHvm1 | Good | 4400 | Hw | 40 | Cw | 40 | Ba | 20 | | |
| 104 (spaced) | CWHvm1 | Good | 4400 | Hw | 50 | Cw | 20 | Ba | 20 | Fd | 10 |
| 105 | CWHvm1 | Medium | 4400 | Hw | 50 | Cw | 20 | Ba | 20 | | |
| 105 (spaced) | CWHvm1 | Medium | 4400 | Hw | 50 | Cw | 20 | Ba | 20 | Fd | 10 |
| 106 | CWHvm1 | Poor | 2500 | Hw | 40 | Cw | 40 | Fd | 20 | | |
| 107 | CWHvm2 | Good | 3600 | Hw | 40 | Ba | 30 | Yc | 30 | | |
| 107 (spaced) | CWHvm2 | Good | 3600 | Hw | 60 | Ba | 20 | Yc | 10 | Cw | 10 |
| 108 | CWHvm2 | Medium | 3600 | Hw | 40 | Ba | 30 | Yc | 30 | | |
| 108 (spaced) | CWHvm2 | Medium | 3600 | Hw | 60 | Ba | 20 | Yc | 10 | Cw | 10 |
| 109 | CWHvm2 | Poor | 2500 | Hw | 40 | Cw | 30 | Yc | 30 | | |
| 110 | MHmm1/ MHmmp1 | Good | 4400 | Ba | 40 | Hm | 30 | Yc | 30 | | |
| 111 | MHmm1/ MHmmp1 | Medium | 4400 | Ba | 40 | Hm | 30 | Yc | 30 | | |
| 112 | MHmm1/ MHmmp1 | Poor | 4400 | Ba | 40 | Hm | 30 | Yc | 30 | | |

The adjusted site index was adjusted to reflect the SIBEC zonal site index estimate for the subzone (Table 28). First the average inventory site index was calculated by subzone, site class, and species. Then the overall average inventory site index for the subzone and species was calculated. An adjustment ratio (SIBEC zonal site index estimate/Subzone average site index) was then used to correct the average site index by subzone, site class, and species. This adjusted site index was used to generate yield tables for future PHR stands.

Table 28 - Site index adjustment procedure

| AUs | Subzone | Site Class | Spp | Area | Site Index Avg | Subzone Avg | SIBEC Zonal SI | Zonal SI/ Subzone Avg | Adjusted SI |
|---|---|---|---|---|---|---|---|---|---|
| 101 | CWHxm2 | Good | Fd | 971 | 29.4 | 26.7 | 32 | 1.200 | 35.3 |
| 102 | CWHxm2 | Medium | Fd | 3,420 | 27.5 | | | | 33.0 |
| 103 | CWHxm2 | Poor | Fd | 652 | 18.1 | | | | 21.7 |
| 104 | CWHvm1 | Good | Hw | 8,164 | 26.1 | 19.9 | 28 | 1.408 | 36.7 |
| 105 | CWHvm1 | Medium | Hw | 28,621 | 19.5 | | | | 27.5 |
| 106 | CWHvm1 | Poor | Hw | 5,698 | 12.7 | | | | 17.9 |
| 107 | CWHvm2 | Good | Hw | 709 | 20.6 | 14.2 | 28 | 1.970 | 40.6 |
| 108 | CWHvm2 | Medium | Hw | 15,787 | 15.8 | | | | 31.1 |
| 109 | CWHvm2 | Poor | Yc | 8,901 | 10.9 | | | | 21.5 |
| 110 | MHmm1/MHmmp1 | Good | Ba | 68 | 14.8 | 13.3 | 12 | 0.903 | 13.4 |
| 111 | MHmm1/MHmmp1 | Medium | Ba | 784 | 14.5 | | | | 13.1 |
| 112 | MHmm1/MHmmp1 | Poor | Ba | 346 | 10.3 | | | | 9.3 |

