# TIMBER SUPPLY ANALYSIS INFORMATION PACKAGE FOR TREE FARM LICENSE 8

**Pope and Talbot Ltd.**

**Boundary Division**

**Management Plan No. 10**


**Prepared by:**

**Timberline Forest Inventory Consultants Ltd.**

**February 14, 2002**

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# 1. INTRODUCTION

This Information Package has been prepared as a source document prior to the completion of the Timber Supply Analysis Report for Management Plan 10 (MP No. 10) for Tree Farm Licence 8 (TFL 8). It serves as a summary of the inputs and assumptions made in preparing the timber supply analysis data model. Included are inventory and landbase summaries, and management assumptions for timber and non-timber resources as they relate to timber supply. The development of growth and yield information was undertaken by J.S. Thrower & Associates Ltd. (JST), and is reported in detail elsewhere (JST, 2001a – included as an appendix to the MP No. 10 document). This Information Package follows the suggested format outlined in the *Guide for Tree Farm Licence Management Plans (20-month) and Calendar Year Reports* (MoF, 2001). The only option identified for analysis at this time is the Base Case, which reflects current management practices on the TFL. This option will be reviewed and evaluated, and an AAC will be selected and submitted for acceptance by the Chief Forester.

# 2. PROCESS

In accordance with the *Guide for Tree Farm Licence Management Plans (20-month) and Calendar Year Reports* (MoF, 2001), this report will be submitted for review and acceptance by the Timber Supply Forester at Timber Supply Branch fourteen (14) months prior to the expiry date of the present management plan for TFL 8. Following acceptance, this report will be included as an appendix to the Timber Supply Analysis Report.

## 2.1 Growth and Yield

Yield tables have been developed by J. S. Thrower & Associates (JST). Tables were developed for all polygons on the timber harvesting landbase, and then grouped into clusters (analysis units) for timber supply analysis purposes. A report documenting this work was previously submitted by JST (JST, 2001a) under separate cover, and is also included as an appendix to the MP No. 10 document.

# 3. TIMBER SUPPLY FORECASTS/OPTIONS/SENSITIVITIES

## 3.1 Base Case

This option reflects current management performance based on the date of commencement for the preparation of Management Plan No. 10. The analysis incorporates:

- Forest cover inventory, updated for disturbance to January 1, 2000;
- Statistical adjustment of dense lodgepole pine inventory attributes;
- Current management regimes;
- Updated mapping of existing roads;
- Current Forest Development Plan approved cut-blocks;
- Updated draft visual quality classes (VQC) for the known scenic areas defined by the Kootenay-Boundary Higher Level Plan Order (KBHLPO);
- Updated landscape units, as defined by the KBHLPO;
- Definition of landscape-level biodiversity requirements in accordance with the KBHLPO;
- Definition of stand-level biodiversity requirements in accordance with the Landscape Unit Planning Guide (LUPG);
- Updated riparian classifications;
- Definition of riparian buffers consistent with Pope & Talbot's operational practice;
- Updated mule deer winter range (DWR) zone;
- New connectivity corridors defined by the KBHLPO;
- Expanded Slope Stability Mapping for areas previously unmapped and unclassified;
- New Terrestrial Ecosystem Mapping (TEM) of Pope & Talbot's Tree Farm Licence 8;
- New Potential Site Index Estimates for the Main Commercial Species on TFL 8;
- Uneven-aged management regimes within the DWR zones; and
- Updated estimates of non-recoverable losses (NRLs).

## 3.2 Sensitivity Analyses

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

Table 3.1 summarizes the sensitivity issues to be addressed.

**Table 3.1 Current management sensitivity analyses**

| Issue | Sensitivity Levels to be Tested |
|---|---|
| Landbase | Adjust timber harvesting landbase ± 10% |
| Growth and yield | Adjust natural stand yields ± 10%<br>Adjust managed stand yields ± 10%<br>Adjust managed stand minimum harvest ages ± 10 years<br>Alter minimum harvest ages to age at 90% of culmination MAI<br>Alter minimum harvest ages to age at culmination MAI<br>Adjust regeneration delays ± 1 year<br>Apply inventory site index to MSYTs in ESSF<br>Apply inventory site index to MSYTs everywhere |
| Resource emphasis | Adjust green-up heights ± 1 metre<br>Adjust IRM disturbance limit ± 5%<br>Adjust VQC disturbance limits ± 5%<br>Adjust DWR disturbance limits ± 5%<br>Apply mature thermal cover requirement in DWR zone<br>Reduce yields in NDT4 open forest types |
| Biodiversity | Adjust mature minimum age ± 10 years<br>Adjust mature+old retention targets ± 5%<br>Alter old minimum age ± 10 years<br>Adjust old retention targets ± 5% |

## 3.3 Alternative Harvest Flows

In all phases of the analysis, the choice(s) of harvest flow will reflect the following objectives:

- Maintain or increase the current harvest level for as long as possible;
- Limit reductions in harvest level to less than 10% of the level prior to the reduction; and
- Achieve a stable long-term harvest level.

A number of different harvest flows will be explored, based on tradeoffs between short and medium-term harvest levels. Forest cover constraints and biological capacity of the net operable landbase will dictate timber availability and harvest level options.

## 3.4 Other Options

No alternative scenarios were identified for this analysis.

# 4. FOREST ESTATE MODEL

## 4.1 Model description

Analyses in support of MP No. 10 will be carried out using CASH6 (Critical Analysis of Schedules for Harvesting) version 6.2j, a proprietary timber supply model developed by Timberline Forest Inventory Consultants. The model uses a geographic approach to landbase and inventory in order to adhere as closely as possible to the intent of forest cover requirements on harvesting. Maximum disturbance and minimum thermal and old growth retention forest cover requirements, as well as biodiversity seral stage requirements are explicitly implemented.

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

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

## 4.2 Timber Supply Analysis

Timber supply analysis for the full two hundred fifty (250) year planning horizon will be carried out using CASH6 operating in aspatial mode.

## 4.3 Twenty Year Spatial Feasibility Analysis

Determination of spatially feasible harvest schedules that incorporate all integrated resource management considerations will be undertaken using CASH6 operating in spatial mode for the first twenty (20) years of the planning horizon. Approved blocks from the current forest development plan (FDP) will be given the highest priority for harvest.

# 5. CURRENT FOREST COVER INVENTORY

All spatial information is registered to the Terrain Resource Inventory Mapping (TRIM), North American Datum (NAD) 83 base. Inventory data has been prepared using the ARC/INFO™ Geographic Information System (GIS). Use of GIS ensures that spatial relationships between the various inventory attributes are maintained throughout the analysis process. For example, existing roads and streams have been buffered to provide specific area reductions from the net harvesting landbase.

The TFL 8 forest cover inventory has been updated for disturbance and projected to the year 2000 by Forsite Consultants Ltd. Furthermore, a statistical adjustment of inventory attributes was applied to dense lodgepole pine stands, following the results of a study undertaken for Pope & Talbot by J.S. Thrower & Associates (JST, 1999). An inventory audit was completed on the TFL and concluded that the mature and immature components of the TFL 8 inventory are statistically acceptable, although the non-forest component of the inventory did not meet provincial standards.

New Terrestrial Ecosystem Mapping (TEM) data were completed by Oikos Ecological Services Ltd., and data-captured by Forsite Consultants Ltd. Furthermore, J.S. Thrower & Associates have completed an approved site index adjustment (SIA) project for TFL 8 (JST, 2001b). Both the new TEM inventory and the results of the SIA project were used in the derivation of growth and yield relationships for this analysis. Inventories of landscape units, known scenic areas, mule deer wintering areas, riparian classifications, and unstable terrain have recently been updated and are incorporated into the GIS database for use in this analysis.

The current inventory consists of timber in several land classes. Timber on the operable but excluded landbase is not available for harvesting under the assumptions of this option. However, this forested land contributes to forest cover and seral stage requirements for non-timber resources, depending on its structural state.

# 6. DESCRIPTION OF LANDBASE

This section describes the TFL 8 landbase and the methodology used to determine the way in which land contributes to the analysis. Some portions of the productive landbase, while not contributing to harvest, may be available to meet other resource needs.

## 6.1 Net harvesting landbase determination

Table 6.1 presents the results of the landbase classification process to identify the timber harvesting or net operable landbase. Individual areas may have several classification attributes. For example, stands within riparian boundaries might also be classified as non-commercial. These areas would have been classified on the basis of this latter attribute, prior to the riparian classification. Therefore, in most cases the net reduction will be less than the total area in the classification. Note that all land within TFL 8 is designated as Schedule B[1].

**Table 6.1 Timber harvesting landbase determination**

| Classification | Area | Volume |
|---|---|---|
| | ha | $m^3$ |
| **Total Landbase (incl. fresh water)** | 77,703 | 11,727,743 |
| Non-crown | 247 | 7 |
| **Total TFL (incl. fresh water)** | 77,456 | 11,727,736 |
| Non-forest | 2,853 | 65 |
| Non-productive | 1,197 | 70,450 |
| **Total Productive** | 73,406 | 11,657,221 |
| Reductions to Productive: | | |
| Non-commercial | 231 | 6 |
| ESAs | 1,558 | 278,068 |
| Unstable terrain | 378 | 64,404 |
| Low site | 449 | 89,724 |
| Deciduous | 333 | 31,545 |
| Non-merchantable | 1,501 | 116,623 |
| Existing roads, trails and landings | 1,068 | 111,439 |
| Lake riparian reserves | 13 | 2,783 |
| Wetland riparian reserves | 115 | 15,848 |
| Stream riparian reserves | 1,832 | 398,648 |
| Trans-Canada trail | 10 | 1,089 |
| NSR | 2,698 | 0 |
| **Total Operable Reductions** | 10,185 | 1,110,176 |
| **Current Net Harvesting Landbase** | 63,221 | 10,547,045 |
| Future additions: | | |
| NSR | 2,698 | 16,195 |
| Future reductions: | | |
| Future roads, trails, landings | 2,091 | 576,726 |
| **Long-term Net Harvesting Landbase** | 63,828 | 9,986,514 |

[1] The Relational Data Dictionary version 2.0, produced by Resources Inventory Branch of the Ministry of Forests, defines Schedule B land as a Tree Farm License on Crown Land.

