GOLDEN TSA

TIMBER SUPPLY REVIEW # 4

TIMBER SUPPLY ANALYSIS
DATA PACKAGE

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Prepared for

Golden DFAM Group

Louisiana Pacific .

Downie Timber .

BC Timber Sales .

Prepared by

Reg Davis, RPF

Forsite Consulting Ltd.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 Introduction

This Draft Data Package has been prepared by Forsite Consultants Ltd under the direction of the Golden Timber Supply Area (TSA) Defined Forest Area Management Group (DFAM) as a source document prior to the completion of the Timber Supply Analysis #4 for Golden TSA. This document follows the format suggested in the *Supplemental Guide for Preparing Timber Supply Analysis Data Packages* (Forest Analysis Branch, 2003). When possible it mimics the Golden TSR 3 Data Package (Appendix A in the TSR 3 Analysis Report) with the intent to allow the easiest comparison possible between the TSR3 and TSR4 analyses.

Key persons contributing to this document, or providing input data for the analysis include the following:

Name	Agency	Role / Contribution
Stuart Frazer	Louisiana Pacific, Golden	DFAM Chairman
Dieter Offerman	Downie Timber Limited, Revelstoke	DFAM Rep
Kevin Lavelle	Ministry of Forests, Revelstoke	DFAM Rep
Rein Kalke	B.C. Timber Sales, Vernon	DFAM Rep
Gordon Nienaber	Ministry of Forests, Victoria	DFAM Rep
Kurt Huettmeyer	Ministry of Forests, Revelstoke	TSR 3 participant, TSR 4 input
Bernie Heuvelman	Louisiana Pacific, Golden	Operational forestry input
Tim Arnett	Louisiana Pacific, Golden	Operational forestry input
Warren Chambers	Louisiana Pacific, Golden	LP GIS data
Elaine Brown	Downie Timber Limited, Revelstoke	Downie Timber GIS data
Robyn Begley	Ministry of Forests, Revelstoke	MoF GIS data
Joe Alcock	Ministry of Forests, Revelstoke	Terrain data; Terrain Project Reports
Jessica Bockus	BCTS, Vernon	BCTS GIS data
Scott King	Louisiana Pacific, Golden	Silviculture expertise
Barb Wadey	Ministry of Forests, Revelstoke	Silviculture expertise
Dawn Doebert	Downie Timber Limited, Revelstoke	Silviculture expertise
Rob Mohr	B.C. Timber Sales, Revelstoke	Silviculture expertise
Peter Gribbon	B.C. Timber Sales, Revelstoke	Silviculture expertise
Hal Maclean	ILMB, Nanaimo	TSR 3 Analyst; TSR 3 data files and assumptions

Note: This version of the Data Package is for review. The final version of this document will incorporate the comments received during the advertised public review period.

1.1 Purpose

The purpose of this Data Package is to:

- provide a detailed account of the land base, growth and yield, and management assumptions related to timber supply that the chief forester must consider under the *Forest Act* when determining an allowable annual cut (AAC) for the Golden TSA and how these will be applied and modelled in the timber supply analysis;
- provide a means for communicating data inputs and analysis methodology among licensees, MoF, ILMB, and MoELP staff, and other users;
- provide MoF staff with the opportunity to review data and information that will be used in the timber supply analysis before it is initiated;
- ensure that all relevant information is accounted for in the analysis to a standard acceptable to MoF staff;
- provide the evidentiary basis for the information used in the analysis.

1.2 Process

The Ministry of Forests (MOF) is currently implementing a policy framework that establishes obligations and opportunities for collaborative forest management within the province's 37 timber supply areas (TSA). This framework is commonly referred to as the Defined Forest Area Management (DFAM) initiative. Under DFAM, specified licensees and BC Timber Sales (BCTS) assume a collective responsibility for timber supply analysis and specified forest health activities within each timber supply area.

The Golden TSA DFAM group consists of Louisiana Pacific, Downie Timber Ltd., and B.C. Timber Sales (BCTS, Okanagan Columbia). This group has chosen to take on the responsibilities of timber supply and forest health with the knowledge that the Forest Investment Account is currently funding the initiatives. Thus, for TSR4, the DFAM group is leading the Timber Supply Review process (Table 1). To deliver on this commitment, the planning and analysis work associated with the TSR was tendered and subsequently awarded to Forsite Consultants Ltd. of Salmon Arm.

Government agencies still play a key role in this TSR process – they set and enforce standards and are responsible for approval of the Data Package and Analysis Reports. The Ministry of Forests (MoF) provides technical support, facilitates resolution of issues, and validates technical information. Various technical or resource specialists in the Integrated Land Management Bureau (ILMB) and Ministry of Environment Lands and Parks (MoELP) also play key roles. The following table shows the general roles and responsibilities associated with the timber supply analysis leading to an AAC determination.

Table 1 Roles and responsibilities in the implementation of a DFAM TSR.

DFAM Group Obligations	Government Obligations	
	Forest Analysis and Inventory Branch Staff	**District and Regional Staff**
Compile data needed for the timber supply analysis, including forest cover and other data related to forest and land characteristics, administration and management regimes. Provide a summary of the data, management assumptions, and modeling methods to be applied in the timber supply analysis in a Data Package document.	Set standards for the data package	Provide data, information, and knowledge of current practices in the TSA.
Provide information to the public and First Nations and summarize comments received for government.		Conduct formal consultation.
Make any necessary changes to the data package and submit for government approval.	Review and accept the data package (focus on how data is to be applied in Timber supply analysis)	Review and accept the data package (focus on confirming current practice).
Perform and document a timber supply analysis according to standards provided by the Ministry of Forests.	Provide technical advice and set standards for the analysis and reporting.	
Submit an Analysis Report and digital file containing the complete dataset used in the timber supply analysis.	Review and accept (together with the Chief Forester) the analysis report.	Review the analysis report to ensure local issues and current practices are adequately reflected.
Provide information to the public and First Nations and summarize comments received for government.		Conduct formal consultation.
Provide additional information as required by the Chief Forester.	Compile and prepare information for presentation to the Chief Forester at the determination meetings.	Assist in compiling and preparing information for presentation to the Chief Forester at the determination meetings.

Major background information used to prepare this Data Package includes:

- *Golden TSR 3 Analysis Report. August 2003.*
- *Kootenay/Boundary Higher Level Plan Order (2002, and amendments)*
- *Forest and Range Practices Act (FRPA, 2002, consolidated to 2006) and*
- *Forest and Range Practices Regulations (FRPR, 2004, consolidated to 2007)*
- *Supplemental Guide for Preparing Timber Supply Analysis Data Packages (Forest Analysis Branch, 2003)*

See the References section for a more extensive list of information that was consulted when preparing this document.

2.0 Inventory and model files

A GIS format inventory file has been provided to the Forest Analysis and Inventory Branch staff for purposes of commenting on the Data Package and for use in subsequent analysis projects.

The forest inventory that was used in this analysis is summarized in Table 2.

Table 2 Forest cover inventory

Characteristic	Description
Standards and format	Combined "FIP-rollover" and "True VRI" format.
Inventory date	VRI completed December 2001
Phase 2 field sampling	VRI phase 2 sampling completed 2003
Phase 2 Adjustments Report	Vegetation Resources Inventory Statistical Adjustment And Net Volume Adjustment Factors. (See Jahraus & Associates, 2007 in the References section)
Adjustments applied	Yes
Projection year	2008
Updates	Harvesting to 2007, based on in-house licensee block data.

2.1 Base Case Option - Overview

The Base Case Option (model run) is the benchmark for the rest of the timber supply analysis. It is based on current management practices within the Golden TSA. This is defined by operational management practices, characteristics of and natural resource values found on the landbase, current silviculture practices, and estimates of present and future growth of forest stands.

Current management includes:

- Forest licensees' operational performance over the last 5 years;
- Management to meet requirements such as the Forest and Range Practices Act (FRPA), the Kootenay Boundary Higher Level Plan Order (HLPO), and other locally relevant legislation and policy;
- Management for non-timber resources, including visual quality objectives; identified wildlife; ungulate winter range (UWR); fish habitat, domestic water supply; and others.

Some of the more significant inventories include mapping of:

- True VRI-format forest cover inventory completed in 2000, sampled for Phase 2 adjustments in 2002, updated to 2007 for harvest depletions, and projected to 2008;
- Adjustments to inventory ages, heights, and volumes for operable stands >30 years old based on the results of the 2002 VRI Phase 2 Volume Adjustment Project;
- operability mapping, completely revised in 2002, with updates in 2008;
- consolidated overview terrain stability mapping for all the available, existing terrain mapping projects; and
- new riparian stream class mapping, derived by GIS in 2008, correlated with the FDIS data (field sampled stream data).

Silviculture practices, harvesting methods and projections of current and future stand yields include:

- Definition of the operating landbase and, conversely, of non-operating areas defined by problem forest types and non-merchantable stands,
- Close utilization standards, and Ministry standard estimates of decay waste and breakage factors (DWB) and operational adjustment factors (OAF),

- Estimates of natural stand yields based on the MoF's Variable Density Yield Projection (VDYP) software;
- Estimates of managed stand yields based on the MoF Research Branch's Table Interpolation of Stand Yields (TIPSY) software;
- Basic silviculture practices;
- Genetic gains from improved seed in a portion of the spruce, pine, fir and larch plantations.

The data and assumptions that are included in the Base Case are described in detail in the following sections.

3.0 Landbase and Inventories

3.1 Forest Cover Inventory

The forest cover inventory is a key component of the analyses. There are two forest cover formats in the Golden TSA: Forest Inventory Planning (FIP-type, or "FIP rollover") and Vegetation Resource Inventory (VRI, or "true VRI").

3.1.1 FIP-type forest inventory

Approximately 15% of the Golden TSA analysis area is FIP-type forest cover. This forest cover is largely within the national parks (ownership code = "51-N", Table 6). It was input into the provincial forest cover inventory in years 1995, 1996 and 1997. This inventory is included in the analysis for purposes of modeling biodiversity.

3.1.2 VRI-type forest inventory

The majority of the forest cover for the Golden TSA was completed in December of 2001. It is a true VRI-type forest inventory. Irregular updates of the inventory have been completed since that date for fires and logging. Licensee harvest block data, current to late 2007, has been embedded onto the forest cover data using a GIS.

The inventory has been adjusted for height, age and volume based on a Phase 2 field sampling project completed in 2002. Inventory Statistical Adjustment and Net Volume Adjustment Factors were compiled in 2007 by Jahraus & Associates. The VAF factors have been incorporated into the forest cover when it was projected to January 2008.

Phase 2 height, age and volume adjustment factors are listed in Table 3. Site index adjustment occurs indirectly as a result of changing the stand ages and heights. Overall, the adjustment procedure decreased heights, increased or decreased some ages, and decreased volumes. Site indices were indirectly increased or decreased depending on the combinations of height and age adjustments. Across the target population, the net effect of all adjustments was a 2.6% decrease in merchantable volume (Table 4, using VDYP 6 at the close utilization level.)

Table 3 VDYP6 Adjustment factors for VT, operable polygons >=30 years of age in the Golden TSA.

Inventory leading species stratum	Height adjustment Ratio of Means	Age Adjustment Ratio of means	"Attribute-adjusted" volume adjustment ratio of means
Cedar/hemlock	0.943	1.214	1.065
Deciduous	0.980	0.732	1.491
Fir/pine	0.954	1.071	1.093
Spruce/balsam	0.867	0.919	1.158

Notes: VT = vegetated; Volume utilization is net dw2:12.5cm+ dbh.
Source: Jahraus & Associates (2007)

Table 4 VDYP6 estimated volume impacts of adjustment (VT, operable, >=30 years of age)

Inventory leading species stratum	N	VDYP6 estimated volume impact (12.5cm Pl or Deciduous; all others 17.5 cm+ dbh net dwb)
Cedar/hemlock	15	0.981 +/- 26.0%
Deciduous	8	0.977 +/- 84.4%
Fir/pine	31	1.018 +/- 13.1%
Spruce/balsam	31	0.932 +/- 16.7%
Overall	85	0.974 +/- 9.5%

Notes: VT = vegetated.
Source: Jahraus & Associates (2007)

The adjustments were applied within this analysis to natural stands using the following methodology:

- The whole forest was projected from the year of inventory (2000) to the year the Phase 2 adjustments were completed (2003) using VDYP6;
- Operable stands over 30 years old were selected for adjustments. Call these stands "**adjusted stands**". Other stands were not adjusted. Call these the "**non-adjusted stands**".
- For **adjusted stands**
  - Stands were assigned to adjustment strata based on leading species (see tables above);
  - The age and height adjustments were applied to the age and height, as of 2003;
  - The adjusted age and height numbers were used to derive an adjusted site index;
  - The stand species, adjusted age, site index were input to VDYP6 along with the volume adjustment factors to derive new stand volumes and stand diameters.
- For **non-adjusted stands**
  - Unadjusted age and site index from the 2000 inventory were used to derive stand volume and diameter at year=2008.

The outputs from both the adjusted and unadjusted stands were input to VDYP6 to produce natural stand yield tables for each stand. Later, the yield tables are assigned to analysis units and the curves for each stand in each analysis unit are weighted by the stand area to generate an <u>area-weighted yield table</u> for each analysis unit.

3.2 Forest Resource Inventories

Many resource inventories are used in the modeling process. These are summarized in Table 5. Their use is briefly described after the table.

Table 5 Resource inventories

Data file	Inventory	Source, Date	Comments / Source
Dgo_arc	Archaeology sites	Archaeology Branch, Victoria, Feb 14, 2008	Known archaeological sites
Dgo_blk	Cutblocks	Forest licensees, March 2008.	Recently logged, and planned cutblocks
Dgo_car	Caribou – HLPO	ILMB, Feb14, 2008	HLPO spatially mapped caribou areas.
Dgo_ca1	Caribou – HLPO	KSDP ftp site, Feb 09 2008	HLPO caribou habitat.
Dgo_con	HLPO Connectivity	KSDP ftp site, Feb 09, 2008	HLPO connectivity map
Dgo_dws	HLPO Domestic Watersheds	KSDP ftp site, Feb 09, 2008	For info only. Not used for analysis.
Dgo_erd	HLPO ERDZ	KSDP ftp site, Feb 09, 2008	HLPO enhanced resource development zones.
Dgo_esa	ESA	TSR3 data, circa 2002	Environmental sensitive area polygons; extracted from the pre-2002 forest cover maps
Dgo_fc	Forest cover	FAIB, Jan 1 2008.	Forest cover; projected and adjusted by FAIB staff.
Dgo_ga2	(Draft GAR) UWR	MoELP ftp site, Feb 14 2008	Draft ungulate winter range.
Dgo_lu	Landscape Units	KSDP ftp site, Feb 09 2008	
Dgo_nbe	Biogeoclimatic subzones	LRDW, Feb 09 2008	
Dgo_oar	Operating Areas	KSDP ftp site, Feb 09 2008	
Dgo_obo	BEO Assignments	KSDP ftp site, Feb 09 2008	Biodiversity emphasis options map; based on “old bec” ;
Dgo_ogm	OGMA; MOGMA	KSDP ftp site, Feb 09 2008	Old growth management areas (OGMA); Mature and old management areas (MOGMA)
Dgo_ope	Operability	Forest licensees, April 2008	2002 version operability; updated in 2008 by licensees.
Dgo_own	Parks and protected	LRDW, Feb 15 2008	Ownership classes. A consolidation for TSR4 of: LRDW Parks and protected, LRDW Woodlot licenses, TSR3 private land parcels, and LRDW CRA tenures (ski hill recreation area/reserve).
	Private lands	TSR 3, 2000	
	Ski Hill reserve	MoF staff, April 2008	
	Woodlot licenses	LRDW, Feb 15 2008	
Dgo_pob	POD Buffers	Derived for TSR4, May 2008	Buffers around streams for HLPO defined distances above consumptive use points of diversion (POD);
Dgo_psb	PSP reserves	LRDW, Feb 05 2008	Reserves around permanent sample plots
Dgo_rdb	Road Buffers	Derived for TSR4, April 2008	Compilation of licensee road data; buffered by GIS.
Dgo_rib	Riparian Buffers	Derived for TSR4, June 2008.	Derived FRPA S-class based on a correlation of the FDIS fisheries field samples with GIS-based upstream stream length; then buffers generate by a GIS.
Dgo_rst	Logged areas	RESULTS, Feb 12 2008	Block footprints (helps identify logged areas)
Dgo_sar	SaRCO Caribou	SaRCO ftp, Jul 11 2008	Species at Risk Coordination Office “incremental” caribou
Dgo_ter	Overview terrain	Compiled for TSR4, Licensee data, June 2008	Slope stability ratings; a compilation of all the available overview terrain mapping projects
Dgo_vqo	VQO	KSDP ftp site, Feb 09, 2008	Visual Quality Objectives (VLI)
Dgo_wtp	Wildlife Tree Patches	Licensee data, April 2008	Compilation of licensee data

Notes:
Dates are often the download date, because source data has a range of updates, or no production date was available.
LRDW = Land and Data Warehouse
KSDP = Kootenay Spatial Data Partnership ftp site.
This data has been made available for review to the staff of government ministries/branches of MoF, MoE and ILMB.

The inventories which most impact the landbase reductions or the forest requirements are described below in more detail.

Ownership

The ownership data is a new compilation of ownership classes, compiled from several sources (Table 6).

Table 6 Ownership classes in the TSR4 Ownership Data

Ownership Class	Description	Source
40-N	Private land parcels	TSR3 ownership map
50-N	Federal Parks	LRDW
63-N	Parks and protected areas	LRDW
77-N	Woodlot Licenses	LRDW
99-N	Golden ski hill reserve	Provided by MoF staff, Revelstoke (from LRDW)
62-C	Crown lands	Any area not covered by the above classes

Landscape Units

Landscape Units divide the TSA into geographic areas that are used for biodiversity management. Several landscape units overlap into the adjacent federal and provincial parks. As the management of old seral forest is based on LU boundaries, for the purposes of modeling biodiversity only, the park areas are included within the timber supply model landbase. However, no harvesting is permitted within the parks and protected areas. The "Golden" landscape units, which cover a portion of the official TSA extents, were used to define the area analyzed in this TSR (as well as the area analyzed in the previous TSR3).

Environmentally Sensitive Areas

Environmentally sensitive sites and areas of significant value for other resource uses were originally delineated within the forest cover inventory as Environmentally Sensitive Areas (ESA's). ESA's are a broad classification of areas that indicate sensitivity for unstable soils (E1s), forest regeneration problems (E1p), snow avalanche risk (E1a), and high water values (E1h). ESA classification was originally part of the forest cover map. Later, the ESA polygons were copied from the forest cover to a separate map. The content of the ESA map is unchanged from the original forest cover map it came from (circa 1999/2000). ESA mapping was used in the Golden TSR 3 to delineate several categories of netdowns, such as sites that were potentially not stable, and sites subject to regeneration problems.

Level B and D Terrain Stability

Terrain mapping is preferred to ESA mapping for delineating sites that are potentially non-stable, and which should be netted out of the THLB. Terrain stability mapping was completed during the 1990's for a substantial portion of the TSA, but this data was not available in GIS format for the last TSR.

All the available terrain stability digital data were compiled, and hardcopy maps digitized, into one GIS map of terrain for the TSA for TSR 4. Terrain stability mapping was available for the majority of the TSA and was used to delineate unstable slopes. Otherwise the ESA mapping was used.

Recreation Inventories

A recreation features inventory (RFI), and resource opportunity spectrum (ROS) inventory are available for the TSA. These inventories do not impact the timber supply analysis.

Visual landscape inventory (VLI)

The Visual Quality Objective (VQO) classes from the visual landscape inventory are used in the timber supply analysis to model visual landscape management practices.

Ungulate Winter Range

The current, approved UWR inventory and management guidelines have been established as a Section 7 notice. However, Ministry of Environment staff recommended that a draft, but soon-to-be-approved (as a Government Actions Regulation (GAR)) UWR map and guidelines be used to model UWR management within the TSA. The draft GAR UWR map and guidelines were used in this analysis.

Roads inventory

A TSA road inventory was compiled from the licensees' in-house road inventories. This forms the basis of the road buffers, which are used as landbase netdowns for existing roads, and to identify the non-developed portions of the TSA that will require future roads and future road netdowns.

Stream, wetland and lake inventory

The TSR3 classified stream map was a GIS-derived stream classification based on the watershed atlas streams. Those roughly correspond to the streams on the 1:50K federal topographic maps.

Fisheries fieldwork has been carried out over the last decade throughout the TSA, but only for scattered sites within portions of watersheds. Only a portion of the field data was compiled, by one licesee, into a classified stream map.

A GIS-based project was carried out to derive a consistent map of FRPA-type stream classes (e.g. S3, S4) for all the streams in the TSA. The riparian classification was assigned to all stream segments, based on a correlation between the FDIS fisheries field samples (i.e. the stream width) and a combination of the GIS-derived upstream stream length and stream gradient. The GIS-classified stream map was then updated wherever licensee field data existed.

As well, the new LRDW data for double line river polygons, wetlands and lakes was classified and added to the classified stream map. Buffers were generated for all streams, wetlands and lakes and used as landbase netdowns.

Old Growth and Caribou Habitat inventory

Both the old seral and the mature-plus-old seral forest requirements have been spatially mapped by ILMB staff. These are called old growth management areas (OGMAs) and mature-plus-old management areas (MOGMAs). The M/OGMA mapping was combined with the spatial mapping of the HLPO caribou requirements with the intent of overlapping the biodiversity and caribou requirements as much as possible.

Recently, the Species at Risk Coordination Office (SARCO) mapped additional "incremental" caribou areas. The areas on the March 2008 version of the SARCO caribou "incremental" map have been added to the areas representing the HLPO caribou requirements.

All these areas (SARCO, pre-SARCO caribou, OGMA, MOGMA) are modeled as 'no harvest' zones in this analysis and hence are identified as THLB landbase exclusions in Table 8.

4.0 Exclusions from the Timber Harvesting Land Base

There are three major landbase classifications of interest in this analysis: gross, productive and timber harvesting landbase. The gross area modeled in this analysis includes Parks and non-park lands (Table 7). The productive landbase contributes to landscape level objectives for biodiversity and non-timber resource management. The productive land base excludes water, non-forest and non-productive types. The timber harvesting land base (THLB) is that portion of the productive landbase where timber harvesting occurs. It excludes areas that are inoperable or uneconomic for timber harvesting; areas set aside for other resources; or areas otherwise off-limits to timber harvesting. Estimates are made for both existing and future reductions to the THLB.

Table 7 Total area of Golden TSA

Geographic Area	Gross Area (ha)
Parks and protected	290,917
Non-park	893,694
Total Area modeled	1,184,611

Of note, the official TSA boundary extends beyond what is considered to be the Golden landscape units (Figure 1). The "extra" areas, which fall totally within Parks, are considered to be either Invermere landscape units (the south-east area) or considered to be part of the Revelstoke LUs (the south-west area).

In summary, the official TSA area (1,310,865 ha) is reduced by these two areas to arrive at the area analyzed in this TSR4 (1,184,611 ha). This is the same area of 1,185,000 ha referred to in TSR 3 as the "Golden analysis area" (TSR3 Analysis Report, page 4). Throughout this report the term "Golden TSA" refers to the area covered by the Golden landscape units, rather than the official TSA area.

Table 8 presents the individual reductions to the gross area of the Golden TSA to arrive at the Timber Harvesting Land Base (THLB), the area available for timber harvesting. Again, the statistics include some of the area of adjacent parks to allow complete coverage of the landscape units for the purpose of analyzing biodiversity management. No timber harvesting is allowed in the parks and protected areas during the timber harvest modelling.

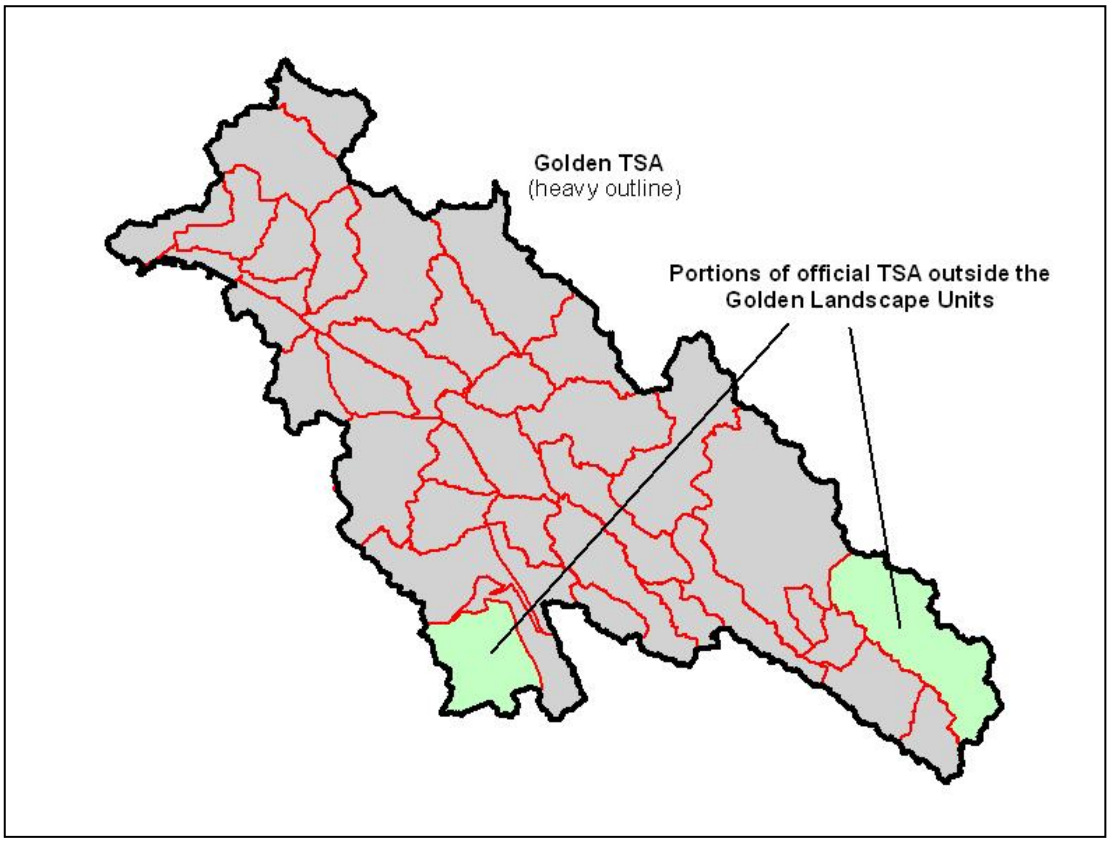

Figure 1 Difference between the Golden TSA and the Golden Landscape Units

Table 8 Timber Harvesting Land Base Determination

	Park Area (ha)	Non-Park Area (ha) (*)	Total Area (ha)	Percent Of Total Area (%)	Percent Of Productive Area (%)
Total land base	**290,917**	**893,694**	**1,184,611**	**100.0**	
Reductions					-
Private, Woodlots, non-contributing administrative classes	0	22,975	22,975	1.9	
Non-forest, non-productive forest	202,630	522,253	724,883	61.2	
Roads, trails, landings	60	4,016	4,076	0.3	
Total productive land base (*)	**88,227**	**344,449**	**432,677**	**36.5**	**100.0**
Reductions					
Parks and protected areas (**)	88,227	0	88,227	7.4	20.4
Inoperable	0	165,829	165,829	14.0	38.3
Unstable terrain (ESA & TSIL)	0	3,376	3,376	0.3	0.8
Non-merch (low site)	0	3,067	3,067	0.3	0.7
PFT (Hw and Decid)	0	5,548	5,548	0.5	1.3
Wildlife (caribou HLPO and SARCO)	0	8,348	8,348	0.7	1.9
Archaeological sites	0	0	0	0.0	0.0
Riparian	0	5,194	5,194	0.4	1.2
Biodiversity - WTRA	0	1,543	1,543	0.1	0.4
Biodiversity – OGMA and MOGMA	0	9,910	9,910	0.8	2.3
Permanent sample plots	0	105	105	0.0	0.0
Total Reductions	88,227	202,920	291,147	24.6	67.3
Current Timber Harvesting Land Base	**0**	**141,530**	**141,530**	**11.9**	**32.7**
Future WTPs	0	652	652	0.1	0.2
Future roads and trails	0	2,516	2,516	0.2	0.6
Net long-term Timber Harvesting Land Base	**0**	**138,362**	**138,362**	**11.7**	**32.0**

Note:
1. All totals are subject to rounding.
2. (*) Park area is included for biodiversity modeling of the productive landbase. Totals below (**) do not include any of this Park area.