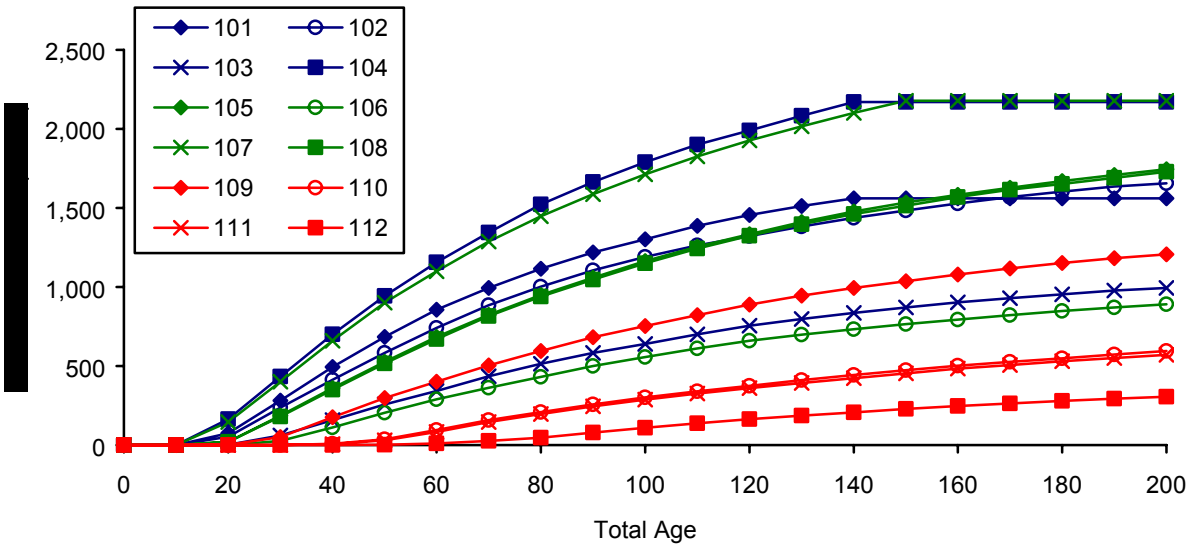


Figure 4 - Yield curves for future PHR stands

### 8.8.3 Genetic gains for future stands

Genetic gains for future stands will be modelled by applying the gains specified in Table 29.

Table 29 - Genetic gain by regeneration era

| Species | Subzone | Genetic gain by era | |
|---|---|---|---|
| | | 2000-06 | 2007+ |
| Cw | CWH xm2 | 0 | 10% |
| Cw | CWH vm1 | 0 | 10% |
| Cw | CWH vm2 | 0 | 5% |
| Cw | MH mm1 | 0 | 5% |
| Fd | All | 12% | 12% |
| Hw | CWH xm2 | 14% | 14% |
| Hw | CWH vm1 | 14% | 14% |
| Hw | CWH vm2 | 7% | 7% |
| Hw | MH mm1 | 7% | 7% |
| Yc | All | 0% | 15% |

Current Site Degradation

Western Forest Products' standard operating practices include the ripping and restocking of trails once logging is completed. Highlead landings are typically small and of no measurable consequence. Helicopter landings are rehabilitated. No additional allowance for current site degradation has been made in Table 13 or Table 14.

Future Site Degradation

Future road systems have been projected within the TFL and area reductions will be applied once the model harvests the polygon. Section 6.14.3 outlines the amount of future road to be built in the TFL over the long term.

### 8.8.4 Regeneration Delay

The regeneration delay refers to the average time elapsed between harvesting and establishment of new plantations on the TFL. For most sites in the TFL regeneration delay is around 2.0 years. However, with time-of-planting fertilization, which is current management practice on all sites, research trials indicate that an “effective” one-year reduction of regeneration delay is appropriate and conservative. Table 30 indicates the regeneration delay period used to shift the yield curve for each regenerated analysis unit. Regeneration delay will be applied in the timber supply model, not in the TIPSY yield model.

Table 30 - Regeneration delay period

| Analysis Unit | Regeneration Delay Years[1] |
|---|---|
| 101 | 1.0 |
| 102 | 1.0 |
| 103 | 1.0 |
| 104 | 1.0 |
| 105 | 1.0 |
| 106 | 1.0 |
| 107 | 1.0 |
| 108 | 1.0 |
| 109 | 1.0 |
| 110 | 1.0 |
| 111 | 1.0 |
| 112 | 1.0 |

[1] Indicate regeneration delay period for stands planted with fertilizer.

### 8.8.5 Species Conversion

A small amount of non-productive brush type (NP BR) is converted on a yearly basis within the TFL. This type occurs in small patches and is usually contiguous to productive forestland. This area is site prepared in conjunction with the harvested area and planted. The area converted on a yearly basis is difficult to quantify and insignificant, it will not be modelled.