### *6.1.1 Area Distributions by Leading Age and Leading Species*

Table 6.2 and Figure 6.1 summarize the distribution of area by leading age for both the productive and net harvesting landbase. Leading age refers to the oldest age in each age class. Land classified as NSR is not included in the summaries.

**Table 6.2 Age distribution**

| Leading Age[1] | Productive Area (ha) | Net Area (ha) |
|---|---|---|
| 0 | 231 | 1 |
| 10 | 7,410 | 6,999 |
| 20 | 7,320 | 6,874 |
| 30 | 4,474 | 4,171 |
| 40 | 1,226 | 1,009 |
| 50 | 1,013 | 850 |
| 60 | 1,315 | 1,147 |
| 70 | 7,171 | 6,386 |
| 80 | 5,251 | 4,688 |
| 90 | 2,692 | 2,159 |
| 100 | 2,042 | 1,880 |
| 110 | 2,194 | 2,045 |
| 120 | 2,548 | 2,353 |
| 130 | 1,428 | 1,179 |
| 140 | 1,113 | 914 |
| 150 | 1,308 | 1,230 |
| 160 | 2,031 | 1,730 |
| 170 | 1,281 | 1,233 |
| 180 | 1,713 | 1,558 |
| 190 | 2,225 | 2,071 |
| 200 | 1,412 | 1,322 |
| 210 | 4,696 | 4,129 |
| 220 | 1,350 | 1,265 |
| 230 | 2,148 | 1,953 |
| 240 | 896 | 712 |
| 250 | 729 | 629 |
| 260 | 2,535 | 2,094 |
| 270 | 220 | 194 |
| 280 | 42 | 38 |
| 290 | 224 | 210 |
| 300 | 0 | 0 |
| > 300 | 216 | 192 |

[1] – Age 0 excludes NSR

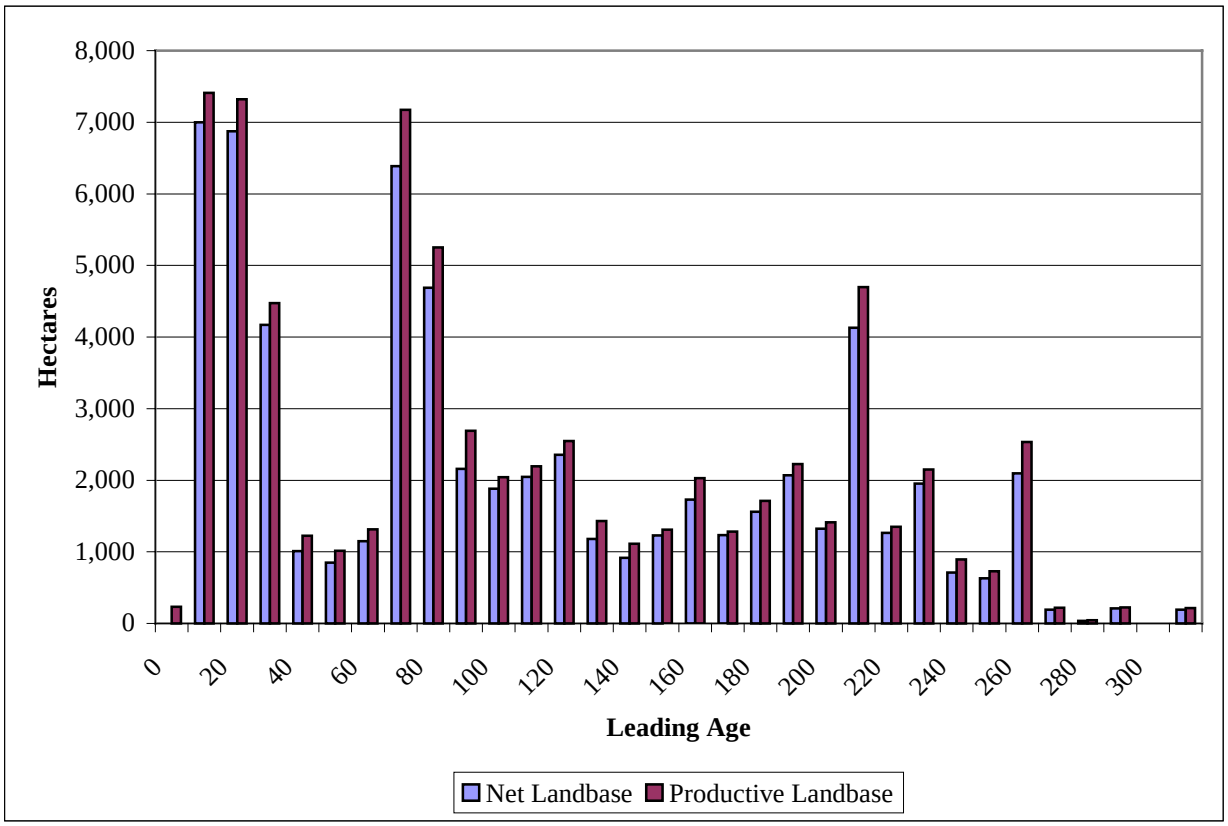


**Figure 6.1 Age distribution**

Table 6.3 and Figure 6.2 summarize the distribution of area by leading species for both the productive and net harvesting landbase. As with the leading age distributions, NSR land is not included in the summaries.

**Table 6.3 Leading species distribution**

| Leading Species | | Productive Area | Net Area |
|---|---|---|---|
| **Name** | **Code** | **(ha)** | **(ha)** |
| Cottonwood | AC | 87 | 0 |
| Aspen | AT | 115 | 0 |
| Amabilis fir | BA | 2,255 | 1,489 |
| Alpine fir | BL | 2,271 | 2,133 |
| Western red cedar | CW | 357 | 277 |
| Paper birch | EP | 85 | 0 |
| Douglas fir | FD | 16,034 | 15,207 |
| Western larch | LW | 10,204 | 9,748 |
| Whitebark pine | PA | 45 | 39 |
| Lodgepole pine | PL | 33,036 | 29,733 |
| Yellow pine | PY | 27 | 26 |
| Engelmann spruce | SE | 5,705 | 4,567 |
| unknown | no coding | 231 | 1 |
| | **Total** | 70,453 | 63,219 |

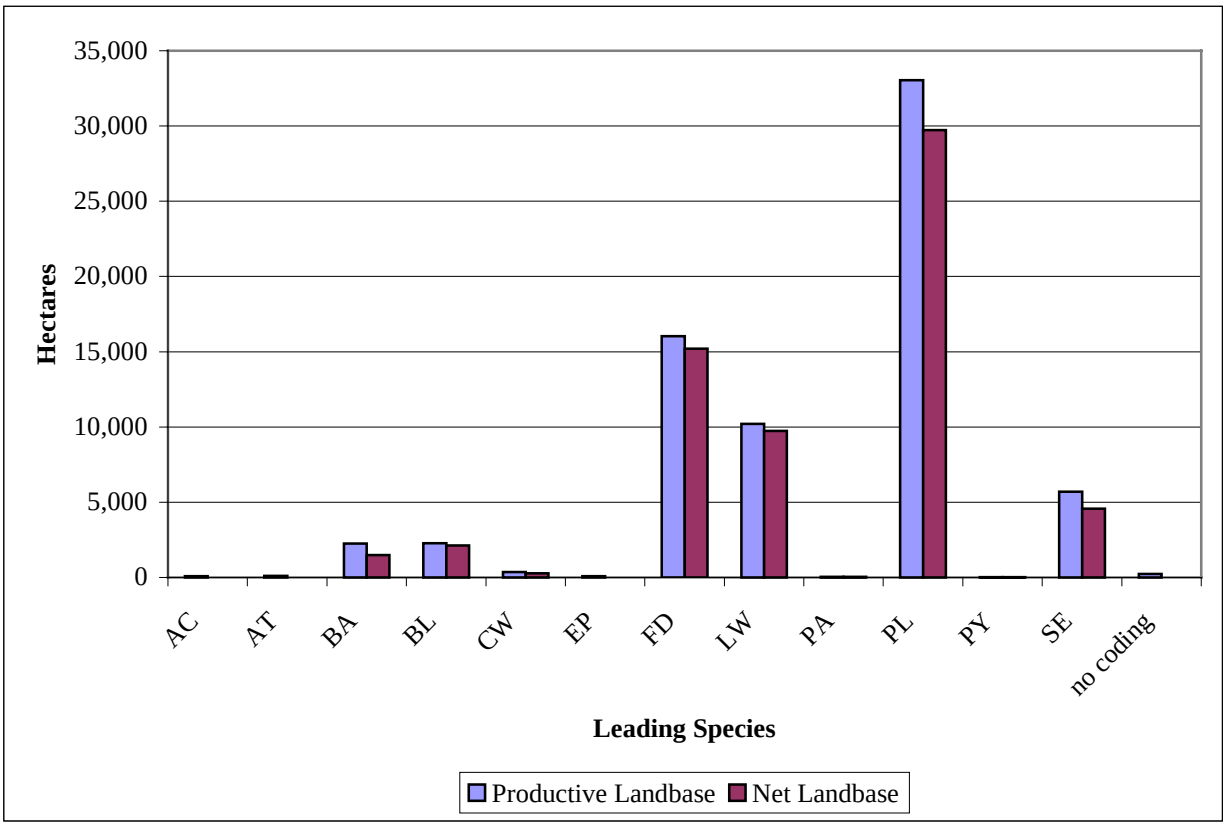


**Figure 6.2 Leading Species Distribution**

## 6.2 Total Area

The total area of TFL 8 is 77,456 hectares (excluding non-crown land within the TFL boundaries, but including fresh water). Of this total, 73,406 hectares are classified in the inventory as productive forest land. The entire area of TFL 8 is designated as Schedule B land.

## 6.3 Non-forest and Non-productive forest

A total of 2,853 hectares was removed from the TFL 8 landbase as non-forested area. The specific components of this area reduction are shown in Table 6.4.

All non-productive and non-classified forest area was also excluded from the net timber harvesting landbase as shown in Table 6.5.

