# TIMBER SUPPLY ANALYSIS

# TREE FARM LICENSE 35
# APPENDIX I: DATA PACKAGE

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***Subject: Data Package for TFL 35 (Jamieson Creek)***

This Data Package has been revised from the January 13, 2010 version as per the May 25, 2010 conference call with David Stuart (Timber Supply Forester, MFR FAIB). This data package now becomes Appendix I of the Timber Supply Analysis Report. If you have any questions at all about the content of this analysis, please feel free to contact myself or Jerry Miehm (jerry.miehm@tecogroup.ca).

Yours Truly,

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# 1.0 INTRODUCTION

## 1.1 Background

On October 21, 2008 the Deputy Chief Forester issued a letter requesting the advancement of the timber supply review schedule due to sustainability concerns. On November 12th, 2008 Weyerhaeuser Company Ltd. (Weyerhaeuser) provided rationale for extending the date for a timber supply review until April 2013, which is the maximum date to complete a determination after the subdivision (which occurred in 2008) of a Tree Farm Licence (TFL). This request was denied and a determination was set for June 30, 2010. Subsequent to this, the licence transfer of TFL 35 from Weyerhaeuser to West Fraser Mills Ltd. (West Fraser) was completed and the deputy Chief Forester issued a letter on June 23, 2010 which has extended the AAC determination date to December 17, 2010.

The last Annual Allowable Cut (AAC) determination for TFL 35, effective March 1st, 2004, set the AAC at 326,600$m^3$/yr[1]. This included a 200,000 $m^3$/yr uplift for fire and mountain pine beetle (MPB) salvage. The data package prepared by Weyerhaeuser for Management Plan (MP) 9[2][3] formed the basis of the information used for the uplift timber supply analysis in 2004.

A Type II Silviculture Strategy[4] (Type II) was completed in March 2008 to explore opportunities to improve the quality and quantity of the timber supply on TFL 35 through investments in incremental silviculture. The Type II data package along with the data package prepared for MP 9 form the basis of the information that describes the data and assumptions used in this analysis.

## 1.2 Changes from the Previous TSR

Many inputs into the analysis process change over time as information is continually updated and legislation is changed. The major changes from the last timber supply review are:

- Updated Land-base summary (see Section 5.0)
- Old Growth Management Areas (OGMA's) have been identified spatially
- MPB impact on mature and Post-Harvest Regenerated (PHR) stands has been modelled. Virtually 100% of the mature pine was attacked by summer 2006

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[1] Ministry of Forests and Range. Tree Farm Licence 35. Rationale for Allowable Annual Cut (AAC) Determination Effective November 1, 2001.

[2] Curry, RPF, Sean. 2000. Timber supply analysis information package for Management Plan #9 on TFL 35; Aug. 4, 2000 revision. Weyerhaeuser Company Limited. iii + 37 pp.

[3] Curry, RPF, Sean. Year unknown. Timber supply analysis for Management Plan #9 on TFL 35. Weyerhaeuser Company Limited. viii + 101 pp.

[4] Timberline Natural Resource Group. Type II Silviculture Strategy, TFL 35 – Jamieson Block. Data Package. March 2008. 20 pp.

- McLure Fire salvage harvesting operations have been completed
- Bark beetle outbreak in spruce leading stands >1500m in the Wentworth Lake area
- Approval of Weyerhaeuser's Forest Stewardship Plan[5] (June 4, 2007) and subsequent changes to management assumptions

[5] Weyerhaeuser Company Ltd., Forest Stewardship Plan for FLA18694, FLA74910, TFL 35 (Jamieson Block), NRFL A76492, Southern Interior Region, Kamloops TSA, Kamloops and Headwaters Forest Districts. June 2007. 51pp + Appendices

# 2.0 INVENTORY INFORMATION

Table 1 provides a list of data sources used in this analysis.

**Table 1 Inventory Information**

| Description | TNRG Coverage Name | Origin | Date last updated | Comments |
|---|---|---|---|---|
| Archaeological Impact Assessment | aoa | MoF Model | 1999 | MoF model replaced 1996 LRMP AIA. |
| Badger WHA | badger | LRDW | 2007 | |
| McLure Fire | mclure_fire | MoF | 2003 | Outer Boundary of McLure Fire |
| Moose Winter Habitat RMZ | moose_wr | LRMP | 1996 | |
| Non-Status Roads | n_status_rds | Weyerhaeuser Company Ltd. | 2007 | TRIM base updated with Weyerhaeuser operational data. |
| Old Growth Management Areas | ogma | Weyerhaeuser Company Ltd. | 2007 | Weyerhaeuser FSP, Appendix B(b) June 2007 |
| Range Tenure | range | LRDW | 2007 | |
| Recreation Areas | rec_polys | LRDW | 2007 | |
| Reserves | reserves | Weyerhaeuser Company Ltd. | 2007 | Operationally updated as blocks were developed |
| Status Roads | status_rds | Weyerhaeuser Company Ltd. | 2008 | TRIM base updated with Weyerhaeuser operational data. |
| Streams | streams | Weyerhaeuser Company Ltd. | 2007 | TRIM base updated with Weyerhaeuser operational data. |
| Forest Cover | t_fc_rc | Weyerhaeuser Company Ltd. | 2008 | 1978 FC Inventory updated with disturbance and silviculture activities 2008Q2. |
| Terrestrial Ecosystem Mapping | tem | Weyerhaeuser Company Ltd. | 2001 | Keystone Environmental completed the inventory under FIA |
| Terrain Stability Mapping | terrain | Weyerhaeuser Company Ltd. | 2000 | June Ryder and Associates completed the mapping |
| Proposed Blocks | tfl35_prop | Weyerhaeuser Company Ltd. | 2008 | Operationally updated as blocks were developed |
| TFL Boundary | tfl_bnd | Weyerhaeuser Company Ltd. | 1998 | SBFEP area removed in 1998 |

| Description | TNRG Coverage Name | Origin | Date last updated | Comments |
|---|---|---|---|---|
| Visual Quality Objectives | vqo | LRDW | 1999 | |
| Riparian Buffers | rip_final | TNRG | 2007 | Buffer created from forest cover |
| Existing Road Buffers | exist_buf | TNRG | 2009 | Buffer created from road data |
| Proposed Road Buffers | prop_buf | TNRG | 2009 | Buffer created from road data |
| Mule Deer Winter Range | mdw_tfl35 | LRMP | 1996 | |
| Named Lake Buffers | lake_buf | TNRG | 2007 | Buffer created from forest cover |
| Unnamed Lake Buffers | ulake_buf | TNRG | 2007 | Buffer created from forest cover |
| H60 and Watersheds | h60 | Weyerhaeuser Company Ltd. | | Weyerhaeuser data, created when IWAPs were done |
| Logged Blocks in McLure Fire | log_fire | Weyerhaeuser Company Ltd. | 2007 | Existing logged blocks within fire boundary |
| WTP Grid Buffered at 1/2 ha | wtp_gridb | Weyerhaeuser Company Ltd. | 2007 | Weyerhaeuser FSP, Appendix B(i) June 2007 |
| WTP Retention Areas | wtr | Weyerhaeuser Company Ltd. | 2007 | Operationally updated as blocks were developed |
| Salvage Blocks | salv | Weyerhaeuser Company Ltd. | 2007 | Operationally updated as blocks were developed |
| Blocks | blk | Weyerhaeuser Company Ltd. | 2007 | Operationally updated as blocks were developed |
| MPB Projection | mpb_all | TNRG | 2007 | Created by TNRG from MoF projections |
| Spruce Bark Beetle | sprucebb | TNRG | 2009 | Created by TNRG from Weyco field reconnaissance |

## 2.1 Implementation

The following sub-sections highlight current management topics for TFL 35.

### *2.1.1 Harvest Performance Reporting*

The 2001 and 2004 AAC Rationale documents have requested that Weyerhaeuser report on its harvesting performance in Marginally Merchantable Stands (MMS) and Terrain Class IV stands. Table 2 shows the harvest performance from 2001-2008 for each category against the total annual harvest on TFL 35 by year. Harvest scheduling during this reporting period

has been focussed on MPB, spruce bark beetle (IBS) and fire salvage operations in accordance with the harvest priorities as stated in Management Plan 9. Almost all of the AAC harvested since 2003 has been salvage priority timber, which would have had an impact on the amount of MMS and TC 4 area that was harvested. Marginally merchantable stands are defined according to the criteria in Table 3.