## 8.9 Silviculture History

### 8.9.1 Existing Managed Immature

Table 31 provides a breakdown of the extent of immature managed stands in the TFL by analysis group, silviculture treatment and age class.

Table 31 - Immature management history by THLB area and age class

| Analysis Unit | No Treatment | | Spaced* | | Fertilized* | | Grand Total |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 | 2 | |
| 1-1 | 107.5 | 164.9 | | 18.5 | | | 229.4 |
| 2-1 | 62.2 | 1,835.2 | | 21.1 | | | 1,997.7 |
| 3-1 | 0.5 | 207.4 | | | | | 191.6 |
| 4-1 | 2,814.2 | 1,708.7 | 180.4 | 132.5 | 17.0 | | 4,488.2 |
| 5-1 | 10,066.5 | 7,202.1 | 635.7 | 767.6 | 62.8 | 158.7 | 18,385.7 |
| 6-1 | 825.3 | 1,147.1 | 19.7 | 4.9 | 12.1 | 48.5 | 2,010.1 |
| 7-1 | 502.6 | 11.6 | 0.4 | | | | 440.0 |
| 8-1 | 3,301.1 | 417.6 | 54.6 | 12.0 | 0.3 | | 3,592.6 |
| 9-1 | 479.5 | 195.2 | | | | | 672.3 |
| 10-1 | 33.2 | | | | | | 23.5 |
| 11-1 | 216.3 | 1.2 | | | | | 184.9 |
| 12-1 | 9.2 | 67.2 | | | | | 71.8 |
| 14-1 | 10.5 | 35.0 | | 6.9 | | | |
| ***Grand Total*** | ***18,428.6*** | ***12,993.3*** | ***890.7*** | ***963.4*** | ***92.2*** | ***207.2*** | ***32,403.3*** |

* Spacing and fertilization hectares reported in the GIS are considerably lower than hectares treated in the TFL 19 Annual reports. Since 1970 approximately 8,200 ha have been spaced and 4,500 ha have been fertilized. Updating of this data will take place prior to Management Plan 10 for TFL 19.

### 8.9.2 Backlog and Current Non-Stocked Areas (NSR)

As of January 1, 2000 the total area of NSR amounted to 3,576.6 ha. Of the NSR area within the TFL, 3,245.2 ha are in the timber harvesting land base with the remainder in constrained areas. Currently, 278.4 ha of backlog areas are reported in the GIS; however, operational staff estimates indicate that most of these area are incorrectly classified and are in fact SR or NP. Natural NSR areas, blow-down and old slash fire escapes areas, are also reported in the GIS. These areas are also believed to be mis-classified and are most likely fully stocked stands. Western Forest Products' target is to re-stock denudated areas within three years of harvest. Since 1987 WFP has planted an average of approximately 1,700 ha/yr.

Table 32 - NSR area

| | **Total Area (ha)** |
|---|---|
| THLB | 3,245.2 |
| Non-THLB | 331.4 |
| ***Total*** | ***3,576.6*** |

Timber supply analysis assumption for dealing with reported NSR is as follows:

- Backlog NSR and Natural NSR areas are assumed to be fully stocked and will be given an age of 10 years.
- Current NSR will be regenerated to their appropriate Analysis Unit within the specified regeneration delay period.

# 9 NON-RECOVERABLE LOSSES

## 9.1 Overview

The intent of this section is to describe the non-recoverable losses that will be deducted from the timber supply analysis. These losses include epidemic losses from insects, disease, wind-throw, and fire.

## 9.2 Insects and Disease

The forests of TFL 19 have been relatively free of major insect or disease infestations and therefore no losses are associated. There have been no major catastrophic outbreaks causing significant unsalvaged mortality or volume losses. The main active agents have been various defoliators and bark beetles. The last defoliator outbreak was in the mid-70's by western black-headed budworm (Acleris gloverana) in stands above 600m near Zeballos. Douglas fir and mountain pine beetle caused pockets of mortality in the mid-60's around Gold River.

Hemlock dwarf mistletoe is widespread throughout merchantable size stands. Sanitation treatments of advanced regeneration are sometimes required to prevent the spread in newly regenerated western hemlock stands. Usually vigorously growing, fully stocked stands are not impacted significantly by hemlock dwarf mistletoe.

