Appendix 2

Timber Supply Analysis Information Package

BRITISH COLUMBIA

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CONTACT: Susann Brown, Timber Supply Forester, TSB
Date typed: 98/10/30 Date revised: 99/02/03 10:42 am

File: 19710-40/53

February 3, 1999

Doug Perdue
Operations Forester
Dunkley Lumber Ltd.
P.O. Box 173
Prince George, British Columbia V2L 4S1

Dear Doug Perdue:

Re: Information Package Acceptance for Management Plan #3, Tree Farm Licence #53

Forest Service and Ministry of Environment, Lands and Parks staff have reviewed the revised information package, dated December 1998, for Management Plan No. 3 (MP No. 3) of Tree Farm Licence 53 (TFL 53).

I accept the information package subject to the revisions that we have discussed and agreed to.

Please include the following in the timber supply analysis:

1. An OAF1 adjustment of 10 percent for pine and 12 percent for spruce in the base case.

2. A maximum of 50 % of the wildlife tree patch zone (which has initially been doubled so that twice as much as required is in the zone) less than 160 years old in the base case.

3. The intent of the 18 % genetic gain for spruce regenerated stand yields is based on a harvesting age close to 80 years. Please model these gains in the base case as per the intent.

4. Sensitivity analyses which show the impact on timber supply of increasing and decreasing managed stand yields by 10 percent.

I may require a natural succession sensitivity analysis if review of the base case information indicates that it is necessary.

.../2

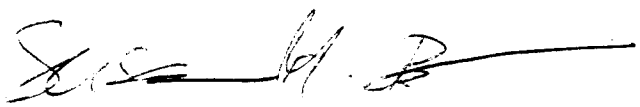
The spruce volume discrepancy between inventory audit volumes and managed stand yields will be analyzed further by Albert Nussbaum and Dunkley Lumber Ltd.

There may be requests for further clarification of some factors in the information package in order that the information can be accurately presented to the chief forester at the allowable annual cut determination meeting.

If you have any questions regarding this letter, please call me at (250) 953-3836.

I wish to thank you and Rob Schuetz for the co-operative working relationship you provided during this process.

Sincerely,



Susann M. Brown
Timber Supply Forester
Timber Supply Branch

pc: Larry Pedersen, Chief Forester
Yvonne Parkinson, Timber Administration Specialist, Prince George Forest Region
Shannon Carson, Planning Forester, Prince George Forest District
Dave Stevenson, Forest Ecosystem Specialist, Prince George Forest District
Charlie Klasen, Timber Tenures Forester, Resource Tenures & Engineering Branch
Albert Nussbaum, Growth & Yield Applications Specialist, Research Branch
Rob Drummond, Officer, Growth & Yield (Predictions), Resources Inventory Branch
Rob Schuetz, Industrial Forestry Service Ltd., 1596 Fifth Avenue, Prince George, B.C. V2L 3L9

0202/03/99

APPENDIX II

DUNKLEY LUMBER LTD.
TREE FARM LICENCE #53
NAVER

Timber Supply Analysis Information Package
in support of
Management Plan # 3

December, 1998

Note: Since the submission of this Information Package in December 1998, changes have been made to the following tables:

Table 2.	included footnote
Table 15.	define excluded forest
Table 17.	n/a for balsam plantations
Table 18.	OAF 1s adjusted
Table 21.	Immature Balsam plantation AUs 23-26 deleted
Table 25.	Revise numbers; WTP forest cover adjusted; greenup delay in years shown
Table 26.	Recalculate culmination age numbers
Table 28.	Completed
Tables 29-37.	Completed

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LIST OF INFORMATION PACKAGE APPENDICES

1.0 INTRODUCTION

This Information Package was prepared to fulfill the timber supply analysis requirements in support of Management Plan #3. The format follows the Ministry of Forest's *Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licences* Version 3, February 1998. This document contains assumptions and modeling procedures that will be used in the timber supply analysis for Tree Farm Licence (T.F.L.) #53.

The purpose of the Timber Supply Analysis Information Package (I.P.) is:

- To provide a detailed account of the factors related to timber supply that the Chief Forester must consider under Section 8 of the Forest Act when determining an allowable annual cut (AAC), and how these are applied in the timber supply analysis;
- To provide a means for communication between licensee, Forest Service and BC Environment staff;
- To provide Forest Service staff with the opportunity to review data and information that will be used in the timber supply analysis before it is initiated;
- To ensure that all relevant information is accounted for in the analysis to a standard acceptable to Forest Service staff;
- To reduce the risk of having analyzes rejected because input assumptions and analysis methods were not agreed upon in advance.

2.0 PROCESS

This revised I.P. incorporates comments received from the Timber Supply Forester and from the District review meeting regarding the I.P. held on November 26, 1998.

This package provides greater explanation of the derivation of the input data to the timber supply model. It also incorporates revisions to the input data to provide the most accurate and realistic information possible on which to base the timber supply analysis.

2.1 Growth and Yield

The natural stand Growth and Yield information, as determined through "Batch" version 4.5 of VDYP; and the managed stand Growth and Yield information, as calculated through Win TIPSY ver. 2.1d, have been submitted separately to facilitate the review process.

2.2 Missing Data/Uncompleted Tables

The following information is not provided as part of this submission of the Information Package. The information will be completed and submitted to the Timber Supply Branch as it becomes available.

1) Information for T.F.L. # 53 specific biodiversity management.

2) Yield Tables have been forwarded to Resources Inventory and Research Branch under separate cover.

3) Area reporting for some of the sensitivity runs will be completed and submitted with the Analysis Report.

3.0 TIMBER SUPPLY FORECASTS/OPTIONS/SENSITIVITY ANALYZES

The purpose of this section is to summarize the harvest forecasts that will be provided. The set of assumptions pertaining to each sensitivity analysis is covered in Section 11.

3.1 Base Case

The base case will identify the short and long-term harvest level based on the current level of integrated resource management, harvesting and silviculture performance. The assumptions include current directions from the Prince George Forest District Manager related to achieving biodiversity requirements, acceptable viewshed management, and riparian reserve and management zone requirements.

Changes which have occurred during the course of Management Plan # 2 will now be incorporated into the base case scenario for Management Plan # 3. These changes are detailed in the following table.

Table 1a: Base Case Timber Supply Analysis

Issue	Action	Comments
Utilization Standards	Natural stands will be managed to close utilization standards and managed stands will be harvested to a minimum D.B.H. of 12.5 cm for all species.	This models harvesting natural stands at our current utilization standards and anticipates that managed stands will be harvested at 12.5+ cm utilization for all species.
Silviculture	Use species mix, densities and regen delay based on current performance.	Species mix and density model current planting practices of 1800 - 2000 sph but are adjusted to 1600 sph to account for first year mortality. Regen delay is based on performance over the last 5 years.
	Model the impacts of using genetically improved stock in the reforestation program.	Reflects the level of improved stock planted since 1993 and future planting levels based on seed procurement.
Site Index	Model the impacts of improved site index information on the Growth and Yield of the T.F.L. land base.	The managed stands modeled on TIPSY will use SIBEC generated site index to project growth.
Legislated FPC Requirements	Model the legislated requirements of the FPC and the Prince George District Stand Level Biodiversity Policy following the *Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licences Version 3, Feb 1998 Appendix IV.*	Includes legislated RMAs and landscape unit biodiversity emphasis modeling as outlined by Branch. District lake guidelines and stand level biodiversity policy (in WTPs) will also be modeled. Calculations are appended.
Sensitive Areas with approved VQO's.	Model the impact of the known scenic area with approved VQO's. This includes the MP#2 line work and VQO's for the Highway and Ahbau viewsheds.	This includes the known scenic areas for the Highway viewshed. VQOs will be used in the model. Slope adjustments based on the known area will be used. Adjustments are calculated using the area-weighted slope of each VQO applied to Table 6 in *Procedures for Factoring Visual Resources into Timber Supply Analysis Mar 1998* .
Roads	The reduction in permanent losses to roads and landings resulting from changes in logging systems and an increase in permanent deactivation are modeled through a reduction in future roads.	With the changeover to roadside harvesting, landings are no longer constructed. Permanent deactivation reflects current performance.
Deciduous Stands	The natural succession of deciduous leading stands with a coniferous component are modeled.	Data shows that natural succession leads to coniferous leading stands over time. Type group 41 (deciduous-coniferous) stands have been included in the T.H.L.B.
Balsam Residual Stands	Maintain a partitioned cut to facilitate rehabilitation of under-performing balsam I.U. stands.	MP#2 established a partitioned cut to facilitate the rehabilitation of I.U. logged areas.