Note that any overlaps between net-downs are removed in Table 8. Any overlap will accrue to the first (highest) category in the table. In subsequent sections the same netdown categories are discussed in more detail and both the gross and the non-overlapping areas are tabulated. The gross areas in subsequent tables may be greater than those in Table 8

4.1 Non-contributing administrative classes

Private (fee-simple) lands, municipal lands, and certain classes of reserves do not contribute to the productive forest landbase. These are summarized in Table 9.

Table 9 Non-contributing administrative classes

Class	Description	Total Area (ha)	Reduction Area (ha)
40-N	Private land	12,963	12,963
77-N	Woodlot Licenses	8,315	8,315
99-N	Golden ski hill reserve	1,697	1,697
Totals		**22,975**	**22,975**

4.2 Non-productive and non-forest area

Non-productive forest land is not capable of producing a merchantable stand within a reasonable length of time. This includes alpine forest, non-productive land covered with commercial species, deciduous and/or coniferous.

Non-forest areas are "*not primarily intended for growing or supporting forest. This includes alpine, rock, slide, non-productive burn, non-productive brush, swamp or muskeg, cultivated, cleared, urban, open range, wild hay meadow, clay bank, gravel bar, and other categories.*" (MoF, 2007).

All non-productive and non-forest stands are removed from both the THLB, and the CFLB. These stands do not contribute to meeting the requirements for biodiversity or other non-timber resources (see the Resource Management sections).

These stands are identified in a FIP-type forest inventory database with a non-productive code value greater than 0 [np_code > 0]. The remaining forest inventory is the newer VRI-type that no longer has non-productive codes assigned. The productive stands have been estimated using the following logic:

- trees must cover a minimum of 10% of the polygon; and
- crown closure must be greater than 25%; and
- site index must be greater than or equal to 8.0 meters.

The area of landbase reduction for each criterion is summarized in Table 10.

Table 10 Non-productive and non-forest area exclusions

Descriptor	Forest Cover Inventory Type	NP Code	Gross area (ha)	Effective reduction Area (ha)
Ice	FIP	1	9,573	9,573
Alpine	FIP	2	72,753	72,753
Rock	FIP	3	768	768
Alpine Forest	FIP	10	9,560	9,560
Non Productive Brush	FIP	11	1,894	1,894
Non-Productive	FIP	12	26,065	26,065
Lake	FIP	15	363	363
River	FIP	25	531	531
Swamp	FIP	35	993	993
Cultivated	FIP	42	6	6
Urban	FIP	54	42	42
VRI – non treed	VRI	n/a	519,514	514,960
VRI – Low cc	VRI	n/a	65,404	63,598
VRI – SI < 8	VRI	n/a	23,808	23,776
Total	**--**		**731,274**	**724,883**

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.3 Non-commercial cover

Non-commercial cover is any "*Productive forest land covered with non-commercial tree species or non-commercial brush*." (MoF, 2007) This is identified in the FIP-type forest cover database as [type identity = 5]. VRI-type forest cover does not have type identify values assigned. All non-commercial stands are removed from the THLB. As well, these stands do not contribute to meeting the biodiversity or other non-timber resource requirements (section 9.0).

There are no NC stands identified in the FIP inventory. This section was included for completeness only.

Table 11 Non-commercial cover

Category	Total Area (ha)	Reduction Area (ha)
Non-commercial	0	0

Non-commercial class is only found within the FIP-type forest inventory (approximately 15% of the gross area).
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.4 Roads trails and landings

A small proportion of the roads may be large enough to be typed as non-forest polygons on the forest cover map. However, these classified roads, trails and landings are not identified as roads per se; they are usually lumped with other non-forest types such as "urban". Classified roads, trails and landings are, therefore, a portion of the non-forest reductions in Table 8.

4.5 Unclassified roads, trails and landings

Most of the roads, trails and landings (RTL) are too narrow to be typed out as polygons in the forest inventory map. These roads are referred to as unclassified. The landbase reduction for unclassified roads was performed by determining an average disturbance width for three classes of roads: 28 m (14 m. each side of centerline) for paved roads, 0 m for trails, and 14 m (7 m. each side of centerline) for all other non-paved and non-trail road type, and then buffering the roads in the GIS. The buffers then were used as landbase netdowns, as per Table 12.

These three road classes correspond to the three classes used in TSR3. However, in TSR3 the analysts assumed that paved roads likely fell on non-forest polygons in the forest inventory, and so no accounting for paved roads was done in TSR3. The road database used in this analysis contained few roads classified as paved, most of these were municipal roads within the city of Golden, so the vast majority of roads in this analysis are "other roads" (Table 12).

Table 12 Reductions for unclassified roads, trails, and landings

(1) Road Type	(2) Road Width (m)	(3) Reduction (%)	Road Length (km)	Gross area (ha)	Effective reduction area (ha)
Paved roads	28	100	4915	6,314	4,076
Other roads	14	100			
Trails	0	0	1315	0	0
Totals	**-**		**6230**	**6,314**	**4,076**

Width is total buffer width, e.g. 14m represents 7m on each side of the road centreline.
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

The landbase reduction for future roads, trails and landings is described in section 4.16.2.

4.6 Parks and Protected Areas

The reduction area of parks and protected areas is summarized in Table 13.

Table 13 Reductions for parks and protected areas

Classification	Productive Forest Area (ha)	Effective Reduction Area (ha)
Parks and Protected	290,917	88,227

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.7 Inoperable / Inaccessible

Area that is not available for timber harvesting due to physical, silvicultural or regeneration difficulties, and economic inaccessibility is classified as "inoperable". Three classes exist in the operability inventory: inoperable, denoted as "I" (Inoperable) or "N" (non-classified, within Parks) and operable (denoted as "A"). The area of classes "I" and "N" are treated as landbase reductions, as per Table 14.

Table 14 Inoperable land base reduction

Classification	Productive Forest Area (ha)	Effective Reduction Area (ha)
I, N	960,242	165,829

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.8 Unstable terrain and environmentally sensitive areas

Environmentally Sensitive Areas (ESA's) are a broad classification of areas that indicate sensitivity for unstable soils (E1s), forest regeneration problems (E1p), snow avalanche risk (E1a), and high water values (E1h). The ESA classification was originally part of the forest cover inventory. The ESA polygons were copied from the forest cover to a separate map, and the map is essentially unchanged from the original forest cover data.

Where completed the ESA soils mapping has been replaced with Terrain Stability mapping. The new terrain mapping was available for 97.1% of the CFLB, the ESA mapping was used on the remaining 2.9%. This terrain mapping is a composite of several projects, all of which utilized the RIC standards of that time (circa 1990's). Terrain stability mapping is thought to provide a better estimate of unstable soils than the Es1 mapping, and is used in this analysis for the bulk of the unstable landbase netdown. Where not available, the ESA cover is used to identify landbase netdowns (Table 15).

The landbase reduction for unstable terrain was based on the profile of unstable (class U) and potentially unstable (class P) in the harvest. Analyses were made of the percentage of U and P class terrain classes within the harvest profile of three periods: the last 30 years (for most of the TSA), and for the last 10 years and 5 years. These latter two were for a smaller portion of the TSA. They also excluded blocks that addressed MPB attack as those blocks usually fell on gentler terrain, and including them would bias the results. The analyses showed an increase in the percentage of U and P in the harvest over time, as we approach the present day. The results from the last 10 years were chosen to determine the netdown for unstable terrain. The following procedure was used:

- The profile of unstable (U) and potentially unstable (P) terrain classes within the operable, productive forest landbase was calculated as 5.3% and 18.5%, respectively;
- The harvest profile of U and P terrain classes within the last 10 years harvest is 3.6 and 32%, respectively;
- The harvest profile for the P class shows no avoidance of that class, so no reduction for P class terrain is required, nor applied;
- The harvest profile for the U class shows that 1.7% of the U is being avoided (a raw percentage which is calculated as 5.3 – 3.6 = 1.7). This represents 32% of the U profile (this is a percent of percent, i.e. 32% = 1.7% avoidance of U in the harvest profile / 5.3% of U in the landbase profile.)
- If the trend from this last 10 years continues, then we expect 32% of the U class polygons will not have been harvested after the whole THLB is developed. And, 32% is our best estimate of the landbase netdown for U class terrain.
- Using an equivalent area concept, 32% of the U class polygons were randomly chosen, and these polygons were treated as a landbase netdown.

The resulting landbase netdowns for unstable terrain and ESAs (where terrain mapping did not exist) are summarized in Table 15.

Table 15 Unstable terrain and environmentally sensitive sites

Description		Percentage Removal	Productive Forest Area (ha)	Effective Reduction (ha)
ESA Soils	S1	90	612	381
ESA Soils	S2	10	6	6
Unstable terrain	TSIL U	32	27,743	2,988
Total			**28,360**	**3,376**

ESA percentage removals are from TSR 3. The ESA classes in TSR3 included other types of ESA, such as avalanche-type ESAs but those types were not found within the area not covered by the new terrain mapping.
32%% of the unstable areas were removed, roughly consistent with field practices.
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown". By far, the majority of the unstable terrain class U polygons fall within the inoperable, so the effective reduction area is only a small portion of the total area of class U polygons.

4.9 Non-merchantable / low site and Problem Forest Types

Non-merchantable forest types are stands that contain tree species not currently utilized, or timber of low quality, small size and/or low volume, or steep topography, or low stocking.

4.9.1 Non-merchantable / low site

Site class is "*The measure of the relative productive capacity of a site for a particular crop or stand, generally based on tree height at a given age*" (MoF 2007). Low site stands grow so slowly that they are not deemed to be suitable for forest production. The landbase reductions for low site stands are summarized in Table 16.

Table 16 Landbase reductions for non-merchantable, low site types

Class	Leading Species	Inventory Type Groups	Site index Or volume (m^3)	Age (years)	Productive area reduction (ha)	Effective area reduction (ha)
Low Productivity Site Index[1]	Spruce, Hemlock, Balsam	12-26	<= 8.0	Any	89,185	1,048
Low Productivity Site Index[1]	Fir, Cedar, Pw, Pl, Py, Larch, Decid	1-11, 27-42	≤ 9.0	Any	549,968	2,020
Total					639,154	3,067

[1] Not applied where stands have logging history and are within the operable.
"Effective reduction" is the area netted out after all previous netdowns are removed; this is sometimes referred to as the "non-overlapping netdown".

Table 17 provides estimates of the stand diameter and volumes at the upper limits of the low site classes. Note that Table 16 is a cut-off value for including/excluding stands in the THLB, and Table 17 is the volume and diameter expected at the same site index values at a reference age=100. If one varies the reference age then one can derive the same numbers as seen in Table 16. And, if the threshold values in Table 16 were varied then the minimum merchantability criteria will force changes in the minimum harvest ages.

Table 17 Non-merchantable forest types –diameter and volumes at threshold site index

Leading Species	SI Upper Limit	Diameter (cm) at breast Height (cm) at upper limit of low site	Volume/ha at upper limit of Low site (m3/ha)
Pine	≤ 9.0	17.4	94.4
Fir	≤ 9.0	23.1	17.3
Cedar	≤ 9.0	20.3	72.8
Spruce	≤ 8.0	21.2	44.8
Hemlock	≤ 8.0	22.8	56.0
Balsam	≤ 8.0	21.4	63.7

Notes: Upper limit d.b.h. and volume are based on a reference age of 100 years; FIZ G, and PSYU 175.

4.9.2 Problem Forest Types

In the Golden TSA the deciduous-leading (hardwood) stands are not considered economically viable. These and the older, high percentage hemlock stands were excluded from the timber harvesting land base (Table 18).

Table 18 Problem Forest Types

Class	Leading Species or Criteria	Inventory Type Groups	Site index Or volume (m^3)	Age (years)	Productive area reduction (ha)	Effective area reduction (ha)
Deciduous[1]	Any deciduous	35-42	n/a	> 30 yr	15,929	4,787
Hemlock	Hw (>= 80%)	12-17	n/a	141 +	4,247	761
Total					**20,176**	**5,548**

[1] Natural stands only, not applied to operable stands with a logging history.
"Effective reduction" is the area netted out after all previous netdowns are removed; this is sometimes referred to as the "non-overlapping netdown".

4.10 Wildlife: Caribou habitat

4.10.1 HLPO caribou habitat requirements

When the OGMAs were being mapped, the equivalent area of the HLPO requirements for caribou were also mapped. Where possible, areas were identified that met both objectives. Caribou areas are also managed as "no harvest" zones, and are therefore treated as landbase exclusions in this analysis. This contrasts with the previous timber supply review where the caribou requirements were modelled as percentage older forest requirements.

4.10.2 SARCO caribou habitat requirements

The Species At Risk Coordination Office (SARCO) recently identified caribou habitat areas that are additional to the HLPO caribou requirements. The SARCO area are also expected to be managed as "no harvest" zones, and therefore are modelled as landbase exclusions in this analysis. The area of HLPO and SARCO caribou habitat exclusions are summarized in Table 19.

Table 19 Caribou habitat landbase exclusions

Source of Caribou Habitat Mapping	Productive area (ha)	Effective reduction area (ha)
Caribou - HLPO Mature	20,426	6,157
Caribou - HLPO Old	2,595	1,834
Caribou - SARCO	507	356
Wildlife (Caribou) Total	**23,529**	**8,348**

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.11 Cultural heritage and Archaeological reductions

Archaelogical Overview (AOA) mapping has been completed for all of the TSA. As development proceeds, detailed archaeological impact assessments (AIA) are completed. To date, the area reserved from forestry activities for protection of heritage resources at the site-specific level has been very small. The area reduction does not significantly impact the timber supply analysis.

Maps of the registered archaeological and heritage sites were obtained from Archaeology Branch. There are 121 individual sites, most being very small, some only 1 square meter. Only those sites over 0.02 ha were incorporated into the data as the very small polygons would have simply been removed by the GIS during the sliver removal process. The gross area of archaeological sites was 14.3 ha (number of sites=55), with a final, effective reduction area of 0.09 ha (Table 20).

Table 20 Registered archaeological site reductions

Archaeological Sites (#)	Productive Area (ha)	Effective Reduction Area (ha)
55	13.82	0.09

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.12 Riparian reserves and management zones – streams

Riparian reserve strategies were implemented in the model by establishing effective reserve buffers around the riparian features inventories (streams, wetlands, lakes) using a GIS.

The HLPO specifies a 30 meter reserve around streams for a specified distance upstream of water intakes (also called points of diversion, or POD). The distance upstream is based on stream order. PODs were located, and the streams with reserves were mapped by hand, and GIS buffers created. The riparian exclusions for HLPO-type stream reserves are summarized in Table 21.

The remainder of the riparian reductions were based on Forest and Range Practices Regulation (FRPR) defaults. To implement this as a landbase net-down, an effective reserve width is determined by adding the effective retention width for the default management zone width to the reserve buffer and assuming it is a (100%) reserve-type buffer (Table 21).

Table 21 Riparian reserve zones – streams

Riparian Class	Riparian Reserve Zone (metres)	Riparian management Zone (metres)	Retention Level (% basal area)	Effective Reserve Width (metres)	Productive area (ha)	Effective area reduction (ha)
DWS Stream Reserves	30	0	100	30	451	92
S1a	0	100	20	20	4,798	279
S1b	50	20	20	54	10,187	2,003
S2	30	20	20	34	6,330	1,260
S3	20	20	20	24	4,015	776
S4	0	30	10	3	1,776	324
S5	0	30	10	3	754	63
Total					**28,312**	**4,798**

Notes: Based on FRPR Sec 47 to 51.
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.13 Riparian reserves and management zones – wetlands and lakes

The reserves and management zones for wetlands and lakes were handled the same way as the streams (above). Effective width landbase reductions are listed in Table 22 and Table 23.

Table 22 Riparian reserve zones –lakes

Riparian Class*	Riparian Reserve Zone (metres)	Riparian Management Zone (metres)	Retention Level (% basal area)	Effective Reserve Width (metres)	Productive area (ha)	Effective area reduction (ha)
Rip L1b	10	0	10	10	2,917	28
Rip L3	0	30	10	3	698	3
Rip Lake total					**3,615**	**31**

Notes: Based on FRPR Sec 47 to 51
* The table only includes the lake classes that occur in the TSA and require riparian reserves (e.g. class L1A do not).
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

Table 23 Riparian reserve zones - wetlands

Riparian Class*	Riparian Reserve Zone (metres)	Riparian Management Zone (metres)	Retention Level (% basal area)	Effective Reserve Width (metres)	Productive area (ha)	Effective area reduction (ha)
W1	10	40	10	14	4,450	290
W3	0	30	10	3	866	75
Total					5,316	365

Notes: Based on FRPR Sec 47 to 51
* The table only includes the wetland classes that occur in the TSA.
"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.14 Biodiversity

4.14.1 Biodiversity – Wildlife Tree Retention Areas

Reserves for existing wildlife tree retention and other cutblock-level, mapped reserves are tallied in Table 24. These areas are the mapped WTPs and other reserves. During the modelling runs they will be set to no-harvest status, and treated as non-THLB.

Table 24 Wildlife tree retention and block-level reserves

Class	Productive area (ha)	Effective reduction area (ha)
WTP and other reserves	2,600	1,543

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.14.2 Old Seral and Mature-plus-old Seral

The Higher Level Plan Order specifies the percentage requirements of old seral and mature-plus-old seral that must be retained within each LU and BEC combination. The equivalent area of both the old and mature-plus-old seral has been mapped by ILMB staff. These areas are called OGMAs (old growth management areas) and MOGMAs (mature old growth management areas). They are modelled as "no-harvest" zones and are treated as landbase exclusions in this analysis. In TSR 3 the biodiversity requirements were modeled as percentage older seral requirements. The exclusions of each type are summarized in Table 25.

Table 25 OGMA and MOGMA landbase exclusions

Biodiversity Reserve Type	Productive area (ha)	Effective reduction area (ha)
Old growth management area (OGMA)	11,074	720
Mature plus old management area (MOGMA)	44,416	9,190
Totals	**55,490**	**9,910**

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.15 Permanent sample plots

The landbase reductions for reserves around permanent sample plots (PSP) are provided in Table 26.

Table 26 Permanent sample plot reductions

PSP Reserves	Productive Area (ha)	Effective Reduction Area (ha)
Total	190	105

"Effective reduction" is the area netted out after all previous netdowns are removed; sometimes referred to as the "non-overlapping netdown".

4.16 Future Land Base Reductions

4.16.1 Future wildlife tree retention areas

The licensees' Forest Stewardship Plans are based on retaining the default 7% of each cutblock as wildlife tree retention areas (WTRA). When possible, WTRAs are placed within existing non-THLB stands, so only a portion of the 7% is actually a landbase reduction. Wildlife tree retention areas are required to be placed at a maximum distance of 500 meters apart. Based on these two factors (7.0% of the THLB reserved when beyond the 500m maximum distance spacing) the area of future wildlife tree retention areas (Table 27) was estimated using the following procedure.

- Within the THLB (Table 27, column 1) apply a 500m buffer around all productive, non-THLB stands to determine the THLB area within 500 m of existing stands that could meet WTRA requirements(column 2);
- The area outside the buffer is the area that requires additional wildlife tree retention (column 3);
- Apply a 7% retention rate to this area to estimate the equivalent area of future wildlife tree retention (column 4);
- Calculate the equivalent, blended rate of retention across the whole THLB (the developed area plus the un-developed area), which is 0.4604 % of the THLB (column 5);
- Apply that percentage as a yield curve reduction against all the future managed stand yield curves.

Table 27 Estimate of future wildlife tree retention areas

(1) Sample THLB Area (ha)	(2) THLB Area within 500 meters of NHLB (%)	(3) THLB Area requiring additional WT retention (%)	(4) Equivalent THLB Retention Area Assuming 7% Retention (7%) X (3) (ha)	(5) Future THLB Reduction (4) / (1) (%)
141,525	93.422 %	6.578 %	652 ha	0.4604 %

4.16.2 Future roads, trails and landings

A recent Forest Practices Branch audit of licensee blocks found that only 4.6% of the area of cutblocks was in permanent access structures (PAS). This included roads, trails and landings. Based on this factor (4.6% of THLB), the area of future roads, trails and landings (Table 28) was estimated using the following sequence:

- Within the THLB (Table 28, column 1) apply a 300m buffer around all existing mapped roads to determine the "developed area" (column 2); the remaining THLB area is the "undeveloped area";
- Within the undeveloped THLB area (column 3), apply a 4.6 % reduction to find the total area (in hectares) representing all future roads, trails and landings (column 4); this translates to a blended percentage of the total THLB landbase (column 5); and
- Apply that blended percentage as a reduction to the future, managed stand yield curves (column 5).

Table 28 Estimate of future roads, trails, and landings

(1) THLB Area (ha)	(2) Developed THLB Area (%)	(3) Non-developed THLB Area (%)	(4) (4) Equivalent THLB Retention Area Assuming 4.6% Area in PAS (3) X (4.6%) (ha)	(5) Future THLB Reduction (4) / (1) (%)
141,525	61.365 %	38.635 %	2,516	1.778 %

4.17 Area additions

No area is added to the landbase during the modelling. In TSR3 there were some Timber Licences that did revert, however the last of the Timber Licenses in the TSA reverted to the Crown just prior to the beginning of this timber supply analysis (March 31, 2008).

4.18 Descriptions of the Landbase

The exclusions described previously define the extent of the productive forest land, and the timber harvest landbase. The characteristics of their age class distribution, species profile and site index profile follow.

4.18.1 Age Class distribution

Statistics and charts of the age class distribution are provided in Table 29, and Figure 2 and Figure 3 . Site index for the contributing and timber harvesting land base is depicted in Figure 4. The average site index of the THLB is 17.1 m.