Root diseases sometimes result in small pockets of mortality. Reforestation with less susceptible species can be used in root rot pockets

## 9.3 Wind-Throw

Wind-throw records are fairly good for the TFL dating back to 1997. Historically, wind-throw has been isolated in relatively small areas with the only major blowdown event in the last decade occurring in 1995. This event occurred mainly on the outer coast portion of the TFL and resulted in little damage.

Staff foresters and engineers in the Nootka Region estimate wind-throw damage in the TFL is approximately 12 ha per year resulting in 9,500 $m^3$, of which 7,125$m^3$ are recovered through savage harvesting.

## 9.4 Fire

The risk of loss of timber due to fire is moderate within the TFL. The bulk of the TFL has a wet climate characterized by cool, wet summers and fire suppression has been efficient; hence the likelihood of losses to forest fire is small.

# 10 INTEGRATED RESOURCE MANAGEMENT

## 10.1 Overview

The intent of this section is to give an overview of the resource inventories available and being used for the timber supply review. The section also describes other resource management information that is being utilized for planning within TFL 19.

## 10.2 Forest Resource Inventory

Table 33 summarizes the forest resource inventories currently be maintained for the TFL.

Table 33 - Forest resource inventory status

| Item | Status | MOF Acceptance Date | Plan |
|---|---|---|---|
| Timber Inventory | Completed in 1988 by Reid, Collins and Associates (now Olympic Resource Management). MOF field audit completed in 1999 (results are still outstanding). | Yes 19-May-93 | Inventory revisions updated annually. |
| Ecosystems | Currently being classified. | | Classification to be completed in 2000. |
| Terrain Stability | Completed in 1997 by Terence Lewis et al. | Submitted 11-Apr-99`` | Currently being reviewed by MOF |
| ESAs | No longer used for planning. New inventories replace the need for this classification. | Yes 08-July-94 | |
| Recreation Inventory | Recreation inventory completed in 1989 by Jeremy Webb of Recreation Resources Limited (updated by Pacific in 1991 and 1993). Includes karst overview. | Yes 26-July-96 | Update to be completed in 2000. |
| Recreation Analysis | Recreation analysis completed and submitted in May, 1994. Update required for MP #9. | Yes 26-July-96 | Update to be completed in 2000. |
| Visual Landscape Inventory | Completed by Recreation Resources Limited (Jeremy Webb) in 1992 and 1994. VQOs considered "'draft". VQOs updated in 1998 as part of MOF visual impact mitigation program. | Submitted 13-Oct-94 | Update to be completed in 2000. |
| Stream Classification | MP#8 classification based on A, B and C stream designations. FDP process has updated to FPC Riparian Classes for a large part of the TFL | DFO 13-July-94 MOE 08-July-94 | Stream Inventories (RIC) in progress. |
| Archaeological | Archaeological Overview Assessment completed by Arcas in 1998. Site specific maps and description on file (held in confidence at request of First Nations). | | |
| Operability | Completed by WFP in 1999. | Submitted 11-Apr-99 | Terms of Reference approved. Currently being reviewed by MOF |
| 20-Year Plan | | | Revised 20-Year plan in preparation for MP9. |

## 10.3 Forest Cover Requirements

### 10.3.1 Forest Cover Objectives - Rationale

The rationale for each forest cover objectives reported in the timber analysis is described below. The rationales are based on the unique attributes of the TFL.

#### *10.3.1.1 VQOs*

Visual quality is currently being managed in all areas having a VQO in the TFL inventory. Visual Quality Objectives to be modelled in the timber supply analysis are Preservation (P), Retention (R), Partial Retention (PR) and Modification (M). The amount of area that can be disturbed at any one-time (i.e. has not achieved visually effective green-up) is 1%, 5%, 15% and 25% respectively. These levels are set at the upper end of the % denudation range for use in timber supply analyses as WFP has been incorporating more visual landscape design within cutblock layout.

A 5 m visually effective green-up (VEG) height is proposed for TFL 19. As Complan uses volume over age curves for yield tables, an age surrogate will be established to represent VEG height for each analysis unit.

#### *10.3.1.2 Wildlife*

##### 10.3.1.2.1 Ungulate winter range

Ungulate winter ranges have been identified in wildlife habitat inventories and delineated. These areas are deducted from the timber harvesting land base.