**Table 2 Harvest Performance in MMS and Terrain Class IV**

| Year | Annual Harvested Area (ha) | MMS Harvest Area (ha) | MMS % of Annual Harvest | TCIV Harvest Area (ha) | TC IV % of Annual Harvest |
|---|---|---|---|---|---|
| 2001 | 398 | 0.0 | 0.0 | 1.7 | 0.4 |
| 2002 | 369 | 0.0 | 0.0 | 1.5 | 0.4 |
| 2003 | 575 | 0.0 | 0.0 | 35.1 | 6.1 |
| 2004 | 1,665 | 0.0 | 0.0 | 47.5 | 2.9 |
| 2005 | 1,036 | 0.0 | 0.0 | 10.7 | 1.0 |
| 2006 | 813 | 0.0 | 0.0 | 3.0 | 0.4 |
| 2007 | 641 | 8.4 | 1.3 | 3.6 | 0.6 |
| 2008 | 303 | 19.4 | 6.4 | 0.0 | 0.0 |
| **Total** | **5,800** | **27.8** | **0.5** | **103.1** | **1.8** |
| **Total MMS / TCIV on the landbase (THLB)** | | **1,434** | | **1,066** | |

**Table 3 Marginally Merchantable Stands**

| Leading Species | Age Class | Height Class | Stocking Class |
|---|---|---|---|
| Pine | >5 | <3 | All |
| | >4 | <3 | All |
| All | All | All | 4 / R |

MP 9 states "Weyerhaeuser will harvest within steep slope areas in proportion to their contribution to the harvest level during the term of MP No. 9. Harvesting on steep slopes will be subject to the development of an adequate volume of timber to make the project economically and operationally viable". The term of MP 9 expires in July 2014 and steep slope harvest operations will be planned during the remaining portion of this term if viable given the current depressed economic conditions and the quality of beetle-killed timber where it exists. Similarly, MMS will be targeted for harvesting where economically viable. Weyerhaeuser will continue to include 100% of MMS and TC IV stands in the THLB.

### *2.1.2 Forest Inventory*

The inventory for TFL 35 is a combination of a 1978 mature inventory, updated for harvesting and silviculture activities up to January 1, 2008. The impact of the McLure Fire is also reflected in this current inventory for depletions, updated survey information and mature forest cover (see Section 5.8 for OAF reductions to the Douglas-fir leading stands

within the fire). An audit of the mature inventory was completed in 1994-95 which showed the inventory to be statistically acceptable and to slightly under-estimate the ground audit volume. The inventory has been updated to reflect MPB salvage up to January 2008 and these stands will follow managed stand yield curves. Shelf life assumptions will be applied to the remaining MPB-affected stands as described in Section 7.8.

### *2.1.3 American Badger Wildlife Habitat Areas*

Two Wildlife Habitat Areas (#3-117 and 3-118) for the American Badger have been approved by the Deputy Minister in the spring of 2010. Both of these areas are in pine-leading second-growth stands where ground squirrel colonies have established. A third area (#3-116) had been proposed, but was not submitted due to the range management and corral system in the area. The Accounts and Measures for Managing Identified Wildlife for badger allow for harvesting activities to occur and reduced stocking densities (<75 stems/ha) are recommended. The WHA designations may be removed (or relocated) over time as the early seral conditions advance in age and crown closure increases resulting in the ground squirrel colonies move elsewhere. The 7.3 hectare area of the WHA's has been removed from the THLB.

# 3.0 ZONE AND ANALYSIS UNIT DEFINITIONS

## 3.1 Management Zones and Objectives

Management zones are established to reflect areas to which specific management objectives or targets are to be applied in the model. Table 4 outlines objectives that are to be incorporated into the base case. Modelling assumptions associated with forest cover constraints are discussed in Section 5.7 below.

**Table 4 Objectives to be tracked**

| Objective / Issue | Methodology |
|---|---|
| Riparian Management | Land Base Netdown and Volume Reductions |
| Landscape Level Biodiversity<br>- Old Growth Management Areas | Land Base Netdown |
| Stand Level Biodiversity (Wildlife Tree Patches) | Land Base Netdown |
| Moose Habitat | Forest Cover Constraint |
| Mule Deer Winter Range | Forest Cover Constraint |
| Badger Habitat | Land Base Netdown |
| Visual Quality Objectives | Forest Cover Constraint |
| Integrated Resource Management and Green-Up | Forest Cover Constraint |

## 3.2 Analysis Unit Definitions

Each polygon on the land base is assigned either an existing natural or existing managed analysis unit depending on the age and silviculture history of the polygon. Every stand is also assigned a future managed stand analysis unit according to the expected regeneration assumptions for that polygon.

### *3.2.1 Existing Natural Stands*

Stands with a projected age of greater than 47 years, and stands without cutblock information with a projected age less than 47 years are considered to be existing natural stands. These stands are assigned an existing natural stand analysis unit and will be modelled with an inventory site index using VDYP 6.6d. Existing natural stand yields will be modelled for each VRI polygon and yield curves will be incorporated into the timber supply model.

### *3.2.2 Existing Managed Stands*

Stands less than projected age 47 years with cutblock information are considered to be existing managed stands. These stands are assigned an existing managed stand analysis unit and will be modelled using TIPSY 4.1. As above, existing managed stand yields will be modelled for each VRI polygon and the yield curves which will be incorporated into the timber supply model.

### *3.2.3 Future Managed Stands*

Following harvest, each stand is assigned to a future managed stand analysis unit according to the regeneration assumptions for that stand. Consistent with MP9, future managed stand analysis units are defined according to BGC variant and site series with some specific silviculture practices associated with management for future mule deer habitat. Regeneration assumptions are applied to each analysis unit as described in Section 5.5.

# 4.0 TIMBER HARVESTING LAND BASE DEFINITION

The THLB is defined as all productive forest expected to support timber harvesting within the TFL. The THLB is determined by netting out categories of land that do not contribute to timber harvesting. Detailed descriptions of each land classification step are included in subsequent sections. Table 5 shows the areas removed from the THLB in each of the netdown categories.

**Table 5 Timber Harvesting Land Base Definition**

| Land Base Classification | Area (ha) | % of Total Area | % of Productive Forest |
|---|---|---|---|
| Total Land Base (Gross Area) | 36,557 | 100.0 | |
| Non-Forest / Non-Productive Forest | 1,072 | 2.9 | |
| Non-Commercial Cover | - | - | |
| Existing Roads, Trails and Landings | 1,048 | 2.9 | |
| **Total Productive Forest** | **34,438** | 94.2 | 100.0 |
| *Reductions to Productive Forest:* | | | |
| Low Site Productivity | 182 | 0.5 | 0.5 |
| Inoperable Areas | 232 | 0.6 | 0.7 |
| Old Growth Management Areas | 485 | 1.3 | 1.4 |
| Deciduous Leading Stands | 71 | 0.2 | 0.2 |
| Riparian Reserves - Streams | 313 | 0.9 | 0.9 |
| Riparian Reserves - Lakes | 70 | 0.2 | 0.2 |
| Riparian Reserves - Wetlands | 43 | 0.1 | 0.1 |
| Badger Habitat | 7 | 0.0 | 0.0 |
| Wildlife Tree Patches - Existing | 550 | 1.5 | 1.6 |
| Wildlife Tree Patches - Future | 57 | 0.2 | 0.2 |
| Proposed Roads | 31 | 0.1 | 0.1 |
| *Total Reductions to Productive Forest* | *2,041* | *5.6* | *5.9* |
| **Current Timber Harvesting Land Base** | **32,447** | 88.6 | 94.1 |

## 4.1 Non-Forest/ Non-Productive Forest

Table 6 summarizes the specific categories within the non-forest designation.

**Table 6 Non-Forest, Non-Productive and Non-Commercial**

| Logging History | Projected Type Identity[1] | Reduction (%) |
|---|---|---|
| No | 0 (Unassigned) | 100 |
| | 5 (Non-Commercial) | 100 |
| | 6 (Non-Productive) | 100 |
| | 8 (No Typing Available) | 100 |

**Data Source and Comments**

The projected type identity data was provided in the Forest Cover inventory (t_fc_rd) coverage.

## 4.2 Existing Roads

A complete road inventory exists for the TFL with roads classified into four categories: main, operational, block, and trails. Roads were buffered according to the right-of-way widths (Table 7). Right of way widths are based on MP 9 analyses and have been verified through random checks.

**Table 7 Existing Roads**

| Road Class | R/W Width (m) | Reduction (%) | Length (km) |
|---|---|---|---|
| Main | 25 | 100 | 26.9 |
| Operational | 15 | 100 | 657.0 |
| Block | 6 | 100 | 16.3 |
| Trails | 5 | 100 | 51.3 |
| **Total** | | | **751.5** |

**Data Source and Comments**

The road data was provided in the status roads (status_rds) and non-status roads (n_status_rds) coverages. Right-of-way widths as per MP 9 are used[6].