Table 29 TFL 14 Age class distribution

Age Range	Productive Total (ha)	Operable (ha)	Timber harvesting Land base (ha)
0	6,263	5,903	5,552
1-20	14,819	14,154	13,287
21-40	46,770	41,803	39,911
41-60	12,903	5,835	4,615
61-80	30,060	13,418	10,767
80-100	48,496	21,503	17,914
101-120	36,487	12,599	10,082
121-140	37,891	10,890	8,409
141-250	127,641	28,294	17,894
251+	71,347	26,338	13,099
Totals	**432,677**	**180,738**	**141,530**

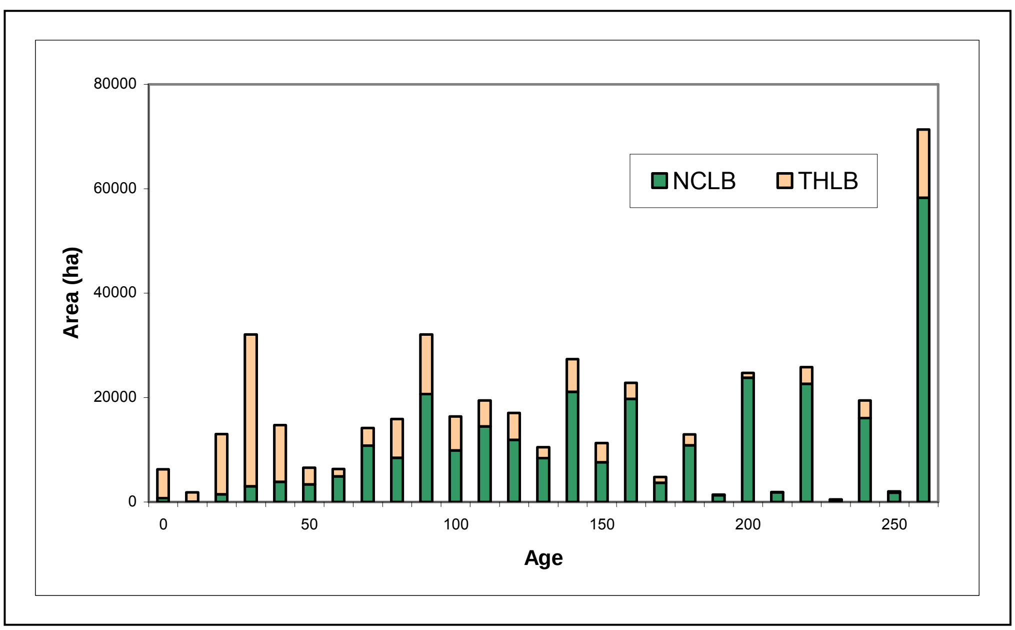

Figure 2 Age class distribution of non-contributing (NHLB) and timber harvesting landbase (THLB)

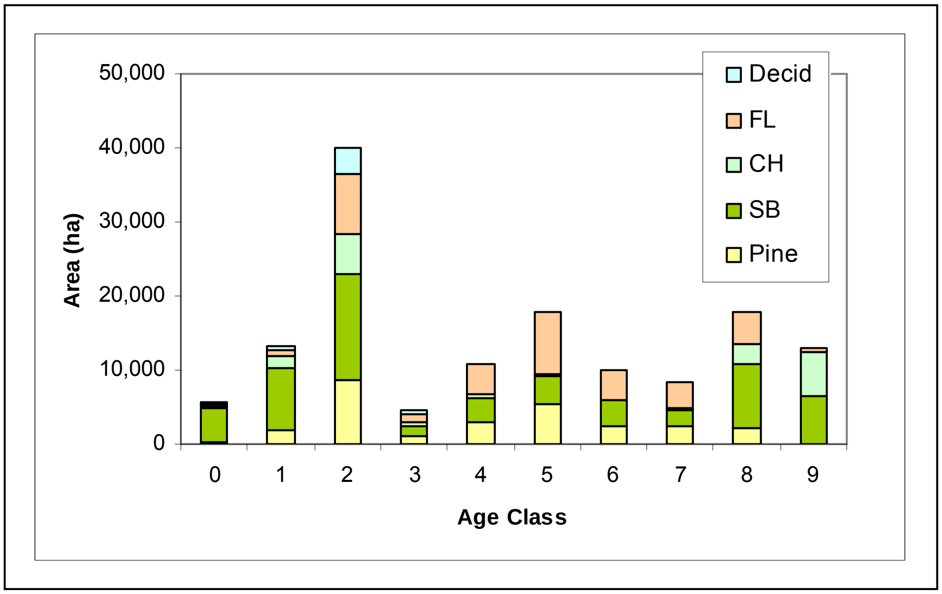

Figure 3 Age class distribution by species group for timber harvesting landbase (THLB)

Spruce and Balsam leading stands cover 40% of the THLB area. Other species groups and their percentage are: Fir and larch (25%), Pine (19%), Cedar/Hemlock (13%) and Deciduous (3%).

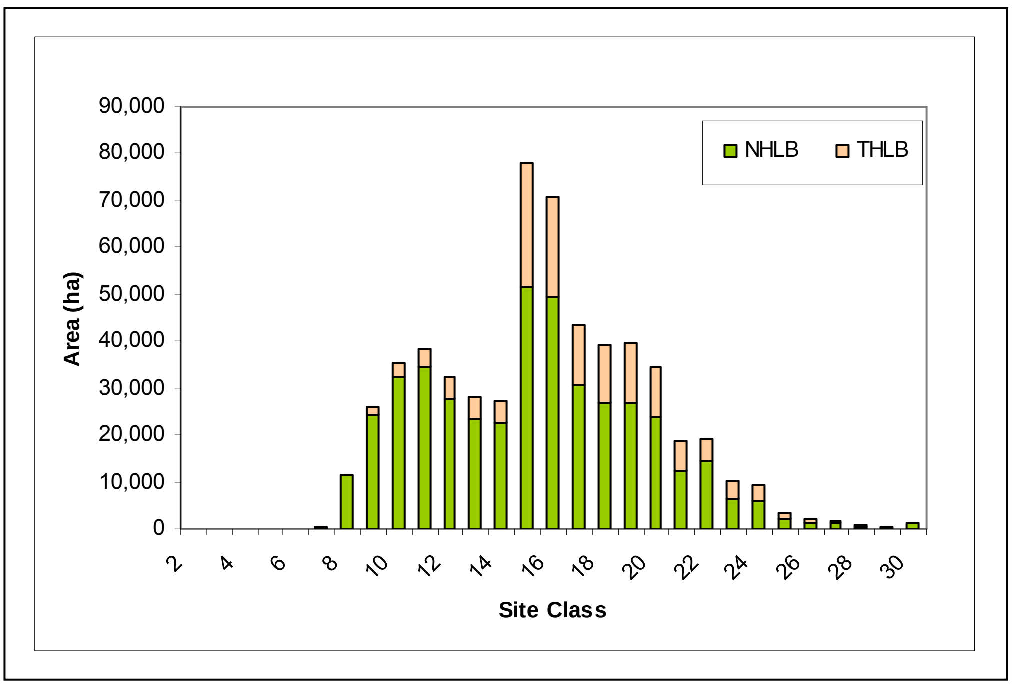

Figure 4 Site index for non-contributing (NCLB) and timber harvesting landbase (THLB).

5.0 Inventory Aggregation

5.1 Analysis Units

To reduce the complexity and volume of information in the timber supply analysis, individual stands are aggregated into 'analysis units' (AU). Groups are largely based on dominant tree species (inventory type group), timber growing capability (site index) and silvicultural management regimes. For example, all fir/larch stands on moderate growing sites with a clearcut silviculture regime may be grouped into a single analysis unit. Each analysis unit has at least one associated yield table that provides the model with the net merchantable volume that is available for harvest at different stand ages.

Several sets of analysis units were created to reflect forest management practices on the THLB:

Existing non-harvested, natural stands (100 series – 95,727 ha of THLB)

> These are stands with no history of harvesting in the past. Most of these stands are >=30 years old today but some younger stand created through natural disturbances are also included. Once harvested, these stands move onto the 200 series as future managed stands (clearcut).

Future managed stands (200 series – same area as 100 series)

> These analysis units are the same as the 100 series analysis units after being harvested. The 200 and 600 series analysis units (see below) undergo the full benefits of forest management practices, such as better initial stocking and planting of stock with higher genetic gains.

Existing clearcut, managed stands (500 series – 45,803 ha of THLB)

> These are previously logged stands. Forest management has had some positive impact on the establishment and growth of these stand compared to natural stands, but not as much as stands logged from today forward. Most of these stands are less than 30 years old today. Once harvested, these stands move onto the 600 series and realize the full benefits of current regeneration practices, such as volume gains from the use of select seed.

Future existing-managed stands (600 series – same area as 500 series)

> These analysis units are the 500 series analysis units after being harvested.

Non-contributing stands (800 series – 0 ha of THLB; 291,147 ha of NHLB)

> These are productive stands in the non-timber harvest land base (NHLB). They track along their own yield curve, undergo disturbances, but do not experience any harvesting. They contribute to biodiversity and other resource requirements.

These broad groups are further sub-divided by criteria of:

- leading species, and
- NSR class (not sufficiently restocked), and
- site index (to differentiate the regeneration and growth characteristics).

Classification thresholds for defining analysis units were determined by balancing the competing objectives of using the fewest number of analysis units (to reduce unnecessary complexity), that are significantly different (in terms of biology, growth characteristics, etc), while trying to maintain reasonable-sized areas (hectares) of each analysis unit. The common species and site index thresholds chosen for the clearcut-based analysis units are listed in Table 30.

Table 30 Existing stand analysis unit species and site index classification thresholds

Leading Species	Logging History	Site Group	Site Index Break-points	Analysis Unit	Inventory Type Groups Name (number)
Douglas-fir, Larch (dry)	NO	1 2 3	>=22 >=17 and <22 <17	Natural - 101 Natural - 102 Natural - 103	F, FPl, FPy, FL, FDecid, LF, L (1, 5, 6, 7, 8, 33, 34)
Douglas-fir (wet)	NO	1 2 3	>=21 >=17 and <21 <17	Natural - 104 Natural - 105 Natural - 106	FC, FH, FS (2, 3, 4)
Cedar	NO	1 2 3	>=19 >=14 and <19 <14	Natural - 107 Natural - 108 Natural - 109	C, CF, CH (9, 10,11)
Hemlock	NO	1 2 3	>=18 >=13 and <18 <13	Natural - 110 Natural - 111 Natural - 112	H, HF, HC, HB, HS, HDecid (12, 13, 14, 15, 16, 17)
Balsam, Spruce S predominant	NO	1 2 3	>=18 >=13 and <18 <13	Natural - 113 Natural - 114 Natural - 115	B, BH, BS, S, SB (18, 19, 20, 21, 24)
Spruce mixed	NO	1 2 3	>=21 >=17 and < 21 <17	Natural - 116 Natural - 117 Natural - 118	SF, SH, SPl, SDecid (22, 23, 25, 26)
Pine	NO	1 2 3 4	>=21 >=19 and <21 >=16 and <19 <16	Natural - 119 Natural - 120 Natural – 121 Natural - 122	PwPa, Pl, PlF, PlS, PlDecid, Py (27, 28, 29, 30, 31, 32)
Decid	YES (1)	Any	Any	Natural – 123	CotConif, CotDecid, DConif, DDecid, Mb, Bi, AConif, ADecid (35, 36, 37, 38, 39, 40, 41, 42)
Douglas-fir, Larch (dry)	YES (2)	Any	ALL	Existing Managed – 501	F, FPl, FPy, FL, FDecid, LF, L (1, 5, 6, 7, 8, 33, 34)
Douglas-fir (wet)	YES (2)	Any	ALL	Existing Managed – 502	FC, FH, FS (2, 3, 4)
Cedar	YES (2)	Any	ALL	Existing Managed – 503	C, CF, CH (9, 10,11)
Hemlock	YES (2)	Any	ALL	Existing Managed – 504	H, HF, HC, HB, HS, HDecid (12, 13, 14, 15, 16, 17)
Balsam, Spruce S predominant	YES (2)	Any	ALL	Existing Managed – 505	B, BH, BS, S, SB (18, 19, 20, 21, 24)
Spruce mixed	YES (2)	Any	ALL	Existing Managed – 506	SF, SH, SPl, SDecid (22, 23, 25, 26)
Pine	YES (2)	Any	ALL	Existing Managed – 507	PwPa, Pl, PlF, PlS, PlDecid, Py (27, 28, 29, 30, 31, 32)
Deciduous (logged)	YES (2)	Any	ALL	Existing Managed – 508	CotConif, CotDecid, DConif, DDecid, Mb, Bi, AConif, ADecid (35, 36, 37, 38, 39, 40, 41, 42)
Backlog 1 (fire or logged)	YES (3)	Any	ALL, >= 60% MSS (4)	Existing Managed – 525	(3)
Backlog 2 (fire or logged)	YES (3)	Any	ALL, < 60% MSS (4)	Existing Managed - 526	(3)

Notes:
YES (1) = With any history of logging; YES (2) = History of logging within last 30 years; YES (3) = History of logging or wildfire
(3) = Any leading species, the areas are statistically assigned based on silviculture records.
(4) = Backlog NSR areas are is divided into those above and below 60% Minimum Stocking Standards (MSS)

6.0 Growth and Yield

This section describes the information/data sources, assumptions, and methods for generating growth and yield estimates for the analysis units described in section 5.1.

6.1 Site Index

Site index (SI) is a measure of the stand's productive potential for a particular tree species. SI in British Columbia is expressed as potential tree height at 50 years breast height age. SI provides standardized comparisons of productive potential between sites, across a broad range of existing stand conditions. As such, we use it as a silvicultural tool to prescribe treatments and analyze investments. SI also serves as the main driver for many growth and yield models, which predict future forest growth and timber yields. Reference: SiteTools V3.3

6.1.1 Site curves

The standard, MoF site index curves are utilized throughout this analysis.

Table 31 Standard MoF site index curves

Species	Source
Douglas Fir (Fdi) + (Pw, Py)	Thrower and Goudie (1992)
Western Larch (Lw)	Brisco, Klinka, and Nigh 2002
Lodgepole Pine (Pli)	Thrower (1994)
Western Red Cedar (Cwi)	Nigh (2000)
Western Hemlock (Hwi)	Nigh (1998)
White Spruce (Sw) + (Sx)	Nigh (1997)
Englemann Spruce (Se)	Chen and Klinka (2000)
Balsam fir (Bl)	Chen and Klinka (2000)
Trembling Aspen (At)	Nigh, Krestov and Klinka (2002)

6.1.2 Site index adjustments

No site index adjustments were used in this analysis.

6.2 Utilization level

Utilization levels define the maximum height of stumps that may be left on harvested areas, the minimum top diameter (inside bark), and the minimum diameter at breast height (dbh) of stems that must be removed from harvested areas. These factors (Table 32) are used when calculating the merchantable stand volume in the analysis.

Table 32 Utilization levels

Species	Utilization		
	Minimum dbh	Maximum stump height	Minimum top dib
Pl	12.5	30	10
All others	17.5	30	10

Notes: dbh = diameter at breast height. Dib = diameter inside bark;
Deciduous species and Pa are netted out of stand volumes

6.3 Decay, waste and breakage for natural stands

Decay, waste and breakage factors are applied to natural stand yield tables to obtain net harvest volumes per hectare. This analysis used the standard values incorporated into the Variable Density Yield Prediction (VDYP 6) model, which are based on species, age, and Special Cruise Number (SC, or PSYU number.)

6.4 Operational adjustment factors for managed stands

6.4.1 Standard Operational Adjustment Factors

Operational Adjustment Factors (OAFs) were applied to adjust (reduce) the yields generated by the TIPSY growth and yield model down to net operational volumes. This included reductions for such factors as gaps in stand stocking, decay/waste/breakage, and endemic forest health losses.

Two types of OAFs were used in the TIPSY model. OAF 1 is a constant percentage reduction to account for openings in stands, distribution of stems or clumping, endemic pests and diseases, and other risks to potential yield. OAF 2 is an increasing percentage reduction that can be applied to account for decay, waste and breakage. OAF 2 is applied after OAF 1 and increases linearly over time from 0 percent at age 0 to the specified percentage at 100 years of age.

The OAF1 and OAF2 value used in this analysis were the provincial defaults of 15% and 5%, respectively.

6.5 Volume reductions

All deciduous stands are netted out of the THLB, except for stands with a previous history of logging, and the deciduous component is netted out of coniferous leading stand yield curves (Table 33). Similarly, all whitebark pine (Pa) leading stands or components of other stands are removed from the THLB or yield curves, respectively.

Table 33 Volume reductions

Stand type	Definition	Volume reduction
Deciduous	ITG = 35 to 42	100%
Pa	ITG = 28 to 31	Pa leading stands removed 100% from the THLB.
Deciduous component of coniferous leading stands	Other ITGs	100% of the deciduous volume; 0% of coniferous volume

Note: ITG = Inventory Type Group

6.6 Yield table development – Natural Stands

Stands are grouped into analysis units primarily based on similar <u>species</u> and <u>site index value</u>. A yield table is developed for each analysis unit.

6.6.1 Methodology

Natural stand yield table values were based on weighting the yield curves for each forest stand. These were derived using VDYP 6 software. The sequence of developing the yield curves was:

- Project all stands to 2008 (end of growing season 2007);
- For those polygons that were adjusted the adjusted age and adjusted height were used to estimate a new site index;
- The species and (adjusted) site index were used to assign each stand to an analysis unit (AU), and/or the species, site index and volume were used to assign the stand to a netdown type.
- After netdowns and AU assignment, an AU yield curve was calculated by area-weighting the volume estimates at each time step (i.e. at time = 10 years, 20 years, etc) from each of the stand yield curves.
- Percentage reductions were applied to future managed stand yield curves for future wildlife tree patches and future RTLs. They were not applied to the natural stand yield curves.

Natural stand analysis unit yield curves are included as Appendix A. The site index values for the clearcut analysis units are in Table 34. The site index values for the NCLB analysis units are in Table 35.

Table 34 Site index assignments for THLB natural stand analysis units.

Analysis Unit	Leading Species	Site Group	Area (ha)	Natural stand site Index	Regenerates To AU #
101	Fd (Dry) and Lw	1	3,201	23.7	201
102		2	12,347	18.0	202
103		3	0	n/a	203
104	Fd (wet)	1	2,268	23.4	204
105		2	7,067	18.6	205
106		3	4,357	15.5	206
107	Cw	1	877	19.1	207
108		2	3,897	15.6	208
109		3	1,169	12.9	209
110	Hw	1	792	18.8	210
111		2	2,309	14.7	211
112		3	3,385	11.2	212
113	B, S predominant	1	3,650	20.8	213
114		2	8,389	15.1	214
115		3	5,112	11.0	215
116	S mixed	1	3,260	23.4	216
117		2	4,634	18.9	217
118		3	7,642	13.9	218
119	Pine	1	3,754	22.5	219
120		2	3,652	19.9	220
121		3	9,944	17.1	221
122		4	2,704	14.7	222
123	Decid	All	1,317	21.1	223

Notes:
AU 123 = Operable stands, with a history of logging over 30 years ago, without no additional genetic worth (versus those that were harvested within last 30 years and are assigned to the existing managed AUs) that have regenerated back to deciduous leading but should not be netted out of the THLB landbase.

Table 35 Site index assignments for non-THLB (NHLB) contributing analysis units

AU	Notes	Leading Species	Site Group	Area (ha)	Site Index	Regenerates To AU #
801	NHLB Conif	Coniferous	All	282,068	14.2	801
802	NHLB Decid	Deciduous	All	9,084	19.2	802

6.6.2 Existing timber volume check

The total forest volume was estimated based on the yield curves, and compared to the volume estimated in the forest inventory (VDYP projected volumes, after adjustments for age, height, and volume). Table 36 is a comparison of the two estimates. The volumes are net of the deciduous-leading stands, and net of the deciduous and Pa component volumes.

Table 36 Timber Volume Check

Stand Type	Inventory Polygon volume (m3)	Yield table (AU) volume (m3)	Percent (%) Difference
THLB Natural	26,828,028	26,405,823	1.6
NHLB	80,381,400	80,315,438	0.1

6.7 Yield table development - managed stands

This section summarizes the inputs used in the TIPSY growth and yield model for the managed stand analysis units (200 and 600 number series). Natural stands (100 series) move onto matching 200 series analysis units after harvest. When existing managed stands (500 series) are harvested, they move onto the future managed stand AU's (600 series). These are identical to the 500 series but reflect the genetic gains for future managed stands.

6.7.1 Silviculture management regimes

Only clearcut systems were modelled in this analysis. A small portion of the stands in the TSA are partial cut, but the small area did not warrant creating separate partial-cut type analysis units.

Average, historical regeneration practices were reflected in the existing managed stand AU inputs (500 series AUs) while current regeneration practices are reflected in the future managed stand AU inputs (200 and 600 series).

6.7.2 Regeneration delay

Regeneration delay is the time between harvesting and the time when a new stand is initiated. The delay incorporates both the time taken to establish a stand, and the age of seedling stock planted, if applicable. For this analysis, a regeneration delay was estimated based on local knowledge of the licensees' silviculture staff.

Existing managed stands.

For existing managed stands, regeneration delay was addressed through the use of actual stand age in the forest inventory file. This age represents the actual age of the stand and not the time since harvesting. For example, a stand may have been harvested 15 years ago but the current stand age is 12 – this implies a 3 year regeneration delay. The use of actual ages eliminated the need to estimate an average regeneration delay for these stands.

Future managed Stands

A regeneration delay of 2 years was estimated based on the local knowledge of the licensees' silviculture staff. Regeneration delays for future managed stands were input into TISPY and are therefore embedded in the published yield curves.

6.7.3 Stand rehabilitation

There is no active program of stand rehabilitation in the TSA. No rehabilitation of problem forest or non-merchantable types was included in the model.

6.7.4 Genetic improvement

As required by the Chief Forester's Standards for Seed Use (Nov 23, 2006), the licensees use select seed for regeneration purposes when reasonable gains are projected. This section describes the yield adjustments used in this analysis to account for the use of select seed (i.e., orchard & select provenance seed with a known genetic gain as measured by Genetic Worth [GW]).

The statistics on the historical use of select seed for all the tables in this section was obtained from the Ministry of Forests Seed Planning & Registry system (SPAR), as summarized by L. McAuley (2008) and B. Wadey (2008). This information was used to derive current practice estimates of net genetic gain (Net GW) at the species level (Table 37). This table illustrates the weighted average GW for each species for the last 5 years [A], the percent improved (class A and B) seed use for each species in the TSA [B], and the estimated Net GW for each species [C]. The Net GW was calculated by multiplying [A] x [B].

Table 37 Average net genetic worth of species planted during last 30 years.

Year	Wt Avg GW by Species (Class A) [A]				% Class A of Total Seedlings Planted [B]				Net GW by Species [C]			
	Lw	Pw	Sx	Pli	Lw	Pw	Sx	Pli	Lw	Pw	Sx	Pli
2003	11	0	18	3	100	100	70	73	11.0	0.0	12.6	2.2
2004	11	0	22	3	75	0	72	60	8.3	0.0	15.8	1.8
2005	11	0	20	3	100	0	94	73	11.0	0.0	18.8	2.2
2006	17	0	24	3	100	0	100	89	17.0	0.0	24.0	2.7
2007	0	0	19	3	77	0	90	0	0.0	0.0	17.1	0.0
5 yr Avg	10.0	0.0	20.6	3.0	90.4	20.0	85.2	59.0	9.5	0.0	17.7	1.8
30 Yr Avg	1.7	0.0	3.4	0.5	15.1	3.3	14.2	9.8	1.6	0.0	2.9	0.3

The 30 years average gains shown are suitable for use in generating existing managed stands yields as they reflect a watered down gain associated with 25 years of planting seed with no gains followed by 5 years of planting with gains . Genetic gains of 1.6% would be applied to Lw, 2.9% to Sx and 0.3% for Pl within the existing managed stands. While class A Pw seedlings have been used in the last 5 years, there is no reported genetic worth value, so 0% net GW was assumed for Pw.

Seed planning units (SPU's) geographically delineate the appropriate area of seedling use for stock coming from particular seed orchards. Each SPU also has defined elevation range for seedlings. The select seed SPU's that occur within the Golden TSA are listed in Table 38.

Table 38 Seed Planning Units in Golden TSA (Class A seed)

Species	Class A Seed Planning Zone	SPU	Min Elev (m)	Max Elev (m)
Western white pine	Kootenay Quesnel (KQ)	15	500	1400
Interior Spruce	East Kootenay All (EK)	25	750	1700
Interior Spruce	Nelson Mid (NE)	04	1000	1500
Lodgepole Pine	East Kootenay Low (EK)	32	800	1500
Western Larch	East Kootenay Low (EK)	34	800	1500
Fdi	East Kootenay Low (EK)	39	700	1400
Fdi	Quesnel Lakes Low (QL)	37	700	1400
Fdi	East Kootenay Low (EK)	39	700	1400

Increased gains are projected for these SPU's within 10 years while the planning horizon for this analysis is > 250 years. One estimate for the planning horizon is used. It is reasonable to use the projected gains across the planning horizon in the base case as this will result in an overestimate for only the first decade and then realistic or conservative estimates for the remaining 24 decades.

The future projected gains are estimated as per Table 39. The estimated, future effective genetic worth for each SPU is provided in column [B] while the availability to meet SPU seed needs is provided in column [C]. The projected GW to be achieved (column D) is the product [B] and [C]. It is assumed that seed from the SPU is eligible for use where that species is planted in the TSA.

Table 39 Seed planning units (Class A seed) genetic worth and seed availability

SPU	% of Seed Use Eligible to come from SPU	Min Elev (m)	Max Elev (m)	Projected Future Genetic Worth (in Year) [B]	Projected Availability (in Year) [C]	Projected Genetic Worth Achieved In Future [D]
PW KQ (15)	100	500	1400	0 (*)	100	**0** (*)
Sx EK All (25)	95%	750	1700	28% (2017+)	75 % (2025+)	**(20.0) + (0.8) = 20.8**
Sx NE Mid (04)	5%	1000	1500	16% (2014+)	100% (2008+)	
PLI EK LOW (32)	100	800	1500	12% (2017+)	100% (2019+)	**12**
LW EK LOW (34)	100	800	1500	20% (2017+)	100% (2008+)	**20**
FDI EK LOW (39)	80%	700	1400	25% (2013+)	100% (2016+)	**(20) + (1.1) = 21.1**
FDI QL LOW (37)	5%	700	1400	22% (2017+)	100% (2010+)	

Values obtained from "Breeding and orchard production" reports (L. McAuley, MoF, 2008)
(*) Although Pw Class A seed is produced the genetic worth is not estimated.

The application of this data by AU in the timber supply model is summarized as Table 40, and is included in the TIPSY inputs tables (Table 42).

Table 40 Summary of genetic worth used for modelling with each species

Species	Existing, Managed Stands Genetic Worth	Future Managed Stands, Genetic Worth
Sx	2.9	20.8
Pli	0.3	12
Lw	1.6	20
Fdi	0.0	21.1

In summary, the 30-year historical average from Table 37 was applied when modeling existing managed stands because this best corresponds with the criteria used to define these stands. When generating the AU yields in TIPSY for these stands, larch will have a 1.6% GW applied, while spruce will have a 2.9% GW applied, and Pl will have 0.3% applied. Future managed stands will have one estimate of the varying future net GW applied, usually chosen at reference year=2017. The Net GW's will be applied to Fd (21.1%), Lw (20%), Pl (12%), and Sx (20.8%). No change in genetic gains was scheduled during the planning horizon.

Genetic gains (Table 40) will be incorporated into the growth and yield curves through TIPSY model functionality. When a species identified in Table 40 is included in a managed stand AU, its associated Net GW will be input into TIPSY. This Net GW reflects the genetic gain associated with all seedlings of a given species planted in a typical year. Where surrogate species were used in TIPSY, the GW employed is prorated to reflect the relative GW's of the original species (i.e. Sx used for Bl but Sx GW not applied to Bl proportion).

6.7.5 Planting Density

Values of 2000 sph were assumed for all plantations. These values were derived from a combination of the TSA silviculture records and staff experience. These densities are considered to reflect the number of stems competing to be crop trees and are between the values for well-spaced and total-stocking densities.

6.7.6 TIPSY managed stand yield table inputs

Existing and future managed yield curves will be derived using the BatchTIPSY (ver 3.2) software with the following inputs.