##### 10.3.1.2.2 Identified wildlife

Recently within the TFL one of the first Wildlife Habitat Areas in the province has been designated. This area, which is 27.7 ha in size, has established to protect one of two known caves used for maternity roosts by the Keen's long-eared Myotis. This area has been removed from the timber harvesting land base.

#### *10.3.1.3 Adjacent Cutblock Green-up*

A 3 metre green-up height is proposed for areas without visual quality objectives. As described in Section 10.3.1.3, an age surrogate for each analysis unit will be used within the model to represent height.

#### *10.3.1.4 Landscape Level Biodiversity*

As Biodiversity Emphasis Options assigned to Landscape Units remain in draft form, the current management option will have forest cover constraints imposed based on government policy. According to the policy, approximately 45 percent of the TFL will be in the lower BEO, 45 percent in the intermediate BEO and 10 percent in the high BEO. As a result, in the current management option the area-weighted average (i.e. 45/45/10) biodiversity constraints (old seral only) for the three BEOs will be applied for each variant in each draft LU.

Sensitivity analyses will evaluate the impacts of managing for biodiversity as specified by the interim BEO ratings assigned to each Landscape Unit. Modelling of the management of Landscape Units assigned

Low, Intermediate and High BEO ratings will be guided by the Biodiversity Guidebook. As indicated to date by government only old seral targets will be modelled during the sensitivity.

#### *10.3.1.5 Reductions to Reflect Volume Retention in Cutblocks*

As previously mentioned WTP are mainly in constrained areas such as riparian reserves, unmerchantable stands or unstable slopes. In order to capture WTP in otherwise unconstrained areas a volume reduction will be implemented in the timber supply model. Current management practice is that at least 13% WTP retention is being managed for (MoF Regional directive until Landscape Unit Planning is implemented). Assuming 75% of the WTP retention is in constrained areas (based on the *Forest Practices Code Timber Supply Analysis*) a volume reduction of 3.25% is recommended (4% will be used due to model limitation and is precautionary) for use in the timber supply analysis. It is expected that this retention level will also address gully management areas left around non-fish bearing streams.

#### *10.3.1.6 Community Watersheds*

Within the TFL there are no designated community watersheds as defined by the Forest Practices Code. The Village of Tahsis draws its water supply from McKelvie Creek with is an unlogged watershed draining into Tahsis River. Due to the small size of this watershed issues surrounding water quality will mainly be dealt with at an operational level. There is no expectation that implementing forest cover constraints in this area is necessary.

#### *10.3.1.7 Higher Level Plans*

Currently, sections of the Vancouver Island Land Use Plan await designation as higher-level plan objectives. WFP is conducting operations within the SMZs to meet the spirit and intent of the draft management objectives for these zones. For modelling purposes, current management constraints such as UWRs, VQOs, and FPC requirements and sensitivity analyses for BEOs will be adequate to address most SMZ objectives, hence no additional forest cover constraints are being modelled specifically for Special Management Zones.

### 10.4 Timber Harvesting

#### 10.4.1 Minimum Harvestable Age

Minimum harvestable ages are simply minimum criteria. While harvesting may occur in stands at the minimum requirements in order to meet forest level objectives (i.e. maintaining overall timber flows) many stands will not be harvested until well past the minimum timber production ages because consideration of other resource values may take precedence.

In the previous analysis, rotation length was selected to be 60 years and the minimum harvestable volume is 350$m^3$ per hectare. Both minimum age and minimum volume requirements must be met before a stand can be harvested. For consistency this minimum harvest criteria will be used in the new analysis.

#### 10.4.2 Operability

The criteria used to determine operability for use in the timber supply analysis are highlighted in Section 6.7. A *Terms of Reference* document outlining the operability classification process was submitted to

Ministry of Forests in August 1998 and contains detailed information regarding the assumptions and criteria used. This document has been included as Appendix III.

### 10.4.3 Initial Harvest Rate

The initial rate for the timber supply analysis will be set at the currently approved harvest level of 978,000$m^3$. Rates will be varied to meet the objectives stated in Section 10.4.7. Once a suitable flow is established sensitivity analyses will be performed. Should these analyses suggest an alternative flow pattern is warranted, additional runs may be initiated. All pertinent rate of harvest information will be included in the Timber Supply Analysis report.