## 4.3 Low Site Productivity

The Terrestrial Ecosystem Mapping (TEM) project identified additional polygons with a "leading non-productive site series" that were not part of our current forest inventory. Because TEM polygon boundaries do not necessarily align with forest cover polygon boundaries, portions of these NP TEM polygons are forested. Given the limited extent of

[6] Phone conversation with Sean Curry June 29th, 2007.

this overlap and the relatively low site indices and reforestation issues, these NP sites from the TEM are removed from the operable land base (Table 8).

**Table 8 Low Productivity Site Series**

| Site Series | Site Series Description | Site Index | Reduction (%) |
|---|---|---|---|
| MSdm2 02 | Juniper - Bluebunch Wheatgrass | 11.2 | 100 |
| ESSFdc2 02 | Juniper - Pinegrass | 11.7 | 100 |
| ESSFdc2 09 | Sedge - Sphagnum | 10.4 | 100 |
| ESSFxc 02 | Pl – Juniper - Lupine | 9.0 | 100 |
| ESSFxc 09 | Bluejoint - Sedge | 9.0 | 100 |
| ESSFxc 10 | Willow - Sedge | 8.7 | 100 |

**Data Source and Comments**

Site series values were taken from the TEM (tem) coverage using the appropriate value based on the leading species described in the Forest Cover inventory (t_fc_rc) coverage. Site index values from the Forest Cover inventory were used for those species with no corresponding site index values in the TEM coverage.

## 4.4 Inoperable Areas

Terrain stability mapping is a method to delineate areas of slope stability with respect to stable, potentially unstable, and unstable terrain within a particular landscape. For this analysis, class V terrain is considered as 100% removed from the THLB, while class IV terrain remains in the THLB. Table 9 below contains the reductions for the two classifications.

**Table 9 Potentially Unstable Slopes**

| Stability Mapping Class | Reduction (%) |
|---|---|
| IV | - |
| V | 100 |

**Data Source and Comments**

The stability mapping class was provided in the terrain coverage.

## 4.5 Old Growth Management Areas (OGMA)

Target OGMA's for the TFL were established through Kamloops LRMP[7]. A draft set of OGMA's were established for TFL 35 in the spring of 2010 by the Integrated Land Management Bureau. These draft OGMA's will be used in this data package. No harvesting

[7] Kamloops Land and Resource Management Plan. July 1995.

is expected to occur in OGMAs and therefore these areas have been removed from the THLB (Table 10).

**Table 10 Old Growth Management Areas**

| Description | Reduction (%) |
|---|---|
| OGMA | 100 |

**Data Source and Comments**

OGMA data was drawn from the ogma coverage.

## 4.6 Deciduous Leading Stands

All deciduous leading stands without a harvest history are removed from the productive forest land base. Any conifer volume contained within this area is not included in the calculation of the conifer harvest levels for this analysis (Table 11). However, future market demand for deciduous species may lead to harvesting in these types and this removal may be re-considered.

**Table 11 Deciduous Leading Stands**

| Logging History | Leading Species | Reduction (%) |
|---|---|---|
| No | Aspen | 100 |
| | Cottonwood | 100 |
| | Birch | 100 |

**Data Source and Comments**

Leading species was determined using the Forest Cover inventory (t_fc_rd) coverage.

## 4.7 Riparian Reserves and Management Zones

All streams within the TFL have been classified. Reserve and management zone widths represent operational practices and objectives as defined in the Forest Stewardship Plans for the TFL.

Riparian reserve and management zone boundaries are determined by buffering riparian features according to the riparian feature class and the buffer widths described in Table 12. Management in these areas is modelled through land base net downs.

Basal area retention factors shown reflect current practice, and are modelled through percent volume reductions which are applied to the yield curves. The reductions are applied only to riparian management zones.

### Table 12 Riparian Management Areas

| Riparian Class | Riparian Management Area | | | |
|---|---|---|---|---|
| | Reserve Zone Width (m) | Management Zone | | |
| | | Width (m) | Basal Area Retention (%) | Forest Cover Constraint |
| *Streams* | | | | |
| S2 | 30 | 20 | 20 | |
| S3 | 20 | 20 | 20 | |
| S4 | 0 | 30 | 10 with fish, 0 without fish | |
| S5 | 0 | 30 | 10 | |
| S6 | 0 | 20 | 0 | |
| *Lakes* | | | | |
| A | 200 | 0 | 100 | |
| B | 0 | 200 | | <= 10% of RMA <3m, areas < 3m to be < 10ha, <50% of RMA to be harvested within any 25yr period |
| C | 10 | 90 | | <= 25% of the RMA <3m, areas < 3m to be < 10ha, |
| D | 0 | 100 | | no reserve, <= 30% of the RMA < 3m |
| E | 0 | 100 | | <= 50% of the RMA < 3m |
| *Wetlands* | | | | |
| W1 | 10 | 40 | 10 | |
| W2 | 10 | 20 | 10 | |
| W3 | 0 | 30 | 0 | |
| W4 | 0 | 30 | 10 | |
| W5 | 10 | 40 | 10 | |

**Data Source and Comments**

Riparian buffers were created based on the classes and buffer widths from Table 12 and are included in the riparian buffer (rip_final) coverage.

## 4.8 Badger Habitat

Two small Wildlife Habitat Areas have been identified for the protection of badger habitat. These have been removed from the timber harvesting land base (Table 13).

**Table 13 Badger Habitat**

| Description | Reduction (%) |
|---|---|
| Badger Habitat (Core) | 100 |

**Data Source and Comments**

These areas were identified in WHA data that was downloaded from the LRDW. The total WHA area on the TFL is 7.2 hectares.

## 4.9 Wildlife Tree Patches

Existing wildlife tree patches (WTP's) have been identified and have been excluded from the THLB as per Table 13. An analysis was undertaken to determine the amount and general location of future WTP's required to meet objectives stated in the Biodiversity Guidebook[8]. Future WTP's were determined by applying a 250-meter buffer (effective WTP area-of-influence) to all forested polygons not in the THLB (existing WTP's, low site, inoperable areas, OGMA, deciduous leading stands, problem forest types (PFT), riparian reserves, and enhanced riparian reserves). The resulting area outside this buffer is area that potentially requires a WTP.

A GIS-based grid generated points showing locations of all WTP's across the TFL. A total of 121 points fell outside the non-THLB buffered area and these identify the potential locations of future WTP's required to provide uniform coverage. The current average WTP size (both THLB and non-THLB) on the TFL is 0.5 hectares. Each of the required WTP points was then buffered, creating a 0.5 hectare WTP which was then spatially netted out of the THLB. While this may not be the ideal or exact location of future WTP's it provides a reasonable approximation of the area required to fulfill WTP requirements.

**Table 14 Wildlife Tree Patches**

| Wildlife Tree Patch | Reduction (%) |
|---|---|
| Existing | 100 |
| Future | 100 |

**Data Source and Comments**

Existing WTP's are described in the reserve coverage, while future WTP's are defined in the WTP grid buffered at 0.5 ha (wtr_grid) coverage.

## 4.10 Future Roads

TFL 35 has a well developed road network, and future roads have been located spatially, buffered and removed from the THLB. Table 14 below describes the future road forecast.

[8] Ministry of Forests and Range. September 1995. Biodiversity Guidebook.

**Table 15 Future Roads**

| Road Class | R/W Width (m) | Reduction (%) | Length (km) |
|---|---|---|---|
| Operational | 15 | 100 | 22.6 |
| Block | 6 | 100 | 1.4 |
| Trails | 5 | 100 | 1.4 |
| **Total** | | | **25.3** |

**Data Source and Comments**

The proposed road buffers (prop_buf) coverage illustrates future permanent roads and trails. Temporary roads are not included in this coverage.