Stands that are classified as alpine (AF) or non-productive (NP) leading and which are also identified as stocking class 1 and 2 have forest cover attributes and potentially can contribute to landscape level biodiversity. While not incorporated into the biodiversity calculations, these components (amounting to approximately 535 ha) provide a margin of safety around the biodiversity requirements.

**Table 6.4 Non-forest area reductions**

| Description | Area removed (ha) |
|---|---|
| Alpine | 25 |
| Rock | 455 |
| Gravel pit | 7 |
| Non-productive brush | 128 |
| Lakes | 111 |
| Gravel bars | 2 |
| Rivers | 39 |
| Swamps | 298 |
| Clearings | 3 |
| Urban | 322 |
| Open range | 1,462 |
| **Total** | 2,853 |

**Table 6.5 Non-productive area reductions**

| Description | Area removed (ha) |
|---|---|
| Non-productive forest | 1,178 |
| No typing available | 19 |
| **Total** | 1,197 |

## 6.4 Non-commercial Brush

It was verified that all land classified as noncommercial in the forest cover inventory database had no commercial tree species. Therefore all 231 hectares of non-commercial area was excluded from the net harvesting landbase.

## 6.5 Operability

Pope and Talbot consider all of TFL 8 to be operable and accessible.

## 6.6 Environmentally Sensitive Areas

All areas classified as highly environmentally sensitive (ESA1s) were removed from the net harvesting landbase, either implicitly as non-crown, non-forest, non-productive or non-commercial, or explicitly as ESA1s. Table 6.6 provides a summary of the ESA1s in TFL 8. Areas of moderate environmental sensitivity (ESA2s) were not removed from the net harvesting landbase in this analysis because the terrain stability surveys completed for TFL 8 (see Section 6.7) were considered to be a more accurate representation of the areas of moderate environmental sensitivity within the TFL. Furthermore, a review

of Pope & Talbot's operations has shown that many blocks intersect areas identified in the forest cover inventory as ESA2s.

**Table 6.6 Environmentally sensitive areas**

| Description | Total (ha) | Productive (ha) | Area removed (ha) |
|---|---|---|---|
| Forest regeneration | 44 | 22 | 22 |
| Soils | 653 | 615 | 615 |
| Soils + regeneration | 1,013 | 920 | 920 |
| **Total** | 1,710 | 1,558 | 1,558 |

It was noted during the preparation of this report that the figures shown in Table 6.6 do not agree with the ESA1 areas reported in the timber supply analysis for Management Plan 9 (Pope & Talbot, 1996). In an attempt to explain the difference, the forest cover inventory file that was originally prepared for the MP9 timber supply analysis was retrieved from archival storage and was found to agree with the total ESA1 areas reported in Table 6.6. While this does not explain the ESA netdown figures reported in MP9, it does validate the numbers reported here.

## 6.7 Terrain Stability

Terrain stability surveys have been done for the entire TFL 8 landbase. Reconnaissance terrain stability mapping (RTSM) has been completed (level D intensity) on 69,355 ha, while detailed terrain stability mapping (DTSM) has been performed (level C intensity) 8,260 ha of the TFL. Both RTSM class U and DTSM class V areas are "expected to contain areas with a high likelihood of landslide initiation following timber harvesting or road construction"[2], and thus were removed from the net harvesting landbase. These reductions, summarized in Table 6.7, are in addition to the ESA1 reductions made for unstable soil types.

**Table 6.7 Unstable terrain**

| Assessment Type | Stability Class | Total (ha) | Productive (ha) | Area removed (ha) |
|---|---|---|---|---|
| Detailed terrain stability mapping, level C | V | 272 | 269 | 274 |
| Reconnaissance terrain stability mapping, level D | U | 205 | 108 | 105 |
| **Total** | | 477 | 376 | 378 |

## 6.8 Problem Forest Types

Table 6.8 summarizes the criteria by which stands were identified as being non-merchantable, of low productivity or of deciduous cover. Stands so classified were removed from the net harvesting landbase. No areas classified as NSR were captured by the low productivity or non-merchantable stand criteria.

Site index limits for low productivity stands were taken from the TSR2 analysis for the Boundary timber supply area (MoF, 2000a). Site index cutoffs for non-merchantable types were determined using a threshold of 100 $m^3$/ha at 120 years of age based on existing stand yield tables. The age, height and site

[2] Mapping and Assessing Terrain Stability Guidebook, August 1999, 2nd edition.

index criteria were applied after applying the dense Lodgepole pine inventory adjustment (see Section 8.1), but before making the site index adjustments described in JST 2001b. While inventory data may indicate reasonable volumes per hectare in some of the problem forest type categories, operational experience on the TFL warrants the consideration of other factors, such as rot, pulp component, piece size and stand density, in the identification of problem forest types.

**Table 6.8 Problem forest types**

| Description | Leading species Code | Inventory Type Group | Age Class | Height Class | Stocking Class | Site Index | Total Area (ha) | Area Removed (ha) | Volume Removed (m3) |
|---|---|---|---|---|---|---|---|---|---|
| Low site index: | | | | | | | | | |
| Pine, larch leading | PL, PA, PY, LW | | any | any | any | < 7.5 | 97 | 87 | 2,245 |
| Spruce, balsam leading | SE, BA, BL | | any | any | any | < 8.0 | 1,055 | 362 | 87,480 |
| Douglas fir leading | FD | | any | any | any | < 8.5 | 0 | | |
| Deciduous: | | | | | | | | | |
| Deciduous leading[1] | | 35-42 | any | any | any | any | 333 | 333 | 31,545 |
| Non-merchantable: | | | | | | | | | |
| Cedar, hemlock leading | | 10-17 | ≥ 9 | any | any | < 13.5 | 0 | | |
| Balsam, spruce leading | | 18-24 | ≥ 9 | 2 | any | < 13.5 | 34 | | |
| Lodgepole pine leading | | 28-31 | any | any | 4 | any | 849 | 727 | 75,524 |
| Lodgepole pine leading | | 28-31 | 3 | 1 | 0 | < 13.5 | 112 | 104 | 602 |
| Lodgepole pine leading | | 28-31 | 3 | 2 | 0 | < 13.5 | 81 | 81 | 3,664 |
| Lodgepole pine leading | | 28-31 | 4 | 2 | 0 | < 13.5 | 626 | 589 | 36,833 |
| | | | | | | **Total** | 3,187 | 2,282 | 237,892 |

[1] – For stands with a minor deciduous component, deciduous volumes are excluded from the analysis by adjusting the associated VDYP yield curves.

## 6.9 Roads, Trails and Landings

### *6.9.1 Existing Roads, Trails and Landings*

Forest operations create roads, trails and landings that can reduce the productivity of growing sites, and reduce the area available for growing trees. Existing roads, trails and landings are often too narrow to be identified as polygons in the digital inventory files. However, existing roads and trails have been mapped for TFL 8, and are thus available as linear features suitable for GIS buffering techniques to delineate the area degraded by existing roads. Table 6.9 provides a summary of the length, assumed width, and area removed for each category of road. Note that the areas given in the table are net of any prior reductions made in the landbase classification process. For example, only 4 hectares were explicitly removed from the landbase for MoTH highways because the bulk of the MoTH highway corridor was already removed from the landbase as part of the non-forest area reductions summarized in Table 6.4.

A significant amount of landing rehabilitation is practiced throughout TFL 8, thus returning many landings to productive forest. Furthermore road buffer widths were rounded upwards to account for landings not rehabilitated. Consequently, no explicit area reduction was made for existing trails or landings.

**Table 6.9 Existing unclassified road area summary**

| Description | Road length | Road Width | Net Area Removed |
|---|---|---|---|
| | km | m | ha |
| MoTH highway | 17.9 | 30 | 4 |
| Secondary roads | 174.6 | 12 | 192 |
| Logging roads | 910.3 | 10 | 872 |
| | | **Total** | 1,068 |

### *6.9.2 Future Roads, Trails and Landings*

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

Based on historical site disturbance surveys on affected blocks, an area reduction of 4.5% was determined to account for the loss of area to future roads, trails and landings. This reduction will be applied to each stand whose age at time 0 is greater than 25 years, the first time it is harvested, and will result in a future reduction to the current timber harvesting landbase of 2,091 hectares. This methodology is consistent with the approach taken in the timber supply analysis for Management Plan 9 (Pope & Talbot, 1996).

## 6.10 Riparian Management Areas

Riparian management areas are designed to minimize the impacts of harvesting in areas immediately adjacent to water bodies, including streams, lakes, swamps and wetlands. A riparian management area consists of a riparian management zone in which harvesting activity is restricted through basal area retention requirements, and may also include a riparian reserve zone immediately adjacent to the water body in which harvesting is fully excluded. The presence of a riparian reserve zone is dependent on the classification assigned to the water body in question.

Current operational practice on TFL 8 results in a range of basal area retention levels in riparian management zones, from 0 to 60%, with a resulting average retention level of 25%. The average retention level was applied to all riparian management zones, irrespective of riparian classification, in determining the area to be removed from the net harvesting landbase. For the purposes of timber supply modelling, the management zone width as defined in the Riparian Management Area Guidebook was reduced by the management zone retention percentage and added to the reserve zone width to arrive at a composite buffer width, as shown in Table 6.10. GIS buffering techniques were then used to construct an effective riparian reserve zone inside of which harvesting activity was fully excluded. Note that the composite buffer width shown in Table 6.10 was applied to each side of stream features, and to the terrestrial side of wetland or lake features.

### *6.10.1 Streams*

Forsite Consultants Ltd, on behalf of Pope & Talbot, has classified all streams within the TFL for timber supply analysis purposes. The classification methodology retained all known stream classifications, and inferred a classification for all other streams using all available relevant data sources and the expertise of a fisheries specialist. A summary of the stream riparian classifications and associated landbase reductions is provided in Table 6.10.