Table 41 Inputs (to TIPSY) for Existing Managed Stand Yield Curves

Existing Managed Stand AU	Regen - Plant/ Natural	Species Composition	Area (ha)	Site Index	OAF VAF	Regen Delay	Utiliz-ation Level	Initial Density	Select Seed Gains
501 – Fd Dry	P 100%	Fd 40 Se 25 Pl 30 Lw 5	3,779	17.2	(2)	2	17.5	2,000	(6)
502 – Fd Wet	P 100%	Fd 40, Se 30 Pl 20 Lw 5 Cw 5	2,477	17.8	(2)	2	17.5	2,000	(6)
503 – Cw	P 100%	Se 40 Cw 40 Fd 10 Hw 10	4,036	18.1	(2)	2	17.5	2,000	(6)
504 – Hw	P 100%	Se 40 Cw 40 Fd 10 Hw 10	1,376	16.3	(2)	2	17.5	2,000	(6)
505 – B, S	P 100%	Se 85 Bl 10 PL5	15,479	16.4	(2)	2	17.5	2,000	(6)
506 – S mixed	P 100%	Sx 60 Cw 20 Fd 10 Pl 10	7,722	15.5	(2)	2	17.5	2,000	(6)
507 – Pine	P 100%	Pli 60 Se 20 Fd 20	7,228	16.3	(2)	2	12.5	2,000	(6)
508 – Decid (1)	P100%	At 50 Sx 35 Pl 10 Fd 5	3,031	19.4	(3)	2	17.5	2,000	(6)
525 Backlog 1	N100	S40 Pli22 Fdi 22 C9 H7	376	16.9	(4)	12	17.5	2,000	n/a
525 Backlog 2	N100	S40 Pli22 Fdi 22 C9 H7	302	18.0	(5)	20	17.5	2,000	n/a

AU 508 = Deciduous leading with a history of logging within the past 30 years.

VAF = volume adjustment factor

(2) OAF1 = 15%, OAF2 = 5%; VAF = 1.00 (no adjustment)

(3) OAF1 = 25%, OAF2 = 5%; VAF = 1.00

(4) OAF1 = 15%, OAF2 = 5%; VAF = 0.90 (10 % reduction)

(5) OAF1 = 15%, OAF2 = 5%; VAF = 0.75 (25 % reduction)

(6) Genetic Worth varies by species; Value based on the limited use of improved stock in the past.

Table 42 Inputs (to TIPSY) for Future Managed Stand Yield Curves

Leading Species	AU No.	Regen Method	Species Composition	Area (ha)	Site Index	Utiliz-ation Level	Initial Density	Select Seed Gains
Lw, Fd (dry)	201	P 100%	Fd 40, Pli 40, Se20	3,201	23.7	17.5	2,000	(1)
	202	P 100%	Fd 40 Pli 40 Se20	12,347	18.0	17.5	2,000	(1)
	203	P 100%	Pli 80 Fd 20			17.5	2,000	(1)
Lw, Fd (wet)	204	P 100%	Fd 40 Se 40 Cw 10 Pl 10	2,268	23.4	17.5	2,000	(1)
	205	P 100%	Fd 40 Se 40 Cw 10 Pl 10	7,066	18.6	17.5	2,000	(1)
	206	P 100%	Fd 50 Pl 40 Se 10	4,358	15.5	17.5	2,000	(1)
Cw	207	P 100%	Se40 Cw40 Fd 10 Pw 5 Hw 5	877	19.1	17.5	2,000	(1)
	208	P 100%	Se40 Cw40 Fd 10 Pw 5 Hw 5	3,873	15.6	17.5	2,000	(1)
	209	P 100%	Se 60 Cw 20 Fd 20	1,169	12.9	17.5	2,000	(1)
Hw	210	P 100%	Se 50 Cw 30 Hw 20	792	18.8	17.5	2,000	(1)
	211	P 100%	Se 50 Cw 30 Hw 20	2,309	14.7	17.5	2,000	(1)
	212	P 100%	Se 50 Cw 25 Fd 15 Hw 5 Pli 5	3,385	11.2	17.5	2,000	(1)
B, S	213	P 100%	Sx 80 Pli 10 Bl 10	3,650	20.8	17.5	2,000	(1)
	214	P 100%	Sx 80 Pli 10 Bl 10	8,388	15.1	17.5	2,000	(1)
	215	P 100%	Se 85, Pli 15	5,130	11.0	17.5	2,000	(1)
S mixed	216	P 100%	Se 50 Cw 30 Fdi 10 Hw5 Pw5	3,260	23.4	17.5	2,000	(1)
	217	P 100%	Se 50 Cw 30 Fdi 10 Hw5 Pw5	4,634	18.9	17.5	2,000	(1)
	218	P 100%	Se 50 Cw 30 Fdi 10 Hw5 Pw5	7,642	13.9	17.5	2,000	(1)
Pine	219	P 100%	Pli 60, Se 20, Fd 20	3,754	22.5	12.5	2,000	(1)
	220	P 100%	Pli 60, Se 20, Fd 20	3,652	19.9	12.5	2,000	(1)
	221	P 100%	Pli 60, Se 20, Fd 20	9,944	17.1	12.5	2,000	(1)
	222	P 100%	Pli 70, Fd 20, Se 10	2,704	14.7	12.5	2,000	(1)
Decid	223	P 100%	Sx 70 Pl20 Fd10	1,317	21.1	17.5	2,000	(1)
Lw, Fd Dry	601	P 100%	Fd 40 Se 25 Pl 30 LW 5	3,779	17.2	17.5	2,000	(1)
Lw, Fd Wet	602	P 100%	Fd 40 Se 35 Cw15 Pw5 Lw5	2,477	17.8	17.5	2,000	(1)
Cw	603	P 100%	Se 40 Cw40 Hw10 Fd5 Pw5	4,036	18.1	17.5	2,000	(1)
Hw	604	P 100%	Se 40 Cw40 Fd10 Hw5 Pw5	1,376	16.3	17.5	2,000	(1)
B, S	605	P 100%	Se 85, Bl 10 PL5	15,479	16.4	17.5	2,000	(1)
S mixed	606	P 100%	Se 55 Cw 25 Fd 10 Hw5 Pw5	7,722	15.5	17.5	2,000	(1)
Pine	607	P 100%	Pl 55 Se 20 Fd 20 Lw5	7,228	16.3	12.5	2,000	(1)
Decid	608	P100%	Sx 70 Pl20 Fd10	3,031	19.4	17.5	2,000	(1)
Backlog 1 (3)	625	P100%	Se 60 Pl 20 Fd10 Cw10	376	16.9	17.5	2,000	(1)
Backlog 2 (3)	626	P100%	Se 60 Pl 20 Fd10 Cw10	302	18.0	17.5	2,000	(1)

Notes:

(1) Genetic Worth varies by species; Values are based on future use of improved genetic stock.

(2) All AU's: OAF1 = 15%, OAF2 = 5%; Regen delay = 2 years.

AU 223 = Operable stands, previously harvested more than 30 years ago, that originally regenerated back to decidous leading and after the first harvest will be planted to coniferous leading.

7.0 Silviculture

7.1.1 Existing managed stands

Existing managed stands are defined as the operable stands with a record of logging within the last 30 years. The 30-year figure corresponds to the time when more intensive silviculture management started within the TSA.

Both existing and future managed stand yield curves were determined using TIPSY. Inputs for the existing managed stands are in Table 42.

7.1.2 Backlog and current non-stocked area (NSR)

Backlog NSR is any area not yet fully stocked that was denuded prior to 1987 when basic silviculture became the obligation of licensees. Not satisfactorily restocked (NSR) areas were determined using RESULTS data. NSR areas include both old burns and past harvesting. Current NSR (2055.2 ha) and backlog NSR (1281.7 ha) is summarized in Table 43.

Table 43 Backlog NSR Area

Leading Species	Current NSR	Estimated backlog NSR >= 60% MSS	Estimated backlog NSR < 60% MSS
Any	2055.2 ha	653.7 ha (51% of backlog)	628 ha (49% of backlog)

Note: MSS = Minimum stocking standard.

Backlog NSR has been assigned to analysis units 525 and 526. Backlog NSR records in the RESULTS data are for portions of opening numbers (a combination of Map + Opening Number) which are often several polygons in the forest cover data. Hence, one cannot identify the forest cover polygons (spatial location) corresponding to the NSR records in the RESULTS data. As a work-around, the equivalent area of backlog NSR, for both the over and under 60% MSS categories, was assigned to forest cover openings (sometimes a group of forest cover polygons). Priority was based on the highest percentage of backlog NSR in the opening number. Openings with the highest proportion of NSR were assigned wholly to NSR, working down to lower percentages of NSR, until the target equivalent-area of NSR had been assigned to openings.

A significant portion of the backlog NSR is due to old fires and is located within the inoperable. That portion remaining on the THLB is summarized in Table 44. The THLB portion of backlog NSR is assigned to analysis unit numbers 525 and 526. The NHLB portion is lumped into the HNLB analysis units (801-coniferous and 802-deciduous) as those backlog NSR polygons will not be logged in the future.

Table 44 THLB portion of backlog NSR

LU	NSR 1	NSR 2	Total
G13	12	0	12
G14	31	35	66
G15	61	0	61
G16	177	285	462
G20	25	0	25
G21	34	5	38
G22	69	0	69
G23	23	0	23
G26	19	0	19
G28	22	20	42
Total	**472**	**345**	**818**

Current NSR status is assumed to be the operable forest cover polygons where the forest cover database has blank (missing) forest cover attribute values and a history of past harvesting. Species and analysis units were assigned to these polygons based on the most prevalent AU found in that same biogeoclimatic subzone, as determined by the polygons which did not have missing species information.

8.0 Unsalvaged Losses

The purpose of this section is to quantify the average annual volume of timber that, in the future, will be damaged or killed on the THLB and will not be salvaged or accounted for by other factors. These losses are due to a number of factors that cause tree mortality, including insects, disease, blowdown, snowpress, wildfires, etc. This factor is meant to capture catastrophic natural events like the fires that occurred in the Golden TSA in 2005. Endemic pest losses are dealt with through factors applied in the growth and yield models as noted below:

> **TIPSY**: Operational Adjustment Factors reduce the gross volumes to account for losses toward maturity such as decay, and endemic forest health issues like minor infestations.
>
> **VDYP**: The model predicts actual average yields from appropriate inventory ground plots. Endemic losses are inherently recognized in the model data.

The TSR3 values were accepted as the best estimate of unsalvaged losses that were available (Table 45).

Table 45 Unsalvaged losses

NRL Category	Area Disturbed per year (ha / year)	Volume / ha (m3/ha)	Volume per Year (m3 / yr)
Wildfire	19.0	268	5,102
Broadcase / fringe burn	2.0	300	600
Total fires	**21.0**	**271**	**5,702**
Spruce bark beetle	0.0	0	0
Douglas-fir bark beetle	1.0	350	350
Mountain pine beetle	3.0	350	1,050
Total insects	**4.0**	**350**	**1,400**
Windthrow / blowdown	1.5	350	525
Avalanche	0.0	0	0
Total Losses	**29.5**	**288**	**7,627**

Disturbances within the NHLB are described in section 9.1.5.2.

9.0 Resource Management

The resource management zones were introduced in section 6.0. This section describes the forest cover requirements that are associated with those management zones.

9.1 Non-timber forest resource management

9.1.1 Forest Cover Requirements

Forest cover requirements are applied within the timber supply model to accommodate the timber and non-timber resource objectives. These requirements maintain appropriate levels of specific forest types that are needed to satisfy the objectives for wildlife habitat, visual quality, biological diversity, etc. Forest cover requirements are used by the model to limit harvesting within the THLB.

These requirements are typically expressed as one of three conditions:

- a maximum amount of forest that can be younger than age X (or shorter than height Y);
- a minimum amount of forest that must be older than age W (or taller than height Z); or
- no harvesting is allowed.

Forest cover requirements may be overlapping. The model will evaluate each requirement independently to ensure that the harvesting of a specific area does not violate any one of the requirements. Table 46 summarizes the management zones that occur in the Golden TSA. The details of specific forest cover requirements follow.

Table 46 Resource emphasis areas

Name	Criteria used to delineate zone/group	Rationale/comments
High Biodiversity Emphasis Option (BEO) Areas	CFLB within BEO / LU / BEC	Designated by the HLPO (Oct 2002). Requirements exist to maintain old and mature forest for biodiversity. When retained old and/or mature stands for biodiversity – connectivity corridors and grizzly habitat areas were given a high priority. Within the Low BEO areas, old seral targets start at 1/3 full targets and full targets must be met by the third rotation. Requirements have been spatially located as OGMAs and MOGMAs, which are modeled as reserve zones (landbase netdowns).
Intermediate BEO Areas	CFLB within BEO / LU / BEC	
Low BEO Areas	CFLB within BEO / LU / BEC	
HLPO Caribou Management Zones	CFLB forest; no "protected" ownership; below 80% slope; by caribou zones	Designated by HLPO Objective 3 (Variance 04) Requirements exist to maintain old and mature forest habitats. Requirements have been spatially located as reserve zones and are modeled as reserve zones (landbase netdowns).
SARCO Caribou Management Zones	THLB; spatially mapped areas within caribou Planning Areas.	SARCO "Incremental Caribou" areas. Under development, almost complete (map version: March 6, 2008). Requirements are modeled as "no harvest" or reserve zones.
Riparian Areas	Reserve widths around classified streams, lakes and wetlands.	Reserve zones are based on the licensee FSPs, which in turn are based on the FRPR riparian reserve widths and basal area retention.
Domestic Watersheds	Reserves around streams upstream of water intakes used for domestic purposes (not for irrigation).	Designated by HLPO Objective 6 and HLPO Map 6.1. Requirements are modeled as "no harvest" or reserve zones.
Ungulate Winter Range (UWR)	CFLB within each LU by habitat class	Draft GAR Order proposed by MoELP (May 2008). When established, management practices will be equivalent to the Invermere TSA GAR Order U-4-008 for UWR.
Visual landscapes	CFLB within each VQO polygon	Visual Quality Objectives defined by the District Manager.
Integrated Resource Management (IRM)	THLB within each LU, except the ERDZ zone (see below)	Designated by the HLPO (Oct 2002). Specifies a minimum green-up height.
Enhanced Resource Development Zone (ERDZ)	THLB within each LU, within the ERDZ	Designated by the HLPO (Oct 2002). Specifies a relaxed (lower) green-up height requirement.

Table 47 Resource emphasis areas – modeling constraints

Name	Crown Forested Area (ha)	THLB Area (ha)	Forest resource requirements.
High Biodiversity Emphasis Option (BEO) Areas	107,928[1]	23,663[1]	Old seral: no harvest within spatial OGMAs. Mature-plus-old seral: no harvest within spatial MOGMAs.
Intermediate BEO Areas	109,001[1]	55,775[1]	
Biodiversity: Low BEO Areas	209,488[1]	62,092[1]	Old seral: no harvest within spatial OGMAs for first rotation; apply a seral percentage requirement at 2/3 full target for the second rotation; increase the seral requirement to (3/3) full target for the third rotation onwards. Mature-plus-old seral: no harvest within spatially mapped MOGMAs.
Caribou Management zones	21,690	0	HLPO: No harvest within spatially mapped caribou areas. SARCO: No harvest within spatially mapped caribou areas.
Riparian Areas	13,125	0	Reserves around classified streams, lakes and wetlands.
Domestic or Sensitive Watersheds	322	0	Reserves around portions of streams upstream of intakes.
Ungulate Winter Range (UWR)	49,566	31,546	MF - dry: min 10% > 100 years MF – dry: min 10% >100 years MF – trans: min 10% >60 years MF – trans: min 10% >100 years; S,F leading MF – mesic: min 10% >60 years MF – mesic: min 20% >100 years; S,F leading MF – moist: min 20% >60 years MF – wet: min 30% >60 years
Visual landscapes	36,152	20,036	Maximum of X% < visual greenup age of Y, applied within each VQO class within each LU.
Integrated Resource Management	98,210	98,210	Maximum of Max. 25% < 2.5 m tall. within LU / IRM zone
Enhanced Resource Development Zone (ERDZ)	43,319	43,319	Maximum of 33%<2 yr within LU / ERDZ zone

Notes:
[1] = These numbers are the area assigned to that BEO according to the HLPO, not the areas of the OGMAs/MOGMAs.

9.1.1.1 Green-up / Maximum disturbance

The HLPO contains green-up requirements that require a logged block to achieve a specific condition called green-up before adjacent areas can be logged. Green-up refers to the average height of the regenerating forest reaching a specified target. Green-up requirements can often be waived if licensees manage for patch size distributions specified in the HLPO and detailed in the Landscape Unit Planning Guide (MoF/MoE 1999). Modeling of adjacent cut-block green-up requirements was accomplished using forest level objectives, as opposed to block specific objectives, because this is consistent with the operational flexibility afforded by patch size management. Green-up requirements and the area of application are provided in Table 48.

Table 48 Green-up requirements by management zone

Management Zone	Green-up Requirement	Modeled Green-up Constraint	Area to Which it applies
HLPO ERDZ Timber Zone	successful regeneration (stocked)	max 33% < 2 yr within LU/ERDZ	THLB area inside the HLPO mapped ERDZ timber zone
Integrated Resource Management Zone	2.5 m tall trees	Max. 25% < 2.5 m tall within LU/IRM	THLB not in ERDZ zone

Age to green-up was determined by calculating a weighted average stand type for each of the zones and then evaluating the age/height relationship for the stand in SiteTools. The IRM zone was S leading with an average site index of 17.3 – giving an 21 year greenup period to reach 2.5 meters height. A 2 year regeneration delay is then added to this value.

9.1.2 Visual Resources

In this analysis, forest cover requirements aimed at meeting these objectives were applied so that the amount of younger stands that can occur in visually sensitive areas was limited. The following procedure was used to model the visual quality objectives:

All VQO polygons had maximum planimetric percent disturbance values assigned based on VQO class, (values provided in Table 49).

Table 49 Visually sensitive areas: Maximum planimetric disturbance percentage

VQO Class	Percent Alteration
Preservation	1%
Retention	5%
Partial Retention	15%
Modification	25%

VQO polygons within each VQO class within each LU had an area weighted average slope assigned and a "visually effective greenup" (VEG) height calculated according to Table 50 extracted from Procedures for Factoring Visual Resources into Timber Supply Analyses (MoF 1998).

Table 50 Tree heights required for meeting visually effective green-up by percent slope

	Slope Class (%)											
	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-45	46-50	51-55	56-60	60+
Tree Height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.3	8.5

Each LU-VQO-class group had the resulting forest cover objective applied to its crown forested area in the model (Table 51). For example, a VQO of Retention and an average slope of 32% would have the following objective: No more than 5% of the crown forested area in that LU and VQO class can be less than 6m tall.

The visually effective green-up heights for each polygon were translated into green-up ages for use during modeling. Age to green-up was calculated in Site Tools using a weighted average stand type. Visually effective greenup ages ranges from 17 to 22 years (plus 2 year regeneration delay), based on an Fd stand with a site index of 17.34.

Table 51 Area weighted slope and greenup height assigned to each LU and VQO combination

LU	VQO	Avg. Slope (%)	Max Non-Veg (%)	Greenup Ht (m) (age a/b)
G14	M	33.228	25	6 (22/24)
G14	PR	28.444	15	5.5 (21,23)
G15	M	22.37	25	5 (20/22)
G15	PR	19.437	15	4.5 (18/20)
G16	M	19.378	25	4.5 (18/20)
G16	PR	17.102	15	4.5 (18/20)
G19	M	20.112	25	4.5 (18/20)
G19	PR	16.592	15	4.5 (18/20)
G20	M	25.217	25	5 (20/22)
G20	PR	24.671	15	5 (20/22)
G20	R	14.345	5	4 (17/19)
G21	M	34.859	25	6 (22/24)
G21	PR	26.681	15	5.5 (21,23)
G22	M	29.774	25	5.5 (21,23)
G22	PR	23.827	15	5 (20/22)
G22	R	11.901	5	4 (17/19)
G23	M	26.126	25	5.5 (21,23)
G23	PR	15.708	15	4.5 (18/20)
G23	R	11.835	5	4 (17/19)
G24	M	32.461	25	6 (22/24)
G25	PR	27.61	15	5.5 (21,23)
G25	R	20.833	5	5 (20/22)
G26	M	26.509	25	5.5 (21,23)
G26	PR	26.438	15	5.5 (21,23)
G26	R	22.534	5	5 (20/22)

Note: (age a/b) = (15/17) = 15 years to reach greenup height; 17 = age including 2 years regeneration delay

9.1.3 Recreation resources

Forest cover retention within the important recreation areas in the Golden TSA was addressed primarily through the netdown process associated with the riparian areas around the streams and lakes.

9.1.4 Wildlife

9.1.4.1 Ungulate winter range

Golden TSA ungulate winter range is currently being managed under both a Section 7 notice, and a pending GAR Order. MoELP staff recommended that the UWR requirements be based on the draft GAR Order. The forest requirements vary by habitat type, as per Table 52.

Table 52 Ungulate winter range requirements

Habitat type	Ungulate Species	Landscape and Stand Level Forest Cover Retention Requirements	Definitions that pertain to Forest Cover Requirements
Open Range	Elk, bighorn sheep, mule deer, white-tailed deer, mountain goat	Stocking standards: 5-75 sph	n/a
Open Forest	Elk, bighorn sheep, mule deer, white-tailed deer, mountain goat	Stocking standards: 76-400 sph	n/a
Managed Forest (dry)	Elk, bighorn sheep, mule deer, white-tailed deer	Min 10% Mature cover	>100 years cc GE 20%; or layer1 age > 100 years
Managed Forest (transitional)	Moose, elk, mule deer, white-tailed deer	Min 10% snow interception cover	>60 years and evergreen cc min 40%
		Min 10% mature cover	>100 years, Fd or Sx leading and cc min 40%
Managed Forest (mesic)	Elk, mule deer	Min 10% snow interception cover	>60 years and evergreen cc min 40%
		Min 20% mature cover	>100 years, Fd or Sx leading and cc min 40%
Managed Forest (Moist)	Moose	Min 20% snow interception cover	>60 years and evergreen cc min 40%
Managed Forest (Wet)	Moose	Min 30% snow interception cover	>60 years and evergreen cc min 40%
Avalanche tracks (*)	Moose, elk	50 m of forest cover adjacent to high value habitat within avalanche tracks	>60 years old

Notes:
cc = evergreen crown closure; all conifers except larch count at full cc; larch and deciduous species at 50% of their crown closure (cited, but not used in modeling).
(*) no GAR-mapping of avalanche tracks, managed through the deployment of OGMAs.

9.1.4.2 Identified wildlife

No Wildlife Habitat Areas (WHAs) have been made know in the Golden TSA as of March 2008. The impacts of future WHA's has been budgeted at a 1% AAC impact by provincial policy. This 1% has not been implemented in the analysis.

9.1.4.3 Caribou

Section 3 of the Kootenay Boundary Higher Level Plan Order specifies caribou habitat management guidelines to be applied in a number of zones within mapped caribou habitat. The forest cover requirements associated with these caribou zones are listed in Table 53. These requirements have been spatially mapped and district policy is to consider these reserves. In addition, the Species at Risk Coordination Office (SARCO) has recommended additional areas of reserves. 23,529 hectares of CFLB are covered by the caribou habitat areas (23,022 hectares associated with the HLPO, and 507 hectares with the SARCO caribou requirements).

Table 53 Example of HLPO caribou forest cover requirements

Caribou Mngt. Zone	Zone Priority	Leading tree species	Minimum Forest retention	Min. Basal Area Remaining	Minimum Forest age class	Notes
1	1,2	Pl, Fd, or Lw	100%	--	--	Previously harvested stands require future decisions
6	2	All	Min 70%	--	8	
8	2	All	Min 30%	--	8	
		All	Min 10%	--	9	
8	2	All	20% Partial cut	70	7	

Notes: Examples of HLPO caribou habitat zones and forest requirements. The equivalent area of the caribou requirements has been spatially mapped and is modeled as a THLB landbase reduction.

9.1.5 Biodiversity

The Landscape Unit Planning Guide (March 1999) provides background direction and guidance on biodiversity management. The Guide dictates that biodiversity be managed at both the landscape and stand levels. The primary mechanism for landscape-level management is retention of old and mature seral forest. Stand-level biodiversity is protected through retention of wildlife trees and wildlife patches. The following sections outline how retention of old and mature forest and wildlife trees/patches was modeled.

9.1.5.1 Landscape level biodiversity

Sections 1 and 2 of the Kootenay Boundary Higher Level Plan Order specify the amount of old and mature forest that must be maintained within each BEC variant inside each Landscape Unit (LU). Landscape units have been legally established along with Biodiversity Emphasis Option (BEO) assignments that guide the level of old/mature forest in each landscape unit.

Several Landscape Units overlap with portions of federal and provincial parks and protected areas. For the purposes of this analysis the productive forest area within all of LUs (with portions in parks and protected) are included in the analysis. The HLPO LU/BEC BEO assignments are listed in Table 54. Old and mature requirements for BEC/BEO combinations are provided in Table 55.