3.2 Sensitivity Analysis

Uncertainty around the data and assumptions used in the base case are investigated using sensitivity analysis. Usually only one assumption is varied for each sensitivity analysis (harvest forecast). These forecasts are also used to provide input into the management direction for the T.F.L. Details on all scenarios are provided in Section 11.

3.2.1 Sensitivity – Biological Diversity (Landscape and Stand Level)

Purpose: To determine the impact of various biodiversity management strategies on the harvest level. This batch of runs will examine different options for managing both stand level and landscape level biodiversity.

Table 1b: Sensitivity Analysis on Biological Diversity

Issue	Scenario	Comments
Biological Diversity	1.1 Model without the Prince George District Stand Level Biodiversity Policy, building on the base case.	In this sensitivity run the lakeshore guidelines and WTP modeling parameters will be turned off.
	1.2 Model the T.F.L. landbase with a low landscape level biodiversity emphasis, starting with the base case.	Rather than a blended 45/45/10 biodiversity emphasis by variant, a low biodiversity emphasis option will be modeled for the T.F.L.
	1.3 Model the T.F.L. specific plan for biodiversity management (Stand-alone).	This scenario was not completed in this analysis.
	1.4 Model a reduced age for "old" seral age stands, building on the base case.	NDT 1 and NDT 2 stands within the T.F.L. do not meet the guidebook definition of old. This run explores using a reduced age to define "old."

3.2.2 Sensitivity – Visually Sensitive Areas

Purpose: To incrementally isolate the downward pressures on timber supply related to VQO's. These runs are structured to manage visual resources in an effort to mitigate impacts on the timber supply. These runs will examine different options for managing visual quality on the T.F.L., consistent with the direction given by the District Manager on September 11, 1998. The known scenic areas in the base case will be turned off and replaced with the following situations:

Table 1c: Sensitivity Analysis on Scenic Areas

Issue	Scenario	Comments
Scenic Areas	2.1 Model the revised landscape inventory of the highway viewshed using VQCs and slope adjusted green-up.	The revised line work completed in April 1998 will be modeled using VQCs. This is consistent with the District Manager's direction given September 11, 1998. Area-weighted slope adjusted green-up heights were derived from the highway line work.
	2.2 Model the revised inventory for the Ahbau Lake viewshed using VQCs and slope adjusted green-up, building on simulation 2.1.	The revised line work for Ahbau Lake will be modeled along with the revised highway line work. Area-weighted slope adjusted green-up heights were again calculated using the revised highway and Ahbau Lake line work.
	2.3 Model the revised inventory for the recreation sites using VEG height as the only requirement, building on simulation 2.2.	Consistent with the District Manager's direction, this run will model the impact of the Rec Site viewshed without VQCs. The slope adjusted green-up from simulation 2.2 will be used for VQC areas and a single slope adjusted green-up will be modeled for all rec sites.
	2.4 Model the visual inventory for the recreation sites using VQCs and slope adjusted green-up, building on simulation 2.3.	The impact of the Recreation Site VQCs will be modeled. The recreation sites included are Naver, Stony Lake South, Genevieve Lake & Teapot Lake. Hay Lake and Yardley Lake are being closed and are not included.
	2.5 Model the implications of using alternative systems (not clearcut) for the highway viewshed.*	VEG cover constraints assume clearcut harvesting. The effect of partial cutting in VQCs in the highway viewshed will be modeled.
	2.6 Reduce VEG height to reflect high density planting.*	Block design, biodiversity retention, road deactivation etc., have an impact on the perception of green-up. This run will model a reduced VEG height to reflect this.

* Simulation 2.5 and 2.6 are intended to model management strategies to reduce the impact of known scenic areas on timber supply. They will be modeled building on a recommended simulation after reviewing the results of the scenic area sensitivity runs.

3.2.3 Sensitivity – Improved Utilization

Purpose: To assess the possibility of changing utilization standards on the T.F.L. Utilization of deciduous leading stands will be assessed. This run will examine the impact of a change in the utilization of the fibre on the T.F.L., using the base case as the starting point.

Table 1d: Sensitivity Analysis on Utilization

Issue	Scenario	Comments
Balsam Residual Stands	3.1. Leave the under-performing balsam I.U. stands to regenerate naturally.	This scenario has been dropped.
Deciduous Stands	3.2. Include harvesting of the deciduous leading stands in the T.H.L.B.	This scenario has been dropped.
	3.3. Convert the deciduous leading stands after harvest to coniferous stands.	Rather than wait for natural succession, the Aspen overstory will be harvested. This will only apply to the area included in the T.H.L.B.

3.2.4 Sensitivity – Enhanced Resource Management Zone (ERMZ)

Purpose: To assess the implication of proposed strategies that could be used to implement the management intent of an ERMZ. These runs will model the impacts of strategies that could be used to implement an ERMZ. These runs will build on the base case.

Table 1e: Sensitivity Analysis on Enhanced Management

Issue	Scenario	Comments
Silviculture	4.1 Model the impacts of commercial thinning and partial cutting through reduced adjacency constraints.	This run will explore the possibility of an expanded commercial thinning program.
Fertilization	4.2 Model the impact of a forest fertilization program.	Site Index increase of 5% will be applied to managed stand yield tables to simulate the effect of fertilization.
Roads	4.3 Model an expanded permanent road deactivation program to increase forest productivity.	Current activity results in 12.5 % of new roads being restored to forest productivity. In this sensitivity the amount of permanent road deactivation will be doubled.
Green-up	4.4 Model a reduced green-up height.	Model the impacts of reducing green-up to 2.5 m to model the intent of reduced constraints in an ERMZ.
O.A.F.s	4.5 Model a reduced O.A.F. resulting from an enhanced level of management.	O.A.F.1s will be reduced by 1/3 for pine and 1/2 for spruce.

3.2.5 Sensitivity – MOF Standard Sensitivity Analysis

Purpose: The MOF has requested additional scenarios be completed along with the supply analysis. These scenarios are designed to assess the implications of uncertainties surrounding inventories, yield estimates and management assumptions. The following sensitivity analyzes were not part of Dunkley's commitment in the SMOOP.