### *6.10.2 Wetlands and Lakes*

Using the definitions provided in the Riparian Management Area Guidebook, GIS techniques were used to classify wetlands and lakes for the purposes of this timber supply analysis. The wetland and lake features themselves were extracted from the TFL 8 forest cover inventory data, the area of each feature was determined using the GIS, and the biogeoclimatic unit in which each feature is contained was determined through an overlay with the Terrain Ecosystem Mapping (TEM) inventory data. A summary of the resulting lake and wetland riparian classifications and associated landbase reductions is provided in Table 6.10.

**Table 6.10 Riparian management area reductions**

| Riparian Class | Length | Reserve Zone Width | Management Zone Width | Management Zone Retention | Buffer Width | Productive Area | Area Removed |
|---|---|---|---|---|---|---|---|
| | km | m | m | % | m | ha | ha |
| Lakes: | | | | | | | |
| L1 | 36.3 | 10 | 0 | 25 | 10 | 51 | 10 |
| L3 | 15.4 | 0 | 30 | 25 | 7.5 | 4 | 3 |
| Wetlands: | | | | | | | |
| W1 | 49.2 | 10 | 40 | 25 | 20 | 42 | 41 |
| W3 | 90.1 | 0 | 30 | 25 | 7.5 | 33 | 32 |
| W5 | 43.5 | 10 | 40 | 25 | 20 | 44 | 42 |
| Streams: | | | | | | | |
| S1 | 17.3 | 50 | 20 | 25 | 55 | 145 | 142 |
| S2 | 41.7 | 30 | 20 | 25 | 35 | 270 | 237 |
| S3 | 182.8 | 20 | 20 | 25 | 25 | 862 | 770 |
| S4 | 339.8 | 0 | 30 | 25 | 7.5 | 476 | 424 |
| S5 | 23.1 | 0 | 30 | 25 | 7.5 | 33 | 30 |
| S6 | 257.3 | 0 | 20 | 25 | 5 | 246 | 229 |
| | | | | | | **Total** | 1,960 |

## 6.11 Trans-Canada Trail

A small segment (approximately 16 km in length) of the Trans-canada trail intersects Block 2 (the northern block) of the TFL. A twelve (12) metre buffer was applied to each side of the trail to identify the no-harvest zone adjacent to the trail. After other reductions to the landbase, 10 hectares were excluded from the net harvesting landbase as a consequence of lying within the no-harvest zone next to the heritage trail.

## 6.12 Not Satisfactorily Restocked Areas

The forest cover inventory for TFL 8 indicates a total of 2,698 hectares of land classified as not satisfactorily restocked (NSR). Pope & Talbot is aggressively rehabilitating these areas and it is anticipated that they will meet minimum stocking standards within the next five years. Consequently they will be returned to the timber harvesting landbase at the beginning of the first simulation decade. The full 2,698 hectares will be given an age of 0 and assigned to managed stand yield tables according to site series (following the growth and yield modelling methodology developed by J.S Thrower & Associates (JST, 2001a)).

## 6.13 Stand-level Biodiversity (Wildlife Tree Patches)

Retention of wildlife trees as single trees or in patches is one of the most valuable practices for maintaining stand level biodiversity. In a timber supply context, the retention of wildlife tree patches (WTPs) is modeled by applying a percentage reduction to stand yields at the time they are harvested by the model. This modelling approach means that WTPs are not counted for their contribution toward landscape level biodiversity requirements, although in reality some WTPs may contribute to both landscape level forest structure and old growth habitat. Explicit landscape level biodiversity objectives are set as indicated in Section 10.2.2.

TFL 8 was established in 1968 and has been under a continuous forest management program for 31 years. The silviculture history of the TFL indicates that forest stand management began in 1976.

In 2000, 25% of the net landbase (16,227 hectares) is between 5 and 25 years of age, and is assumed to have been disturbed without wildlife tree retention.

Stand-level biodiversity will be modeled based on the Landscape Unit Planning Guide (March 2000). All areas within TFL 8 fall in the Boundary Resource Management Zone of the Kootenay-Boundary Higher Level Plan Order (KBHLPO). The landscape units (LUs) defined under the KBHLPO are used in this timber supply analysis.

Portions of three LUs cover TFL 8 (see Section 7.3 for further information on LUs) . Table 6.11 shows the wildlife tree retention (WTR) requirements at the subzone level for each landscape unit, calculated in accordance with Section 3.1 of the Landscape Unit Planning Guide (LUPG). In operational planning practice, the WTR objectives shown in Table 6.11 are established for each subzone within a landscape unit, and will be applied to each cutblock within the subzone.

For the purposes of this timber supply analysis, however, wildlife tree retention will be modeled as follows. Silviculture regimes on TFL 8 include clear-cut harvesting every where outside of the mule deer winter range areas, and a combination of single tree selection, small (< 1 ha) patch cuts and a small component of conventional clear-cut harvesting within the mule deer wintering areas. It is assumed that wildlife tree retention will easily be met in the areas subject to uneven aged management. Following provincial wildlife tree retention policy (MoF, 2000b), and the methodology applied in the Boundary Timber Supply Area Timber Supply Review 2 process, it is further assumed that areas outside the timber harvesting landbase will meet 50% of the wildlife tree retention requirement shown in Table 6.11. Therefore an average wildlife tree retention requirement of 4% (0.5 * 8%) will be applied as a reduction to the volume per hectare that is harvested, regardless of landscape unit or ecosystem subzone, within the area subjected to even-aged management.

**Table 6.11 Wildlife tree retention requirements**

| Landscape Unit | BEC Subzone | Productive | Net | Net Harvested | Net Harvested | Available | Gross WTP Retention | Net WTP Retention |
|---|---|---|---|---|---|---|---|---|
| | (TEM) | ha | ha | ha | % | % | % | % |
| B1 | ICH mk | 2 | 2 | 0 | 0 | 100 | 7 | 4 |
| B1 | IDF dm | 4,504 | 4,380 | 79 | 2 | 97 | 7 | 3 |
| B1 | MS dm | 1,919 | 1,848 | 429 | 23 | 96 | 9 | 4 |
| B7 | ESSFdc | 6,742 | 4,900 | 554 | 11 | 73 | 5 | 3 |
| B7 | ICH mk | 5,484 | 4,869 | 490 | 10 | 89 | 7 | 3 |
| B7 | ICH mw | 307 | 273 | 137 | 50 | 89 | 11 | 5 |
| B7 | IDF dm | 6,642 | 6,182 | 1,009 | 16 | 93 | 8 | 4 |
| B7 | MS dm | 16,049 | 14,319 | 2,478 | 17 | 89 | 8 | 4 |
| B8 | ESSFdc | 3,602 | 3,131 | 511 | 16 | 87 | 7 | 4 |
| B8 | IDF dm | 9,821 | 9,026 | 2,613 | 29 | 92 | 9 | 5 |
| B8 | MS dm | 18,334 | 16,991 | 7,927 | 47 | 93 | 11 | 5 |
| | **Total** | 73,406 | 65,919[1] | 16,227 | 25 | 90 | 8 | 4 |

[1] – The net area reported here includes all NSR area.

# 7. FOREST INVENTORY ORGANIZATION

## 7.1 Introduction

In order to reduce the complexity of the forest description for the purposes of timber supply analysis simulation, aggregation of individual forest stands is necessary. However, it is critical that this aggregation obscures neither differences in biological productivity nor differences in management objectives and prescriptions. It is important to note that aggregation of the landbase will be consistent in all options and sensitivity analyses. This is to ensure that differences in results reflect differences in management decisions and not inventory aggregation.

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

Biodiversity planning is done in accordance with the Landscape Unit Planning Guide, and the definition of "priority biodiversity" planning described within. This priority biodiversity planning is the current focus of landscape unit planning and consists of two objectives: "retention of old growth forest; and stand structure through WTR." TFL 8 lies entirely within the Boundary Resource Management Zone established through the Kootenay-Boundary Higher Level Plan Order (KBHLPO), which took effect on January 31, 2000, and thus is also subject to resource management zone objectives established through the KBHLPO.

Unique management characteristics are modeled by grouping areas into two CASH6 forest cover groups:

1. Landscape level biodiversity will be modeled at the landscape unit–biogeoclimatic ecosystem classification variant/natural disturbance type (LU-BEC/NDT) level. Old growth requirements (based on biodiversity emphasis assignments) from the Landscape Unit Planning Guide (LUPG) will be assigned to each LU-BEC/NDT in order to address landscape level biodiversity. Landscape level biodiversity is described in greater detail in Section 10.2.2 (Landscape Level Biodiversity – Rationale).
2. Resource emphasis areas (REAs) are aggregates of area with similar non-timber resource concerns. These include visual sensitivity, wildlife habitat, and timber emphasis areas. Maximum disturbance (based on green-up height requirements), minimum mature and old growth forest cover objectives will be assigned to each REA forest cover group to address needs of the resource. REAs are aggregated within each landscape unit to reflect operational management of the resource. Where REA classifications overlap, areas must meet all overlapping forest cover objectives before harvesting.

## 7.2 Analysis Unit Definitions

Analysis unit definitions (clusters) were determined as part of the yield curve development process undertaken by J.S. Thrower and Associates. In total, the landbase was grouped into 437 different analysis units representing the clear cut (CC) and patch cut (PC) silvicultural systems, and an additional 22 analysis units for the single tree selection system (STS). A report documenting this work is included as an appendix to the MP No. 10 document (JST, 2001a).

## 7.3 Landscape Units

Portions of three landscape units intersect TFL 8, designated as B1, B7 and B8. Biogeoclimatic Ecosystem Classification and Natural Disturbance Types (BEC/NDT) are based on the updated

Terrestrial Ecosystem Mapping (TEM). In general, seral stage objectives applied at the LU-BEC variant level are intended to address biodiversity (seral stage) representation and ensure that an acceptable distribution of age classes is maintained. Biodiversity representation is modeled in the base case through mature+old and old-growth seral stage distributions, in accordance with the KBHLPO (Objective #2). Landscape level biodiversity is described in greater detail in Section 10.2.2 (Landscape Level Biodiversity – Rationale).

Table 7.1 summarizes the distribution of LU-BEC variants on TFL 8, and also shows the biodiversity emphasis option (BEO) assigned to each LU-BEC combination. Biodiversity emphasis options are assigned in accordance with the KBHLPO (Objective #1). It should be noted that, while the KBHLPO BEOs were originally developed with reference to the provincial BEC inventory, the BEC variants listed in Table 7.1 derive from the new TEM inventory for TFL8.