### 10.4.4 Harvest Rules

Since the timber supply model is spatially based, a couple of options are available to implement harvest rules. Like typical timber supply models, harvesting stands on an oldest first basis is available as a harvest rule. However, an additional rule of closest to the log dump can be used. This rule allows the model to harvest in a pattern typical of actual operations. Additional rules can be placed on the model to control the harvest levels by operating area. A number of options are expected to be run to determine which rule set gives the most realistic approximation of current and future harvest scheduling.

### 10.4.5 Harvest Profile

Harvesting to the inventory profile in TFL19 has been achieved and will continue. No constraints will be imposed in the model to target certain species or product grades.

### 10.4.6 Silviculture Systems

The majority of the TFL is currently harvested using clearcut with reserve or retention harvest methods. There is no significant dispersed partial cutting occurring at this time.

For the purposes of modelling clumped retention, volume reductions as discussed in Section 10.2.1.6 in combination with even-aged growth and yield projections for the remaining harvested area should be adequate, albeit imperfect.

To date the Licensee has focussed management strategies for conservation of biodiversity at the landscape level. Riparian reserves, wildlife tree patches and other exclusions from the timber harvesting land base are examples of areas being managed for conservation. Strategies for stand level retention within the TFL are now being investigated to augment higher-level conservation plans. A committee is active within WFP to explore the use of a variety of silviculture systems to retain more within-stand structure during harvesting.

As pressures to adopt non-traditional cutting methods and uneven-aged silviculture systems mount, growth and yield models need to be developed and calibrated for predicting the long term outcome of partial cutting in coastal old-growth and second-growth stands. As there is little experience on the coast and few, if any, stands to sample for partial cutting response, models will have to deviate significantly from the usual strategy of permanent sample plot analyses. Due to the lack of growth and yield data and

predictive tools, the licensee will not attempt to model partial cutting for this timber supply analysis. However the Licensee is, and will be, supportive of any initiatives of the Ministry of Forests to meet the challenge of developing uneven-aged models for the Coastal Western Hemlock Zone.

### 10.4.7 Harvest Flow Objectives

The objective of the volume-based analysis in the TFL is to maintain current harvest levels for as long as possible. As the transition from current harvest levels to the long-term harvest level occurs efforts will be made to restrict the rate of volume change per decade to <10%.

# APPENDIX I - DETAILED AREA AND VOLUME SUMMARIES

Table 34 - Area (ha) by leading species, and age class

| Leading Species | Age_class | | | | | | | | | | Immature Area | Mature Area | Total Area | Immature Volume | Mature Volume | Total Volume |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | | | |
| Hw | | 12,555.7 | 6,727.1 | 3,007.4 | 2,669.1 | 2,060.4 | 159.1 | 301.6 | 3,836.2 | 20,857.7 | 27,178.9 | 24,995.5 | 52,174.4 | 4,552,677.8 | 16,785,360.9 | 21,338,038.7 |
| Ba | | 2,256.1 | 80.1 | | 25.7 | 77.9 | 30.4 | 10.8 | 254.7 | 2,706.9 | 2,470.2 | 2,972.3 | 5,442.6 | 89,325.6 | 2,646,348.3 | 2,735,673.9 |
| Cw | | 1,631.7 | 124.4 | 71.8 | 460.1 | 305.4 | 71.0 | 32.1 | 2,252.3 | 7,852.1 | 2,664.3 | 10,136.5 | 12,800.8 | 184,656.1 | 5,884,328.9 | 6,068,985.0 |
| Yc | | 98.5 | 15.7 | | 4.2 | 7.7 | | 0.2 | 352.2 | 5,772.6 | 126.1 | 6,125.0 | 6,251.1 | 2,156.2 | 2,665,905.7 | 2,668,061.9 |
| Ss | | 18.3 | 37.8 | | | | | | | 73.3 | 56.1 | 73.3 | 129.4 | 17,789.0 | 77,838.1 | 95,627.2 |
| Fd | | 1,641.9 | 7,044.5 | 278.6 | 2,234.3 | 770.0 | 125.6 | 105.4 | 757.4 | 1,277.3 | 12,094.9 | 2,140.1 | 14,235.0 | 2,847,037.0 | 1,643,673.0 | 4,490,709.9 |
| Pl | | | 9.2 | 30.6 | 306.3 | 102.6 | | | 0.9 | | 448.7 | 0.9 | 449.6 | 81,985.8 | 165.7 | 82,151.5 |
| Dec | | 10.8 | 58.6 | 194.4 | 113.6 | 84.8 | 5.2 | | | | 467.3 | | 467.3 | 177,197.8 | | 177,197.8 |
| NSR | 3,245.1 | | | | | | | | | | 3,245.1 | | 3,245.1 | | | |
| Total | 3,245.1 | 18,213.0 | 14,097.4 | 3,582.7 | 5,813.4 | 3,408.7 | 391.4 | 450.1 | 7,453.7 | 38,539.8 | 48,751.7 | 46,443.6 | 95,195.3 | 7,952,825.3 | 29,703,620.6 | 37,656,445.9 |