Table 1f: Additional Analysis

Issue	Scenario	Comments
Landbase	5.1 Model the impact of increasing the timber harvesting landbase by 5%	Test impact regarding uncertainty with inventory information
	5.2 Model the impact of decreasing the T.H.L.B. by 5%	
Natural Stand Yield Estimates	5.3 Model the impact of increasing unmanaged stand yields by 10%	Test implications of under or over estimating empirical stand yields
	5.4 Model the impact of decreasing unmanaged stand yields by 10%	
Minimum Harvest Age	5.5 Model the impact of using Culmination Age as the minimum harvest age for unmanaged stands	Test implications of varying the minimum harvest age
Visuals	5.6 Model the impact of using the mid-range denudation VAC for each VQO rather then the high VAC	Test the impact of VAC constraints in Visually Sensitive Areas
Forest Cover Constraints	5.7 Model the impact of increasing IRM zone forest cover constraints by 10%	Test the impact of forest cover constraints
	5.8 Model the impact of reducing IRM zone forest cover constraints by 10%	
Biodiversity	5.9 Model for mature plus old seral stage and just show the results	Test the impact of the suggested objectives in the biodiversity guidebook
	5.10 Model old seral stage targets if full BDG values are applied at all times	
Managed Stand Yield Estimates	5.11 Model the impact of increasing managed stand yields by 10%	Test implications of under or over estimating managed stand yields
	5.12 Model the impact of decreasing managed stand yields by 10%	
Alternative Harvest Flows	5.13 Test impact of alternative harvest flows	Assess variation in harvest flow patterns (See Section 3.3)

3.3 Alternative Harvest Flows over Time

One of the requirements of Section 8 of the *Forest Act* is that the chief forester considers the short and long-term implications to British Columbia of alternative rates of timber harvesting from the area.

Several issues must be considered in developing the base case harvest flow. For example, where harvest levels are declining, the rate of decline from the current harvest level should be controlled to avoid large and abrupt future harvest shortfalls and the long-term level should be stable.

However, there are many possible harvest flows with different decline rates, different starting harvest levels, and potential tradeoffs between short and long-term forecasts. Several alternative flow forecasts that will enable the chief forester to assess short, medium, and long-term tradeoffs in the base case analysis.

In timber supply analysis various harvest flows (short, medium or long-term) are sometimes possible without compromising long-term sustainable harvest flows. In this analysis the short-term harvest level will be increased to the maximum level possible. This will be followed with a decline of 10% per decade to the long-term sustainable harvest flow. Depending on the outcome of the base harvest forecast, alternative rates of decline (or increase), or period prior to decline (or increase), will be explored. A flat line to step-up harvest flow will also be produced.

4.0 MODEL

Dunkley proposes to use the FSSIM version 3 model for this timber supply analysis. The model was developed by the MOF's Timber Supply Branch.

5.0 CURRENT FOREST COVER INVENTORY

The forest inventory conforms to Ministry of Forest's standards. The current forest cover inventory is based on a re-inventory preformed by Dunkley during the term of MP # 1. The photography for this inventory was taken in 1991. The re-inventory on the T.F.L. occurred shortly thereafter. Given the fact that: a) the re-inventory is relatively current (especially when compared to many TSAs); b) ground sampling was very intensive and localized to the T.F.L.; and c) the long history of harvesting operations on the T.F.L. landbase, Dunkley Lumber Ltd. is relatively comfortable with the accuracy of the inventory (i.e., species, age, height, stocking) for timber supply analysis purposes.

An inventory audit of forest stands within T.F.L. # 53 was completed by the MoF in February 1998. The audit compared existing volumes versus inventory volumes (predicted in VDYP) in forest stands. The audit showed that there is no significant difference between the audit volume and the inventory volume for the T.F.L. as a whole.

Although the forest cover inventory has not changed since MP#2, new information has been added to address management issues on the license. The site index of managed stands has been changed to reflect the SIBEC project completed for the T.F.L. The results of this project only applies to managed stands. The subzone and variant within each forest stand was area-weighted to calculate an adjusted site index for each forest polygon. This adjusted site index is used to project managed stand yield tables using the TIPSY model.

The forest cover inventory was updated for disturbances and inventory attributes. The inventory was projected to April, 1997, using FCAPS. The custodian of the data, Hugh Hamilton Ltd. in Vancouver, conducted this update.

6.0 DESCRIPTION OF LANDBASE

6.1 Timber Harvesting Land Base Determination

The purpose of Table 2 is to summarize the area reductions made to the total area of the T.F.L., to arrive at the landbase that is available for timber harvesting. The reductions and additions are listed in the order in which they are applied. Each reduction and addition is described in more detail in the appropriate sections that follow.

Table 2: Timber Harvesting Land base Determination

Classification	Area (ha)	Percent of Productive Forest
Total Area (incl. Water)	87,660.7	
Less: Non -forest	4,881.0	
Potentially Productive Area	82,779.7	100.00%
Reductions to Productive Area:		
Non-productive	1,462.0	1.77%
Non-commercial cover	330.3	0.40%
Environmentally sensitive areas	1,366.3	1.65%
Recreation sites	160.2	0.19%
Legislated lakeshore reserves	70.5	0.09%
Legislated wetland reserves	322.2	0.39%
Stream riparian reserves	1,856.8	2.24%
Wetland management zones	229.3	0.28%
Stream riparian management zones	1,362.6	1.65%
District policy lake mgmt. area	233.8	0.28%
Low productivity sites	539.1	0.63%
Problem forest types (merchantability)	3,422.4	4.13%
Existing roads, trails and landings	1,281.9	1.55%
Plantations with incorrect site index	733.7	0.90%
N.S.R.	1,451.7	1.75%
Total Reductions to Productive Forest	14,822.8	17.91%
Net Land Base	67,956.9	82.09%
Additions:		
N.S.R.	1,451.7	1.75%
Plantations with incorrect SI	733.7	0.90%
Initial Timber Harvesting Land Base	**70,142.3**	**84.70%**
Losses to Future Roads	764.5	0.90%
Future Timber Harvesting Land Base	69,377.8	83.80%

Discrepancies exist between the gross T.F.L. area reported in Table 2 and the gross area reported in the M.P.#2 Timber Supply Analysis Report for T.F.L. 53 . The difference are largely due to redigitizing the T.F.L. boundary, which resulted in numerous hair-line 'sliver' polygons around the perimeter of the T.F.L.

6.2 Total Area

The total area of Tree Farm License # 53 including fresh water is 87,660.7 hectares.

6.3 Non-Forest

Non-forest includes fresh water, snow, ice, rock, alpine, classified roads, camps, etc. The area for these items was derived from the T.F.L. forest inventory file. Type I.D. #6 was used to identify these areas. Details are provided in Table 3.

Table 3: Non-Forest Area

Description	**Total Area (ha)**
Rock	6.3
Clay Bank	5.0
Lake	1,740.4
Gravel Bar	2.3
River	64.7
Swamp	2,905.2
Clearing	26.9
Urban (incl. Classified Roads and Private Land)	130.2
Total	4,881.0

6.4 Non-Productive Forest

Non-productive forest was identified on the inventory file using Type I.D. #5. Details are shown in Table 4.

Table 4: Non-Productive Forest Area

Description	Total Area (ha)
Alpine Forest	26.6
NP Brush	666.2
Non Productive	769.2
Total	1,462.0

6.5 Inoperable/Inaccessible

There are no areas within the T.F.L. that are currently inoperable / inaccessible because of terrain, other than those accounted for in ESA reductions. Economic viability is addressed in merchantability reductions, through problem forest types (Section 6.14) and low site deductions (Section 6.7).