**Table 7.1 Landscape units, ecosystem types, and biodiversity emphasis**

| Landscape Unit | NDT | BEC variant | Biodiversity Emphasis | Area (ha) | | |
|---|---|---|---|---|---|---|
| | | | | Total | Productive | Net |
| B1 | 3 | ICH mk 1 | H | 1 | 0 | 0 |
| | | | I | 2 | 2 | 2 |
| | 3 | MS dm 1 | H | 167 | 165 | 156 |
| | | | I | 1,907 | 1,754 | 1,692 |
| | 4 | IDF dm 1 | H | 3,239 | 2,870 | 2,770 |
| | | | I | 1,931 | 1,633 | 1,610 |
| B7 | 2 | ICH mw 2 | L | 312 | 307 | 273 |
| | 3 | ESSFdc 1 | L | 7,569 | 6,742 | 4,900 |
| | 3 | ICH mk 1 | L | 5,687 | 5,484 | 4,869 |
| | 3 | MS dm 1 | L | 16,484 | 16,049 | 14,319 |
| | 4 | IDF dm 1 | L | 7,387 | 6,642 | 6,182 |
| B8 | 3 | ESSFdc 1 | L | 3,763 | 3,602 | 3,131 |
| | 3 | MS dm 1 | L | 18,796 | 18,333 | 16,990 |
| | 4 | IDF dm 1 | L | 10,458 | 9,821 | 9,026 |
| | | | **Total** | 77,703 | 73,405 | 65,918[1] |

[1] – Includes NSR area

## 7.4 Resource Emphasis Areas

The resource emphasis areas defined for this analysis are listed in Table 7.2. Maximum disturbance (based on green-up height requirements), minimum mature and old growth forest cover objectives will be assigned to REA forest cover group according to the requirements of the particular resource. REAs are aggregated within each landscape unit to reflect operational management of the resource. Where REA classifications overlap, areas must meet all overlapping forest cover objectives before harvesting.

Known scenic areas have been designated through the KBHLPO. The Boundary Forest District has recommended draft visual quality classes (VQCs) for these areas. Forest connectivity corridors have also been identified as part of the KBHLPO, and are to be managed for mature and old seral forest retention (Objectives 5(2) and 5(3)). Mule deer winter range (DWR) zones are also identified, and will be managed through a combination of single tree selection (STS) and small patch cut (PC) silvicultural systems, with a small component of conventional clear-cut harvesting, as well as through forest cover requirements.

**Table 7.2 Resource emphasis areas**

| Resource Emphasis Area | Total Area (ha) | Productive Area (ha) | Net Area (ha) |
|---|---|---|---|
| Forest connectivity corridors - IDFdm1, B1, High | 2,952 | 2,620 | 2,527 |
| Forest connectivity corridors - IDFdm1, B1, Intermediate | 1,325 | 1,126 | 1,108 |
| Forest connectivity corridors - MSdm1, B1, High | 14 | 14 | 13 |
| Forest connectivity corridors - MSdm1, B1, Intermediate | 99 | 92 | 88 |
| Forest connectivity corridors - ESSFdc1, B7 | 3,268 | 2,711 | 1,790 |
| Forest connectivity corridors - ICHmw2, B7 | 312 | 307 | 273 |
| Forest connectivity corridors - MSdm1, B7 | 1,200 | 1,189 | 1,112 |
| Forest connectivity corridors - ESSFdc1, B8 | 2,974 | 2,836 | 2,569 |
| Forest connectivity corridors - MSdm1, B8 | 4,365 | 4,169 | 3,832 |
| Deer winter range - IDFdm1, B1 | 3,020 | 2,663 | 2,565 |
| Deer winter range - MSdm1, B1 | 80 | 80 | 76 |
| Deer winter range - IDFdm1, B7 | 4,394 | 3,961 | 3,637 |
| Deer winter range - MSdm1, B7 | 615 | 601 | 523 |
| Deer winter range - ICHmk1, B7 | 781 | 774 | 634 |
| Deer winter range - IDFdm1, B8 | 2,173 | 1,969 | 1,791 |
| Deer winter range - MSdm1, B8 | 21 | 19 | 19 |
| Retention visual quality | 218 | 194 | 183 |
| Partial retention visual quality | 1,344 | 1,223 | 1,152 |
| Modification visual quality | 9 | 8 | 5 |
| Integrated resource management - B1 | 3,588 | 3,588 | 3,588 |
| Integrated resource management - B7 | 25,084 | 25,084 | 25,084 |
| Integrated resource management - B8 | 27,103 | 27,103 | 27,103 |

# 8. GROWTH AND YIELD

J.S. Thrower and Associates undertook the development of growth and yield relationships for this analysis. A report documenting this work and the results is included as an appendix to the MP No. 10 document (JST, 2001a).

## 8.1 Inventory Adjustment for Dense Lodgepole Pine

Based on the results of an study conducted by J.S. Thrower & Associates for Pope & Talbot (JST,1999 – included as an appendix to the MP No. 10 document), a statistical adjustment of inventory attributes was undertaken for dense lodgepole pine stands. The stands to which the adjustment was applied were selected using the criteria in Table 8.1. The adjustment equations were the following:

Adjusted age = 0.98 * Inventory age

Adjusted height = 1.176 * Inventory height

Adjusted volume = 0.912 * Inventory volume.

**Table 8.1 Dense lodgepole pine stand criteria**

| Inventory type group | Age class | Height class | Stocking class | Site class |
|---|---|---|---|---|
| 28-31 | Any | Any | 4 | Any |
| 28-31 | 3 | 1 | 0 | P |
| 28-31 | 3 | 2 | 0 | P |
| 28-31 | 4 | 2 | 0 | P |
| 28-31 | Any | Any | 3 | Any |

## 8.2 Silviculture History

### *8.2.1 Immature Managed Stands*

All stands with a current age less than 26 are assigned to managed stand yield curves, reflecting the silviculture history of the license. Stands older than 25 years are assigned to VDYP curves.

### *8.2.2 Current and Backlog Not Satisfactorily Restocked Areas*

Areas designated in the inventory as “not satisfactorily restocked” (NSR) originally contained operable timber, were harvested and have not yet regenerated to commercial species. For every stand scheduled for harvest there is a target period for regeneration following harvest. Land that fails to regenerate during this period is considered backlog NSR. Land that has been harvested recently, for which the regeneration delay period has not yet expired, is current NSR. Current NSR is part of the working forest and will be regenerated on schedule. According to licensee records for TFL 8, there are 318 hectares of backlog NSR and 2,381 hectares of current NSR. It is assumed that all NSR area will be replanted within the first five (5) years of the planning horizon. This area will therefore be assigned to managed stand yield tables based on the growth and yield modelling methodology developed by J.S. Thrower & Associates (JST, 2001a).

### *8.2.3 Regeneration Delay*

Regeneration delay is the time elapsed between harvesting and the establishment of a new stand of trees. The end of the regeneration delay is time zero for a yield table; it is the point in time when measurable stand growth begins. The age of the seedling should be included in the estimate of regeneration delay. This may be accomplished either in the growth and yield or the timber supply model, however care must be taken not to double count the age of the seedling.

For this analysis, regeneration delays will be applied in the timber supply model, rather than in the yield curve construction. Regeneration delays ranging between one (1) and three (3) years were estimated by Pope and Talbot staff for each silviculture regime, and were provided with the growth and yield package prepared analysis by J.S. Thrower & Associates (JST, 2001a).

## 8.3 Existing Timber Volume Check

The large number of analysis units (see Section 7.2) used to represent growth and yield relationships precludes the enumeration of timber volume comparisons by analysis unit. Table 8.2 therefore presents a comparison of the *total* initial timber volume calculated from the yield curves and from the inventory volume for each polygon.

**Table 8.2 Timber Volume Check**

| Polygon Volume | Yield Curve Volume | % Difference |
|---|---|---|
| 10,547,164 | 10,436,406 | -1.050 |

# 9. NON-RECOVERABLE LOSSES

Damage to timber caused by fire, wind, insects, diseases and other pests contribute to loss in harvestable volumes. This volume loss is difficult to quantify, although losses to insect and disease that normally occupy stands (endemic losses) are accounted for in empirical yield curve estimates. Depending on the type of damage and stand accessibility, losses due to catastrophic or epidemic events may be either salvageable or unsalvageable. These non-recoverable losses are not accounted for in the yield curves.

TFL 8 has good road access virtually throughout, so any occurrence of catastrophic stand damage is both relatively easily detected and accessible for salvage harvesting. Salvage operations may be carried out under amendments to existing cutting authorities, by initiating new cutting permit, under the blanket salvage cutting authority (CP 999) or under the Ministry of Forests Small Business Program Salvage Hunting Permit. Stands within the timber harvesting landbase that are damaged and not recovered are usually small, isolated or of marginal quality.

Estimates of annual unsalvaged losses were derived with guidance from the document titled "Methods to Estimate Unsalvaged Losses for Timber Supply Reviews" (MoF, 2000c), and are summarized in Table 9.1. In total, 900 $m^3$/yr will be discounted from the annual harvest levels indicated in the timber supply model.