## 4.11 Additional Net Downs

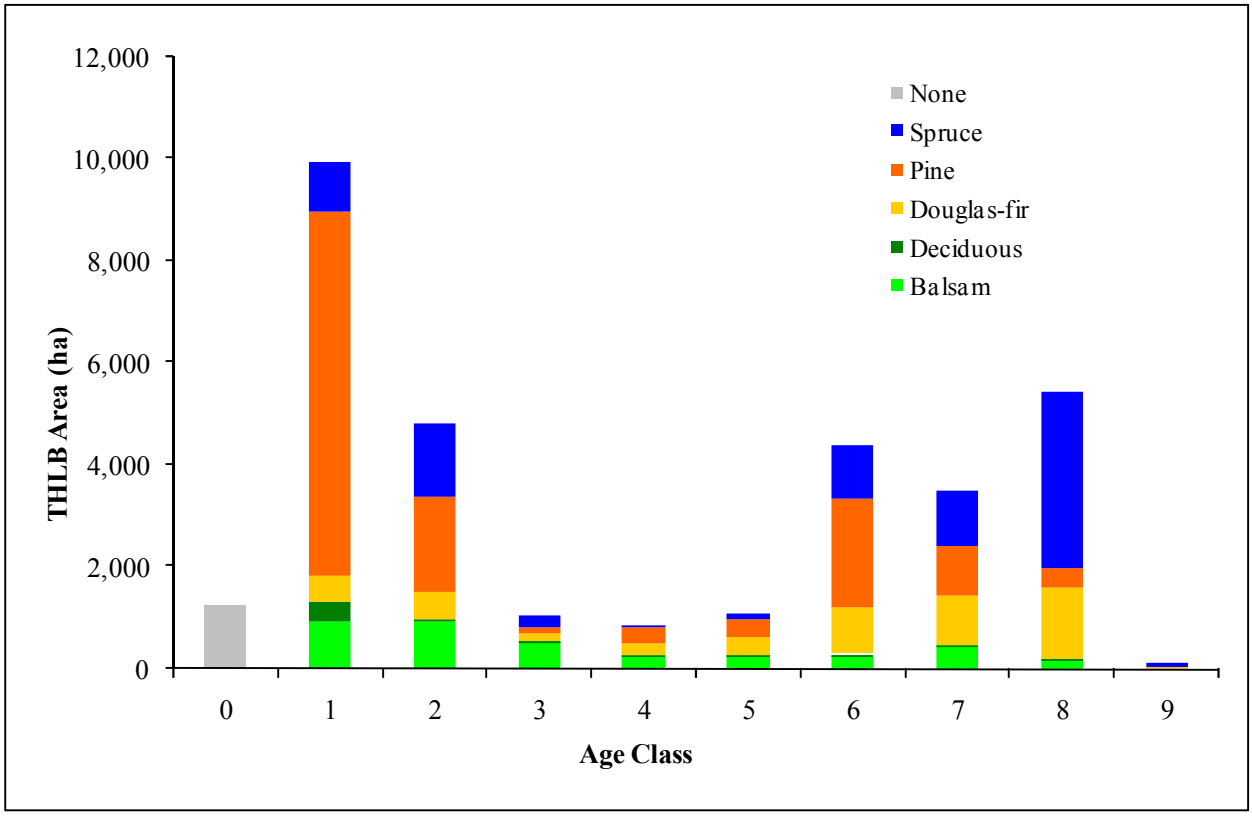
Weyerhaeuser will not be using Environmentally Sensitive Areas (ESA's) during this analysis. Level "C" Terrain Stability Mapping was recently completed, along with some Level "A" assessments. All soil related ESA's are replaced by this new data. For this analysis, class V terrain is considered as 100% removed from the THLB, while class IV terrain remains in the THLB.

No land base removals have been identified as a result of the recreation inventory. Recreation values are contained within the riparian reserve and management zones and the visual quality objectives (VQO's) associated with the riparian features. No additional constraints are added.

## 4.12 Age Class Distribution

The current distribution of area within the THLB by age class and leading species is illustrated in Figure 1. The majority of pine and balsam leading stands are in earlier age classes while the majority of Douglas-fir and spruce leading stands are in older age classes.

**Figure 1 Current Age Class Distribution by Leading Species**



# 5.0 CURRENT FOREST MANAGEMENT ASSUMPTIONS

## 5.1 Utilization Levels

Table 15 describes the utilization specifications that define minimum DBH, maximum stump height, minimum top diameter and minimum log length by species that are used to determine gross merchantable volume.

**Table 16 Utilization Standards**

| Species | Minimum DBH (cm) | Maximum Stump Height (cm) | Minimum Top Diameter (cm) | Minimum Log Length (m) |
|---|---|---|---|---|
| Lodgepole pine | 12.5 | 30.0 | 10.0 | 3.0 |
| All other species and ages | 17.5 | 30.0 | 10.0 | 3.0 |

## 5.2 Volume Exclusions for Mixed Species

In mixed species stands, deciduous volumes are removed from the conifer-leading stands.

## 5.3 Minimum Harvestable Volume

The base case will use a minimum harvest volume of 150 $m^3$/ha of merchantable volume and an average piece size of 0.2 $m^3$/tree to define the minimum merchantable criteria by stand age for regenerating stands. Stands will not be considered harvestable until this threshold stand age has been achieved.

Additionally, stands that suffer merchantable volume loss as a result of epidemic insect infestations will also be held to these merchantability criteria. If a stands merchantable volume drops below the 150$m^3$/ha threshold then it will not be available for harvest until such time that it re-acquires 150$m^3$/ha. Stands that do not re-acquire 150$m^3$/ha will be put on a natural stand yield table with a 15 year regeneration delay. Shelf-life assumptions affecting merchantable volume are discussed in Section 7.8.

## 5.4 Silviculture Systems

The base case will assume clear cut harvesting in all stands.

## 5.5 Regeneration Assumptions in Managed Stands

As discussed above, future managed stand analysis units are based on site series with some specific silviculture practices associated with management for future mule deer habitat. Regeneration assumptions developed for MP 9 were used in the yield tables for each future managed stand analysis units. The species composition, density and regeneration delay was based upon Weyerhaeuser's Enhanced Forest Management Program which followed a regime of detailed mapping, immediate site preparation, prompt planting with higher targets and minimums and prompt planting. Survey results from 2000 showed that total trees on average are 2,000 sph which is higher than the target of 1,800 sph. These regeneration assumptions are detailed in Table 16.

**Table 17 Regeneration Assumptions**

| Site Series | | SP 1 | SP 2 | PCT 1 | PCT 2 | Initial Density | OAF 1 | OAF 2 | Regen Type | SI | Regen. Delay | Util. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESSFdc2 | 01 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 18.8 | 1 | 12.5 |
| ESSFdc2 | 03 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 15.9 | 1 | 12.5 |
| ESSFdc2 | 04 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 14.9 | 1 | 12.5 |
| ESSFdc2 | 05 | PL | S | 80 | 20 | 1800 | 0.89 | 0.967 | P | 17.8 | 1 | 12.5 |
| ESSFdc2 | 06 | PL | S | 80 | 20 | 1800 | 0.89 | 0.967 | P | 20.8 | 1 | 12.5 |
| ESSFdc2 | 07 | S | | 100 | | 1800 | 0.89 | 0.962 | P | 20.2 | 1 | 17.5 |
| ESSFdc2 | 08 | S | | 100 | | 1800 | 0.89 | 0.962 | P | 13.8 | 1 | 17.5 |
| ESSFxc0 | 01 | PL | S | 70 | 30 | 1800 | 0.89 | 0.967 | P | 16.8 | 1 | 12.5 |
| ESSFxc0 | 02 | PL | S | 70 | 30 | 1800 | 0.89 | 0.967 | P | 8.9 | 1 | 12.5 |
| ESSFxc0 | 05 | PL | S | 70 | 30 | 1800 | 0.89 | 0.967 | P | 13.9 | 1 | 12.5 |
| ESSFxc0 | 06 | PL | S | 80 | 20 | 1800 | 0.89 | 0.967 | P | 17.8 | 1 | 12.5 |
| ESSFxc0 | 07 | S | | 100 | | 1800 | 0.89 | 0.962 | P | 20.2 | 1 | 17.5 |
| ESSFxc0 | 08 | S | | 100 | | 1800 | 0.89 | 0.962 | P | 12.7 | 1 | 17.5 |
| ICHmk2 | 01 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 22.8 | 1 | 12.5 |
| ICHmk2 | 02 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 16.8 | 1 | 12.5 |
| ICHmk2 | 03 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 18.8 | 1 | 12.5 |
| ICHmk2 | 04 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 20.8 | 1 | 12.5 |
| ICHmk2 | 05 | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 25.9 | 1 | 17.5 |
| IDFdk2 | 01 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 17.8 | 1 | 12.5 |
| IDFdk2 | 01[1] | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 16.5 | 1 | 17.5 |
| IDFdk2 | 02 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 12.9 | 1 | 12.5 |
| IDFdk2 | 02[1] | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 13.4 | 1 | 17.5 |
| IDFdk2 | 03 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 15.9 | 1 | 12.5 |
| IDFdk2 | 03[1] | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 14.9 | 1 | 17.5 |
| IDFdk2 | 04 | PL | FD | 90 | 10 | 1800 | 0.89 | 0.967 | P | 18.8 | 1 | 12.5 |