6.6 Non-Commercial Cover

Table 5 specifies the amount of NCC that exists on the T.F.L. NCC is also identified on the inventory file using Type I.D. # 5. NCC is defined as non-merchantable forest stands occupying productive forest land.

Table 5: Non-Commercial Cover

Description	Total Area (ha)
NCC	330.3

6.7 Low Productivity Sites

Table 6 documents the area that is not suitable for harvest due to its low timber growing potential. Low site is one of two methods used in this analysis to identify unmerchantable stands of forests. The issue surrounding the accuracy of using a site index to predict the future productivity of a mature or over mature stand of trees accounts for the low site index values used in Table 6.

A review of the area in plantations with a site index less then the upper limit of exclusion led to an on-site review of several of these plantations. The review confirmed that these stands were incorrectly classified as low sites and are in fact plantations with a healthy population of commercial species. There are currently a total 815.2 ha of regenerating stands where the site index on the file is not representative of the growth potential of the site. These areas are added back to the T.H.L.B. The plantations were identified as Sw, DF, and Pl polygons with a site index below 5.9 and an age between 1 and 40 years. These plantations were excluded from the T.H.L.B. through the Low Site net down. Since they were removed as one of the last items in the net down, they have been added back to the T.H.L.B. to ensure appropriate reductions for other concerns (e.g., riparian, roads, ESAs etc.). A description of these areas is provided in Table 7.

Table 6: Low Site Index

Timber Types	Site Index Upper Limit of Exclusion	Total Area (ha)	Reduction Area (ha)
Fir	8.8	0.0	0.0
Balsam	7.8	215.3	167.2
Spruce	7.5	500.3	247.6
Spruce / Pine	7.5	149.8	65.0
Spruce / Deciduous	7.5	0.0	0.0
Pine	7.8	65.2	53.0
Pine / Spruce	7.8	30.0	0.0
Pine / Deciduous	7.8	0.0	0.0
Deciduous Leading	7.5	6.8	6.3
Total		967.4	539.1

Table 7. Plantations with incorrect Site Index

Timber Type	Age Group	Site Index	Gross Area (ha)	Net Area (ha)
Douglas-fir	11-20	0-5.9	7.9	7.2
White Spruce	1-10	0-5.9	67.7	62.8
	11-20	0-5.9	559.3	501.3
	21-30	0-5.9	149.3	140.5
	31-40	0-5.9	1.5	1.5
Aspen	11-20	0-5.9	4.7	0.0
Pine	11-20	0-5.9	16.7	15.7
	21-30	0-5.9	8.1	4.7
Total			815.2	733.7

6.8 ESAs and Recreation Sites

Environmentally sensitive areas (ESAs) require special treatment when harvesting. Some ESAs may not be harvested at all, since they represent areas having concerns which may adversely impact non-timber resources or regeneration. Recreation sites were digitized from maps of the gazetted sites provided by the MOF District Recreation Officer. Table 8 details the ESAs and recreation sites appearing in T.F.L. #53.

Table 8: Area Reductions for ESAs and Recreation Sites

ESA Category	ESA Description	Gross Area (ha)	% Reduction	Net Area Reduction (ha)
Es1	Steep slopes – high	611.7	100.0	607.9
Es2	Steep slopes - moderate	498.6	0.0	0.0
Ep1	Plantability – high	1,178.6	100.0	657.7
Ep2	Plantability - moderate	756.9	0.0	0.0
Ea1	Avalanche -high	0.0	0.0	0.0
Ea2	Avalanche - moderate	0.0	0.0	0.0
Ew1	Wildlife - high	0.0	0.0	0.0
Ew2	Wildlife - moderate	0.0	0.0	0.0
Eh1	Water - high	0.0	0.0	0.0
Eh2	Water - moderate	0.0	0.0	0.0
Ef1	Fisheries - high	0.0	0.0	0.0
Ef2	Fisheries - moderate	0.0	0.0	0.0
Er1	Recreation - high	0.0	0.0	0.0
Er2	Recreation - moderate	0.0	0.0	0.0
Esp2	slope/plantability - mod	36.7	0.0	0.0
Esp1	slope/plantability - high	94.2	100.0	94.2
Epr1	plantability/rec - high	6.5	100.0	6.5
Total ESAs		3,183.2		1,366.3
Total Recreation Sites		213.4	100.0	160.2

6.9 Riparian Reserves and Management Zones - Streams, Lakes and Wetlands

A stream classification inventory conducted by AGRA Environmental Services Ltd., was completed for the Ahbau Creek and Willow River portion of T.F.L. # 53. The inventory was submitted for approval to the Ministry of Environment. The methodology used to incorporate the stream classification is detailed below.

Stream classifications, assigned through the inventory, were summarized to assign a riparian reserve zone (RRZ) and a riparian management zone (RMZ) according to the Operational Planning Regulations of the Forest Practices Code. A weighted average RRZ width was determined for the classified streams. The weighted average was then used to buffer all streams in T.F.L. # 53. Management Zone widths were applied using the same methodology. The legislated RMZ width was factored for percent retention by stream class, as derived from summarizing the prescribed retention in silviculture prescriptions. This data is included in Appendix V.

Table 9: Riparian Reserve Zones

Location	Riparian Class	Stream Length (m)	Buffer Width (1) (m)	Reserve Area (ha)	Mgmt Zone Area (ha)	Net Area Reduction (ha)
All	Legislated Stream Riparian Reserves	1,304,435.0	9.0	2,348.0	n/a	1,856.8
	Stream Riparian Management Zone		8.0	n/a	2,087.1	1,362.6

(1) This is the weighted average reserve width of the stream to one side. Buffers were applied to both sides of every stream.

6.10 Lakeshore Reserves

The forested reserve area around lakes and wetlands were derived through GIS buffering using Prince George Forest District classification. The Management Zones were applied using the same methodology used for streams, with the zone width factored by percent retention by class. The rationale was derived from summarizing the prescribed retention in silviculture prescriptions.

Two lake classes occur in the T.F.L., Class A and Class C. An average legislated (FPC) reserve width of 10 metres was buffered around both classes of lakes. District policy, on the other hand, has increased the reserve width around Class A and C lakes. According to this policy, a 200m reserve width is required around Class A lakes (190 m beyond Code requirements) and a 30-metre reserve around Class C lakes (20 m beyond Code requirements). A management zone also exists beyond these reserves. Herein, harvesting may occur while maintaining a percent retention of stems. To simplify the modeling of management zones, the management area was multiplied by the percent retention to derive an equivalent reserve reduction. This reduction was calculated to be 3 metres beyond the 200 metre reserve zone for Class A lakes and 4 m beyond the 30 metre reserve around Class C lakes.

Wetlands also have a management zone around them of varying widths and stem retention. Dunkley has calculated this management zone to have an equivalent area reduction of 8.4 metres. Details of the effect of these zones on the operable landbase are provided in Table 10.