**Table 9.1 Estimated non-recoverable losses**

| Loss Agent | Estimated NRL ($m^3$/yr) |
|---|---|
| Wildfire | 14 |
| Mountain pine beetle | 108 |
| Douglas fir bark beetle | 62 |
| Spruce bark beetle | 45 |
| Catastrophic blowdown | 215 |
| Non-catastrophic blowdown in & adj. to blocks | 75 |
| Non-catastrophic blowdown adj. to new roads | 30 |
| Non-catastrophic blowdown adj. to existing roads | 276 |
| Retention trees | 75 |
| **Total** | 900 |

# 10. INTEGRATED RESOURCE MANAGEMENT

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

## 10.1 Forest Resource Inventories

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

**Table 10.1 Non-timber resource inventory status**

| Inventory | Data Source | Mapping Scale | Date of Completion | Date of Approval | Agency/Authority |
|---|---|---|---|---|---|
| Landscape units | Ministry of Forests | 1:600,000 | Dec 2000 | Jan 2001 | KBHLPO |
| Biodiversity emphasis | Ministry of Forests | 1:600,000 | Dec 2000 | Jan 2001 | KBHLPO |
| Known scenic areas | Ministry of Forests | 1:600,000 | Dec 2000 | Jan 2001 | KBHLPO |
| Ungulate winter range | Ministry of Forests | 1:125,000 | Oct 1998 | Oct 1998 | Boundary Forest District |
| Terrain stability | J.M. Ryder and Assoc. Terrain Analysis Inc. & E.B.A. Engineering Ltd. | 1:20,000 | Oct 1997, Jan 1998 & Mar 1999 | April 1999 | FRBC |
| Connectivity corridors | Ministry of Environment, Lands and Parks | 1:500,000 | Dec 2000 | Jan 2001 | KBHLPO |
| Stream / riparian classifications | Ministry of Environment, Lands and Parks & Forsite Consultants Ltd. | 1:20,000 | Apr 2001 | Aug 2001 | Ministry of Water, Land and Air Protection |
| Terrestrial ecosystem mapping (TEM) | Oikos Ecological Services Ltd. & JS Thrower and Assoc. Ltd. | 1:20,000 | Mar 2000 | Mar 2000 | Resource Inventory Branch |

## 10.2 Forest Cover Requirements

The analysis will apply forest cover objectives to model wildlife habitat guidelines, biodiversity, hydrologic green-up, and visual quality objectives. In addition, silvicultural green-up requirements will be explicitly modeled as part of the Twenty Year Spatial Feasibility Analysis. Forest cover objectives place maximum and minimum limits on the amount of young second growth and/or old growth found in landbase aggregates (LU-BEC/NDTs and REAs).

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

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

Any number of forest cover groups may be used to aggregate forest stands for the purpose of modelling forest cover objectives. For example, a forest cover group will be created to model mule deer winter range habitat within a specific region of the TFL and this will be overlapped with landscape level biodiversity requirements for Landscape Unit-BEC/NDT.

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

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

The use of forest cover objectives as described above improves forest management modelling by ensuring that non-timber resources are given appropriate consideration. Table 10.2 summarizes the assignment of the various REAS and LU-BEC variant combinations to the CASH6 management levels for the base case analysis. Mule deer winter range will be managed through the application of disturbance constraints applied separately within each LU-BEC variant, following the methodology adopted in the Timber Supply Review Analysis Report for the Boundary Timber Supply Area (MoF, 2000a). Known scenic areas will be managed by the application of visual quality objectives in the form of disturbance constraints. The remaining area, classified as the Integrated Resource Management (IRM) zone, will be managed by applying disturbance constraints applied within each landscape unit. Old seral, and mature plus old seral, requirements for landscape level biodiversity will be represented by applying overlapping cover requirements through the mature and old retention zone levels in CASH6. Similar requirements will also be applied within the forest connectivity corridors (FCC).

**Table 10.2 CASH6 Management Level Assignments**

| Management level | Disturbance zone | Policy # | Mature retention zone | Policy # | Old retention zone | Policy # |
|---|---|---|---|---|---|---|
| 1 | DWR, B1, IDFdm1 | 1 | | | | |
| | DWR, B1, MSdm1 | 2 | | | | |
| | DWR, B7, IDFdm1 | 3 | | | | |
| | DWR, B7, MSdm1 | 4 | | | | |
| | DWR, B7, ICHmk1 | 5 | | | | |
| | DWR, B8, IDFdm1 | 6 | | | | |
| | DWR, B8, MSdm1 | 7 | | | | |
| 2 | VQC Retention | 8 | | | | |
| | VQC Partial retention | 9 | | | | |
| | VQC Modification | 10 | | | | |
| 3 | | | FCC, B1 - H, IDFdm1 | 14 | FCC, B1 - H, IDFdm1 | 14 |
| | | | FCC, B1 - I, IDFdm1 | 15 | FCC, B1 - I, IDFdm1 | 15 |
| | | | FCC, B1 - H, MSdm1 | 16 | FCC, B1 - H, MSdm1 | 16 |
| | | | FCC, B1 - I, MSdm1 | 17 | FCC, B1 - I, MSdm1 | 17 |
| | | | FCC, B7 - L, ESSFdc1 | 18 | FCC, B7 - L, ESSFdc1 | 18 |
| | | | FCC, B7 - L, ICHmw2 | 19 | FCC, B7 - L, ICHmw2 | 19 |
| | | | FCC, B7 - L, MS dm1 | 20 | FCC, B7 - L, MS dm1 | 20 |
| | | | FCC, B8 - L, ESSFdc1 | 21 | FCC, B8 - L, ESSFdc1 | 21 |
| | | | FCC, B8 - L, MS dm1 | 22 | FCC, B8 - L, MS dm1 | 22 |
| 4 | IRM, B1 | 11 | | | | |
| | IRM, B7 | 12 | | | | |
| | IRM, B8 | 13 | | | | |
| 5 | | | B1 - H, ICHmk1 | 1 | B1 - H, ICHmk1 | 1 |
| | | | B1 - H, IDFdm1 | 2 | B1 - H, IDFdm1 | 2 |
| | | | B1 - I, IDFdm1 | 3 | B1 - I, IDFdm1 | 3 |
| | | | B1 - H, MSdm1 | 4 | B1 - H, MSdm1 | 4 |
| | | | B1 - I, MSdm1 | 5 | B1 - I, MSdm1 | 5 |
| | | | B7 - L, ESSFdc1 | 6 | B7 - L, ESSFdc1 | 6 |
| | | | B7 - L, ICHmk1 | 7 | B7 - L, ICHmk1 | 7 |
| | | | B7 - L, ICHmw2 | 8 | B7 - L, ICHmw2 | 8 |
| | | | B7 - L, IDFdm1 | 9 | B7 - L, IDFdm1 | 9 |
| | | | B7 - L, MSdm1 | 10 | B7 - L, MSdm1 | 10 |
| | | | B8 - L, ESSFdc1 | 11 | B8 - L, ESSFdc1 | 11 |
| | | | B8 - L, IDFdm1 | 12 | B8 - L, IDFdm1 | 12 |
| | | | B8 - L, MSdm1 | 13 | B8 - L, MSdm1 | 13 |

### *10.2.1 Forest Cover Objectives – Rationale*

Forest cover requirements for resource emphasis areas are based on the following sources.

#### 10.2.1.1 Disturbance Requirements - VQCs

The methodology for arriving at the maximum disturbance percentage in VQC zones is based on the report “Procedures for Factoring Recreation Resources into Timber Supply Analyses” (MoF, 1998).

*STEP 1 - review the visual landscape inventory*

Table 10.3 summarizes the productive area by VQC class.

**Table 10.3 VQC area summary**

| VQC | Total Area (ha) | Productive Area (ha) | Net Area (ha) |
|---|---|---|---|
| Retention (R) | 218 | 194 | 183 |
| Partial retention (PR) | 1,344 | 1,223 | 1,152 |
| Modification (M) | 9 | 8 | 5 |
| **Total** | 1,571 | 1,425 | 1,340 |

*STEP 2 - establish percent denudation range*

Table 10.4 summarizes the percent denudation range for each VQC, as listed in the Procedures report. These ranges apply to the total forested or "green" area of the landscape.

**Table 10.4 Percent denudation range for each VQC**

| VQC | % denudation range |
|---|---|
| R | 1.1 – 5 |
| PR | 5.1 – 15 |
| M | 15.1 – 25 |

*STEP 3 - establish percent denudation figure for each zone*

Based on the inventory data, the productive landbase is summarized in Table 10.5 by VQC and visual absorption capacity (VAC), in order to determine the area distribution by VAC within each VQC. The percentages included in this table are taken from Table 5 in the "Procedures". The area-weighted average values will be employed in the analysis.

**Table 10.5 VQC Productive area (ha) and percent distribution by VAC**

| VQC | VAC | | | | | | Total Area | Weighted Average |
|---|---|---|---|---|---|---|---|---|
| | High | | Medium | | Low | | | |
| | Area (ha) | % | Area (ha) | % | Area (ha) | % | (ha) | % |
| R | 0 | 5.0 | 173 | 3.0 | 21 | 1.1 | 194 | 2.8 |
| PR | 310 | 15.0 | 630 | 10.0 | 283 | 5.1 | 1,223 | 10.1 |
| M | 8 | 25.0 | 0 | 20.0 | 0 | 15.1 | 8 | 25.0 |
| **Total** | 318 | | 803 | | 304 | | 1,425 | |

### 10.2.1.2 Wildlife Requirements

Mule deer wintering areas will be managed using a combination of single tree selection, small patch cuts, and conventional clear-cut harvesting. Maximum disturbance requirements will be imposed throughout the mule deer winter range zone and the BEC variant level, as shown in Table 10.6. Single-tree selection (STS) management within the mule deer winter range zone never exceeds 50% basal area removal, and consequently is assumed to always satisfy green up requirements. Therefore, STS stands were modeled

so as to ensure that these stands never fall below the minimum green-up height in any of the resource emphasis areas.

#### 10.2.1.3 Greenup Requirements

Green-up height requirements in the mule deer winter range zone have been defined in accordance with the KBHLPO.

Green-up height requirements in the Integrated Resource Management (IRM) zone are specified by the KBHLPO – Objective #4. The KBHLPO specifies a green-up height of 2.5 metres on adequately stocked areas, and 3.0 meters for areas not adequately restocked. Given the fact that all existing NSR is scheduled for rehabilitation within the first five (5) years of the planning horizon, the green-up height of 2.5 metres will be applied to the IRM zone throughout the full planning horizon.

The green-up height requirements to be applied in the Visual Quality Objective (VQO) zones are specified in the Kootenay-Boundary Land Use Implementation Strategy.

A summary of forest cover constraints is provided in Table 10.6.