Table 54 LU/BEC BEO Assignments

LU	BEO	NDT	BEC	Area (ha)		LU	BEO	NDT	BEC	Area (ha)
G01	H	1	ESSFwc 2	4,466		G11	I	1	ESSFwc 2	1,996
G01	H	1	ESSFwcw	1,541		G11	I	1	ESSFwcw	853
G01	H	1	ICH wk 1	2,675		G11	I	1	ICH vk 1	1,242
G01	H	3	ESSFdk 1	2,710		G11	I	1	ICH wk 1	1,218
G02	I	1	ESSFvc	761		G12	H	1	ESSFwc 2	1,527
G02	I	1	ESSFwc 2	2,018		G12	H	1	ESSFwcw	950
G02	I	1	ESSFwcw	847		G12	H	1	ICH wk 1	2,342
G02	I	1	ICH vk 1	928		G13	H	1	ESSFvc	5,026
G02	I	1	ICH wk 1	3,110		G13	H	1	ESSFwc 2	3,988
G02	I	2	ICH mw 1	187		G13	H	1	ESSFwcw	1,768
G03	L	1	ESSFwc 2	2,935		G13	H	1	ICH wk 1	4,010
G03	L	1	ESSFwcw	1,446		G13	H	2	ICH mw 1	986
G03	L	1	ICH vk 1	2,119		G14	L	1	ESSFwc 2	6,802
G03	L	1	ICH wk 1	3,778		G14	L	1	ESSFwcw	1,831
G03	L	2	ESSFmm 1	339		G14	L	1	ICH wk 1	7,185
G03	L	2	ICH mw 1	1,334		G14	L	2	ICH mw 1	2,397
G04	I	1	ESSFwc 2	4,451		G15	L	1	ESSFwc 2	2,793
G04	I	1	ESSFwcw	2,754		G15	L	1	ESSFwcw	1,148
G04	I	1	ICH wk 1	5,173		G15	L	1	ICH wk 1	254
G04	I	2	ESSFmm 1	919		G15	L	2	ICH mw 1	5,020
G04	I	2	ICH mw 1	4,220		G16	I	1	ESSFwc 2	765
G06	H	1	ESSFwc 2	1,517		G16	I	2	ICH mw 1	23,533
G06	H	1	ESSFwcw	783		G16	I	3	ESSFdk 2	1,141
G06	H	1	ICH wk 1	1,835		G17	L	1	ESSFwc 2	3,648
G06	H	2	ICH mw 1	365		G17	L	1	ESSFwcw	1,233
G07	L	1	ESSFwc 2	4,224		G17	L	2	ICH mw 1	5,205
G07	L	1	ESSFwcw	1,537		G18	L	1	ESSFwc 2	2,524
G07	L	1	ICH wk 1	6,663		G18	L	1	ESSFwcw	710
G07	L	2	ICH mw 1	1,214		G18	L	2	ICH mw 1	3,591
G08	L	1	ESSFwc 2	3,738		G19	L	1	ESSFwc 2	4,771
G08	L	1	ESSFwcw	1,782		G19	L	1	ESSFwcw	1,488
G08	L	1	ICH wk 1	618		G19	L	1	ICH wk 1	552
G08	L	2	ICH mw 1	7,266		G19	L	2	ICH mw 1	5,455
G09	L	1	ESSFwc 2	4,092		G19	L	3	ESSFdk 2	920
G09	L	1	ESSFwcw	1,506		G20	I	1	ESSFwc 2	497
G09	L	2	ICH mw 1	6,222		G20	I	1	ESSFwcw	194
G10	L	1	ESSFwc 2	4,397		G20	I	2	ICH mw 1	8,126
G10	L	1	ESSFwcw	1,043		G20	I	3	ESSFdk 1	2,512
G10	L	1	ICH wk 1	3,269		G20	I	3	ESSFdk 2	2,526
G10	L	2	ICH mw 1	5,207		G20	I	3	ICH mk 1	1,786

(continued)

LU	BEO	NDT	BEC	Area (ha)		LU	BEO	NDT	BEC	Area (ha)
G20	I	3	MS dk	1,729		G26	H	3	MS dk	19,366
G20	I	4	IDF dm 2n	530		G26	L	2	ICH mw 1	2,857
G21	I	2	ICH mw 1	4,146		G26	L	3	ESSFdk 1	18,914
G21	L	3	ESSFdk 2	14,036		G26	L	3	ESSFdk 2	10,672
G21	L	3	ICH mk 1	8,456		G26	L	3	ICH mk 1	5,393
G22	I	2	ICH mw 1	6,456		G27	H	3	ESSFdk 1	3,947
G22	L	1	ESSFwm	5,418		G27	H	3	MS dk	4,357
G22	L	1	ICH wk 1	3,613		G28	H	3	ESSFdk 1	8,634
G22	L	3	ESSFdk 2	2,142		G28	H	3	ESSFdk 2	865
G23	I	2	ICH mw 1	8,701		G28	H	3	ESSFdku	394
G23	I	3	ESSFdk 2	6,216		G28	H	3	ICH mk 1	2,302
G23	I	3	ICH mk 1	8,017		G28	H	3	MS dk	22,337
G23	I	3	MS dk	1,448		G29	L	1	ESSFwc 2	2,927
G24	H	2	ICH mw 1	598		G29	L	1	ESSFwcw	1,100
G24	H	3	ESSFdk 2	4,150		G29	L	1	ICH wk 1	5,860
G25	L	3	ESSFdk 1	1,831		G29	L	2	ICH mw 1	261
G25	L	3	ESSFdk 2	277		G38	H	1	ESSFvc	179
G25	L	3	ICH mk 1	669		G38	H	1	ESSFwm	2,169
G25	L	3	MS dk	2,611		G38	H	1	ICH wk 1	2,143
G25	L	4	IDF dm 2n	192						

Table 55 Old and mature forest cover requirements for landscape level biodiversity objectives

BEC Zone	NDT	Mature Age (yrs)	Old Age (yrs)	Mature+Old Seral Req			Old Seral Requirements				
				Low	Inter	High	Low * 1st Rot	Low * 2nd Rot	Low * 3rd Rot	Inter	High
ESSFvc, ESSFwcw, ESSFwc2, ESSFwm	1	> 120	> 250	19	36	54	6.3	12.6	19	19	28
ICHvk1, ICHwk1	1	>100	>250	17	34	51	4.3	8.7	13	13	19
ESSFmm1	2	> 120	> 140	14	23	34	4.7	9.3	14	14	21
ICHmw1	2	> 100	> 250	15	31	46	3.0	6.0	9	9	13
ESSFdk, dku, ESSFdk1, dk2, ESSFdkw	3	> 120	> 140	14	23	34	4.7	9.3	14	14	21
ICHmk1	3	> 100	> 140	14	23	34	4.7	9.3	14	14	21
MSdk	3	> 100	> 140	14	26	39	4.7	9.3	14	14	21
IDF dm 2n	4	> 100	> 250	17	34	51	4.3	8.7	13	13	19

* Old seral requirements in Low BEO areas start at 1/3 old for first 80 years, 2/3 old for the next 80 years, and full old beyond for the Base Case (FRPA).

The target amount of old seral retention was calculated for each LU/BEO/BEC variant combination, and both old seral and mature-plus-old retention areas have been spatially identified and mapped as old growth management areas (OGMA) and mature and old management areas (MOGMA), respectively. Within the low biodiversity emphasis (BEO) areas only the 1/3 drawdown requirement for old seral has been mapped, as per the Higher Level Plan Order for the first rotation (assumed to be 80 years). In low BEO units the 2/3 target requirement and full (3/3) target requirements will be modeled as older seral retention requirements for the second and third rotations, respectively (i.e. in years 81-160, and 161 years+). The requirements are applied to the CFLB within each LU-BEC combination.

9.1.5.2 Disturbance of areas above the operability line

As crown forested stands in the non-THLB contribute toward several forest cover objectives (for example, landscape level biodiversity), it is important that the age class distributions in these stands remain consistent with natural processes. By implementing disturbance in these stands, a more natural age class distribution can be maintained in the model and a more realistic contribution toward seral goals ensured. To achieve this, a constant area was disturbed annually in each LU/NDT combination. The amount of disturbance is based on the BEC variants and their associated natural disturbance intervals and old seral definitions as outlined in the Biodiversity Guidebook (September 1995) and Table 56.

Using the negative exponential equation, the proportion of the forest that would typically occur as old seral forest can be calculated based on the disturbance interval (% area old = exp(-[old age / interval]). Using this % area in old, the calculation of an effective rotation age associated with this seral distribution was possible (Effective rotation age = interval / (1 – proportion old)). The effective rotation age can then be used to define an annual area of disturbance. For example, ESSF variants in NDT3 have a disturbance interval of 150 yrs and an old definition of 140 yrs. This translates into a typical age class distribution where 39% of the area is "old" (>140 yrs) and the oldest stands are around 230 years. Thus 1/230th of the area needs to be disturbed each year to maintain this age class distribution.

The Base Case includes:

- Annual disturbance of the inoperable, contributing Non-THLB area. The selection of the stands to be disturbed was determined by random selection.
- OGMAs, plus the application of an old seral stage requirement to maintain a minimum amount of old consistent with the % old targets wherever the target area had not been mapped as OGMAs in low BEO units.

This method is a slight simplification of Option 4 in 'Modeling Options for Disturbance Outside the THLB - Working Paper' (MoF, June 2003).

Table 56 Calculation of area to be disturbed annually in forested non-THLB by NDT / BEC

NDT	BEC	Age Old (yrs)	Return Interval (yrs)	Prop-Ortion Burned / Year	Effective Rotation Age (yrs)	Disturbance (proportion per year) [A]	Contributing Non-THLB Area (ha) [B]	Annual Area Disturbed By BEC [A} x [B]
1	ESSF	250	250	0.37	395	0.0025	91,898	232
1	ICH	250	250	0.37	395	0.0025	36,750	93
2	ESSF	200	250	0.29	350	0.0029	1,214	3
2	ICH	250	250	0.37	395	0.0025	38,451	97
3	ESSF	150	140	0.39	231	0.0043	69,919	303
3	ICH	150	140	0.39	231	0.0043	8,830	38
3	MS	150	140	0.39	231	0.0043	37,344	162
4	IDF	250	250	0.37	395	0.0025	483	1
						Totals		**930**

The disturbance is implemented in the model using a random uniform probability. Each NDT is 'turned over' once during a period equal to its effective rotation age and then once again over the next effective rotation age, etc. There is no guarantee that any particular portion of the landbase will actually be disturbed in any one year. Across the NCLB, approximately 930 ha is disturbed each year (0.05%), resulting in an average 'turning over' of the landbase every ~ 306 years (range is 231 to 395 years).

9.1.5.3 Wildlife tree retention areas (WTRA)

Wildlife tree retention is one of the primary methods to address stand level biodiversity objectives. Section 3.2 and Appendix 3 of the Landscape Unit Planning Guide (March 1999) describe the process for determining wildlife tree retention requirements at the BEC sub-zone level in order to establish LU objectives. On May 15, 2000, the Assistant Deputy Ministers of Forests and Environment, Lands and Parks approved changes to Section 3.2 of the Landscape Unit Planning Guide. Detailed policy on management of wildlife trees is provided in the document Provincial Wildlife Tree Policy and Management Recommendations (MoF/WLAP, February, 2000).

The Licensees' FSPs are based on Section 66 (1) of the Forest and Range Practices Regulation (FRPR). Licensees are retaining, on an area basis, 7% of the total area of their cutblocks. When possible, retention is within non-THLB areas. Existing, mapped WTRA's are removed from the THLB as landbase netdowns. These are within or adjacent to existing cutblocks.

The estimate of future WTRA's was described in section 4.0

9.1.5.4 Coarse Woody Debris

Management of Coarse Woody Debris (CWD) is another factor in the management of stand level biodiversity. As per provincial policy, it was assumed that CWD objectives are managed operationally while meeting the harvest utilization standards.

9.1.5.5 Patch size objectives

Patch size management has been adopted in the Golden TSA in an effort to more closely mimic natural disturbance patterns and minimize fragmentation of the land base. Patch size management attempts to achieve the patch size distributions specified in the Landscape Unit Planning Guide (MoF/MoE 1999), and is an alternative to cut block adjacency green-up objectives. Cutblock green-up requirements (adjacency) are not modeled directly in this analysis because landscape level forest cover objectives are used to approximate these requirements. As patch management is also a spatial issue beyond the resolution of this timber supply analysis, the same landscape level objectives were used to approximate patch management requirements. In the opinion of the authors, spatial analyses completed in previous projects have confirmed that these landscape level forest cover objectives are consistent with the flexibility associated with patch size management and the operational application of green-up requirements.

9.1.5.6 Connectivity

The HLPO objectives for connectivity were incorporated while spatially locating the OGMAs and MOGMAs (4.14). Stands within the connectivity corridors were considered as a higher priority when allocating these old and mature forest retention areas. No further modeling was done for connectivity objectives.

9.1.6 Domestic Watersheds

The HLPO Objective 6 and HLPO Map 6.1. identify the water intakes where reserves are required around portions of the streams up-stream of the intakes for domestic water use (versus for purposes of irrigation). Streams are to be protected by a thirty meter reserve on each side of the stream for distance that depends on the stream order. Streams segments were mapped and reserves were modeled as “no harvest” areas in the base case, and hence are treated as THLB exclusions (Section 4.12).

9.1.7 Lakeshore, wetland and riparian management zones

In general, riparian management was predominately addressed through a netdown process that reflected both the reserve and management zones (Section 4.13).

9.2 Timber Harvesting

9.2.1 Minimum harvesting age / merchantability standards

For this analysis, minimum harvestable ages were defined by the following criteria:

- minimum volume per hectare (200 m3/ha for C or H stands, or 150m3/ha for other species), and
- minimum piece size (25 cm mean DBH, except for 20cm mean DBH for Pl stands), and
- the age at which 95% of the culmination of the mean annual increment (CMAI) is achieved (Table 57).

These merchantability criteria were adopted from TSR 3.

In order for the stand within the timber supply model to be considered for harvesting, it must achieve an age where the criteria described above are achieved. This ensures that the timber supply model is harvesting stands that meet reasonable economic criteria, and emulate what is generally current practice by forest licensees.

Note that these are minimum criteria, not the actual ages at which stands are forecast for harvest. Some stands may be harvested at the minimum thresholds to meet forest-level objectives while other stands may be not be harvested until well past there "optimal" timber production ages due to management objectives for other resource values, such as requirements for the retention of older forest or ungulate winter range. The minimum harvest age to be utilized for each analysis unit is defined in Table 58 and Table 59.

Table 57 Minimum merchantability rules

Leading Species	Minimum Volume (m3/ha)	Minimum DBH (cm)	Percent of Culmination
C, H	200	25	95
Pine	150	20	95
Decid (logged)	100	25	95
Other	150	25	95

Notes:
The low value for deciduous, previously logged stands (AU = 123) assumes some form of stand rehabilitation, otherwise the minimum harvest age, if based on a minimum of 150 m3/ha, will be 245 years.

Table 58 Minimum age to reach merchantability criteria

Description	AU Nat	Age to Reach			MHA		AU Man	Age to Reach			MHA
		Min DBH	Min Vol	95% MAI				Min DBH	Min Vol	95% MAI	
Fd (dry), Lw	101	50	56	76	76		201	30	37	55	55
Fd (dry), Lw	102	60	76	93	93		202	50	56	74	74
Fd (dry), Lw	103	n/a	n/a	n/a	n/a		203	n/a	n/a	n/a	n/a
Fd (wet), Lw	104	50	46	75	75		204	40	48	60	60
Fd (wet), Lw	105	60	66	85	85		205	50	56	79	79
Fd (wet), Lw	106	70	76	95	95		206	70	76	85	85
Cw	107	50	66	68	68		207	50	57	82	82
Cw	108	60	86	74	86		208	60	66	100	100
Cw	109	80	115	80	115		209	80	86	118	118
Hw	110	50	66	69	69		210	50	57	81	81
Hw	111	70	76	81	81		211	60	76	105	105
Hw	112	80	116	118	118		212	90	96	135	135
B, S	113	60	56	74	74		213	40	57	70	70
B, S	114	70	76	93	93		214	60	76	97	97
B, S	115	100	105	128	128		215	90	106	133	133
S - mixed	116	50	56	73	73		216	40	47	67	67
S – mixed	117	60	66	85	85		217	50	57	82	82
S – mixed	118	80	86	108	108		218	70	76	111	111
Pine	119	50	46	55	55		219	30	37	48	48
Pine	120	60	46	60	60		220	30	47	55	55
Pine	121	70	66	71	71		221	40	56	65	65
Pine	122	80	76	84	84		222	40	66	69	69
Decid	123	80	95	71	95		223	40	46	68	68

Table 59 Minimum age to reach merchantability- Existing Managed Stands

Description	AU Nat	Age to Reach			MHA		AU Man	Age to Reach			MHA
		Min DBH	Min Vol	95% MAI				Min DBH	Min Vol	95% MAI	
Fd (dry), Lw	501	60	58	82	82		601	60	66	81	81
Fd (wet), Lw	502	60	46	82	82		602	50	56	87	87
Cw	503	50	47	84	84		603	50	56	87	87
Hw	504	60	59	93	93		604	60	67	96	96
B, S	505	60	58	88	88		605	60	66	89	89
S mixed	506	60	57	95	95		606	60	56	71	71
Pine	507	40	47	69	69		607	40	56	68	68
Decid	508	40	37	67	67		608	50	57	75	75
Backlog 1	525	70	66	110	110		625	50	66	86	86
Backlog 2	526	70	78	115	115		626	50	56	80	80

9.2.2 Operability / harvest systems

An operability line separates the operable and inoperable portions of the Golden TSA. The last complete operability mapping project was completed in 2002. A minor update was completed in April, 2008 by the forest licensees and that version is used in this analysis.

Any past harvesting above the 2008 operability line is considered as inoperable in this analysis.

9.2.3 Initial Harvest Rate

The Base Case harvest forecast will use 492,627 as the initial harvest rate, based on:

485 000 m3/yr [A] + **7,627** m3/yr [B] = **492 627** /yr [C]

Where: [A] = current AAC, [B] = un-salvaged losses, [C] = initial harvest rate.

9.2.4 Harvest rules

Harvest rules have the objective of influencing the model so the harvest profile in the model will reasonably match the harvest profile seen on-the-ground. Licensees don't necessarily follow an "oldest-first" harvest priority. Numerous pressures influence forest operations and the harvest profile may vary greatly between 5-year periods. The more notable examples are the recent bark beetle infestations and fires.

To reflect the current concentration on harvesting to control the MPB, the harvest priority rules in Table 60 were adopted for the Base Case scenarios.

Harvest Priorities are: (1) relative-oldest first; (2) intent is to cap % pine in harvest at 70%; then (3) prioritize within groups: (a) Pine; (b) fir; then (c) other species.

Table 60 Harvest priority rules

Harvest priority	Description
Overall harvest priority; Cover constraints	Relative oldest first harvest rule; and Ensure all forest cover requirements are met at all times.
Susceptible to Mountain pine beetle stands	Highest priority is lodgepole pine leading stands, with a maximum of 70% of the harvest to come from Pl leading stands; then
Fir-leading stands	Fir-leading leading stands; then
Other species	Other stands in the THLB.

9.2.5 Harvest profile

No specific harvest profile was modeled, although pine-leading stands are expected to dominate due to a priority placed on harvesting pine-leading stands before other species (above). The maximum contribution of pine-leading stands to the harvest was capped at 70% each model period (each decade, unless otherwise specified).

9.2.6 Silviculture Systems

Silviculture systems are predominately clearcut and clearcut-with-reserves, with negligible areas of partial cutting. Partial cutting is employed largely within the visual landscapes. This was deemed to be too minor to model separately. In the past, partial cutting was used within pine-salvage stands but this practice is no longer followed, and re-entries into past salvage stands have set these stands into a clearcut management regime.

Planting is by far the predominant method of regeneration. Natural regeneration was modeled only in the existing, backlog NSR stands.

9.2.7 Harvest flow objectives

Except for the sensitivity analyses where alternate harvest flow objectives are examined, the objectives for harvest flow in the Base Case are:

- Initially, start at the current AAC,
- Maintain the current AAC for as long as possible (the intent is that the mid-term harvest level will not be reduced to below the LTSY level), and
- If necessary, reduce the harvest flow at a maximum rate of 10% in any one decade,
- If necessary, minimize the length of any fall-down period,
- When possible, increase the harvest flow at a maximum rate of 10% per decade, and
- Reach a stable, long-term harvest flow rate associated with a constant (flat line) total inventory.

Modeling will be performed for at least 300 years, using 10-year periods, and reporting will be for the first 250 years.

10.0 Timber Supply Modeling and Forecasts

This section provides a summary of the modeling which will be completed following the acceptance of the Data Package. This includes the model and the intended harvest forecasts that will be completed, and which will then be documented in the TSR Analysis Report.

10.1 Model

Forest Planning Studio (FPS) version 6.0.2.0 will be used to complete the timber supply analysis. FPS was developed by Dr. John Nelson at the University of British Columbia (UBC) and is a spatially explicit forest estate simulation model. All events in the model are directly linked to stand level polygons or harvest units and thus allow tracking of individual stand attributes and spatial relationships through time. Each polygon belongs to a specific stand type (Analysis Unit) and has attributes such as age, harvest system, and land base status (THLB or Non THLB). Results are typically aggregated for reporting at higher levels (i.e. harvest flow for the entire unit).

A wide range of constraints can be modeled on the land base: harvest exclusion, spatial adjacency/maximum cutblock size, maximum disturbance/young seral, minimum mature/old seral, and equivalent clearcut area (ECA) limits. Constraints are applied to groups of polygons (cliques) and harvest is restricted if a constraint is not satisfied. A single polygon can belong to many overlapping cliques and each of them must be satisfied in order to allow harvest of the polygon. Where a mature or old cover constraint is not met, harvesting may still occur if there are any eligible stands remaining after the oldest stands are reserved to meet the constraint.

Harvest is implemented using a set of priorities to queue stands for harvest. In each period, the model harvests the highest priority eligible stands until it reaches the harvest target or exhausts the list of opportunities. Harvest can be implemented in single years, multiple year periods or a combination of these. Where periods are used, the midpoint of the period is typically used as the point where harvest opportunity is evaluated because it is a good balance between the start of the period (pessimistic) and the end of the period (optimistic).

10.2 Base Case

The Base Case is based on current management practices within the Golden TSA. This is defined by operational management practices, characteristics of and natural resource values found on the landbase, current silviculture practices, and estimates of present and future growth of forest stands. The preceding sections described the assumptions and data that are included in the Base Case.

10.3 Sensitivity Analyses

Sensitivity runs are used to test the uncertainty inherent in the data and management assumptions and are performed by modifying one input and examining the impact that change has on the model outputs. The sensitivity runs provide a picture of what factors in the Base Case are most influential, in relative terms, to the outputs. Table 61 is the list of proposed sensitivity analyses.

Table 61 Base Case sensitivity analyses.

Parameter Adjusted	Definition	Number of Runs
Natural stand yields	Natural stand yields +/- 10%	2
Managed stand yields	Managed stand yields +/- 10%	2
Regeneration delay	Regeneration delay +2 / -1 years	2
Minimum harvest age (MHA)	Base case values +/- 10 years	2
MHA (volume criteria only)	New values based on minimum volume criteria only	2
MHA (MAI criteria only)	New values based on attaining maximum mean annual increment only	2
Timber harvesting landbase	Increase/decrease landbase by 10%	2
Genetic gains	Managed stand yields without genetic gains	2
	Totals	**16**

10.4 Alternate harvest flows over time

The harvest flow is the estimated rate of harvest for each period (10 years/period) over a long term planning horizon (250 years or more). There are many possible harvest flows with different starting harvest levels, and with different rates of declining and/or increasing harvests between periods. For example, it is possible to 'trade off' the mid- or long-term harvest for short-term harvest, or vice versa. A number of harvest flows will be produced for the Base Case option (Table 62). These provide a picture of the trade-offs that were inherent in developing the recommended harvest flow.

Table 62 Alternate Base Case harvest flows

Alternate Harvest Flow	Key parameters	Number of runs
Maximum starting harvest level	Highest possible starting level with a maximum decline per decade not to exceed 10% of the previous decade.	1
Maintain current AAC	Maintain, for as long as possible, the current AAC without any decline. Maintain the mid-term harvest level, if possible, above the long term sustained yield.	1
Non-declining even flow.	Maximum harvest level with no decline in harvest in any period.	1
	Totals	**3**

10.5 Other options

Other options are used to quantify the impacts of alternate management, or combinations of modeling assumptions that are significantly different than the Base Case. Table 63 summarizes the options that will be examined.

Table 63 Other Options

Option	Key management parameters
Non-spatial Biodiversity and Caribou Option ("Non-spatial Option")	**Non-spatial Biodiversity and Caribou Option** – Assume that spatially deployed biodiversity OGMAs and Mature; and spatially deployed HLPO-related caribou were not available. Model the requirements as aspatial (percentage) older forest requirements. The intent is to quantify the effect, if any, of the spatial mapping.
Mountain Pine Beetle Option ("MPB Option")	**Mountain Pine Beetle Option** - Assume catastrophic MPB attack levels as forecast by Ministry of Forest staff (Eng et al, 2005). The intent is to explore a worst-case scenario where almost all Pl volume is lost in a very short time frame. The goal would be to capture as much of the attacked pine as possible under an AAC uplift before it becomes uneconomic to salvage, and then, reduce the harvest to a long term sustainable level.
Split-TSA Harvest Flow ("MPB Option")	**Split-TSA Harvest Flow Option** – This option will examine harvest flows from three portions of the TSA: north, mid and south. The intent is to examine the wood supply that flows north and west to Revelstoke versus that which flows south to Golden. The "mid" portion could flow either north or south.

10.6 Non-spatial OGMA and Caribou Option

This option is designed to show the timber supply implications of modeling the caribou, and the biodiversity seral requirements as aspatial older seral requirements. The differences between the Base Case and this option are:

- The mapped areas that representing the HLPO aspatial caribou requirements are "turned off" and are replaced with aspatial, older seral requirements. The SARCO caribou "incremental" areas remain as no harvest areas, or THLB netdowns (no change from Base Case).
- OGMAs and MOGMAs are "turned off" and biodiversity targets are modeled as older seral requirements, as per the HLPO. In the low BEO areas, starting in the first rotation, the old seral requirements start at 1/3-target levels and increase to full targets by the end of three rotations.

  (*) = modeled as THLB reductions

10.6.1 Old growth management areas

In the base case, the required area of old seral retention was calculated for each LU/BEO/BEC variant combination and old seral retention areas have been spatially identified and mapped as old growth management areas (OGMAs) and mature-plus-old management areas (MOGMAs). In this option the OGMAs and MOGMAs are replaced with aspatial seral requirements. The effect is seen in the landbase netdown table (Table 64).

10.6.2 Caribou management areas

In the base case, the required area of older forest types was calculated and equivalent area was spatially identified and mapped as caribou reserves. In this option the caribou reserves are replace with the HLPO caribou seral requirements. The effect is a significant increase in the timber harvesting landbase (Table 64).