Table 10: Lakeshore Reserve and Management Zones

Location (e.g., zone)	Riparian Class	Class	Buffer Width (m) (per side)	Reserve Area (ha)	Management Area (ha)	Net Reduction (ha)	
All	Legislated Lakeshore Reserves	all	10.0	1,863.2	n/a	70.5	
	Legislated Wetland Reserves	all	10.0	2,179.8	n/a	322.2	
	Wetland Management Zone	all	8.4	n/a	1,024.7	229.3	
	District Policy Lake Reserve Areas	A	200.0	272.8	n/a	215.3	233.8
		C	30.0				
	Legislated Lakeshore Management zone	A	3.0	n/a	21.4	18.5	
		C	4.0				

6.11 Wildlife Habitat Reductions

Modeling implications for wildlife management are intertwined with many of the biodiversity, adjacency and IRM assumptions used in the base case. Stand level area deductions for riparian areas and other excluded forested landbase will also contribute to wildlife habitat. Landscape level assumptions, although not current management, are included in the base case. This addresses the maintenance of old and mature forest habitat across the T.F.L. Adjacency and green-up are modeled by restricting the amount of young forest below a given height (3.0 m in the IRM zone, 4.2m to 5.4m in visually sensitive areas based on slope analysis). Wildlife tree patch deductions are also factored into the analysis. This generalized biodiversity approach has replaced species specific management assumptions. There are no known wildlife habitat features that require area deductions on the T.F.L.

6.12 Cultural Heritage Resource Reductions

There are no known cultural heritage resources on T.F.L. #53. Archaeological impact assessments have been made on six medium to high potential areas identified by an archaeological overview assessment (AOA) provided by the Prince George Forest District. These assessments have not turned up any resource features. As well, during MP #2, advice from the Heritage Conservation Branch of the Ministry of Small Business, Tourism and Culture indicated that there were no known heritage sites on record for T.F.L. #53. As a result, there was no decrease in the timber harvesting landbase due to cultural heritage resources.

6.13 Other Sensitive Site Reductions

There are no known "other sensitive sites" on T.F.L.#53.

6.14 Problem Forest Types

Problem forest types are stands which are physically operable and exceed low site criteria, These stands are excluded from the timber harvesting landbase at the present time due to the stands being too old, too short, and/or having too small a diameter. Although many of these stands may be harvested in part, they are not specifically targeted for harvesting at the present time. Changes in timber value, timber availability, and sawmill requirements may change Dunkley's perception of the value of these stands in the future.

Table 11 documents the areas that are currently considered to be problem forest types. The landbase deductions are described according to inventory file attributes.

The problem forest type stands are the same as those excluded in MP # 2 and were selected based on field inspections of representative stands. The Age/Height/Stocking number codes are standard Inventory Branch label codes. Definitions for these codes are provided in Table 12.

Table 11: Problem Forest Types

Species	Inventory Type Group	Characteristics			
		Age/Height/Stocking	Reduction Percent	Total Area	Net Area reduction
F	1 - 8	age class >=7 and height class =2 and stocking class = 2	100	23.3	23.3
C, H	9 - 17	All	100	0.0	0.0
B, BH	18 - 19	age class >= 6 and height class = 2, or age class >= 6 and stocking class = 2	100	944.4	824.3
BS	20	age class >= 6 and height class = 2	100	1,247.4	1,157.4
S	21 - 26	age class >=7 and height class = 2 and stocking class = 2	100	45.3	27.3
Pl	28 - 31	age class >= 5 and height class = 2 and stocking class >= 2	100	280.4	109.8
Cot, Alder Maple, AtDec	35 - 39,42	all	100	1,101.6	1,014.3
AtCon	41	all	0	1,796.7	0.0
Bi	40	all	100	290.0	266.0
Total				5,729.1	3,422.4

Table 12: Age, Height, Stocking Definitions

Age Class		Height Class		Stocking Class		
#	Age Range (years)	#	Height Range (m)	Class #		Definition
5	81 - 100	1	0 - 10.4	0		immature
6	101-120	2	10.5 - 19.4	1		mature & ≥ 76 stems/ha, 27.5+ cm dbh
7	121-140	3	19.5 - 28.4	2		mature & < 76 stems/ha, 27.5+ cm dbh
8	141 - 250	4	28.5 - 37.4	Sub-div. of 2	3	mature Pl ≥ 311 stems/ha, 17.5+cm dbh and 50% of stems 7.5+ cm dbh are ≥ 12.5+ cm dbh
9	251 +	5	37.5 - 46.4		4	mature Pl <311/ha, 15.5+cm dbh or ≥ 311/ha, 17.5+ cm dbh and <50% stems 7.5+ cm are ≥ 12.5+ cm dbh

6.15 Roads, Trails and Landings

Roads, trails and landings exist on the inventory files as either lines passing through forest cover polygons, or if the road and right-of-way is sufficiently large, as polygons themselves. If a road and right-of-way exists as a polygon on the inventory file, it is deemed a classified road. If a road passes through the middle of a polygon, it is deemed an unclassified road. Reductions to the timber harvesting landbase must account for both of these descriptions.

6.15.1 Classified roads, trails and landings

Roads which have a right-of-way identified on the inventory file by a break in the forest cover polygons are excluded in the net down as non-forest and were removed in Section 6.3 "NON-FOREST". These areas are usually classified as either "urban" or "clearing".

6.15.2 Unclassified roads, trails and landings

Roads, trails and landings passing through the center of a forest stand polygon can only be identified on the MOF's forest cover files as 'strings' without any associated area. To ensure that the road width and right-of-way area which exists around these 'strings' are identified and removed from the Timber Harvesting Land

Base, programmed routines within a GIS are used to buffer the area around the different classes of road. Prior to buffering these strings, the files were updated to incorporate new roads and deactivated roads. Similarly, past management strategies reflecting the impact of harvesting operations on the road network are reviewed.

Three significant management strategies have been implemented during the term of MP #2 that impact the area in roads, landings and trails:

1. Harvesting operations on the T.F.L. have been converted exclusively to roadside logging. This has eliminated the construction of landings in cut blocks, reduced skid trail compaction, and increased the area of in-block roads.

2. The Forest Practices Code has made the full rehabilitation of bladed and frequently used skid trails a requirement. Dunkley has already fully implemented this requirement. This has resulted in less trails being constructed through increased awareness, and excavator rehabilitation of all trails resulting from current logging.

3. Dunkley has also implemented a large-scale, permanent road deactivation program on the T.F.L.. This program includes roads constructed for current harvesting and a reduction in existing roads through FRBC funded road deactivation. The objective of this program is to restore full forest productivity to the targeted roads.

To reflect these changes in field operations the road and landing calculations used in support of MP #2 have been adjusted. From MP #2 the following right-of-way and road widths were determined.

	Deduction width
Forest Service Roads	20.9 m (1)
Operational Roads	12.2 m (2)
On-block Roads	4.3 m (3)
Landings	0.24 ha/landing (4)

1. The entire road right-of-way was included as a deduction as it was assumed that this area would remain cleared for safety reasons.

2. The area of the right-of-way brushed for line-of-sight was deducted from the net landbase.

3. The road width included unplanted portions of the block such as ditches and cuts and fills which were deemed non-productive.

4. Landing area included the non-reforested portions of the landing.

For this information package, these average widths were applied to the lengths of road, by road class, using the T.F.L.'s GIS database to determine an area reduction.

The road system in the GIS database has been updated to include permanent road deactivation. Permanently deactivated roads that have been planted are not included in the deductions for roads, trails and landings. Table 13 summaries the area removed for current roads, trails and landings.

Table 13: Unclassified roads, trails, and landings

Location	Road Class	Buffer Width (m)	Road Length (km)	Deactivation Length (km)	Total Area [2] (ha)	Net Area (ha)
All	FSR	20.9	143.5	0.0	299.9	243.1
	Primary Operational	20.9	231.9	0.0	484.7	432.4
	Secondary Operational	12.2	169.5	9.3	195.5	177.5
	On-block	4.3	500.4	24.1	204.8	184.2
	Landings [1]	n/a	n/a	n/a	252.0	244.7
Total			1,045.3	33.4	1,436.9	1,281.9

1 Represents 1,050 landings.

2 The total area in roads was excluded from the "Total Productive TFL Forest Area" in the Timber Supply Analysis. This area is now deemed non-forest and does not contribute to biodiversity.