| Site Series | | SP 1 | SP 2 | PCT 1 | PCT 2 | Initial Density | OAF 1 | OAF 2 | Regen Type | SI | Regen. Delay | Util. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDFdk2 | 04[1] | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 18.0 | 1 | 17.5 |
| IDFdk2 | 05 | PL | FD | 90 | 10 | 1800 | 0.89 | 0.967 | P | 20.8 | 1 | 12.5 |
| IDFdk2 | 05[1] | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 22.0 | 1 | 17.5 |
| IDFdk2 | 06 | PL | S | 80 | 20 | 1800 | 0.89 | 0.967 | P | 19.8 | 1 | 12.5 |
| IDFdk2 | 06[1] | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 20.4 | 1 | 17.5 |
| IDFdk2 | 07 | PL | S | 80 | 20 | 1800 | 0.89 | 0.967 | P | 21.8 | 1 | 12.5 |
| IDFxh2 | 01 | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 16.5 | 1 | 17.5 |
| IDFxh2 | 02 | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 14.1 | 1 | 17.5 |
| IDFxh2 | 04 | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 15.7 | 1 | 17.5 |
| IDFxh2 | 05 | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 15.7 | 1 | 17.5 |
| IDFxh2 | 06 | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 18.0 | 1 | 17.5 |
| IDFxh2 | 07 | FD | S | 70 | 30 | 1800 | 0.89 | 0.961 | P | 21.2 | 1 | 17.5 |
| MSdm2 | 01 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 21.8 | 1 | 12.5 |
| MSdm2 | 01[1] | PL | FD | 50 | 50 | 1800 | 0.89 | 0.967 | P | 21.8 | 1 | 12.5 |
| MSdm2 | 03 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 16.8 | 1 | 12.5 |
| MSdm2 | 03[1] | FD | | 100 | | 1800 | 0.89 | 0.961 | P | 16.5 | 1 | 17.5 |
| MSdm2 | 04 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 19.8 | 1 | 12.5 |
| MSdm2 | 04[1] | PL | FD | 50 | 50 | 1800 | 0.89 | 0.967 | P | 19.8 | 1 | 12.5 |
| MSdm2 | 05 | PL | | 100 | | 1800 | 0.89 | 0.967 | P | 22.8 | 1 | 12.5 |
| MSdm2 | 05[1] | FD | PL | 70 | 30 | 1800 | 0.89 | 0.961 | P | 22.7 | 1 | 17.5 |
| MSdm2 | 06 | S | PL | 80 | 20 | 1800 | 0.89 | 0.962 | P | 26.5 | 1 | 17.5 |
| MSdm2 | 07 | S | | 100 | | 1800 | 0.89 | 0.962 | P | 15.9 | 1 | 17.5 |

[1] - reflects different regeneration assumptions associated with management for mule deer habitat.

## 5.6 Not Satisfactorily Restocked (NSR) Areas

No backlog NSR currently exists on the TFL and planting is scheduled for all harvested blocks within the prescribed regeneration delays. Beyond the application of regeneration delay, there are no additional modelling requirements to address NSR.

## 5.7 Forest Cover Requirements

Modeling integrated resource management objectives will be accomplished through the use of forest cover constraints, adjacency restrictions and cutblock size limitations (spatial analysis only). Table 17 summarizes the forest cover constraints that will be modelled for each management objective. Each of these is discussed in further detail in the sections below.

**Table 18 Forest Cover Constraints Summary**

| Location | Objective | Modeling technique(s) |
|---|---|---|
| Moose Winter Habitat | Ensure adequate habitat in winter range in maintained | Constrain forest cover such that at least 33% of the Crown Forest Land Base (CFLB) in these areas is greater than 16m tall. |
| Badger Habitat Area[9] | Preserve critical badger habitat | No constraints on harvesting. |
| Mule Deer Winter Range | Ensure adequate habitat in winter range in maintained | Constrain forest cover such that at least 25% of the MDWR zone has a crown closure class of: (i)2 or greater in the BG, PP or IDFxh biogeoclimatic zones; or (ii)4 or greater in all other biogeoclimatic zones unless the leading species is pine in which case the crown closure must be 6 or greater; |
| Tranquille Community Watershed | Ensure water quality is maintained in Community Watershed. | Constrain forest cover such that no more than 30% of the area within a community watershed is less than 4.8m tall. |
| Visual Quality Objectives | Maintain visual quality in visually sensitive areas | Constrain forest cover such that the area less than 3m in height is less than the maximum percent alteration values in **Error! Reference source not found.** |
| All management zones except the visual landscape management zone | Adjacency restrictions and three pass harvesting sequence | Given a green-up height of 3m, no more than 33% of the area will be less than 3m. |

[9]The areas within these WHAs are 5.2 ha and 2.1 ha and in early seral stands, therefore any timber supply impacts will be negligible.

### *5.7.1 Moose Habitat*

Moose habitat objectives for TFL 35 are defined as follows[10]:

> (a) **"Mature Forest Cover"** means a forested area that, based on forest cover inventory information or on actual circumstances, is at least 16 metres in height and:
>
> a. is not located within an Established Cutblock; and
>
> b. is located within a harvested Cutblock that is not an Established Cutblock.
>
> (b) **"Visual Screening"** means an area of timber or other vegetation that:
>
> (ii) is within an area where moose hunting is permitted;
>
> (iii) is within 500 metres of a highway, secondary road or major forestry road;
>
> (iv) is located within 20 meters of the perimeter of a W1 or W5 wetland that
>
> a. contains significant moose forage,
> b. is visible from that highway, secondary road or major forestry road; and
>
> (v) is at least 3 metres in height.
>
> **Maintaining Forest Cover and Forage** means:
>
> (a) harvesting a Cutblock to which this FSP applies will ensure that, when added to the area of Established Cutblocks, such Cutblock does not cause as of the completion of that harvesting:
>
> (i) the area of Mature Forest Cover in each contiguous portion of Critical Moose Winter Range to be less than 33% of the forested area in that portion of the Critical Moose Winter Range;
>
> **Maintaining Visual Screening**
>
> Subject to Paragraph 5.1.8.4, a Holder of this FSP harvesting a Cutlblock to which this FSP applies will not cause the area of Visual Screening to be less than 50% of the total area located within 20 meters of the perimeter of the wetland.

For this analysis it is assumed that all requirements for visual screening can be attained through existing riparian management objectives.

[10]Weyerhaeuser Company Ltd. 2007. Forest Stewardship Plan TFL 35 (Jamieson Block) June 4th 2007.

A forest cover constraint is applied to all Critical Moose Winter Range ensuring that 33% of the Crown Forest Land Base (CFLB) in these areas is greater than 16m tall. The Moose Winter Range covers an area of approximately 9,819 ha of CFLB (9,279 ha of THLB).

### *5.7.2 Badger Habitat*

Badger habitat management objectives are defined in the Stewardship Plan as follows:

> (a) **"Badger Habitat Area"** means an area of suitable habitat for badger as identified on the map in Appendix B(e) to this FSP.
>
> **Limitations on Harvesting and Road Construction** means that a Holder of this FSP:
>
> (a) harvesting a Cutblock to which this FSP applies will not mechanically disturb soil within 20 metres of a burrowing site located in a Badger Habitat Area and
>
> (b) will not construct a road to which this FSP applies in a Badger Habitat Area.

### *5.7.3 Mule Deer Winter Range*

Mule Deer winter range objectives are defined in the Stewardship Plan as follows:

> (a) **"Suitable Snow Interception and Thermal Cover"** means:
>
> (i) a forest cover polygon that:
>
> (A) is greater than 0.25 hectares in size;
>
> (B) is conifer leading; and
>
> (C) has a crown closure class of:
>
> (I) 2 or greater in the BG, PP or IDFxh biogeoclimatic zones; or
>
> (II) 4 or greater in all other biogeoclimatic zones unless the leading species is pine in which case the crown closure must be 6 or greater;
>
> (ii) an area harvested under a single-tree or group selection system; or
>
> (iii) a forested area that contains the attributes and size characteristics specified in clause (i);
>
> **Retaining Contributing Snow Interception Cover** means**:**
>
> (a) not have caused less than 25% of the forested crown land in each Ungulate Winter Range Planning Unit in that Mule Deer Winter Range to be retained as Contributing Snow Interception and Thermal Cover
>
> (b) where practicable, the contributing snow interception cover

identified in subparagraph (a) above will preferably be achieved by Douglas-fir leading stands: and

(c) where available at harvest commencement, and practicable to do so, have retained Contributing Snow Interception and Thermal Cover within 250 metres (horizontal distance) of a point on the Cutblock.