**Table 10.6 Forest cover requirements – base case**

| Resource Emphasis Area | Disturbance | |
|---|---|---|
| | Min height (m) | Max % |
| Mule deer winter range | 2.5 | 25 |
| Landscape unit B1, IDFdm1 | 2.5 | 25 |
| Landscape unit B1, MSdm1 | 2.5 | 25 |
| Landscape unit B7, IDFdm1 | 2.5 | 25 |
| Landscape unit B7, MSdm1 | 2.5 | 25 |
| Landscape unit B7, ICHmk1 | 2.5 | 25 |
| Landscape unit B8, IDFdm1 | 2.5 | 25 |
| Landscape unit B8, MSdm1 | 2.5 | 25 |
| Visual quality class | | |
| Retention | 7 | 2.8 |
| Partial retention | 7 | 10.1 |
| Modification | 6 | 25.0 |
| IRM | | |
| Landscape unit B1 | 2.5 | 25 |
| Landscape unit B7 | 2.5 | 25 |
| Landscape unit B8 | 2.5 | 25 |

### *10.2.2 Landscape level Biodiversity - Rationale*

Biodiversity planning is done in accordance with the KBHLPO (Objectives 1 and 2) and with the Landscape Unit Planning Guide, and the definition of "priority biodiversity" planning described therein. This priority biodiversity planning is the current focus of landscape unit planning and consists of two objectives: "retention of old growth forest; and stand structure through WTR".

Three of the landscape units defined for the Boundary Timber Supply Area through the KBHLPO intersect TFL 8 (see Table 7.1). Cover requirements for mature and old seral stage forests are modeled within each landscape unit at the BEC variant level. Mature and old seral stages are defined by the KBHLPO, as summarized in Table 10.7.

**Table 10.7 Mature and Old Seral Definitions**

| Natural Disturbance Type | BEC Zone | Mature (yrs) | Old (yrs) |
|---|---|---|---|
| NDT 2 | ICH | > 100 | > 250 |
| NDT 3 | ICH | > 100 | > 140 |
| | ESSF | > 120 | > 140 |
| | MS | > 100 | > 140 |
| NDT 4 | IDF | > 100 | > 250 |

All of the productive forest within each LU/BEC contributes to the seral stage requirements. The forest cover requirements as specified in the KBHLPO (Objective #2) are summarized in Table 10.8. The old growth retention target percentages reflect the policy of allowing 2/3 draw down within low biodiversity emphasis areas so long as full old growth requirements are met by the end of the third rotation. A rotation length of 71 years has been assumed in the table, following the example set in the Boundary Timber Supply Area TSR2 analysis report (MoF, 2000a). In reality, the CASH6 timber supply model does not allow the explicit representation of increasing retention levels over time. Therefore the approach taken in analysis is to set the targets at the first rotation level shown in the table (reflecting the 1/3 draw down where appropriate), and to verify through post simulation review of the model outputs that the full old growth target areas are retained by the end of the third rotation period.

**Table 10.8 BEC/NDT mature+old and old growth seral stage requirements**

| BEO | NDT | BEC Zone | Mature+Old | Old Retention % | | |
|---|---|---|---|---|---|---|
| | | | Retention % | 0 - 71 yrs | 72 - 141 yrs | > 141 yrs |
| Low | 2 | ICH | > 15 | > 3 | > 6 | > 9 |
| | 3 | ESSF | > 14 | > 4.7 | > 9.3 | > 14 |
| | | ICH | > 14 | > 4.7 | > 9.3 | > 14 |
| | | MS | > 14 | > 4.7 | > 9.3 | > 14 |
| | 4 | IDF | > 17 | > 4.3 | > 8.6 | > 13 |
| Intermediate | 3 | ICH | > 23 | > 14 | > 14 | > 14 |
| | | MS | > 26 | > 14 | > 14 | > 14 |
| | 4 | IDF | > 34 | > 13 | > 13 | > 13 |
| High | 3 | ICH | > 34 | > 21 | > 21 | > 21 |
| | | MS | > 34 | > 21 | > 21 | > 21 |
| | 4 | IDF | > 51 | > 19 | > 19 | > 19 |

Areas within the mule deer winter range zone that are to be managed by single tree selection are subject to 50% basal area removal at each entry. Therefore, once the first stand entry has been made they are assumed never to develop the structural characteristics of either mature or old seral habitat, although they do contribute to the total area of any LU/BEC seral zone in which they fall. In order to model this, the target percentages specified by the KBHLPO were adjusted as shown in Table 10.9. The target areas for each seral were calculated using the KBHLPO target percentages. Then, for each seral zone containing a component of STS management, the STS area within the zone was subtracted from the base area of the zone, and a new target percentage was calculated to achieve the KBHLPO target area within the reduced base area of the seral zone. The adjusted target percentages shown in the three right-most columns of Table 10.9 are the values actually applied in the timber supply analysis.

**Table 10.9 Seral stage requirements, adjusted for single tree selection**

| Seral Zone | Description | Base Area | STS Area | KBHLPO | | | | | | Adjusted | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mature+Old | 1/3 Old | 3/3 Old | Mature+Old | 1/3 Old | 3/3 Old | Mature+Old | 1/3 Old | 3/3 Old |
| | | ha | ha | % | % | % | ha | ha | ha | % | % | % |
| 1 | B1 - ICHmk1 - I | 2.25 | 0.00 | 23.0 | 14.0 | 14.0 | 0.52 | 0.32 | 0.32 | 23.00 | 14.00 | 14.00 |
| 2 | B1 - IDFdm1 - H | 2,870.44 | 755.13 | 51.0 | 19.0 | 19.0 | 1,463.92 | 545.38 | 545.38 | 69.21 | 25.78 | 25.78 |
| 3 | B1 - IDFdm1 - I | 1,629.59 | 125.96 | 34.0 | 13.0 | 13.0 | 554.06 | 211.85 | 211.85 | 36.85 | 14.09 | 14.09 |
| 4 | B1 - MSdm1 - H | 164.74 | 17.29 | 34.0 | 21.0 | 21.0 | 56.01 | 34.60 | 34.60 | 37.99 | 23.46 | 23.46 |
| 5 | B1 - MSdm1 - I | 1,753.98 | 0.00 | 26.0 | 14.0 | 14.0 | 456.03 | 245.56 | 245.56 | 26.00 | 14.00 | 14.00 |
| 6 | B7 - ESSFdc1 - L | 6,723.51 | 0.00 | 14.0 | 4.7 | 14.0 | 941.29 | 316.01 | 941.29 | 14.00 | 4.70 | 14.00 |
| 7 | B7 - ICHmk1 - L | 5,450.18 | 110.13 | 14.0 | 4.7 | 14.0 | 763.02 | 256.16 | 763.02 | 14.29 | 4.80 | 14.29 |
| 8 | B7 - ICHmw2 - L | 307.02 | 0.00 | 15.0 | 3.0 | 9.0 | 46.05 | 9.21 | 27.63 | 15.00 | 3.00 | 9.00 |
| 9 | B7 - IDFdm1 - L | 6,597.93 | 1,279.97 | 17.0 | 4.3 | 13.0 | 1,121.65 | 283.71 | 857.73 | 21.09 | 5.33 | 16.13 |
| 10 | B7 - MSdm1 - L | 16,020.59 | 141.66 | 14.0 | 4.7 | 14.0 | 2,242.88 | 752.97 | 2,242.88 | 14.12 | 4.74 | 14.12 |
| 11 | B8 - ESSFdc1 - L | 3,601.73 | 0.00 | 14.0 | 4.7 | 14.0 | 504.24 | 169.28 | 504.24 | 14.00 | 4.70 | 14.00 |
| 12 | B8 - IDFdm1 - L | 9,789.12 | 615.02 | 17.0 | 4.3 | 13.0 | 1,664.15 | 420.93 | 1,272.59 | 18.14 | 4.59 | 13.87 |
| 13 | B8 - MSdm1 - L | 18,264.46 | 8.60 | 14.0 | 4.7 | 14.0 | 2,557.02 | 858.43 | 2,557.02 | 14.01 | 4.70 | 14.01 |

### *10.2.3 Forest Connectivity Corridors – Rationale*

The KBHLPO identifies designated forest connectivity corridors (FCCs), and stipulates that old and mature seral objectives as defined in Table 10.8 are to be met by drawing qualifying area from a hierarchy of landbase categories. A simplified interpretation of this strategy was implemented for the present analysis as follows.

In addition to being part of the resource emphasis areas defined by the LU-BEC/BEO units on management level 5 in Table 10.2, FCCs were also defined as separate resource emphasis areas within each LU-BEC/BEO unit, as indicated by management level 3 in Table 10.2. Target percentages for mature and old seral retention within each FCC resource emphasis area were calculated based on the target hectares shown in Table 10.9 for the seral zone to which they belong, assuming that as much of the target area as possible should come from the FCC even if that meant that 100% of the FCC was reserved for biodiversity. These target percentages were adjusted to reflect the presence of any STS areas within the FCC zone in a manner analogous to the method described in the preceding section. Thus, the action of the seral cover requirements within the FCC zones is to reserve as much of the FCC as needed (up to 100%) to meet the target area for the larger seral zone that defines the FCC zone. The action of the cover constraints applied to the larger seral zones causes any shortfall in the area available in the FCC portion of the seral zone to be taken from the remainder of the seral zone.

### *10.2.4 Stand Level Biodiversity – Rationale*

The practice of leaving wildlife tree patches (WTPs) was modeled by reducing the average volume per hectare that is harvested, to account for trees that must be left within cutblocks. The methodology for determining this allowance has been described in Section 6.13.

## 10.3 Cultural Heritage Resources

There are no known cultural heritage resources with any associated timber supply impact within the boundaries of TFL 8.

## 10.4 Timber Harvesting

### *10.4.1 Minimum Merchantability Standards*

Minimum harvest age was assessed for each analysis unit, as the age at which the mean annual increment (MAI) in stand volume reaches 95% of it's maximum value. Culmination age is defined as the age at which stand volume, less decay, waste and breakage, is maximized to a precision of one decimal place. The large number of analysis units used to represent growth and yield relationships precludes a tabular summary of minimum harvest ages. Instead, the distribution of net landbase area by minimum harvest age categories is illustrated in Figure 10.1. The impact of this choice of MHA criterion was explored as a sensitivity analysis issue.