6.15.3 Future Roads Trails and Landings

This reduction is applied as a percent reduction against all stands that will be disturbed in the future. It will apply to stands greater than 30 years of age. The 30-year cut off was derived to account for the fact that stands less than 30 years of age are likely plantations which already have a road system developed to access them. History records contain harvesting which dates back 40 years. A 10-year time buffer was applied to account for additional roads through previously harvested areas. The net result is a conservative estimate since 10 years of harvested area will have both a current road deduction and a future road deduction.

The calculation for future roads, trails and landings are again based upon the calculations used in MP#2. These calculations are included in Appendix III. The data is adjusted to reflect current management. There will be no future construction of Forest Service Roads on the T.F.L.

Comparison of Future Road Deductions

	MP #2		MP #3
Operational Roads	0.42%		0.42%
On-block Roads	0.64%		0.83% (1)
Landings	1.10%		0.0% (2)
Subtotal	2.16%		1.25%
Permanent Road deactivation		12.5%	(0.16) (3)
Future Reductions			**1.09%**

1. It was calculated that on-block roads developed for roadside logging have approximately 30% more length of road than is required for a landing road system.
2. Landings are no longer constructed under our current harvesting system.
3. 1996, 1997 data show that 12.5% of roads constructed for current logging are permanently deactivated. This applies to both operational and on-block roads.

6.16 Exclusion of Specific Geographically Defined Area

There are no exclusions of "specific geographically defined areas" beyond those already discussed for T.F.L. #53.

6.17 Any Other Landbase Exclusions

There are no "other landbase exclusions" beyond those already discussed for T.F.L. #53.

6.18 Area Additions

There are three areas which are added back to the timber harvesting landbase after the appropriate reductions for ESAs, problem forest types, low sites, riparian reserves etc. are performed. These are: 1) Not satisfactorily restocked (NSR) areas, 2) Plantations with an incorrect SI, and 3) Balsam IU stands. A fourth area worth mentioning was not removed through the net down process. This area is deciduous leading (Type Group 41) stands. An explanation for all four areas are included.

1. NSR

The gross area of NSR on the T.F.L is 1,572.6 ha of which 120.9 ha has been lost to ESAs and riparian reserves. The remaining 1,451.7 ha comprises 269.3 ha which is current NSR and 1,182.4 ha is backlog NSR. The amount of NSR has been reduced significantly from the 3,320.1 ha of NSR at the start of MP #2. This is a result of both backlog NSR treatment and a reduction in regeneration delay that reduces current NSR.

FRBC funding is being utilized to reduce backlog NSR. Treatments have been carried out in 1997 and 1998 and are budgeted to continue until the NSR is eliminated.

Current NSR is a company obligation and treated under silviculture prescriptions. Given the performance on treating NSR to-date, it is appropriate that the NSR stands are a component of the base case addition to the T.H.L.B.

NSR is added back to the managed stand analysis units by species on a prorated basis. Backlog NSR was differentiated from current NSR by year of logging. NSR with logging history after 1987 was considered current NSR. Current NSR was assumed to be treated within 1 year. Backlog NSR is assumed to be treated and completely eradicated over the next decade. Table 23 in Section 8.9.2 describes the NSR area which gets added to managed stand analysis units by group and zone.

2. Plantations

Plantations with an incorrect site index were netted down for roads, riparian, ESAs etc., and then added back to the T.H.L.B.. A description of this area is provided in Section 6.7 and is detailed in Table 7.

3. Balsam I.U.

The total area of Balsam Intermediate Utilization (I.U.) stands requiring rehabilitation is 2,728.3 gross hectares or 1,819.5 net hectares. This was determined from forest cover polygons for the information package. There has been an increase in treatable I.U. polygons from the 1,365.0 ha included in MP #2. MP #2 used the FRDA I.U. survey area summary to determine the I.U. area.

During the term of MP #2, Dunkley treated 152.0 ha of Balsam I.U. stands. Thirty-eight hectares of this were mechanically site prepared in 1998 and will be planted in 1999. 114.0 ha have been successfully converted to young spruce and pine plantations through the I.U. logging program.

A partitioned cut of 20,500 m3 for Balsam I.U. stands was established for the term of MP #2. As of March 1, 1998 8,134m3 of I.U. stand volume has been harvested under this partition. Harvesting has been conducted on an annual basis. This harvesting activity generates poor quality logs at a very high cost. These factors, in combination with market conditions and influences such as the US Lumber Quota, have not made it possible to carry out a larger scale I.U. logging program.

In order to respond quickly to favorable conditions, Dunkley has four I.U. blocks under cutting permit; three additional I.U. blocks with approved Silviculture

Prescriptions and two more blocks in an approved Forest Development Plan. These blocks in total contain 20,218m3. The volume of the I.U. areas cruised to-date average approximately 75-100 m3/ha. This fits with the requirement that I.U. cutting permits average less than 140 m3/ha.

Budget constraints within the Ministry of Forests have not enabled site preparation and survey work to be conducted on I.U. stands during MP #2 until this year (i.e., 1998). FRBC funding was budgeted by Dunkley in 1998 and site preparation was completed. FRBC funding should allow the site preparation and plant option for treating I.U. stands to continue. Given Dunkley's performance in I.U. stands to-date, and our readiness to respond to favorable conditions in the future, it is appropriate that the I.U. stands remain in the base case T.H.L.B.

4. Deciduous

The gross area of deciduous leading stands on the T.F.L. totals 3,188.3 ha (see Table 11). Within this area, 1,796.7 ha is Type Group 41 which has deciduous as the leading species and conifer as a major secondary species. 1,117 ha of this is included in the T.H.L.B. after deductions. 540.3 ha of the total is Age Class 1 or 2 (e.g. $\leq$ 40 years) and requires treatment (or an inventory update) to meet free growing conifer status. These stands are being added back into the T.H.L.B. The remaining area in Type Group 41 will succeed naturally to a conifer leading stand as evidenced by permanent sample plot data for T.F.L. # 53 and other studies. The Age Class 1 and 2 areas will revert through silviculture intervention to AU 13. Type Groups 35 and 36 are not included in the Age Class 1 and 2 add-back, as these tend to represent wetter sites with high wildlife values.

Table 14: Area Additions

Reason for Area Addition	Identification	Analysis Unit assigned to	Gross Area (ha)	Net Area (ha)
NSR	FIP	Prorata	1,572.6	1,451.7
Balsam IU	Polygon specific	5	2,728.3	1,819.5
Deciduous [1]	T.G. 41 > 40 years of age	20	1,195.9	1,117.0
	T.G. 41 ≤40 years	13	600.8	540.3
Improper Site Index classification [2]	Conifer stands with SI < 6 and age <40 years	1	7.9	7.2
		8	774.5	706.2
		15	29.5	20.3
		total	811.9	733.7

1 Deciduous leading stands (with a coniferous understory) convert to coniferous leading stands through natural mortality. Field data shows that the coniferous understory becomes the dominant species after 120 years of age. See Appendix XIII for more information.

2 These stands are plantations where a calculated site index based on age and height does not indicate the potential growth.