Table 64 Landbase Comparisons – Base Case and Non-spatial Biodiversity and Caribou Option

	Base Case Scenario (ha)	**Non-spatial Biod and Caribou (ha) (*)**
Total land base	**1,184,611**	**1,184,611**
Reductions		
Private, Woodlots, non-contributing administrative classes	22,975	22,975
Non-forest, non-productive forest	724,882	724,882
Roads, trails, landings	4,077	4,077
Total productive land base (*)	**432,677**	**432,677**
Reductions		
Parks and protected areas (**)	88,227	88,227
Inoperable	165,829	165,829
Unstable terrain (ESA & TSIL)	3,376	3,376
Non-merch (low site)	3,067	3,067
PFT (Hw and Decid)	5,548	5,548
Wildlife (caribou HLPO and SARCO)	8,348	0
Archaeological sites	0	0
Riparian	5,194	5,367
Biodiversity - WTRA	1,543	1,651
Biodiversity – OGMA and MOGMA	9,910	0
Permanent sample plots	105	120
Total Reductions	291,147	273,185
Current Timber Harvesting Land Base	**141,530**	**159,492**
Future WTPs	652	652
Future roads and trails	2,516	2,836
Net long-term Timber Harvesting Land Base	**138,362**	**156,004**

Note:
1. All totals are subject to rounding.
2. (*) Some Park area is included for biodiversity modeling on the productive landbase. Totals below (**) do not include any of this Park area.

Note that any overlaps between net-downs are removed in the table. Any overlap will accrue to the first (highest) category in the table.

10.7 Mountain Pine Beetle Scenario

This option examines the impacts assuming catastrophic infestation of mountain pine beetle (MPB). It includes an uplift in AAC to capture the majority of impacted pine volume; high mortality of pine with both salvaged and unsalvaged pine volumes; and a possible decline in mid term harvest volume once the epidemic is over. The assumptions in this Option are based on the Base Case Option, with additional MPB-related assumptions adopted from the Mountain Pine Beetle Initiative Modeling Project by M. Eng. Et al. (2005, 2006) and Walton et al. (2007). In many cases our assumptions are simplifications of those used in these projects.

10.7.1 Attack Priority

In both the NCLB and THLB the pine is attacked in a priority order based on the pine volume (m3) and the proportion of pine volume (m3/ha) in each stand. As pine volume increases and/or the pine proportion increases, and if the stand age is > 60 years, then it is more likely that the stand will be attacked. The spatial spread of the MPB is not modeled.

10.7.2 Attack volume

The Walton et al (2007) project estimated that 68% of the pine volume in the Golden TSA will be killed over the next 15 years, barring some agent like cold weather ending the epidemic (Table 65). The volume of pine attacked and killed generally follows a rising, then falling curve. We approximate this curve as three 5-year attack periods, as in Table 65.

Table 65 Percent pine volume killed during the first four 5-year periods of the MPB epidemic.

Period (5 years/period)	Cumulative volume killed over 15 years (% total) (Ref: Walton et al, 2007)	Pine volume killed in the model during this period (% of total pine volume)
1	16	16
2	48	32
3	68	20

The modeling is simplified by assuming that the estimated volume of pine killed (total volume of Pl on the landscape times the percentage killed in Table 65) is translated to a stand volume. If 100,000 m3 of pine is to be killed in one period, then we will model this as 100,000 m3 of stand volume killed (with priority on pine-volume stands).

10.7.3 Salvage Volume

Within each 5-year period an attempt is made to salvage the volume that is attacked within the THLB. The salvage harvest is prioritized for stands that have over 40% pine content. If required, a maximum 20% AAC uplift is added to salvage pine stands, over the current AAC of 485,000 m3/yr. If the volume of attacked wood is greater than the uplift volume then the extra volume is assumed to be lost, and not recovered later.

10.7.4 Regen Delays

Stands that are salvaged are assumed to be reforested within 2 years. Non-salvaged stands are subject to a 10-year regeneration delay. All stands in the NCLB are not salvaged. Some stands in the THLB may not be salvaged due to economics (as reflected in the minimum harvest ages), or due to the excessive volume of attack. These stands are assumed to regenerate to natural stand analysis units.

10.8 Split-TSA Harvest Flow Scenario

This option examines the harvest flow from three portions of the TSA: north, mid and south. The portions reflect the harvest flow direction: wood from the “north” logically flows to Revelstoke, while the wood from the “south” flows to Golden. The mid portion could flow either direction. The intent is to shed light on the question: “What harvest can be expected from each portion of the TSA, and in turn what portions of the

TSA should be expected to flow north to Revelstoke vs. south to Golden. This option is identical to the Base Case, except that sub-TSA harvest flow controls will be applied to each portion of the TSA.

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APPENDIX A. NATURAL STAND (VDYP) YIELD TABLES

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Lw, Fd (dry) - best

Analysis Unit	Age	Volume	Diameter	MAI
101	0	0	0	0.0
101	10	0	0	0.0
101	20	0	2	0.0
101	30	23	20	0.8
101	40	76	22	1.9
101	50	129	24	2.6
101	60	180	26	3.0
101	70	229	28	3.3
101	80	275	30	3.4
101	90	318	32	3.5
101	100	355	34	3.6
101	110	386	36	3.5
101	120	414	38	3.5
101	130	440	40	3.4
101	140	461	42	3.3
101	150	481	44	3.2
101	160	498	45	3.1
101	170	513	47	3.0
101	180	526	49	2.9
101	190	538	50	2.8
101	200	550	52	2.8
101	210	561	54	2.7
101	220	572	55	2.6
101	230	582	57	2.5
101	240	591	59	2.5
101	250	600	61	2.4
101	260	600	61	2.3
101	270	600	61	2.2
101	280	599	61	2.1
101	290	599	61	2.1
101	300	598	61	2.0
101	310	597	61	1.9
101	320	597	61	1.9
101	330	596	61	1.8
101	340	595	61	1.8
101	350	593	61	1.7

Lw, Fd (dry) - mod

Analysis Unit	Age	Volume	Diameter	MAI
102	0	0	0	0.0
102	10	0	0	0.0
102	20	0	0	0.0
102	30	1	6	0.0
102	40	26	19	0.7
102	50	62	22	1.2
102	60	99	23	1.7
102	70	135	25	1.9
102	80	169	27	2.1
102	90	201	28	2.2
102	100	232	30	2.3
102	110	261	32	2.4
102	120	286	34	2.4
102	130	309	35	2.4
102	140	328	37	2.3
102	150	346	38	2.3
102	160	360	39	2.3
102	170	373	41	2.2
102	180	385	42	2.1
102	190	396	44	2.1
102	200	407	45	2.0
102	210	417	46	2.0
102	220	426	48	1.9
102	230	435	49	1.9
102	240	444	51	1.9
102	250	452	52	1.8
102	260	452	52	1.7
102	270	453	52	1.7
102	280	453	52	1.6
102	290	453	52	1.6
102	300	453	53	1.5
102	310	453	53	1.5
102	320	453	53	1.4
102	330	452	53	1.4
102	340	452	53	1.3
102	350	452	53	1.3

Lw, Fd (wet) - best

Analysis Unit	Age	Volume	Diameter	MAI
104	0	0	0	0.0
104	10	0	0	0.0
104	20	0	4	0.0
104	30	25	20	0.8
104	40	88	22	2.2
104	50	153	24	3.1
104	60	215	26	3.6
104	70	273	28	3.9
104	80	327	30	4.1
104	90	376	32	4.2
104	100	420	34	4.2
104	110	457	36	4.2
104	120	489	39	4.1
104	130	519	41	4.0
104	140	547	42	3.9
104	150	571	44	3.8
104	160	594	46	3.7
104	170	614	48	3.6
104	180	633	49	3.5
104	190	650	51	3.4
104	200	666	53	3.3
104	210	682	54	3.2
104	220	696	56	3.2
104	230	710	58	3.1
104	240	724	60	3.0
104	250	736	61	2.9
104	260	738	61	2.8
104	270	739	62	2.7
104	280	741	62	2.6
104	290	742	62	2.6
104	300	743	62	2.5
104	310	744	62	2.4
104	320	745	63	2.3
104	330	745	63	2.3
104	340	746	63	2.2
104	350	747	63	2.1

Lw, Fd (wet) - mod

Analysis Unit	Age	Volume	Diameter	MAI
105	0	0	0	0.0
105	10	0	0	0.0
105	20	0	1	0.0
105	30	2	12	0.1
105	40	41	21	1.0
105	50	91	22	1.8
105	60	139	24	2.3
105	70	184	26	2.6
105	80	226	27	2.8
105	90	265	29	2.9
105	100	301	31	3.0
105	110	334	33	3.0
105	120	363	34	3.0
105	130	390	36	3.0
105	140	413	38	3.0
105	150	434	39	2.9
105	160	453	40	2.8
105	170	470	42	2.8
105	180	486	43	2.7
105	190	500	44	2.6
105	200	514	46	2.6
105	210	527	47	2.5
105	220	540	49	2.5
105	230	551	50	2.4
105	240	563	51	2.3
105	250	573	53	2.3
105	260	575	53	2.2
105	270	577	53	2.1
105	280	578	53	2.1
105	290	579	53	2.0
105	300	581	54	1.9
105	310	582	54	1.9
105	320	583	54	1.8
105	330	584	54	1.8
105	340	585	54	1.7
105	350	586	55	1.7

Lw, Fd (wet) - poorest

Analysis Unit	Age	Volume	Diameter	MAI
106	0	0	0	0.0
106	10	0	0	0.0
106	20	0	0	0.0
106	30	0	5	0.0
106	40	10	18	0.3
106	50	45	21	0.9
106	60	83	22	1.4
106	70	119	24	1.7
106	80	153	25	1.9
106	90	184	27	2.0
106	100	213	28	2.1
106	110	240	30	2.2
106	120	264	31	2.2
106	130	286	32	2.2
106	140	307	34	2.2
106	150	325	35	2.2
106	160	341	36	2.1
106	170	355	37	2.1
106	180	369	38	2.1
106	190	382	39	2.0
106	200	395	40	2.0
106	210	407	41	1.9
106	220	419	43	1.9
106	230	430	44	1.9
106	240	441	45	1.8
106	250	451	46	1.8
106	260	453	46	1.7
106	270	455	46	1.7
106	280	456	46	1.6
106	290	458	47	1.6
106	300	459	47	1.5
106	310	461	47	1.5
106	320	462	47	1.4
106	330	463	47	1.4
106	340	464	47	1.4
106	350	465	48	1.3

Cw - best

Analysis Unit	Age	Volume	Diameter	MAI
107	0	0	0	0.0
107	10	0	0	0.0
107	20	0	1	0.0
107	30	5	20	0.2
107	40	62	22	1.6
107	50	114	24	2.3
107	60	161	26	2.7
107	70	203	29	2.9
107	80	241	31	3.0
107	90	270	33	3.0
107	100	293	35	2.9
107	110	313	38	2.8
107	120	328	40	2.7
107	130	350	42	2.7
107	140	372	44	2.7
107	150	392	46	2.6
107	160	410	48	2.6
107	170	427	50	2.5
107	180	443	52	2.5
107	190	458	53	2.4
107	200	473	55	2.4
107	210	487	57	2.3
107	220	503	58	2.3
107	230	520	60	2.3
107	240	535	61	2.2
107	250	550	62	2.2
107	260	551	62	2.1
107	270	553	63	2.0
107	280	554	63	2.0
107	290	555	64	1.9
107	300	556	64	1.9
107	310	557	64	1.8
107	320	558	65	1.7
107	330	558	65	1.7
107	340	559	65	1.6
107	350	560	66	1.6

Cw - mod

Analysis Unit	Age	Volume	Diameter	MAI
108	0	0	0	0.0
108	10	0	0	0.0
108	20	0	0	0.0
108	30	0	5	0.0
108	40	26	21	0.7
108	50	74	22	1.5
108	60	118	24	2.0
108	70	157	26	2.2
108	80	192	27	2.4
108	90	219	29	2.4
108	100	241	31	2.4
108	110	259	33	2.4
108	120	273	35	2.3
108	130	294	36	2.3
108	140	314	38	2.2
108	150	333	40	2.2
108	160	351	41	2.2
108	170	367	43	2.2
108	180	383	44	2.1
108	190	398	45	2.1
108	200	413	47	2.1
108	210	427	48	2.0
108	220	444	49	2.0
108	230	460	51	2.0
108	240	476	51	2.0
108	250	492	52	2.0
108	260	494	53	1.9
108	270	496	53	1.8
108	280	498	53	1.8
108	290	499	54	1.7
108	300	501	54	1.7
108	310	502	54	1.6
108	320	503	55	1.6
108	330	505	55	1.5
108	340	506	55	1.5
108	350	507	56	1.4

Cw - poorest

Analysis Unit	Age	Volume	Diameter	MAI
109	0	0	0	0.0
109	10	0	0	0.0
109	20	0	0	0.0
109	30	0	4	0.0
109	40	3	15	0.1
109	50	35	21	0.7
109	60	70	22	1.2
109	70	102	23	1.5
109	80	131	25	1.6
109	90	154	26	1.7
109	100	173	27	1.7
109	110	188	29	1.7
109	120	201	30	1.7
109	130	218	31	1.7
109	140	235	33	1.7
109	150	251	34	1.7
109	160	265	35	1.7
109	170	279	36	1.6
109	180	292	37	1.6
109	190	304	38	1.6
109	200	316	39	1.6
109	210	328	40	1.6
109	220	341	41	1.6
109	230	354	42	1.5
109	240	368	42	1.5
109	250	380	43	1.5
109	260	383	43	1.5
109	270	385	44	1.4
109	280	387	44	1.4
109	290	389	44	1.3
109	300	391	44	1.3
109	310	392	45	1.3
109	320	394	45	1.2
109	330	395	45	1.2
109	340	397	45	1.2
109	350	398	46	1.1

Hw - best

Analysis Unit	Age	Volume	Diameter	MAI
110	0	0	0	0.0
110	10	0	0	0.0
110	20	0	2	0.0
110	30	3	17	0.1
110	40	54	21	1.4
110	50	123	23	2.5
110	60	183	25	3.1
110	70	237	27	3.4
110	80	283	29	3.5
110	90	316	31	3.5
110	100	342	33	3.4
110	110	362	36	3.3
110	120	377	38	3.1
110	130	399	40	3.1
110	140	420	41	3.0
110	150	438	43	2.9
110	160	453	45	2.8
110	170	467	46	2.7
110	180	480	47	2.7
110	190	491	48	2.6
110	200	502	50	2.5
110	210	512	51	2.4
110	220	522	52	2.4
110	230	530	53	2.3
110	240	538	54	2.2
110	250	546	55	2.2
110	260	549	56	2.1
110	270	551	57	2.0
110	280	553	58	2.0
110	290	555	58	1.9
110	300	557	59	1.9
110	310	558	60	1.8
110	320	560	60	1.8
110	330	561	61	1.7
110	340	563	62	1.7
110	350	564	62	1.6

Hw - mod

Analysis Unit	Age	Volume	Diameter	MAI
111	0	0	0	0.0
111	10	0	0	0.0
111	20	0	0	0.0
111	30	0	4	0.0
111	40	7	15	0.2
111	50	47	21	0.9
111	60	105	23	1.8
111	70	157	24	2.2
111	80	204	26	2.6
111	90	241	28	2.7
111	100	270	30	2.7
111	110	294	32	2.7
111	120	313	34	2.6
111	130	337	36	2.6
111	140	359	37	2.6
111	150	379	39	2.5
111	160	396	40	2.5
111	170	412	41	2.4
111	180	426	42	2.4
111	190	438	43	2.3
111	200	451	45	2.3
111	210	463	46	2.2
111	220	474	47	2.2
111	230	485	48	2.1
111	240	494	49	2.1
111	250	503	50	2.0
111	260	507	51	2.0
111	270	511	52	1.9
111	280	514	52	1.8
111	290	517	53	1.8
111	300	520	54	1.7
111	310	523	55	1.7
111	320	526	55	1.6
111	330	528	56	1.6
111	340	530	57	1.6
111	350	532	57	1.5

Hw - poorest

Analysis Unit	Age	Volume	Diameter	MAI
112	0	0	0	0.0
112	10	0	0	0.0
112	20	0	0	0.0
112	30	0	0	0.0
112	40	0	4	0.0
112	50	2	14	0.0
112	60	22	20	0.4
112	70	60	22	0.9
112	80	100	24	1.3
112	90	134	25	1.5
112	100	164	27	1.6
112	110	188	28	1.7
112	120	209	30	1.7
112	130	232	32	1.8
112	140	254	33	1.8
112	150	274	35	1.8
112	160	291	36	1.8
112	170	307	37	1.8
112	180	322	38	1.8
112	190	335	39	1.8
112	200	348	40	1.7
112	210	360	41	1.7
112	220	372	42	1.7
112	230	383	43	1.7
112	240	394	44	1.6
112	250	404	45	1.6
112	260	410	46	1.6
112	270	415	46	1.5
112	280	420	47	1.5
112	290	424	48	1.5
112	300	428	49	1.4
112	310	431	49	1.4
112	320	434	50	1.4
112	330	437	51	1.3
112	340	440	51	1.3
112	350	442	52	1.3

B, S - best

Analysis Unit	Age	Volume	Diameter	MAI
113	0	0	0	0.0
113	10	0	0	0.0
113	20	0	0	0.0
113	30	2	12	0.1
113	40	33	21	0.8
113	50	105	23	2.1
113	60	170	25	2.8
113	70	227	27	3.2
113	80	275	29	3.4
113	90	315	30	3.5
113	100	348	32	3.5
113	110	377	34	3.4
113	120	401	35	3.3
113	130	423	37	3.3
113	140	443	38	3.2
113	150	461	40	3.1
113	160	476	41	3.0
113	170	489	42	2.9
113	180	501	43	2.8
113	190	511	43	2.7
113	200	521	44	2.6
113	210	530	45	2.5
113	220	538	46	2.4
113	230	545	47	2.4
113	240	551	48	2.3
113	250	557	49	2.2
113	260	560	50	2.2
113	270	563	50	2.1
113	280	565	51	2.0
113	290	567	52	2.0
113	300	569	52	1.9
113	310	570	53	1.8
113	320	572	53	1.8
113	330	573	54	1.7
113	340	574	55	1.7
113	350	575	55	1.6

B, S - mod

Analysis Unit	Age	Volume	Diameter	MAI
114	0	0	0	0.0
114	10	0	0	0.0
114	20	0	0	0.0
114	30	0	1	0.0
114	40	6	15	0.2
114	50	28	19	0.6
114	60	74	22	1.2
114	70	121	24	1.7
114	80	162	25	2.0
114	90	198	27	2.2
114	100	230	28	2.3
114	110	258	30	2.3
114	120	282	32	2.4
114	130	306	33	2.4
114	140	327	34	2.3
114	150	347	35	2.3
114	160	364	36	2.3
114	170	380	37	2.2
114	180	394	38	2.2
114	190	407	39	2.1
114	200	420	40	2.1
114	210	431	41	2.1
114	220	441	42	2.0
114	230	451	43	2.0
114	240	460	44	1.9
114	250	469	45	1.9
114	260	473	45	1.8
114	270	476	46	1.8
114	280	480	47	1.7
114	290	483	47	1.7
114	300	485	48	1.6
114	310	487	48	1.6
114	320	490	49	1.5
114	330	491	49	1.5
114	340	493	50	1.5
114	350	495	50	1.4

B, S - poorest

Analysis Unit	Age	Volume	Diameter	MAI
115	0	0	0	0.0
115	10	0	0	0.0
115	20	0	0	0.0
115	30	0	0	0.0
115	40	0	2	0.0
115	50	4	14	0.1
115	60	14	20	0.2
115	70	42	21	0.6
115	80	76	22	1.0
115	90	107	24	1.2
115	100	136	25	1.4
115	110	162	26	1.5
115	120	186	27	1.6
115	130	209	29	1.6
115	140	230	30	1.6
115	150	250	31	1.7
115	160	268	31	1.7
115	170	285	32	1.7
115	180	300	33	1.7
115	190	315	34	1.7
115	200	328	35	1.6
115	210	341	35	1.6
115	220	352	36	1.6
115	230	363	37	1.6
115	240	374	38	1.6
115	250	383	39	1.5
115	260	388	39	1.5
115	270	393	40	1.5
115	280	397	40	1.4
115	290	401	41	1.4
115	300	405	42	1.4
115	310	408	42	1.3
115	320	412	43	1.3
115	330	414	43	1.3
115	340	417	44	1.2
115	350	419	44	1.2

S mixed - best

Analysis Unit	Age	Volume	Diameter	MAI
116	0	0	0	0.0
116	10	0	0	0.0
116	20	0	0	0.0
116	30	0	8	0.0
116	40	50	21	1.3
116	50	132	23	2.6
116	60	205	25	3.4
116	70	269	27	3.8
116	80	324	29	4.1
116	90	370	31	4.1
116	100	409	33	4.1
116	110	443	35	4.0
116	120	470	37	3.9
116	130	495	38	3.8
116	140	515	40	3.7
116	150	532	41	3.5
116	160	546	42	3.4
116	170	558	43	3.3
116	180	568	44	3.2
116	190	576	45	3.0
116	200	584	45	2.9
116	210	591	46	2.8
116	220	598	47	2.7
116	230	604	48	2.6
116	240	609	49	2.5
116	250	614	50	2.5
116	260	617	51	2.4
116	270	620	51	2.3
116	280	622	52	2.2
116	290	624	52	2.2
116	300	625	53	2.1
116	310	627	53	2.0
116	320	628	54	2.0
116	330	629	55	1.9
116	340	630	55	1.9
116	350	631	56	1.8

S mixed - mod

Analysis Unit	Age	Volume	Diameter	MAI
117	0	0	0	0.0
117	10	0	0	0.0
117	20	0	0	0.0
117	30	0	4	0.0
117	40	9	17	0.2
117	50	72	22	1.4
117	60	138	24	2.3
117	70	198	26	2.8
117	80	251	27	3.1
117	90	297	29	3.3
117	100	337	31	3.4
117	110	372	33	3.4
117	120	402	34	3.4
117	130	430	36	3.3
117	140	453	37	3.2
117	150	472	38	3.1
117	160	488	39	3.1
117	170	502	40	3.0
117	180	514	41	2.9
117	190	524	42	2.8
117	200	534	43	2.7
117	210	543	44	2.6
117	220	552	45	2.5
117	230	559	46	2.4
117	240	566	46	2.4
117	250	572	47	2.3
117	260	576	48	2.2
117	270	579	48	2.1
117	280	582	49	2.1
117	290	585	50	2.0
117	300	588	50	2.0
117	310	590	51	1.9
117	320	592	51	1.9
117	330	593	52	1.8
117	340	595	52	1.8
117	350	596	53	1.7

Pine - best

Analysis Unit	Age	Volume	Diameter	MAI
118	0	0	0	0.0
118	10	0	0	0.0
118	20	0	0	0.0
118	30	0	0	0.0
118	40	0	7	0.0
118	50	10	17	0.2
118	60	48	21	0.8
118	70	96	23	1.4
118	80	142	24	1.8
118	90	185	26	2.1
118	100	223	28	2.2
118	110	256	29	2.3
118	120	286	31	2.4
118	130	315	32	2.4
118	140	340	33	2.4
118	150	362	35	2.4
118	160	381	36	2.4
118	170	398	37	2.3
118	180	414	37	2.3
118	190	428	38	2.3
118	200	441	39	2.2
118	210	453	40	2.2
118	220	464	41	2.1
118	230	475	42	2.1
118	240	485	43	2.0
118	250	494	44	2.0
118	260	499	44	1.9
118	270	503	45	1.9
118	280	507	45	1.8
118	290	511	46	1.8
118	300	515	46	1.7
118	310	518	47	1.7
118	320	521	47	1.6
118	330	523	48	1.6
118	340	526	49	1.5
118	350	528	49	1.5

Pine - best

Analysis Unit	Age	Volume	Diameter	MAI
119	0	0	0	0.0
119	10	0	0	0.0
119	20	0	1	0.0
119	30	55	16	1.8
119	40	123	18	3.1
119	50	181	20	3.6
119	60	231	21	3.9
119	70	275	23	3.9
119	80	313	24	3.9
119	90	347	26	3.9
119	100	377	27	3.8
119	110	404	28	3.7
119	120	429	30	3.6
119	130	452	31	3.5
119	140	467	32	3.3
119	150	479	33	3.2
119	160	488	33	3.1
119	170	493	34	2.9
119	180	495	34	2.8
119	190	494	35	2.6
119	200	496	35	2.5
119	210	500	35	2.4
119	220	503	36	2.3
119	230	506	36	2.2
119	240	509	37	2.1
119	250	512	37	2.0
119	260	514	38	2.0
119	270	517	38	1.9
119	280	518	38	1.9
119	290	520	38	1.8
119	300	522	39	1.7
119	310	523	39	1.7
119	320	525	39	1.6
119	330	526	40	1.6
119	340	527	40	1.6
119	350	528	40	1.5

Pine - mod+

Analysis Unit	Age	Volume	Diameter	MAI
120	0	0	0	0.0
120	10	0	0	0.0
120	20	0	1	0.0
120	30	33	16	1.1
120	40	95	17	2.4
120	50	151	19	3.0
120	60	199	20	3.3
120	70	242	21	3.5
120	80	279	23	3.5
120	90	313	24	3.5
120	100	343	25	3.4
120	110	370	26	3.4
120	120	396	28	3.3
120	130	420	29	3.2
120	140	435	30	3.1
120	150	448	31	3.0
120	160	457	31	2.9
120	170	462	32	2.7
120	180	465	32	2.6
120	190	463	33	2.4
120	200	466	33	2.3
120	210	470	34	2.2
120	220	473	34	2.2
120	230	476	34	2.1
120	240	479	35	2.0
120	250	483	35	1.9
120	260	485	36	1.9
120	270	487	36	1.8
120	280	489	36	1.7
120	290	491	36	1.7
120	300	492	37	1.6
120	310	494	37	1.6
120	320	495	37	1.5
120	330	496	38	1.5
120	340	497	38	1.5
120	350	498	38	1.4

Pine - mod

Analysis Unit	Age	Volume	Diameter	MAI
121	0	0	0	0.0
121	10	0	0	0.0
121	20	0	2	0.0
121	30	7	10	0.2
121	40	54	16	1.4
121	50	100	17	2.0
121	60	142	19	2.4
121	70	179	20	2.6
121	80	212	21	2.7
121	90	242	22	2.7
121	100	270	23	2.7
121	110	295	25	2.7
121	120	318	26	2.7
121	130	340	27	2.6
121	140	354	28	2.5
121	150	366	28	2.4
121	160	375	29	2.3
121	170	381	30	2.2
121	180	383	30	2.1
121	190	383	31	2.0
121	200	386	31	1.9
121	210	389	32	1.9
121	220	392	32	1.8
121	230	396	33	1.7
121	240	399	33	1.7
121	250	402	34	1.6
121	260	404	34	1.6
121	270	406	34	1.5
121	280	407	34	1.5
121	290	409	35	1.4
121	300	410	35	1.4
121	310	412	35	1.3
121	320	413	35	1.3
121	330	414	36	1.3
121	340	415	36	1.2
121	350	416	36	1.2