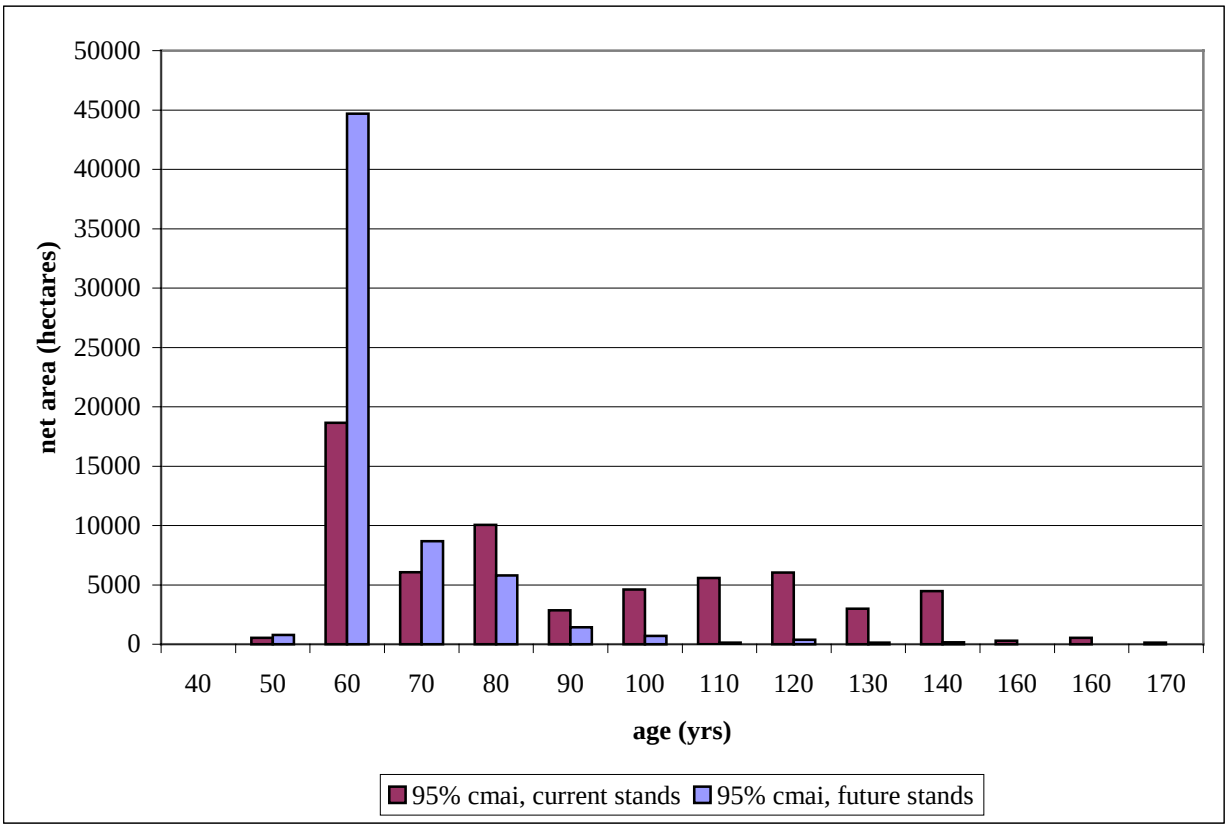


**Figure 10.1 Minimum harvest ages, at 95% of culmination MAI**

It should be recognized that the application of cover constraints in particular zones may delay stand entry well beyond these minimum ages. This will result in realized long-term harvest levels that are lower than the theoretical Long Run Sustained Yield (LRSY), which is based on harvesting all stands at culmination age. LRSY values calculated on the basis of both natural and managed stand yield curves are shown in Table 10.10.

**Table 10.10 LRSY values for natural and managed stands**

| Description | Natural | Managed |
|---|---|---|
| THLB, including NSR (ha) | 65,918 | 65,918 |
| - future roads (ha) | 0 | 2,091 |
| = Long term THLB (ha) | 65,918 | 63,827 |
| * average MAI at culmination ($m^3$/ha) | 2.71 | 4.22 |
| **= theoretical gross LRSY ($m^3$/yr)** | 178,639 | 269,184 |
| - wildlife tree patch retention ($m^3$/yr) | 7,146 | 10,767 |
| - non-recoverable losses ($m^3$/yr) | 900 | 900 |
| **= theoretical net LRSY ($m^3$/yr)** | 170,593 | 257,517 |

Various harvest methods will be employed across TFL 8 in consideration of both harvesting and silvicultural systems.

### *10.4.2 Initial Harvest Rate*

The current AAC for TFL 8[3] is 144,720 $m^3$/yr. In addition, an allowance must be made for non-recoverable losses. As the timber supply analysis is based on the net harvest plus NRLs, the initial gross harvest level for the current management strategy option was set to 145,620 $m^3$/yr, providing a starting point for the analysis.

### *10.4.3 Harvest Rule*

Harvest rules are used by the simulation model to rank stands for harvest. The standard rule is oldest first. With this rule, older stands are queued for harvest ahead of younger stands. Harvest rules interact with forest cover constraints to determine the actual order of harvesting within the model. If a higher ranked stand is in a constrained zone and cannot be harvested then the model will choose the next highest ranked stand that can be harvested.

### *10.4.4 Harvest Flow Objectives*

In all phases of the analysis, the harvest flow will reflect a balance of the following objectives:

- Maintain short term levels as long as possible;
- Limit shifts in harvest level to less than 10% of the level prior to the shift; and
- Achieve a long term stable harvest level.

Forest cover constraints and biological capacity of the net operable landbase will ultimately dictate the harvest level determined in the analysis.

[3] The current AAC is defined by Instrument No. 20 for TFL 8.

# 11. SENSITIVITY ANALYSES

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

## 11.1 Landbase Definition

### *11.1.1 Adjust timber harvesting landbase by +/- 10%*

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

## 11.2 Growth and Yield Assumptions

### *11.2.1 Adjust natural stand yields by +/- 10%*

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

### *11.2.2 Adjust managed stand yields by +/- 10%*

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

### *11.2.3 Adjust managed stand minimum harvest ages +/- 10 years*

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

### *11.2.4 Alter minimum harvest ages to age at 90% of culmination MAI*

Stand minimum harvest ages will be set to the age at which MAI reaches 90% of it's maximum value.

### *11.2.5 Alter minimum harvest ages to age at 100% of culmination MAI*

Stand minimum harvest ages will be set to the age at which MAI reaches it's maximum value.

### *11.2.6 Adjust regeneration delay by +/- 1 year*

Regeneration delay will be altered to measure the timber supply impact.

### *11.2.7 Apply FIP site index to MSYTs in ESSF*

The effect of the site index adjustment applied to stands in the ESSFdc1, based on an empirically derived elevation model, was removed by using the inventory site index to derive new MSYTs for those stands.

### *11.2.8 Apply FIP site index to all MSYTs*

The effect of the site index adjustment applied to future managed stand growth predictions was removed by using the inventory site index to derive new MSYTs for the entire THLB.

## 11.3 Resource Emphasis Assumptions

### *11.3.1 Adjust green-up heights by +/- 1 metre*

Green-up heights will be altered to measure the impacts on timber supply.

### *11.3.2 Alter IRM maximum disturbance limits by +/- 5 %*

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

### *11.3.3 Alter VQC maximum disturbance limits by +/- 5 %*

VQC disturbance percentages will be altered by +/- 5%

### *11.3.4 Alter DWR maximum disturbance limits by +/- 5 %*

Maximum disturbance limits in the mule deer winter range zone will be altered by +/- 5%

### *11.3.5 Apply mature thermal cover retention requirements in DWR*

Following the Kootenay-Boundary Land Use Plan Implementation Strategy for Mule deer winter range as closely as is possible in an aspatial forest level analysis context, the mature forest cover requirements shown in Table 11.1 will be applied to the mule deer winter range zone in this sensitivity analysis.

**Table 11.1 Mule deer winter range mature forest retention requirements**

| Mule deer winter range type | **Min age (yrs)** | **Min %** |
|---|---|---|
| IDF dm 1, slopes < 50% | 101 | 25 |
| IDF dm 1, slopes > 50%, southern aspects | 101 | 15 |
| ICH mk 1 | 121 | 35 |
| MS dm 1 | 121 | 35 |

The requirements shown in the table will be applied within the mule deer winter range areas at the LU-BEC variant level.

### *11.3.6 Reduce yields in NDT4 open forest types*

To simulate the impact of converting, and maintaining, selected NDT4 areas in an open forest condition, stand yields will be reduced. Based on a comparison of TASS (Tree and Stand Simulator) runs at 1500 trees/ha (representative of fully stocked condition) and at 100 trees/ha (representative of open forest regime), management to produce open forest conditions was assumed to result in an 80% reduction in yield compared to a fully stocked stand.

## 11.4 Biodiversity Assumptions

### *11.4.1 Adjust minimum age for mature seral condition by +/- 10 years*

The minimum ages defining the onset of mature seral stand structures will be altered by +/- 10 years to assess the impact on timber availability and supply.

### *11.4.2 Adjust mature+old seral retention target +/- 5 %*

The minimum retention targets for mature + old seral habitat will be altered by +/- 5 % to assess the impact on timber availability and supply. Appropriate adjustments will be made to account for the presence of single tree selection areas and forest connectivity corridors within each LU/BEC variant (see Sections 10.2.2 and 10.2.3 for further details).

### *11.4.3 Adjust minimum age for old seral condition by +/- 10 years*

The minimum ages defining the onset of old seral stand structures will be altered by +/- 10 years to assess the impact on timber availability and supply.

### *11.4.4 Adjust old seral retention target +/- 2 %*

The minimum retention targets for old seral habitat will be altered by +/- 2 % to assess the impact on timber availability and supply. Appropriate adjustments will be made to account for the presence of single tree selection areas and forest connectivity corridors within each LU/BEC variant (see Sections 10.2.2 and 10.2.3 for further details).

# 12. REFERENCES

Pope & Talbot, 1996. TFL 8 Management Plan 9, Appendix V – Timber Supply Analysis.

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