7.0 INVENTORY AGGREGATION

7.1 Management Zones and Multi-Level Objectives (Groups)

The analysis for T.F.L. # 53 contains the zones and groups shown in Table 15. A flow diagram showing the relationship between analysis units, zones and groups is provided in Appendix X.

Table 15: Zones and Groups

Group	Zone [3]	Area (ha)					
		Gross	Non-Forest	Productive Area	Excluded Area	Excluded Forest [4]	T.H.L.B.
NDT 1 ESSF wk1	IRM	7,836.6	97.3	7,739.3	611.8	525.0	7,127.5
	VQO M	769.5	2.9	766.6	90.6	78.1	676.0
	Total NDT 1	8,606.1	100.2	8,505.9	702.4	603.1	7,803.5
NDT 2 SBS wk1	IRM	28,662.7	2,325.8	26,336.9	3,357.7	2,237.0	22,979.2
	VQO PR	1,108.1	2.6	1,105.5	189.2	164.6	916.3
	VQO M	152.5	0.0	152.5	1.5	1.0	151.0
	Total NDT 2	29,923.3	2,328.4	27,594.9	3,548.4	2,402.6	24,046.5
NDT 3 SBS dw SBS mk SBS mw	IRM	46,395.6	2,435.2	43,960.4	8,030.7	6,166.6	35,929.7
	VQO P	15.8	3.2	12.6	7.5	6.8	5.1
	VQO R	42.7	1.4	41.3	19.2	16.2	22.1
	VQO PR	888.2	3.3	884.9	133.7	124.8	751.2
	VQO M	1,773.6	9.3	1,764.2	195.5	174.7	1,568.9
	VQO MM	15.4	0.0	15.4	0.0	0.0	15.4
	Total NDT 3	49,131.3	2,452.3	46,678.8	8,386.6	6,489.1	38,292.4
Total		87,660.7	4,881.0	82,779.7	12,637.4	9,494.8	70,142.3

[3] Visual polygons were re-digitized resulting in very slight discrepancies between the areas used in MP #2 and this information package. The zones listed here were all spatially defined through a GIS. A WTP zone was also created which represented 4% of the T.H.L.B. area from each of the zones described above.

[4] Excluded forest area is outside the T.H.L.B. but is represented by analysis unit 21. This area contributes to biodiversity objectives within each group. It also contributes to forest cover objectives within visually sensitive areas. The area is less then the total reductions to productive forest after the gross area in unclassified roads trail and landings have been removed as well as NP and NCC areas which exist without any trees on them.

7.2 Analysis Units

Analysis Units (AUs) are the basic building blocks around which inventory data and other information is assembled for use in forest estate planning models. They represent the general level of aggregation, or detail at which a timber supply analysis is carried out. The areas shown in the following table exclude area adjustments made for NSR.

Table 16. Analysis Units

Analysis Unit (#)	Analysis Unit (Name and site quality)	Net Area (ha)[5]	Variable used to define Analysis Unit		Rationale used or Comment
			Type Group	Site index	
1	Fir	1,305.5	1, 4, 5, 8	8.8 +	
2	Balsam Good	607.6	18, 20	16.01+	
3	Balsam Medium	1,736.2	18, 20	13.01 - 16.00	
4	Balsam Poor	3,422.9	18, 20	7.81 - 13.00	
5	Balsam IU	1,819.5	18, 20	all	historic IU Logging
6	Spruce Good	10,074.3	21, 22, 24	18.01+	
7	Spruce Medium	10,553.7	21, 22, 24	14.60 - 18.00	
8	Spruce Poor	7,910.7	21, 22, 24	7.51 - 14.59	
9	Spruce/Pine Good	3,055.3	25	20.01+	
10	Spruce/Pine Medium	5,617.9	25	14.60 - 20.00	
11	Spruce/Pine Poor	831.3	25	7.51 - 14.59	
12	Spruce/Decid Good	2,039.1	26	18.01+	
13	Spruce/Decid Medium/Poor	1,547.1	26	7.51 - 18.01	
14	Pine Good	4,187.5	28	20.01+	
15	Pine Medium/Poor	2,390.6	28	7.81 - 20.00	
16	Pine/Spruce Good	7,437.1	29, 30	16.01+	
17	Pine/Spruce Medium/Poor	1,967.1	29, 30	7.81 - 16.00	
18	Pine/Deciduous Good	905.4	31	16.01+	
19	Pine/Deciduous Medium/Poor	164.8	31	7.81 - 16.00	
20	Aspen Conifer	1,117.0	7.5+	7.51+	
21	Excluded forested area [6]	0.0	all	0.0+	Monitor forest cover
T.H.L.B. (Exclusive of NSR)		68,690.6			

[5] Net area is exclusive of NSR add backs.

[6] Excluded Forest Area is net of reductions for unclassified roads trails and landings. The forest area in AU 21 equals 11,200 hectares

8.0 GROWTH AND YIELD

The yield curves have been forwarded to Resources Inventory and Research Branch staff for their review and acceptance.

8.1 Site Index Assignments

Site indices for existing unmanaged stands were assigned using the MOF's Variable Density Yield Prediction Model, batch version 4.5.

Site indices for existing managed stands were assigned using an adjusted site index based upon a BEC Classification for T.F.L. #53. Site indices are based upon the biogeoclimatic zone, subzone and site series of each stand or portion of each stand. Biogeoclimatic information was loaded into a GIS and intersected with the forest cover layer. The table used to derive site index by site series and subzone is provided in Appendix VII.

8.2 Utilization Levels

As stated in the SMOOP, during the term of MP #3 harvesting will be conducted to the utilization standards, as indicated in Table 17.

Table 17: Utilization Levels

Species	Utilization			
	Minimum Dbh (cm)		Maximum Stump Height (cm)	Minimum Top dib (cm)
	unmanaged stands	plantations		
Spruce	17.5	12.5	30.0	10.0
Balsam	17.5	n/a	30.0	10.0
Douglas-fir	17.5	12.5	30.0	10.0
Lodgepole Pine	12.5	12.5	30.0	10.0
Aspen	17.5	12.5	30.0	10.0

Unmanaged stand utilization levels are consistent with cutting permit documents. Managed stands will be harvested to a minimum dbh of 12.5 cm. Stump height and top diameter will remain the same. This reflects the assumption that the uniformity of managed stands will

allow a more consistent utilization standard. It is a strategy appropriate for the T.F.L. where the timber supply is forecast to be most restricted 60-80 years in the future when the plantations are reaching merchantable ages.

8.3 Decay Waste and Breakage for Unmanaged Stands

The current inventory file no longer has the original P.S.Y.U. designations as an overlay to the digital data base. To obtain net volumes per hectare, Ministry of Forests' decay, waste and breakage factors provided in the Variable Density Yield Prediction Model (VDYP) for Forest Inventory Zone (FIZ) I and Public Sustained Yield Unit (PSYU) 121 (Naver) were used.

8.4 Operational Adjustment Factors for Managed Stands

Operational adjustment factors for managed stands were derived using field procedures detailed in the recent Ministry of Forest publication on assessing O.A.F.1 in the field:

O.A.F. 1 Project Report 1 MOF BC, FRBC September 1997, and

O.A.F. 1 Project Report 2 MOF BC, FRBC January 1998.