Management for MDWR is modelled by ensuring that at least 25% of the forested land base within each Ungulate Winter Range Planning Unit is retained as Contributing Snow Interception and Thermal Cover. As there is only one Ungulate Winter Range Planning Unit within TFL 35, this constraint will be applied to the entire MDWR area. Mule Deer Winter Range covers an area of approximately 730 ha of CFLB (606 ha of THLB).

### *5.7.4 Community Watersheds*

A forest cover constraint will be applied to ensure that a maximum of 30% of the Community Watershed area within the TFL is in stands less than 4.8m in height. 106 ha of the TFL are within the Tranquille CWS area.

### *5.7.5 Visual Quality Objectives*

Visual quality objectives from the Stewardship plan are as follows:

(a) **"Non-Greened-Up"** means areas within Established Cutblocks that are visible from a viewpoint representative of significant public viewing opportunities that:

(i) have been harvested or are planned to be harvested in a manner that does not satisfy at least one of the following criteria:

(A) at least 75% of the net area to be reforested is stocked:

(I) such that the average height of the tallest 10% of the trees on the area is a minimum of 3 metres;

(II) in accordance with the stocking standards applicable to the Cutblock; and

(III) with at least 700 trees per hectare of a commercially valuable species that are at least 1.3 metres in height;

(d) **"Percent Alteration"**: means the proportion of a Visual Landscape Unit in a non-greened-up state based on the following formula:

$$\text{Percent Alteration} = \frac{\text{Area within Visual Landscape Unit that is non-greened-up (ha)}}{\text{}}$$

VQO's will be modeled according to the maximum percent alteration numbers in Table 18 except when harvesting is for salvage operations. VQO targets will be modelled separately for each VDU.

**Table 19 VQO Parameters**

| Established Visual Quality Objective | Maximum Percent Alteration | Maximum Size of Contiguous Non-Greened-Up Areas in a Visual Landscape Unit (hectares) | CFLB / THLB Area (ha) | Design Elements (as determined from a viewpoint representative of significant public viewing opportunities) |
|---|---|---|---|---|
| Preservation | 5% | 1 | 1 / 1 | Not easily distinguishable from pre-harvest landscape |
| Retention | 10% | 5 | 198 / 163 | Not rectilinear or geometric in shape |
| Partial Retention | 30% | 25 | 972 / 919 | Not rectilinear or geometric in shape |
| Modification | 50% | Unlimited | 837 / 803 | Not rectilinear or geometric in shape unless the cut block is less than 15 contiguous hectares |
| Maximum Modification | 100% | Unlimited | None | None |

### *5.7.6 Integrated Resource Management*

For areas considered not visually sensitive (no VQO classification) stands will be eligible for harvest when the adjacent cutblock has attained a stand height of 3 m. A constraint will be applied that allows no more than 33% of the landscape unit below green-up (<3m) at any point in time. Weyerhaeuser also has operational exemptions[11] that supersede the green-up or wildlife constraints and these will apply to any salvage harvesting.

### *5.7.7 Landscape Level Biodiversity*

The TFL lies completely within the Skull Landscape Unit of the Kamloops TSA, which is designated as having a low biodiversity emphasis option. Landscape level biodiversity constraints are addressed through the removal of OGMA lands from the THLB.

## 5.8 Current Unsalvaged Losses

Table 19 shows the estimated average annual unsalvaged volume loss to catastrophic events such as insect epidemics, fires, wind damage or other agents over the long-term on the THLB. The unsalvaged loss column reflects only those volumes that will not be recovered or salvaged.

[11]Weyerhaeuser Company Ltd. 2007. Forest Stewardship Plan TFL 35 (Jamieson Block) June 4th 2007.

### Table 20 Unsalvaged Losses

| Analysis Unit | Cause of Loss | Annual Unsalvaged Loss ($m^3$/yr) |
|---|---|---|
| All | Fire | 47 |
| Douglas-fir and balsam only | Insects | 250 |
| All | Wind | 250 |
| | **Total** | |

The unsalvaged losses data for fire is based on annual estimates when data was collected over a six year period (1994-99) which reflects an average forest fire cycle period in the Kamloops area. The 47 $m^3$/yr represents minimal losses from fire due to the extensive road network on TFL 35 which facilitates aggressive fire suppression activities and prompt salvage of any fire damaged timber.

The McLure Fire of 2003 impacted approximately 10% of TFL 35 by area and this event has not been included as part of the average because the 2003 fire season in the Kamloops Fire Zone represents such an anomaly. Rather, the losses due to this fire have been accounted for by a one-time volume reduction. The two leading types within the fire area that were not salvaged were:

1) previously harvested residual balsam stands of low merchantability that were 100% fire-killed, and;
2) Douglas-fir leading stands (~100 ha)[12] that incurred a lower intensity ground-fire burn with an estimated 10% volume loss due to fire-kill and/or subsequent Douglas-fir beetle.

The forest cover inventory has been updated with recent survey information in the balsam residual stands and mature volume is no longer available in those types. A 10% OAF (in addition to the OAF1 values listed in Table 16) will be applied to the yield curves for the Douglas-fir leading stands within the fire area to account for the losses from the fire. Therefore, these losses are not included in the unsalvaged losses table.

Losses due to insects in Table 19 do not include MPB or IBS outbreaks. MPB losses are accounted for in the shelf-life assumptions (see Section 7.8) that will be applied to all pine volume starting in the year 2006. For the IBS outbreak Weyerhaeuser[13] has identified a 3,158 ha gross area in the Wentworth Lake area where IBS has attacked a significant component of the spruce in mature (age-class 5 and greater) stands. Where spruce occurs in mature balsam leading stands (~450 ha) within the identified IBS area, the yield curves

[12]Curry, RPF. Sean. Letter to Henry Benskin, A/Deputy Chief Forester, TFL 35 MPB AAC Uplift January 05 update. January 2005.

[13] Weyerhaeuser Company Ltd. IBS mapped area of Moderate to High 2008 beetle attack. May 2008.

will be reduced to reflect 50% of the spruce volume loss as no harvest is assumed in these stands in the next five years. In some stands this may drop the total merchantable volume below 150m$^3$/ha. These stands will remain unharvestable by the model unless the non-spruce component grows above the merchantability threshold. For spruce within spruce leading stands (~1,300 ha) a 5 year shelf life will be assumed, after which the yield curves will be reduced by 100% of the spruce component to reflect the projected volume loss. These stands will remain unharvestable by the model unless the non-spruce component grows above the merchantability threshold.

Douglas-fir bark beetle losses continue to occur in the Jamieson Canyon area and Western Balsam bark beetle continues to cause mortality in the mature balsam component. These losses are included in the Table 19 estimates for insects.

Unsalvaged losses due to wind along a cutblock edge are based on an average of 25m$^3$/block projecting 20 blocks harvested per year over time. This was reduced by 50% to account for the number of blocks harvested where there is no mature timber along the cutblock edges for blowdown to impact. This equates to a projected loss of 250 m$^3$/year.

# 6.0 FOREST ESTATE MODEL

Timber supply analysis will be conducted using the Patchworks spatial optimization model. Patchworks is a spatially explicit harvest scheduling optimization model developed by Spatial Planning Systems in Ontario. It is capable of developing spatially explicit harvest allocations that explore trade-offs between a broad range of conflicting management and harvest goals.

For this analysis Patchworks will be formulated to schedule blocks for harvested based on maximizing harvest volume over the long-term subject to meeting non-timber and other management objectives on the land base. As such, there are no explicit harvest rules, other than minimum merchantability limits, applied to the model. Merchantability limits are set up such that no stands may be harvested before they have achieved 150$m^3$/ha. Growing stock constraints will be applied to the model to ensure that the harvest forecast is sustainable. The model will have a planning horizon of 250 years (starting in 2010) and will use five year planning periods. The model will be set up to maximize the salvage of IBS stands within the first 5 years. For mountain pine-beetle affected stands the model will rely on shelf life assumptions and the minimum merchantability criteria to prioritize salvage. Through the optimization, the model will prioritize the salvage of stands that will fall below merchantability while balancing harvest-flow and non-timber objectives. A number of different alternate harvest flow forecasts will be assessed in order to understand the trade-offs between these values and objectives. This will include a maximum non-declining run, as well as a run that declines by no more than 10% per decade to the long-term sustainable yield level.

Patchworks has the ability to assess trade-offs through multiple account analysis. Targets are established with threshold values and incur a penalty when the model results fall outside the permissible threshold. The optimization process seeks out a solution that minimizes the overall penalties incurred. For the base case, the model will be set up to ensure that none of the targets are violated except where exceptions are permitted for salvage harvesting. Allowing deviations from the targets for green-wood harvesting will be assessed through sensitivity analysis.