# APPENDIX II - OPERABILITY CLASSIFICATION

## 1) SOURCES OF INFORMATION

### a) Resource Inventories

i) Report of the Forest Inventory, TFL (1989) – Reid Collins
ii) Forest cover mapping – WFP G.I.S. inventory base; 1:10,000 scale. TRIM base mapping UTM NAD 83.
iii) Terrain stability overview mapping (1997) – T. Lewis; MoF 5 Class System; 1:20,000 scale
iv) Stream classification mapping – WFP; known fish streams; 1:20,000 scale
v) Landscape Inventory and Analysis – Recreation Resources Ltd., Aug. 1994
vi) Recreation Resource Inventory TFL 19 (1993) – J.B. Webb, Recreation Resources Limited
vii) Recreation Analysis Report (1994) – Recreation Resources Ltd.

### b) Reconnaissance

i) Aerial
ii) Ground

### c) Photography

i) 1:15,000 scale aerial photography (1995)

## 2) ASSUMPTIONS AND PLANNING CONSIDERATIONS

Terrain Stability Note:

The level “C” terrain stability overview mapping is by definition, a relatively coarse filter. Local knowledge and historical evidence show that at a more refined level, Class 4 and Class 5 terrain as identified on the overview may include terrain of more stable classifications. There will, therefore, be small areas identified as operable, which will be in apparent conflict with the overview mapping.

Ultimately, the area excluded from the operable land base as Class 4 and Class 5 terrain, will be that identified by the overview mapping net of those areas deemed to be of a more stable classification. Prior to any development activity, field terrain stability assessments will be conducted on all areas identified on the overview as having stability concerns, as required by the Forest Practices Code.

**a) Forest Road Specifications**

i) Grades

(1) Favourable

(a) Maximum sustained grades of +18%

(b) Switchbacks and short pitches up to +20%

(2) Adverse

(a) Maximum sustained grades of –8%

(b) Short intervals up to –12%

ii) Terrain

(1) Roads are not proposed on Class 5 terrain

(2) Roads may cross Class 4 inclusions to access timber (terrain field assessments will be conducted prior to development as per the Forest Road Regulation)

(3) Roads can be constructed on Class 1 through 3 terrain

**(b) Yarding Systems – Physical Constraints**

i) Conventional Yarding Systems ($O_C$ or $O_{CE}$)

Conventional yarding is subdivided into two operable types based on forest cover: “Operational Conventional” ($O_C$) and “Operable Conventional with Economic constraints based on forest cover” ($O_{CE}$). (Refer to section 2)c);Yarding Systems – Forest Cover Constraints). The physical constraints described hereafter hold true for both conventionally operable subtypes.

(1) Highlead (includes 27.4 meter tower and grapple yarders)

(a) Square Lead

(i) 250 meters preferred maximum yarding distance

(ii) 350 meters acceptable in occasional situations with adequate deflection

(b) Corners

(i) 350 meters preferred maximum yarding distance

(ii) 400 meters acceptable in occasional situations with adequate deflection

(c) Terrain

(i) Logs are fully suspended on Class 4

(ii) Not considered on Class 5

(2) Longline
  (a) Distance Constraints – Uphill Yarding (shotgun system preferable)
    (i) Maximum yarding – 1,000 meters
  (b) Distance Constraints – Downhill Yarding
    (i) Maximum yarding and tail hold – 750 meters
  (c) Not considered on Class 5 terrain
  (d) Situations indicating consideration for use
    (i) Terrain stability concerns
      1. Largely continuous terrain Class 4 road development required to yard conventionally
      2. Improve deflection to minimize ground disturbance
    (ii) Portion of setting inaccessible by road due to terrain constraints
      1. Class 5
      2. Rock bluffs
      3. Canyons
    (iii) Minimize isolation of timber
    (iv) Preferable to heli-logging where useable
    (v) Economics dictates skyline over extra and expensive road