Pine - poorest

Analysis Unit	Age	Volume	Diameter	MAI
122	0	0	0	0.0
122	10	0	0	0.0
122	20	0	2	0.0
122	30	0	2	0.0
122	40	27	15	0.7
122	50	67	17	1.3
122	60	106	18	1.8
122	70	141	19	2.0
122	80	172	20	2.2
122	90	202	21	2.2
122	100	229	22	2.3
122	110	254	23	2.3
122	120	277	24	2.3
122	130	299	25	2.3
122	140	314	26	2.2
122	150	326	26	2.2
122	160	335	27	2.1
122	170	341	27	2.0
122	180	344	28	1.9
122	190	343	28	1.8
122	200	347	29	1.7
122	210	350	29	1.7
122	220	353	30	1.6
122	230	357	30	1.6
122	240	360	31	1.5
122	250	363	31	1.5
122	260	365	32	1.4
122	270	367	32	1.4
122	280	369	32	1.3
122	290	370	33	1.3
122	300	372	33	1.2
122	310	373	33	1.2
122	320	374	33	1.2
122	330	375	34	1.1
122	340	376	34	1.1
122	350	377	34	1.1

Decid - all

Analysis Unit	Age	Volume	Diameter	MAI
123	0	0	0	0.0
123	10	0	0	0.0
123	20	0	1	0.0
123	30	4	8	0.1
123	40	19	12	0.5
123	50	36	18	0.7
123	60	53	20	0.9
123	70	69	22	1.0
123	80	83	24	1.0
123	90	94	26	1.0
123	100	104	27	1.0
123	110	112	29	1.0
123	120	118	31	1.0
123	130	124	32	1.0
123	140	129	33	0.9
123	150	134	34	0.9
123	160	136	35	0.9
123	170	138	35	0.8
123	180	140	36	0.8
123	190	142	36	0.7
123	200	143	36	0.7
123	210	145	37	0.7
123	220	146	37	0.7
123	230	148	38	0.6
123	240	149	38	0.6
123	250	150	38	0.6
123	260	151	38	0.6
123	270	151	39	0.6
123	280	151	39	0.5
123	290	152	39	0.5
123	300	152	39	0.5
123	310	152	39	0.5
123	320	152	39	0.5
123	330	152	39	0.5
123	340	152	40	0.4
123	350	153	40	0.4

CFLB Coniferous

Analysis Unit	Age	Volume	Diameter	MAI
801	0	0	0	0.0
801	10	0	0	0.0
801	20	0	0	0.0
801	30	3	3	0.1
801	40	15	10	0.4
801	50	38	17	0.8
801	60	69	21	1.2
801	70	103	22	1.5
801	80	136	24	1.7
801	90	166	25	1.8
801	100	193	27	1.9
801	110	217	28	2.0
801	120	238	29	2.0
801	130	259	31	2.0
801	140	278	32	2.0
801	150	294	33	2.0
801	160	309	34	1.9
801	170	322	35	1.9
801	180	333	36	1.9
801	190	343	36	1.8
801	200	353	37	1.8
801	210	363	38	1.7
801	220	372	39	1.7
801	230	381	40	1.7
801	240	389	41	1.6
801	250	397	42	1.6
801	260	400	42	1.5
801	270	403	43	1.5
801	280	405	43	1.4
801	290	408	44	1.4
801	300	410	44	1.4
801	310	412	44	1.3
801	320	414	45	1.3
801	330	416	45	1.3
801	340	417	46	1.2
801	350	418	46	1.2

CFLB Deciduous

Analysis Unit	Age	Volume	Diameter	MAI
802	0	0	0	0.0
802	10	0	0	0.0
802	20	0	2	0.0
802	30	5	12	0.2
802	40	23	16	0.6
802	50	44	19	0.9
802	60	63	21	1.1
802	70	80	23	1.1
802	80	95	25	1.2
802	90	107	27	1.2
802	100	118	29	1.2
802	110	126	30	1.1
802	120	133	32	1.1
802	130	139	34	1.1
802	140	144	35	1.0
802	150	149	36	1.0
802	160	152	37	1.0
802	170	155	37	0.9
802	180	157	37	0.9
802	190	159	38	0.8
802	200	160	38	0.8
802	210	162	39	0.8
802	220	164	39	0.7
802	230	165	39	0.7
802	240	167	40	0.7
802	250	168	40	0.7
802	260	169	40	0.7
802	270	169	40	0.6
802	280	169	41	0.6
802	290	169	41	0.6
802	300	170	41	0.6
802	310	170	41	0.5
802	320	170	41	0.5
802	330	170	41	0.5
802	340	170	41	0.5
802	350	170	41	0.5

APPENDIX B. MANAGED STANDS (TIPSY) YIELD TABLES

<insert tables after this page>

Lw, Fd (dry) - best

Analysis Unit	Age	Volume	Diameter	MAI
201	0	0	0	0.0
201	10	0	0	0.0
201	20	3	0	0.2
201	30	65	20	2.2
201	40	175	26	4.4
201	50	275	30	5.5
201	60	364	34	6.1
201	70	427	36	6.1
201	80	469	39	5.9
201	90	494	40	5.5
201	100	515	42	5.2
201	110	534	43	4.9
201	120	531	43	4.4
201	130	528	43	4.1
201	140	526	43	3.8
201	150	523	43	3.5
201	160	520	43	3.3
201	170	517	43	3.0
201	180	514	43	2.9
201	190	511	43	2.7
201	200	509	43	2.5
201	210	506	43	2.4
201	220	503	43	2.3
201	230	500	43	2.2
201	240	497	43	2.1
201	250	494	43	2.0
201	260	492	43	1.9
201	270	489	43	1.8
201	280	486	43	1.7
201	290	483	43	1.7
201	300	480	43	1.6
201	310	477	43	1.5
201	320	475	43	1.5
201	330	472	43	1.4
201	340	469	43	1.4
201	350	466	43	1.3

Lw, Fd (dry) - mod

Analysis Unit	Age	Volume	Diameter	MAI
202	0	0	0	0.0
202	10	0	0	0.0
202	20	0	0	0.0
202	30	6	15	0.2
202	40	46	20	1.2
202	50	109	23	2.2
202	60	176	26	2.9
202	70	230	28	3.3
202	80	278	30	3.5
202	90	318	32	3.5
202	100	351	34	3.5
202	110	379	35	3.4
202	120	401	36	3.3
202	130	420	37	3.2
202	140	435	38	3.1
202	150	447	38	3.0
202	160	456	39	2.9
202	170	463	39	2.7
202	180	469	40	2.6
202	190	475	40	2.5
202	200	478	40	2.4
202	210	481	41	2.3
202	220	484	41	2.2
202	230	485	41	2.1
202	240	487	41	2.0
202	250	488	42	2.0
202	260	489	42	1.9
202	270	489	42	1.8
202	280	489	42	1.7
202	290	488	42	1.7
202	300	485	42	1.6
202	310	482	42	1.6
202	320	480	42	1.5
202	330	477	42	1.4
202	340	474	42	1.4
202	350	471	42	1.3

Lw, Fd (wet) - best

Analysis Unit	Age	Volume	Diameter	MAI
204	0	0	0	0.0
204	10	0	0	0.0
204	20	1	0	0.1
204	30	26	18	0.9
204	40	128	24	3.2
204	50	242	29	4.8
204	60	347	34	5.8
204	70	426	37	6.1
204	80	485	40	6.1
204	90	525	42	5.8
204	100	558	44	5.6
204	110	584	45	5.3
204	120	581	45	4.8
204	130	578	45	4.4
204	140	575	45	4.1
204	150	572	45	3.8
204	160	569	45	3.6
204	170	566	45	3.3
204	180	563	45	3.1
204	190	560	45	2.9
204	200	556	45	2.8
204	210	553	45	2.6
204	220	550	45	2.5
204	230	547	45	2.4
204	240	544	45	2.3
204	250	541	45	2.2
204	260	538	45	2.1
204	270	535	45	2.0
204	280	532	45	1.9
204	290	529	45	1.8
204	300	526	45	1.8
204	310	522	45	1.7
204	320	519	45	1.6
204	330	516	45	1.6
204	340	513	45	1.5
204	350	510	45	1.5

Lw, Fd (wet) - mod

Analysis Unit	Age	Volume	Diameter	MAI
205	0	0	0	0.0
205	10	0	0	0.0
205	20	0	0	0.0
205	30	2	14	0.1
205	40	30	19	0.8
205	50	98	23	2.0
205	60	178	27	3.0
205	70	245	30	3.5
205	80	310	32	3.9
205	90	361	34	4.0
205	100	403	36	4.0
205	110	437	38	4.0
205	120	464	39	3.9
205	130	488	40	3.8
205	140	509	41	3.6
205	150	523	42	3.5
205	160	534	43	3.3
205	170	545	44	3.2
205	180	554	44	3.1
205	190	562	45	3.0
205	200	568	45	2.8
205	210	573	45	2.7
205	220	576	46	2.6
205	230	579	46	2.5
205	240	581	46	2.4
205	250	578	46	2.3
205	260	575	46	2.2
205	270	571	46	2.1
205	280	568	46	2.0
205	290	565	46	1.9
205	300	562	46	1.9
205	310	558	46	1.8
205	320	555	46	1.7
205	330	552	46	1.7
205	340	548	46	1.6
205	350	545	46	1.6

Lw, Fd (wet) - poorest

Analysis Unit	Age	Volume	Diameter	MAI
206	0	0	0	0.0
206	10	0	0	0.0
206	20	0	0	0.0
206	30	1	13	0.0
206	40	16	17	0.4
206	50	52	20	1.0
206	60	98	23	1.6
206	70	144	25	2.1
206	80	183	27	2.3
206	90	217	28	2.4
206	100	246	29	2.5
206	110	272	31	2.5
206	120	292	32	2.4
206	130	310	32	2.4
206	140	325	33	2.3
206	150	340	34	2.3
206	160	352	35	2.2
206	170	363	35	2.1
206	180	372	36	2.1
206	190	380	36	2.0
206	200	386	36	1.9
206	210	392	37	1.9
206	220	396	37	1.8
206	230	401	37	1.7
206	240	404	38	1.7
206	250	406	38	1.6
206	260	408	38	1.6
206	270	410	38	1.5
206	280	412	38	1.5
206	290	414	39	1.4
206	300	412	39	1.4
206	310	409	39	1.3
206	320	407	39	1.3
206	330	405	39	1.2
206	340	402	39	1.2
206	350	400	39	1.1

Cw - best

Analysis Unit	Age	Volume	Diameter	MAI
207	0	0	0	0.0
207	10	0	0	0.0
207	20	0	0	0.0
207	30	1	13	0.0
207	40	31	19	0.8
207	50	114	24	2.3
207	60	214	28	3.6
207	70	294	31	4.2
207	80	376	35	4.7
207	90	443	37	4.9
207	100	499	40	5.0
207	110	543	42	4.9
207	120	583	43	4.9
207	130	622	45	4.8
207	140	656	46	4.7
207	150	680	47	4.5
207	160	701	48	4.4
207	170	719	49	4.2
207	180	737	50	4.1
207	190	751	51	4.0
207	200	764	51	3.8
207	210	775	52	3.7
207	220	785	52	3.6
207	230	794	53	3.5
207	240	789	53	3.3
207	250	785	53	3.1
207	260	780	53	3.0
207	270	776	53	2.9
207	280	771	53	2.8
207	290	767	53	2.6
207	300	762	53	2.5
207	310	758	53	2.4
207	320	753	53	2.4
207	330	749	53	2.3
207	340	744	53	2.2
207	350	740	53	2.1

Cw - mod

Analysis Unit	Age	Volume	Diameter	MAI
208	0	0	0	0.0
208	10	0	0	0.0
208	20	0	0	0.0
208	30	0	0	0.0
208	40	2	15	0.1
208	50	34	19	0.7
208	60	100	23	1.7
208	70	176	27	2.5
208	80	243	29	3.0
208	90	300	32	3.3
208	100	359	34	3.6
208	110	410	36	3.7
208	120	453	38	3.8
208	130	490	40	3.8
208	140	520	41	3.7
208	150	546	42	3.6
208	160	573	43	3.6
208	170	600	44	3.5
208	180	623	45	3.5
208	190	641	46	3.4
208	200	657	47	3.3
208	210	671	48	3.2
208	220	681	48	3.1
208	230	691	49	3.0
208	240	701	49	2.9
208	250	709	50	2.8
208	260	716	50	2.8
208	270	723	50	2.7
208	280	729	51	2.6
208	290	734	51	2.5
208	300	730	51	2.4
208	310	725	51	2.3
208	320	721	51	2.3
208	330	717	51	2.2
208	340	712	51	2.1
208	350	708	51	2.0

Cw - poorest

Analysis Unit	Age	Volume	Diameter	MAI
209	0	0	0	0.0
209	10	0	0	0.0
209	20	0	0	0.0
209	30	0	0	0.0
209	40	0	0	0.0
209	50	4	16	0.1
209	60	31	19	0.5
209	70	76	22	1.1
209	80	128	25	1.6
209	90	179	27	2.0
209	100	221	29	2.2
209	110	258	30	2.3
209	120	297	32	2.5
209	130	332	33	2.6
209	140	360	34	2.6
209	150	384	36	2.6
209	160	404	36	2.5
209	170	420	37	2.5
209	180	435	38	2.4
209	190	447	38	2.4
209	200	461	39	2.3
209	210	472	40	2.2
209	220	483	40	2.2
209	230	493	41	2.1
209	240	500	41	2.1
209	250	507	42	2.0
209	260	513	42	2.0
209	270	518	42	1.9
209	280	522	43	1.9
209	290	526	43	1.8
209	300	523	43	1.7
209	310	520	43	1.7
209	320	517	43	1.6
209	330	513	43	1.6
209	340	510	43	1.5
209	350	507	43	1.4

Hw - best

Analysis Unit	Age	Volume	Diameter	MAI
210	0	0	0	0.0
210	10	0	0	0.0
210	20	0	0	0.0
210	30	1	13	0.0
210	40	29	19	0.7
210	50	109	24	2.2
210	60	206	28	3.4
210	70	287	31	4.1
210	80	368	34	4.6
210	90	434	37	4.8
210	100	486	39	4.9
210	110	528	40	4.8
210	120	562	42	4.7
210	130	598	43	4.6
210	140	629	45	4.5
210	150	651	46	4.3
210	160	669	47	4.2
210	170	685	47	4.0
210	180	699	48	3.9
210	190	713	49	3.8
210	200	725	49	3.6
210	210	735	50	3.5
210	220	743	50	3.4
210	230	751	51	3.3
210	240	758	51	3.2
210	250	753	51	3.0
210	260	749	51	2.9
210	270	745	51	2.8
210	280	740	51	2.6
210	290	736	51	2.5
210	300	732	51	2.4
210	310	727	51	2.3
210	320	723	51	2.3
210	330	719	51	2.2
210	340	715	51	2.1
210	350	710	51	2.0

Hw - mod

Analysis Unit	Age	Volume	Diameter	MAI
211	0	0	0	0.0
211	10	0	0	0.0
211	20	0	0	0.0
211	30	0	0	0.0
211	40	1	15	0.0
211	50	21	18	0.4
211	60	77	22	1.3
211	70	145	26	2.1
211	80	212	28	2.7
211	90	268	30	3.0
211	100	320	32	3.2
211	110	371	34	3.4
211	120	413	36	3.4
211	130	448	37	3.4
211	140	478	39	3.4
211	150	503	40	3.4
211	160	524	41	3.3
211	170	545	42	3.2
211	180	566	42	3.1
211	190	585	43	3.1
211	200	601	44	3.0
211	210	614	45	2.9
211	220	625	45	2.8
211	230	635	46	2.8
211	240	644	46	2.7
211	250	651	47	2.6
211	260	657	47	2.5
211	270	663	47	2.5
211	280	667	48	2.4
211	290	671	48	2.3
211	300	667	48	2.2
211	310	664	48	2.1
211	320	660	48	2.1
211	330	656	48	2.0
211	340	652	48	1.9
211	350	648	48	1.9

Hw - poorest

Analysis Unit	Age	Volume	Diameter	MAI
212	0	0	0	0.0
212	10	0	0	0.0
212	20	0	0	0.0
212	30	0	0	0.0
212	40	0	0	0.0
212	50	2	15	0.0
212	60	10	17	0.2
212	70	39	20	0.6
212	80	79	22	1.0
212	90	121	25	1.3
212	100	166	26	1.7
212	110	203	28	1.8
212	120	234	29	2.0
212	130	263	31	2.0
212	140	294	32	2.1
212	150	322	33	2.1
212	160	347	34	2.2
212	170	368	35	2.2
212	180	388	36	2.2
212	190	404	36	2.1
212	200	417	37	2.1
212	210	428	38	2.0
212	220	439	38	2.0
212	230	451	39	2.0
212	240	461	39	1.9
212	250	471	40	1.9
212	260	480	40	1.8
212	270	488	41	1.8
212	280	495	41	1.8
212	290	500	41	1.7
212	300	497	41	1.7
212	310	494	41	1.6
212	320	491	41	1.5
212	330	488	41	1.5
212	340	486	41	1.4
212	350	483	41	1.4

B, S - best

Analysis Unit	Age	Volume	Diameter	MAI
213	0	0	0	0.0
213	10	0	0	0.0
213	20	0	0	0.0
213	30	7	15	0.2
213	40	48	21	1.2
213	50	142	26	2.8
213	60	235	29	3.9
213	70	326	32	4.7
213	80	390	34	4.9
213	90	430	36	4.8
213	100	459	37	4.6
213	110	479	39	4.4
213	120	491	40	4.1
213	130	493	40	3.8
213	140	495	41	3.5
213	150	496	42	3.3
213	160	496	42	3.1
213	170	494	42	2.9
213	180	493	43	2.7
213	190	490	43	2.6
213	200	488	43	2.4
213	210	485	43	2.3
213	220	482	43	2.2
213	230	479	43	2.1
213	240	477	43	2.0
213	250	474	43	1.9
213	260	471	43	1.8
213	270	469	43	1.7
213	280	466	43	1.7
213	290	463	43	1.6
213	300	461	43	1.5
213	310	458	43	1.5
213	320	455	43	1.4
213	330	452	43	1.4
213	340	450	43	1.3
213	350	447	43	1.3

B, S - mod

Analysis Unit	Age	Volume	Diameter	MAI
214	0	0	0	0.0
214	10	0	0	0.0
214	20	0	0	0.0
214	30	0	0	0.0
214	40	4	15	0.1
214	50	26	19	0.5
214	60	79	23	1.3
214	70	143	26	2.0
214	80	199	28	2.5
214	90	249	30	2.8
214	100	300	31	3.0
214	110	339	33	3.1
214	120	368	34	3.1
214	130	388	35	3.0
214	140	404	36	2.9
214	150	417	36	2.8
214	160	427	37	2.7
214	170	436	37	2.6
214	180	442	38	2.5
214	190	447	38	2.4
214	200	451	38	2.3
214	210	454	39	2.2
214	220	456	39	2.1
214	230	457	39	2.0
214	240	456	40	1.9
214	250	454	40	1.8
214	260	453	40	1.7
214	270	451	40	1.7
214	280	450	40	1.6
214	290	448	40	1.5
214	300	446	40	1.5
214	310	443	40	1.4
214	320	440	40	1.4
214	330	438	40	1.3
214	340	435	40	1.3
214	350	433	40	1.2

B, S - poorest

Analysis Unit	Age	Volume	Diameter	MAI
215	0	0	0	0.0
215	10	0	0	0.0
215	20	0	0	0.0
215	30	0	0	0.0
215	40	0	0	0.0
215	50	2	15	0.0
215	60	10	17	0.2
215	70	32	20	0.5
215	80	65	22	0.8
215	90	102	24	1.1
215	100	141	26	1.4
215	110	173	27	1.6
215	120	200	28	1.7
215	130	225	29	1.7
215	140	250	30	1.8
215	150	274	31	1.8
215	160	294	32	1.8
215	170	309	32	1.8
215	180	322	33	1.8
215	190	334	33	1.8
215	200	342	34	1.7
215	210	349	34	1.7
215	220	354	34	1.6
215	230	359	34	1.6
215	240	363	35	1.5
215	250	366	35	1.5
215	260	369	35	1.4
215	270	371	35	1.4
215	280	372	35	1.3
215	290	374	36	1.3
215	300	372	36	1.2
215	310	369	36	1.2
215	320	367	36	1.1
215	330	365	36	1.1
215	340	363	36	1.1
215	350	361	36	1.0

S mixed - best

Analysis Unit	Age	Volume	Diameter	MAI
216	0	0	0	0.0
216	10	0	0	0.0
216	20	0	0	0.0
216	30	13	16	0.4
216	40	103	23	2.6
216	50	228	29	4.6
216	60	341	33	5.7
216	70	438	37	6.3
216	80	511	40	6.4
216	90	567	42	6.3
216	100	617	45	6.2
216	110	653	46	5.9
216	120	683	48	5.7
216	130	707	49	5.4
216	140	703	49	5.0
216	150	699	49	4.7
216	160	696	49	4.4
216	170	692	49	4.1
216	180	688	49	3.8
216	190	684	49	3.6
216	200	681	49	3.4
216	210	677	49	3.2
216	220	673	49	3.1
216	230	669	49	2.9
216	240	665	49	2.8
216	250	662	49	2.6
216	260	658	49	2.5
216	270	654	49	2.4
216	280	650	49	2.3
216	290	647	49	2.2
216	300	643	49	2.1
216	310	639	49	2.1
216	320	635	49	2.0
216	330	631	49	1.9
216	340	628	49	1.8
216	350	624	49	1.8

S mixed - mod

Analysis Unit	Age	Volume	Diameter	MAI
217	0	0	0	0.0
217	10	0	0	0.0
217	20	0	0	0.0
217	30	1	0	0.0
217	40	24	18	0.6
217	50	100	23	2.0
217	60	195	27	3.3
217	70	274	31	3.9
217	80	354	34	4.4
217	90	419	36	4.7
217	100	471	38	4.7
217	110	512	40	4.7
217	120	546	42	4.6
217	130	581	43	4.5
217	140	611	45	4.4
217	150	630	46	4.2
217	160	647	47	4.0
217	170	661	47	3.9
217	180	675	48	3.8
217	190	687	49	3.6
217	200	698	49	3.5
217	210	707	50	3.4
217	220	714	50	3.2
217	230	720	51	3.1
217	240	726	51	3.0
217	250	722	51	2.9
217	260	718	51	2.8
217	270	714	51	2.6
217	280	710	51	2.5
217	290	706	51	2.4
217	300	701	51	2.3
217	310	697	51	2.2
217	320	693	51	2.2
217	330	689	51	2.1
217	340	685	51	2.0
217	350	681	51	1.9

S mixed - poorest

Analysis Unit	Age	Volume	Diameter	MAI
218	0	0	0	0.0
218	10	0	0	0.0
218	20	0	0	0.0
218	30	0	0	0.0
218	40	1	14	0.0
218	50	9	17	0.2
218	60	52	21	0.9
218	70	111	24	1.6
218	80	176	27	2.2
218	90	230	29	2.6
218	100	277	31	2.8
218	110	325	33	3.0
218	120	369	35	3.1
218	130	406	36	3.1
218	140	436	37	3.1
218	150	462	39	3.1
218	160	483	40	3.0
218	170	502	40	3.0
218	180	521	41	2.9
218	190	540	42	2.8
218	200	556	43	2.8
218	210	570	44	2.7
218	220	583	44	2.7
218	230	593	45	2.6
218	240	601	45	2.5
218	250	609	46	2.4
218	260	616	46	2.4
218	270	622	46	2.3
218	280	628	47	2.2
218	290	633	47	2.2
218	300	629	47	2.1
218	310	626	47	2.0
218	320	622	47	1.9
218	330	618	47	1.9
218	340	615	47	1.8
218	350	611	47	1.7

Pine - best

Analysis Unit	Age	Volume	Diameter	MAI
219	0	0	0	0.0
219	10	0	0	0.0
219	20	12	0	0.6
219	30	96	20	3.2
219	40	191	25	4.8
219	50	277	28	5.5
219	60	343	31	5.7
219	70	399	34	5.7
219	80	439	35	5.5
219	90	465	37	5.2
219	100	483	38	4.8
219	110	489	39	4.4
219	120	492	40	4.1
219	130	495	40	3.8
219	140	501	41	3.6
219	150	505	42	3.4
219	160	502	42	3.1
219	170	500	42	2.9
219	180	497	42	2.8
219	190	494	42	2.6
219	200	491	42	2.5
219	210	489	42	2.3
219	220	486	42	2.2
219	230	483	42	2.1
219	240	480	42	2.0
219	250	478	42	1.9
219	260	475	42	1.8
219	270	472	42	1.7
219	280	470	42	1.7
219	290	467	42	1.6
219	300	464	42	1.5
219	310	461	42	1.5
219	320	459	42	1.4
219	330	456	42	1.4
219	340	453	42	1.3
219	350	450	42	1.3

Pine - mod+

Analysis Unit	Age	Volume	Diameter	MAI
220	0	0	0	0.0
220	10	0	0	0.0
220	20	2	0	0.1
220	30	54	17	1.8
220	40	134	22	3.4
220	50	208	26	4.2
220	60	274	28	4.6
220	70	322	30	4.6
220	80	366	32	4.6
220	90	398	34	4.4
220	100	423	35	4.2
220	110	443	36	4.0
220	120	457	37	3.8
220	130	468	38	3.6
220	140	475	38	3.4
220	150	481	39	3.2
220	160	485	39	3.0
220	170	485	40	2.9
220	180	485	40	2.7
220	190	484	40	2.5
220	200	484	40	2.4
220	210	483	41	2.3
220	220	480	41	2.2
220	230	477	41	2.1
220	240	475	41	2.0
220	250	472	41	1.9
220	260	469	41	1.8
220	270	466	41	1.7
220	280	464	41	1.7
220	290	461	41	1.6
220	300	458	41	1.5
220	310	456	41	1.5
220	320	453	41	1.4
220	330	450	41	1.4
220	340	448	41	1.3
220	350	445	41	1.3