Patchworks is approved for use in Timber Supply Review and Management Plan analysis by the Ministry of Forest and Range Forest Analysis and Inventory Branch.

# 7.0 GROWTH AND YIELD

The following describes the growth and yield assumptions for existing natural, existing managed and future managed stand yield curve development. Due to the number of yield curves associated with this project, the yield curves will be provided in a digital format.

## 7.1 Existing Natural Stands

Stands with a projected age of greater than 47 years, and stands without cutblock information with a projected age less than 47 years, will be modelled with an inventory site index using VDYP 6.6d. Every forest cover polygon is assigned to an analysis unit based on criteria defined in Section 3.2. The projected height, projected age, stocking class, crown closure, and species composition from the VRI inventory label are used to generate the yield tables for each individual polygon. Stand-level yield tables for existing stands are then incorporated into the timber supply model.

## 7.2 Existing Managed Stands

Stands less than projected age 47 years with cutblock information will be modelled with TIPSY 4.1. Regeneration assumptions developed for MP 9 are used in the yield tables, but they are applied at a VRI polygon level. Silviculture eras defined in the MP 9 analysis have been updated for projected age and retained in this analysis. Silviculture eras are defined in Table 20 below. Species composition and density from the inventory, potential site index (PSI), and OAF's developed in MP 9 are used as inputs into TIPSY. A mortality model was developed to estimate the appropriate TIPSY input density such that the model outputs the inventory density at the inventory age. Genetic gains are not applied in existing managed stands, and existing yields from the TIPSY model were reduced to the conifer component according to the inventory label.

**Table 21 Silviculture Era Definitions**

| Silviculture Era | Definition |
|---|---|
| 1 | projected age between 33 and 47 years inclusive |
| 2 | projected age between 21 and 32 years inclusive |
| 3 | projected age less than 21 years |

Where a VRI polygon is made up of more than one site series, yield tables are first calculated for each component site series within the polygon. The yield table for the VRI polygon is then calculated as the area-weighted average of the component site series-level yield tables. The yield table for the analysis unit represents the area-weighted average of the component forest cover polygon-level yield tables.

## 7.3 Future Managed Stands

Consistent with MP9, future managed stand yield curves will be modelled using TIPSY based on the regeneration assumptions listed in Table 16. Operational adjustment factors, genetic gains, site productivity, decay, waste and breakage, and riparian volume reductions are described in the following sections.

## 7.4 Operational Adjustment Factors

Operational adjustment factors (OAF) as shown in Table 21 will be applied as per the 2001 AAC Rationale document[14]. OAF 1 and 2 values were negotiated between Sean Curry (Weyerhaeuser) and Albert Nussbaum (MoF) in November 2000 for MP#9 using the new OAF1 format. Mike Clarkson was the Timber Supply Forester involved in the acceptance of MP#9 and Bob MacDonald (MoF Growth and Yield, Kamloops Region) approved the OAF1 and 2 values.

OAF1 accounts for factors affecting the yield curve across all ages, and consists of four components including: non-commercial competition; non-productive spatial holes such as thin soil, rock; endemic disease and insect loss; and, random catastrophic events such as ice, wind and snow damage.

OAF2 accounts for decay, waste and breakage. OAF2 numbers accepted in MP#9 were derived from the 1976 MFR report "Metric Diameter Class, Decay Waste and Breakage factors, All Inventory Zones". The projected diameters from TIPSY were linked to those in the MFR report and these were adjusted for age. Species specific OAF2 values were created as Pl 3.3%, Fdi 3.9%, and Sx 3.8%.

**Table 22 Operational Adjustment Factors**

| OAF | Leading Species | Era 1 and 2 | Era 3 |
|---|---|---|---|
| 1 | ALL | 0.890 | 0.900 |
| 2 | PL | 0.967 | 0.967 |
| 2 | FD | 0.961 | 0.961 |
| 2 | S | 0.962 | 0.962 |

## 7.5 Site Productivity

PSI estimates from the TFL35 Site Index Adjustment project[15] will be used as inputs for existing and future managed stands.

[14] Baker, Ken. Deputy Chief Forester. Rationale for AAC Determination, TFL 35. November 2001. 42 pp.

[15] J.S.Thrower and Associates Ltd. Site Index Adjustments Using BEC Classification on TFL 35. February 2000. 20 pp.

## 7.6 Genetic Gains

Historic genetic gain for lodgepole pine and spruce was calculated for improved stock planted on the TFL from 1989-2007 using published data from the Forest Genetics Council[16]. Genetic gains of 5.4% for lodgepole pine and 5.7% for spruce were applied to future productivity group 1 stands as defined in MP 9 data package.

Weyerhaeuser[17] will be utilizing 100% Class A seed where available in the future (100% is assumed to be available). Future mean genetic gain for lodgepole pine elevation 700-1400 m is 13% and 1400-1600 m is 15%. Genetic gain for spruce 700-1300 m is 19% and 1300-1900 m is 15%. This genetic gain will be applied to all future managed stand yield curves.

## 7.7 Riparian Management Zone Volume Reductions

Volume reductions will be applied to the yield curves to reflect the basal area retention requirements for stream and wetland riparian management zones defined in Table 12. The specific value is dependent upon the stream or wetland classification. There are no volume reductions in lake riparian management zones, as these are addressed through forest cover constraints as per Table 12.

## 7.8 Mountain Pine Beetle

Based on recent field observations[18] it is assumed that pine-leading stands in age class 3 have incurred 80% mortality of the pine component. An average of 15% mortality of the pine component of age class 2 pine leading stands is assumed, although there is some variation across the land-base. There is virtually no observed mortality at the higher elevations, approximately 33% mortality in the mid-elevation band, and <10% mortality of the pine component at the southern end of the TFL. It is unlikely that a significant component of the pine volume from these stands is merchantable and therefore the yield curves for these stands will be reduced using an OAF based on the percentage of mortality for pine within these stands.

The pine component on all other age-class 4 and older stands on the land base will behave according to the stand's "shelf-life" - the duration for which a pine tree that has been damaged or killed by the MPB will retain a merchantable value.

A shelf-life curve, developed by Timberline through a project for the Merritt TSA, identifies the grade proportion (using standard MoFR grade criteria) and merchantable net volume for pine as it relates to time since attack[19]. The curve is derived from data collected through two projects in which 461 trees were destructively sampled throughout BC (Table 22)

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[16] Forest Genetics Council of British Columbia. http://www.for.gov.bc.ca/hti/speciesplan/

[17] Low, RPF, Kelly. Weyerhaeuser Company Ltd. May 2009. Personal communication.

[18] Freudenberger, RPF, Kurt. Weyerhaeuser Company Ltd. May 2009. Personal communication.

[19] Webb, Jim. Timberline. Shelf-life Curve Update. May 2009.

through a contract with the Ministry of Forests and Range in 2006 and 2007. The trees were bucked to 5m log lengths or longer and from stump height up to 10cm utilization and scaled in the bush to determine grade and merchantable volumes. Scaling was completed by a certified scaler on the same day the trees were fallen. The estimated age of MPB attack sampled was from 1 to 9 years.

**Table 23 Log Data Used for Shelf-life Analysis**

| Geographic Location | Sample Year | Log Count | Net Volume ($m^3$) |
|---|---|---|---|
| Burns Lake | 2006 | 440 | 76.7 |
| North (Quesnel and area) | 2007 | 239 | 42.9 |
| Quesnel | 2006 | 471 | 79.6 |
| South (Kamloops and Monte Creek) | 2007 | 92 | 19.1 |
| Vanderhoof | 2006 | 456 | 78.1 |
| Total | | 1698 | 296.3 |

The data shows that there is geographic variability but that this is minor and general trends for grade proportion and merchantability exist. This has been supported by the mill studies conducted by Forestry Innovation Investment over the last three years[20] . In general terms, the majority of the net volume scaled in the shelf-life projects was grade 2. Grade proportion in the initial two years after MPB attack reflect a non-MPB attacked stand and grade proportion from year three onwards reflect degrade as trees dry (Figure 2). The data shows that relative to a green tree little degrade occurs in year one due to checking although this is more noticeable in year two. Merchantable percent for grades one and two remains relatively consistent in the initial six years after MPB attack and starts to decline as of year seven (Figure 3). The merchantable percent of grade four declines steadily over all years sampled. The sample size sampled seven to nine years after attack was small relative to other years sampled.