(3) Ground Based (hydraulic hoe forwarders) (note: this type may also include ground based systems used in alternative systems such as forwarders and skidders where suitable)
  (a) Distance Constraints
    (i) 150 meters maximum distance to road side
    (ii) May be used, where appropriate, to forward to highlead system (60m maximum)
  (b) Terrain
    (i) Class 1 and 2 terrain with minor inclusions of Class 3
    (ii) 30% maximum sustained slope
    (iii) small inclusions of steeper ground acceptable

(ii) Non-Conventional Yarding Systems

Non-conventional yarding is subdivided into two operable types, Operable Helicopter ($O_H$) or Operable Helicopter with Economic constraints ($O_{HE}$). (Refer to section 2)c); Yarding Systems – Forest Cover Constraints). The physical constraints hereafter apply to both the economically constrained and non-economically constrained helicopter operable types.

(1) Helicopter ($O_E$ or $O_{HE}$)
  (a) Flight Distance
    (i) 1.0 kilometer or less preferred
    (ii) Up to 2.0 kilometers acceptable where no alternative exists

  (b) Both water and land drops are considered

  (c) Uphill flight acceptable using same constraints as in (1) above

  (d) Slope constraint determined by terrain class (i.e. not considered on Class 5 terrain; steep slopes on class 4 or less terrain are

considered)

(e) Situations indicating consideration for use
(i) Timber inaccessible by road due to terrain constraints
1.Class 5
2.Rock bluffs
3.Canyons

(ii) Isolated location (i.e. conventional development uneconomic due to sheer distance from current development and insufficient merchantable timber in between)

(iii) Terrain stability issues

**(c) Yarding Systems – Forest Cover Constraints**

As previously mentioned, forest cover is broken into two operable types, one with economic constraints (denoted by the subscript "E" in the operability descriptor) and the other without economic constraints (and no modifier in the descriptor).

The economic constraint is indicative of timber which is on the margin of operability in terms of volume, quality and species. In good economic times, operability types with the "E" modifier will be operable. In poor economic times these same types may not be operable. These types are seen as opportunity timber and given the unpredictability of the economy, should have no associated requirement to harvest for cut control purposes.

i) Conventional yarding systems ($O_C$)
(1) All height class 4 and above
(2) All height class 3 with cedar or cypress as primary species with the exception of stocking class 3 stands which are excluded
(3) Height class 3 stands with hembal or Douglas fir as primary species which are in close proximity to $O_C$ types noted in points (1) and (2)

ii) Conventional Yarding Systems with Economic Constraints ($O_{CE}$)
(1) Height class 3 stands with hemlock or balsam as primary species which are not in close proximity to $O_C$ types described in points i) (1) and (2)
(2) Stocking class 3 stands with Douglas fir, cedar, cypress or spruce as primary or secondary species
(3) Deciduous stands – operability determination based upon local knowledge

iii) Non-Conventional Yarding Systems
(1) Helicopter ($O_H$)
(a) All height class 4 and above

(2) Helicopter with Economic Constraints ($O_{HE}$)
(a) Height class 3 stands with cedar, cypress, spruce or Douglas fir as primary species (excluding stocking class 3 stands)

(b) Height class 3 stands with cedar, cypress, spruce or Douglas fir as secondary species with the exception of all height class 3 stocking class 3 combinations which are excluded
(c) Pure hemlock balsam height class 3 stands are excluded

**d) Economically Inoperable Forest Cover ($I_E$)**

(1) All mature height class 1 and 2
(2) Pure hemlock balsam height class 3 stocking class 3 open stands
(3) Pine dominant stands

**e) Physically Inoperable Lands ($I_P$)**

(1) All non-productive types (i.e. rock, brush, swamp, alpine, lakes, rivers, dryland sorts, camps, quarries, etc.)
(2) Land feature limitations (eg. Major gullies)
(3) Areas rendered physically and/or economically inaccessible by extreme terrain and/or distance, from development, which is physically and/or economically possible. (This distinction pertains to those areas to which access is physically possible, but so physically onerous that it is economically prohibitive)

**f) Other Inoperable**

Areas which are inoperable for environmental or institutional reasons, will be withdrawn through the G.I.S. (eg. ESA, terrain class 5, riparian, wetland or lake reserves, deer winter ranges, research plots, etc.)