Pine - mod

Analysis Unit	Age	Volume	Diameter	MAI
221	0	0	0	0.0
221	10	0	0	0.0
221	20	1	0	0.1
221	30	24	14	0.8
221	40	78	19	2.0
221	50	140	23	2.8
221	60	195	25	3.3
221	70	242	27	3.5
221	80	282	29	3.5
221	90	314	30	3.5
221	100	339	31	3.4
221	110	360	32	3.3
221	120	376	33	3.1
221	130	390	34	3.0
221	140	402	35	2.9
221	150	411	35	2.7
221	160	419	36	2.6
221	170	425	36	2.5
221	180	430	36	2.4
221	190	434	37	2.3
221	200	436	37	2.2
221	210	438	37	2.1
221	220	440	37	2.0
221	230	441	38	1.9
221	240	442	38	1.8
221	250	442	38	1.8
221	260	442	38	1.7
221	270	442	38	1.6
221	280	442	38	1.6
221	290	442	39	1.5
221	300	439	39	1.5
221	310	437	39	1.4
221	320	434	39	1.4
221	330	432	39	1.3
221	340	429	39	1.3
221	350	426	39	1.2

Pine - poorest

Analysis Unit	Age	Volume	Diameter	MAI
222	0	0	0	0.0
222	10	0	0	0.0
222	20	0	0	0.0
222	30	9	13	0.3
222	40	43	17	1.1
222	50	92	20	1.8
222	60	139	23	2.3
222	70	178	24	2.5
222	80	211	26	2.6
222	90	239	27	2.7
222	100	263	28	2.6
222	110	284	29	2.6
222	120	301	30	2.5
222	130	314	30	2.4
222	140	324	31	2.3
222	150	332	31	2.2
222	160	339	32	2.1
222	170	346	32	2.0
222	180	352	33	2.0
222	190	356	33	1.9
222	200	360	33	1.8
222	210	364	33	1.7
222	220	367	34	1.7
222	230	369	34	1.6
222	240	371	34	1.5
222	250	372	34	1.5
222	260	373	34	1.4
222	270	374	34	1.4
222	280	374	35	1.3
222	290	375	35	1.3
222	300	373	35	1.2
222	310	371	35	1.2
222	320	369	35	1.2
222	330	366	35	1.1
222	340	364	35	1.1
222	350	362	35	1.0

Decid - all

Analysis Unit	Age	Volume	Diameter	MAI
223	0	0	0	0.0
223	10	0	0	0.0
223	20	0	0	0.0
223	30	14	16	0.5
223	40	65	21	1.6
223	50	160	26	3.2
223	60	247	29	4.1
223	70	334	32	4.8
223	80	392	35	4.9
223	90	433	36	4.8
223	100	461	38	4.6
223	110	481	39	4.4
223	120	491	40	4.1
223	130	494	41	3.8
223	140	498	41	3.6
223	150	500	42	3.3
223	160	500	42	3.1
223	170	500	43	2.9
223	180	498	43	2.8
223	190	495	43	2.6
223	200	492	43	2.5
223	210	489	43	2.3
223	220	487	43	2.2
223	230	484	43	2.1
223	240	481	43	2.0
223	250	478	43	1.9
223	260	476	43	1.8
223	270	473	43	1.8
223	280	470	43	1.7
223	290	467	43	1.6
223	300	465	43	1.6
223	310	462	43	1.5
223	320	459	43	1.4
223	330	457	43	1.4
223	340	454	43	1.3
223	350	451	43	1.3

APPENDIX C. EXISTING MANAGED STANDS (TIPSY) YIELD TABLES

<insert tables after this page>

Lw, Fd (dry)

Analysis Unit	Age	Volume	Diameter	MAI
501	0	0	0	0.0
501	10	0	0	0.0
501	20	0	0	0.0
501	30	5	14	0.2
501	40	47	18	1.2
501	50	138	21	2.8
501	60	256	24	4.3
501	70	367	26	5.2
501	80	462	28	5.8
501	90	544	30	6.0
501	100	614	32	6.1
501	110	670	33	6.1
501	120	718	34	6.0
501	130	761	35	5.9
501	140	798	36	5.7
501	150	830	37	5.5
501	160	857	38	5.4
501	170	880	38	5.2
501	180	897	39	5.0
501	190	912	39	4.8
501	200	924	40	4.6
501	210	936	40	4.5
501	220	947	40	4.3
501	230	955	41	4.2
501	240	962	41	4.0
501	250	968	41	3.9
501	260	972	41	3.7
501	270	976	42	3.6
501	280	978	42	3.5
501	290	981	42	3.4
501	300	975	42	3.3
501	310	970	42	3.1
501	320	964	42	3.0
501	330	958	42	2.9
501	340	952	42	2.8
501	350	947	42	2.7

Lw, Fd (wet)

Analysis Unit	Age	Volume	Diameter	MAI
502	0	0	0	0.0
502	10	0	0	0.0
502	20	0	0	0.0
502	30	5	14	0.2
502	40	50	18	1.3
502	50	156	22	3.1
502	60	290	25	4.8
502	70	410	27	5.9
502	80	517	30	6.5
502	90	610	32	6.8
502	100	686	33	6.9
502	110	749	35	6.8
502	120	804	36	6.7
502	130	850	37	6.5
502	140	893	38	6.4
502	150	929	39	6.2
502	160	957	40	6.0
502	170	978	40	5.8
502	180	998	41	5.5
502	190	1015	42	5.3
502	200	1031	42	5.2
502	210	1045	42	5.0
502	220	1056	43	4.8
502	230	1065	43	4.6
502	240	1073	44	4.5
502	250	1080	44	4.3
502	260	1084	44	4.2
502	270	1088	44	4.0
502	280	1092	45	3.9
502	290	1093	45	3.8
502	300	1087	45	3.6
502	310	1080	45	3.5
502	320	1074	45	3.4
502	330	1067	45	3.2
502	340	1061	45	3.1
502	350	1055	45	3.0

Cw

Analysis Unit	Age	Volume	Diameter	MAI
503	0	0	0	0.0
503	10	0	0	0.0
503	20	0	0	0.0
503	30	2	14	0.1
503	40	58	19	1.5
503	50	217	24	4.3
503	60	406	27	6.8
503	70	566	31	8.1
503	80	718	34	9.0
503	90	854	36	9.5
503	100	966	38	9.7
503	110	1055	40	9.6
503	120	1131	42	9.4
503	130	1208	43	9.3
503	140	1279	45	9.1
503	150	1341	46	8.9
503	160	1384	47	8.7
503	170	1422	48	8.4
503	180	1456	49	8.1
503	190	1489	49	7.8
503	200	1518	50	7.6
503	210	1543	51	7.3
503	220	1566	51	7.1
503	230	1584	52	6.9
503	240	1601	52	6.7
503	250	1615	53	6.5
503	260	1627	53	6.3
503	270	1638	53	6.1
503	280	1629	53	5.8
503	290	1619	53	5.6
503	300	1610	53	5.4
503	310	1600	53	5.2
503	320	1591	53	5.0
503	330	1581	53	4.8
503	340	1572	53	4.6
503	350	1562	53	4.5

Hw

Analysis Unit	Age	Volume	Diameter	MAI
504	0	0	0	0.0
504	10	0	0	0.0
504	20	0	0	0.0
504	30	0	0	0.0
504	40	12	16	0.3
504	50	124	21	2.5
504	60	280	25	4.7
504	70	441	28	6.3
504	80	573	31	7.2
504	90	700	33	7.8
504	100	816	36	8.2
504	110	914	37	8.3
504	120	997	39	8.3
504	130	1063	41	8.2
504	140	1123	42	8.0
504	150	1186	43	7.9
504	160	1243	44	7.8
504	170	1294	45	7.6
504	180	1335	46	7.4
504	190	1369	47	7.2
504	200	1397	48	7.0
504	210	1421	48	6.8
504	220	1445	49	6.6
504	230	1465	49	6.4
504	240	1484	50	6.2
504	250	1501	50	6.0
504	260	1516	51	5.8
504	270	1529	51	5.7
504	280	1539	52	5.5
504	290	1549	52	5.3
504	300	1540	52	5.1
504	310	1531	52	4.9
504	320	1522	52	4.8
504	330	1513	52	4.6
504	340	1504	52	4.4
504	350	1495	52	4.3

B, S

Analysis Unit	Age	Volume	Diameter	MAI
505	0	0	0	0.0
505	10	0	0	0.0
505	20	0	0	0.0
505	30	0	0	0.0
505	40	15	16	0.4
505	50	104	22	2.1
505	60	247	25	4.1
505	70	387	28	5.5
505	80	509	30	6.4
505	90	636	32	7.1
505	100	728	33	7.3
505	110	790	35	7.2
505	120	836	36	7.0
505	130	871	36	6.7
505	140	900	37	6.4
505	150	923	38	6.2
505	160	940	38	5.9
505	170	952	39	5.6
505	180	962	39	5.3
505	190	966	40	5.1
505	200	965	40	4.8
505	210	963	40	4.6
505	220	961	41	4.4
505	230	958	41	4.2
505	240	957	41	4.0
505	250	955	41	3.8
505	260	952	41	3.7
505	270	948	42	3.5
505	280	946	42	3.4
505	290	942	42	3.2
505	300	936	42	3.1
505	310	931	42	3.0
505	320	925	42	2.9
505	330	920	42	2.8
505	340	914	42	2.7
505	350	909	42	2.6

S (mixed)

Analysis Unit	Age	Volume	Diameter	MAI
506	0	0	0	0.0
506	10	0	0	0.0
506	20	0	0	0.0
506	30	0	0	0.0
506	40	10	16	0.3
506	50	86	20	1.7
506	60	211	24	3.5
506	70	353	27	5.0
506	80	472	29	5.9
506	90	580	31	6.4
506	100	685	33	6.9
506	110	770	34	7.0
506	120	834	36	7.0
506	130	889	37	6.8
506	140	931	38	6.7
506	150	970	39	6.5
506	160	1009	40	6.3
506	170	1042	40	6.1
506	180	1071	41	6.0
506	190	1094	42	5.8
506	200	1114	42	5.6
506	210	1129	43	5.4
506	220	1139	43	5.2
506	230	1149	44	5.0
506	240	1158	44	4.8
506	250	1165	44	4.7
506	260	1171	45	4.5
506	270	1176	45	4.4
506	280	1181	45	4.2
506	290	1185	45	4.1
506	300	1178	45	3.9
506	310	1171	45	3.8
506	320	1164	45	3.6
506	330	1157	45	3.5
506	340	1150	45	3.4
506	350	1143	45	3.3

Pine

Analysis Unit	Age	Volume	Diameter	MAI
507	0	0	0	0.0
507	10	0	0	0.0
507	20	2	0	0.1
507	30	30	13	1.0
507	40	117	18	2.9
507	50	227	21	4.5
507	60	330	24	5.5
507	70	420	26	6.0
507	80	494	27	6.2
507	90	562	29	6.2
507	100	617	30	6.2
507	110	660	31	6.0
507	120	694	32	5.8
507	130	722	32	5.6
507	140	746	33	5.3
507	150	767	33	5.1
507	160	787	34	4.9
507	170	804	34	4.7
507	180	817	35	4.5
507	190	828	35	4.4
507	200	838	36	4.2
507	210	846	36	4.0
507	220	850	36	3.9
507	230	855	36	3.7
507	240	859	37	3.6
507	250	861	37	3.4
507	260	864	37	3.3
507	270	866	37	3.2
507	280	867	37	3.1
507	290	869	38	3.0
507	300	864	38	2.9
507	310	859	38	2.8
507	320	854	38	2.7
507	330	849	38	2.6
507	340	844	38	2.5
507	350	839	38	2.4

Decid - all

Analysis Unit	Age	Volume	Diameter	MAI
508	0	0	0	0.0
508	10	0	0	0.0
508	20	2	0	0.1
508	30	37	15	1.2
508	40	187	21	4.7
508	50	366	25	7.3
508	60	523	28	8.7
508	70	668	31	9.5
508	80	782	33	9.8
508	90	847	35	9.4
508	100	895	36	9.0
508	110	933	37	8.5
508	120	965	38	8.0
508	130	987	39	7.6
508	140	998	40	7.1
508	150	999	40	6.7
508	160	1001	41	6.3
508	170	1005	41	5.9
508	180	1006	42	5.6
508	190	1005	42	5.3
508	200	1004	42	5.0
508	210	1001	43	4.8
508	220	997	43	4.5
508	230	991	43	4.3
508	240	986	43	4.1
508	250	980	43	3.9
508	260	975	43	3.8
508	270	969	43	3.6
508	280	963	43	3.4
508	290	958	43	3.3
508	300	952	43	3.2
508	310	947	43	3.1
508	320	941	43	2.9
508	330	935	43	2.8
508	340	930	43	2.7
508	350	924	43	2.6

Backlog 1

Analysis Unit	Age	Volume	Diameter	MAI
525	0	0	0	0.0
525	0	0	0	0.0
525	20	0	0	0.0
525	30	0	0	0.0
525	40	0	0	0.0
525	50	12	16	0.2
525	60	52	19	0.9
525	70	135	24	1.9
525	80	240	27	3.0
525	90	340	30	3.8
525	100	426	32	4.3
525	110	504	34	4.6
525	120	570	35	4.8
525	130	625	37	4.8
525	140	669	38	4.8
525	150	708	39	4.7
525	160	743	40	4.6
525	170	773	41	4.5
525	180	799	41	4.4
525	190	819	42	4.3
525	200	835	43	4.2
525	210	849	43	4.0
525	220	863	44	3.9
525	230	873	44	3.8
525	240	883	44	3.7
525	250	889	45	3.6
525	260	896	45	3.4
525	270	902	45	3.3
525	280	907	46	3.2
525	290	910	46	3.1
525	300	912	46	3.0
525	310	915	46	3.0
525	320	909	46	2.8
525	330	904	46	2.7
525	340	899	46	2.6
525	350	893	46	2.6

Backlog 2

Analysis Unit	Age	Volume	Diameter	MAI
526	0	0	0	0.0
526	0	0	0	0.0
526	20	0	0	0.0
526	30	0	0	0.0
526	40	0	0	0.0
526	50	2	0	0.0
526	60	23	17	0.4
526	70	87	22	1.2
526	80	186	26	2.3
526	90	297	29	3.3
526	100	389	31	3.9
526	110	475	34	4.3
526	120	547	36	4.6
526	130	606	37	4.7
526	140	652	38	4.7
526	150	693	40	4.6
526	160	731	41	4.6
526	170	761	41	4.5
526	180	785	42	4.4
526	190	804	43	4.2
526	200	822	44	4.1
526	210	835	44	4.0
526	220	847	45	3.9
526	230	858	45	3.7
526	240	866	45	3.6
526	250	874	46	3.5
526	260	880	46	3.4
526	270	886	46	3.3
526	280	890	47	3.2
526	290	893	47	3.1
526	300	895	47	3.0
526	310	896	47	2.9
526	320	891	47	2.8
526	330	886	47	2.7
526	340	880	47	2.6
526	350	875	47	2.5

Lw, Fd (dry)

Analysis Unit	Age	Volume	Diameter	MAI
601	0	0	0	0.0
601	10	0	0	0.0
601	20	0	0	0.0
601	30	3	14	0.1
601	40	29	18	0.7
601	50	81	22	1.6
601	60	143	25	2.4
601	70	198	27	2.8
601	80	244	29	3.1
601	90	287	31	3.2
601	100	322	33	3.2
601	110	349	34	3.2
601	120	373	35	3.1
601	130	393	36	3.0
601	140	410	37	2.9
601	150	424	38	2.8
601	160	435	38	2.7
601	170	444	39	2.6
601	180	451	39	2.5
601	190	457	40	2.4
601	200	461	40	2.3
601	210	466	40	2.2
601	220	470	41	2.1
601	230	472	41	2.1
601	240	475	41	2.0
601	250	476	41	1.9
601	260	477	42	1.8
601	270	479	42	1.8
601	280	479	42	1.7
601	290	480	42	1.7
601	300	477	42	1.6
601	310	474	42	1.5
601	320	471	42	1.5
601	330	468	42	1.4
601	340	466	42	1.4
601	350	463	42	1.3

Lw, Fd (wet)

Analysis Unit	Age	Volume	Diameter	MAI
602	0	0	0	0.0
602	10	0	0	0.0
602	20	0	0	0.0
602	30	0	0	0.0
602	40	13	17	0.3
602	50	67	22	1.3
602	60	143	25	2.4
602	70	211	28	3.0
602	80	272	31	3.4
602	90	329	34	3.7
602	100	375	36	3.8
602	110	415	37	3.8
602	120	447	39	3.7
602	130	474	40	3.6
602	140	501	41	3.6
602	150	522	42	3.5
602	160	539	43	3.4
602	170	553	44	3.3
602	180	565	45	3.1
602	190	575	45	3.0
602	200	585	46	2.9
602	210	593	46	2.8
602	220	600	47	2.7
602	230	605	47	2.6
602	240	611	47	2.5
602	250	614	48	2.5
602	260	618	48	2.4
602	270	621	48	2.3
602	280	624	49	2.2
602	290	627	49	2.2
602	300	623	49	2.1
602	310	619	49	2.0
602	320	616	49	1.9
602	330	612	49	1.9
602	340	608	49	1.8
602	350	605	49	1.7

Cw

Analysis Unit	Age	Volume	Diameter	MAI
603	0	0	0	0.0
603	10	0	0	0.0
603	20	0	0	0.0
603	30	0	0	0.0
603	40	18	18	0.5
603	50	89	23	1.8
603	60	183	27	3.1
603	70	265	30	3.8
603	80	340	33	4.3
603	90	411	36	4.6
603	100	469	38	4.7
603	110	516	40	4.7
603	120	555	42	4.6
603	130	591	43	4.5
603	140	627	45	4.5
603	150	658	46	4.4
603	160	680	47	4.3
603	170	700	48	4.1
603	180	716	49	4.0
603	190	732	50	3.9
603	200	746	50	3.7
603	210	759	51	3.6
603	220	769	51	3.5
603	230	779	52	3.4
603	240	787	52	3.3
603	250	794	53	3.2
603	260	800	53	3.1
603	270	806	54	3.0
603	280	810	54	2.9
603	290	806	54	2.8
603	300	801	54	2.7
603	310	796	54	2.6
603	320	792	54	2.5
603	330	787	54	2.4
603	340	782	54	2.3
603	350	777	54	2.2

Hw

Analysis Unit	Age	Volume	Diameter	MAI
604	0	0	0	0.0
604	10	0	0	0.0
604	20	0	0	0.0
604	30	0	0	0.0
604	40	3	16	0.1
604	50	48	20	1.0
604	60	121	24	2.0
604	70	201	28	2.9
604	80	268	30	3.4
604	90	330	33	3.7
604	100	390	35	3.9
604	110	440	37	4.0
604	120	482	39	4.0
604	130	516	41	4.0
604	140	546	42	3.9
604	150	575	43	3.8
604	160	604	44	3.8
604	170	629	45	3.7
604	180	650	46	3.6
604	190	666	47	3.5
604	200	680	48	3.4
604	210	692	48	3.3
604	220	703	49	3.2
604	230	713	50	3.1
604	240	722	50	3.0
604	250	730	51	2.9
604	260	737	51	2.8
604	270	743	51	2.8
604	280	749	52	2.7
604	290	754	52	2.6
604	300	749	52	2.5
604	310	745	52	2.4
604	320	741	52	2.3
604	330	736	52	2.2
604	340	732	52	2.2
604	350	727	52	2.1

B, S

Analysis Unit	Age	Volume	Diameter	MAI
605	0	0	0	0.0
605	10	0	0	0.0
605	20	0	0	0.0
605	30	0	0	0.0
605	40	5	15	0.1
605	50	41	21	0.8
605	60	106	24	1.8
605	70	179	27	2.6
605	80	239	29	3.0
605	90	300	32	3.3
605	100	348	33	3.5
605	110	382	34	3.5
605	120	405	35	3.4
605	130	423	36	3.3
605	140	438	37	3.1
605	150	450	38	3.0
605	160	458	38	2.9
605	170	465	39	2.7
605	180	470	39	2.6
605	190	472	40	2.5
605	200	472	40	2.4
605	210	471	40	2.2
605	220	470	41	2.1
605	230	468	41	2.0
605	240	468	41	2.0
605	250	467	41	1.9
605	260	466	41	1.8
605	270	464	42	1.7
605	280	462	42	1.7
605	290	460	42	1.6
605	300	458	42	1.5
605	310	455	42	1.5
605	320	452	42	1.4
605	330	450	42	1.4
605	340	447	42	1.3
605	350	444	42	1.3

S (mixed)

Analysis Unit	Age	Volume	Diameter	MAI
606	0	0	0	0.0
606	10	0	0	0.0
606	20	0	0	0.0
606	30	11	0	0.4
606	40	48	17	1.2
606	50	100	21	2.0
606	60	148	23	2.5
606	70	192	25	2.7
606	80	229	27	2.9
606	90	261	28	2.9
606	100	289	29	2.9
606	110	311	30	2.8
606	120	329	31	2.7
606	130	343	32	2.6
606	140	354	33	2.5
606	150	364	33	2.4
606	160	373	34	2.3
606	170	380	34	2.2
606	180	386	34	2.1
606	190	392	35	2.1
606	200	396	35	2.0
606	210	399	35	1.9
606	220	402	36	1.8
606	230	405	36	1.8
606	240	407	36	1.7
606	250	408	36	1.6
606	260	409	37	1.6
606	270	410	37	1.5
606	280	410	37	1.5
606	290	410	37	1.4
606	300	408	37	1.4
606	310	405	37	1.3
606	320	403	37	1.3
606	330	400	37	1.2
606	340	398	37	1.2
606	350	396	37	1.1

Pine

Analysis Unit	Age	Volume	Diameter	MAI
607	0	0	0	0.0
607	10	0	0	0.0
607	20	0	0	0.0
607	30	16	13	0.5
607	40	63	18	1.6
607	50	117	22	2.3
607	60	169	24	2.8
607	70	215	26	3.1
607	80	253	28	3.2
607	90	286	29	3.2
607	100	313	30	3.1
607	110	335	31	3.0
607	120	352	32	2.9
607	130	365	33	2.8
607	140	377	34	2.7
607	150	387	34	2.6
607	160	397	35	2.5
607	170	404	35	2.4
607	180	410	36	2.3
607	190	414	36	2.2
607	200	419	36	2.1
607	210	422	37	2.0
607	220	423	37	1.9
607	230	425	37	1.8
607	240	426	37	1.8
607	250	427	37	1.7
607	260	428	38	1.6
607	270	428	38	1.6
607	280	429	38	1.5
607	290	429	38	1.5
607	300	427	38	1.4
607	310	424	38	1.4
607	320	422	38	1.3
607	330	419	38	1.3
607	340	417	38	1.2
607	350	414	38	1.2

Decid - all

Analysis Unit	Age	Volume	Diameter	MAI
608	0	0	0	0.0
608	10	0	0	0.0
608	20	0	0	0.0
608	30	7	14	0.2
608	40	40	20	1.0
608	50	117	24	2.3
608	60	202	28	3.4
608	70	276	30	3.9
608	80	344	33	4.3
608	90	390	35	4.3
608	100	422	36	4.2
608	110	447	37	4.1
608	120	465	38	3.9
608	130	478	39	3.7
608	140	483	40	3.5
608	150	487	40	3.2
608	160	489	41	3.1
608	170	491	41	2.9
608	180	492	42	2.7
608	190	491	42	2.6
608	200	491	42	2.5
608	210	489	42	2.3
608	220	488	43	2.2
608	230	485	43	2.1
608	240	483	43	2.0
608	250	480	43	1.9
608	260	477	43	1.8
608	270	474	43	1.8
608	280	472	43	1.7
608	290	469	43	1.6
608	300	466	43	1.6
608	310	463	43	1.5
608	320	461	43	1.4
608	330	458	43	1.4
608	340	455	43	1.3
608	350	452	43	1.3

Backlog 1

Analysis Unit	Age	Volume	Diameter	MAI
625	0	0	0	0.0
625	10	0	0	0.0
625	20	0	0	0.0
625	30	2	0	0.1
625	40	17	17	0.4
625	50	69	22	1.4
625	60	139	25	2.3
625	70	208	28	3.0
625	80	266	30	3.3
625	90	324	32	3.6
625	100	368	34	3.7
625	110	400	35	3.6
625	120	426	36	3.6
625	130	447	37	3.4
625	140	464	38	3.3
625	150	480	39	3.2
625	160	493	40	3.1
625	170	503	40	3.0
625	180	510	41	2.8
625	190	514	41	2.7
625	200	518	42	2.6
625	210	521	42	2.5
625	220	523	42	2.4
625	230	526	43	2.3
625	240	527	43	2.2
625	250	529	43	2.1
625	260	530	43	2.0
625	270	530	44	2.0
625	280	530	44	1.9
625	290	530	44	1.8
625	300	527	44	1.8
625	310	524	44	1.7
625	320	521	44	1.6
625	330	518	44	1.6
625	340	515	44	1.5
625	350	511	44	1.5

Backlog 2

Analysis Unit	Age	Volume	Diameter	MAI
626	0	0	0	0.0
626	10	0	0	0.0
626	20	0	0	0.0
626	30	3	0	0.1
626	40	28	18	0.7
626	50	91	23	1.8
626	60	172	27	2.9
626	70	242	29	3.5
626	80	307	32	3.8
626	90	363	34	4.0
626	100	403	35	4.0
626	110	433	37	3.9
626	120	458	38	3.8
626	130	479	39	3.7
626	140	495	40	3.5
626	150	510	40	3.4
626	160	518	41	3.2
626	170	523	42	3.1
626	180	528	42	2.9
626	190	532	42	2.8
626	200	536	43	2.7
626	210	539	43	2.6
626	220	541	43	2.5
626	230	543	44	2.4
626	240	544	44	2.3
626	250	545	44	2.2
626	260	544	44	2.1
626	270	544	45	2.0
626	280	543	45	1.9
626	290	540	45	1.9
626	300	537	45	1.8
626	310	534	45	1.7
626	320	530	45	1.7
626	330	527	45	1.6
626	340	524	45	1.5
626	350	521	45	1.5

APPENDIX D.

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APPENDIX E.

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