[20] Forestry Innovation Investment. Website accessed May 2009 regarding mill trial results and comparisons: http://www.bcfii.ca/industry_resources/pdf/Weyco_Princeton_Mill_Trial_Report_FII_Final.pdf

**Figure 2 Proportion of Grade by Field Estimated Year of MPB Attack**

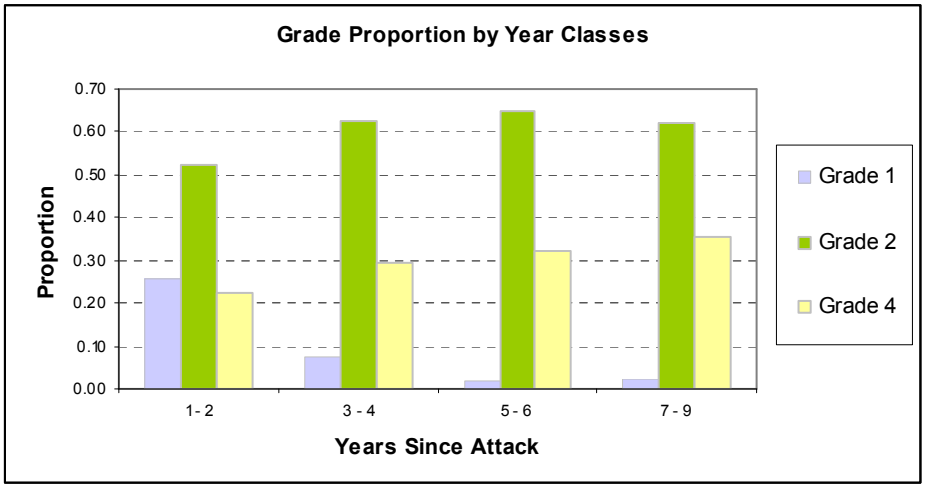
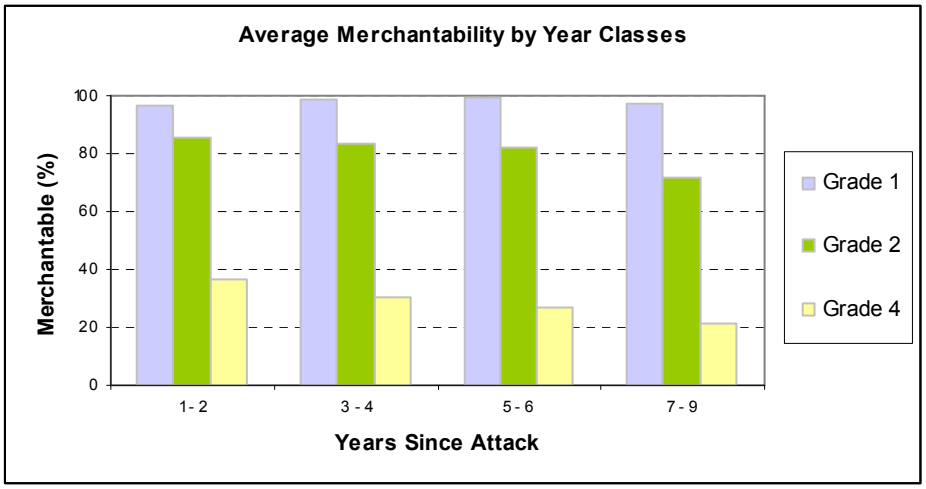



**Figure 3 Merchantability of Grade by Field Estimated Year of MPB Attack**



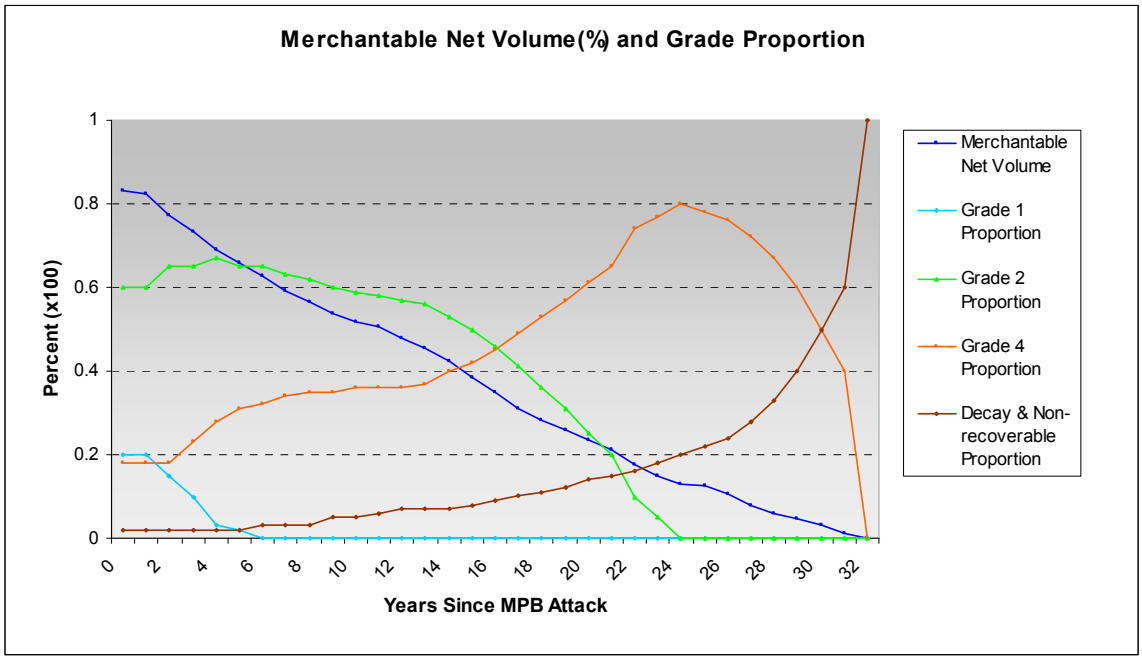

The shelf-life curve developed (see Figure 4) is for net volume and includes grades 1, 2 and 4 and decay or non-recoverable volumes. Certain assumptions were used to determine the shelf-life curve.

Assumptions:

1. Net merchantable volume is for the pine component in a stand based on the predominant year of attack. It is weighted for each grade by the proportion of the grade sampled in the year of attack.
2. In many stands, several years of multiple attacks occur. A reasonable approach to calculate the net merchantable volume for a stand with multiple years of attack would be to weight by the proportion attacked in each year.

3. Grade 1 volume, while scaled in the field in trees up to eight (8) years after attack, no longer exists in the mill output data five (5) years after attack and has been modelled accordingly.
4. Decay in standing trees sampled was <2% on average in stands up to 9 years after attack. Decay and non-recoverable proportions increase as fallen trees in contact with the ground decay more rapidly than trees standing.
5. While minor amounts of deadfall will occur, the extent of deadfall is projected to increase 15 to 20 years after attack. Fallen trees become part of the non-recoverable proportion.
6. Grade 4, while <50% merchantable, includes a component that can be milled.
7. Averages are for the province.
8. Averages are for all piece sizes.

**Figure 4 Shelf-life by Grade Proportion and Merchantable Net Volume**




The shelf-life grade distributions shown in Figure 4 will be applied to the pine component of the volume curve for all merchantable stands impacted by MPB. Using this approach the model will track the individual grade components of the volume curves. The decay and non-recoverable proportion of the stand volume will be considered as unsalvaged loss to be reported out of the model separately. Only the merchantable portion of the volume will contribute achieving stand-level merchantability limits and will be included in the harvest forecast.

# 8.0 SENSITIVITY ANALYSIS

The following tables summarize the details of the base case and the sensitivity analyses to be undertaken.

| Description & Objective |
|---|
| **Maximize pine and spruce salvage (short-term harvest)** |
| **Spruce volume (in spruce leading stands within IBS area) reduced by 50% after 5 years.** *Objective* – To understand the impact of different shelf-life assumptions for spruce. |
| **Minimize mid-term fall down** |
| **Maximize long-term harvest level** |
| **Reduced minimum harvest volumes for post-MPB stands.** *Objective* - To determine the impacts of reduced minimum harvest volumes so that mature, residual post-MPB stands will be harvested. Minimum harvest volumes 100 $m^3$/ha were used. |
| **Reduced minimum harvest volumes for all stands.** Objective - To determine the impact on harvest flows of reducing the minimum harvest volume to 100 $m^3$/ha |
| **Existing Stand Yields.** +/- 10% |
| **Regenerated Stand Yields.** +/- 10% |
| **Minimum Merchantability Criteria.** +/- 10 years in minimum harvest age threshold |
| **THLB change.** +/- 5% |
| **Visual Quality Objectives.** Allow trade-offs of VQO targets versus salvage. |
| **Green-up Periods.** +/- 10% |
| **Regeneration Delay.** + 2 years |