Technical details on the survey performed on T.F.L. #53 are provided in Appendix IX. The O.A.F. 1 Project Report 2 is required to extrapolate the results depicted in Appendix IX against the Estimate of O.A.F. 1 tables appended to the Report 2. Table 18 shows the results of Dunkley's project involving an overview of stocking gaps and O.A.F. 1 estimates for TIPSY. Note that a 6% adjustment factor was applied to the calculated O.A.F. 1 for Spruce and a 7% adjustment factor for Pine. This adjustment was applied to account for unforseen and/or unaccounted for events such as blister rust, root rot, weevil etc.

Table 18: Operational Adjustment Factors for Managed Stands

Species		Df	Sw	Pl	Bl
O.A.F. 1	Calculated	15	6	3	15
	Adjustment	0	6	7	0
	Applied to TIPSY	15	12	10	15
O.A.F. 2		5	5	5	5

8.5 Volume Deductions

There are no volume deductions to be applied on T.F.L. #53 other than those described in Section 8.3 and 8.4. To address internal wildlife tree patch retention, a zone was created wherein 4% of the T.H.L.B. was assigned a double rotation. This was done in an attempt to simulate a second pass harvest of wildlife tree patches. The percent of the landbase was derived from a review of silviculture prescriptions, which indicated that an average of 2% of the merchantable area within a block was reserves as a WTP. The rationale for using 4% of the net area in WTPs is supplied in Appendix VIII.

The Draft Inventory Audit Results: Overview T.F.L #53 February 1998 indicated that there is no significant difference between the audit volume and the inventory volume for all sample polygons. Dunkley received a copy of the inventory audit results for T.F.L #53. Our assessment of the results is that the audit supported the VDYP estimated volumes for unmanaged stands on the T.F.L.

8.6 Yield Table Development

8.6.1 Aggregated Yield Tables

Yield tables will be aggregated so that unmanaged and managed curves exists for each analysis unit. Aggregation was done using the VDYP site index for all of the stands in the T.H.L.B. separated into AUs. There will be no 'zone specific' yield curves.

8.7 Yield Tables for Unmanaged Stands

Yield tables for unmanaged stands were generated using the Variable Density Yield Prediction (VDYP) 'batch' model, version 4.5.

Separate curves were not produced for unmanaged mature stands versus unmanaged immature stands. A temporary yield curve was created for each forest polygon in the T.H.L.B. The yield curves were then grouped by analysis unit and area-weighted to provide one curve for each analysis unit. All of the net area in each analysis unit was used in the generation of the curves, with the exception of the plantations with the incorrect SI. These stands were ignored in the creation of the unmanaged stand curves. The same set of curves are applied to each zone within T.F.L. #53.

Adjustments were made to the VDYP predicted volume of two of the analysis units. AU 5, representing Balsam I.U. stands were capped at 100 m3/ha. AU 20, representing deciduous stands which would convert to coniferous through seral succession, had a 50% O.A.F. applied to the curve (See appendix XIII for more information).

Tabular and graphical summaries for each analysis unit are not included with this report. Copies of the curves have been forwarded to Mr. Robb Drummond at the MOF Resources Inventory Branch for approval.

8.7.1 Existing Timber Volume Check

To verify that significant error did not occur in the aggregation of polygons into analysis units, the total volume of the current inventory (i.e., T.H.L.B.) using V.D.Y.P. polygon specific volumes was compared to the total volume of the current inventory (i.e., T.H.L.B.) using analysis unit volumes.

Table 19: Total T.F.L. Volume

	Method Used		
	Polygon Specific	**Analysis Unit**	**% difference**
Total volume (m3)	13,026,393.3	13,533,665.2	3.9

The calculations were performed as follows:

1) Total polygon specific inventory volume: ∑(all polygon in the T.H.L.B. (projected VDYP volume/ha 'multiplied by' net polygon area))

2) Total analysis unit volumes: ∑all analysis units (∑all age classes (analysis unit area in age class 1 'multiplied by' VDYP estimated volume @ age class 1))

8.8 Yield Tables for Managed Stands

Managed stand yield tables were created using the Windows Table Interpolation Program for Stand Yields (Version 2.1d) for spruce, lodgepole pine and fir. Balsam stands will regenerate naturally to the existing VDYP curve. Aspen-conifer stands will regenerate to pine-spruce stands following seral succession and harvesting.

Two levels of TIPSY curves were created. Stands harvested between 1973 and 1997 form the first set. After assessing areas harvested between 1972 and 1982 it was determined that 1973 would be the starting point. Stands harvested prior to 1972 were predominantly harvested using intermediate utilization standards and were thought to be better represented by unmanaged stand yield tables.

Stands harvested between 1972 and 1982 were assessed for stocking density, brush levels, crop tree performance and silviculture treatments. Using these criteria, each opening was then categorized as being a natural stand or a managed stand (see Appendix XII). For the openings harvested between 1972 and 1982, a total of 765 hectares were determined to be better represented by natural stand growth and yield. In 1972, a total of 940 hectares were harvested. By including 1972 harvesting in the natural stand growth and yield curves, those openings harvested between 1972 and 1982 that are best represented by natural stand growth and yield are accounted for in the timber supply analysis. Using 1973 as a cut-off year rather than the individual stands simplifies the yield table creation.

Stands harvested between 1982 and 1997 have benefited from restocking and free growing requirements. These openings are represented by managed stand yield tables.

Stands harvested in 1998 and into the future will incorporate the genetically improved seed used in Dunkley's reforestation program. Between 1993 and 1997 approximately 20% of all seedlings planted are from improved seed. Dunkley has also purchased Class A seed from the Vernon Seed Orchard Company. We intend to use improved seed for all spruce planted in the year 2000 and beyond. The seedlots purchased from the VSOC have a genetic worth of 18%. Alvin Yanchuck , Research Branch - Forest Genetics advised that this can be applied as a positive adjustment factor to the predicted TIPSY yields. Regeneration yields for areas harvested on or after 1998 will incorporate this genetic worth value, prorated

by the amount of spruce planted. 1998 is used as the starting period for this treatment to incorporate past performance in using improved seed.

Table 20: Regenerated Yield Tables

Logging History	Regenerated yield curve	Rationale
prior to 1972	VDYP	IU logging
1973 - 1997	TIPSY	basic silviculture
1998 +	TIPSY + (genetic gain)	plant genetically improved Sw seed

8.8.1 Silviculture Systems

The mature and over-mature stands in T.F.L. #53 are predominantly spruce, spruce-balsam and spruce-lodgepole pine. Clearcutting will generally be the prescribed harvesting system for these timber types.

8.8.2 Silviculture Management Regimes

Site indices for the regenerated stands are derived using the area-weighted site series/subzone/site index combination. See Appendix III. (Note: If a polygon was split into two or more site series, the site indices relating to the two or more portions of each stand were area-weighted to derive an appropriate average site index for that stand). The change in site index, by analysis unit, going from the area-weighted VDYP site index to the area-weighted Biogeoclimatic Ecosystem Classification (BEC) site index is shown in Table 21. Species, site index, treatment and planting density were input into the WinTIPSY model as per the information shown in Table 21. O.A.F.1 was applied as per the rationale in Section 8.4. O.A.F. 2 is assumed to be 5% as suggested in the TIPSY operations manual.

The WinTIPSY model does not model for managed balsam stands. Since portions of these stands are assumed to regenerate naturally, the portion which remains balsam will regenerate to the original VDYP curve.

Tabular and graphical summaries for each analysis unit are not included with this report. However, copies of the curves have been forwarded to Mr. Albert Naussbaum at the MOF Research Branch for approval.

8.8.3 Aggregated Yield Tables

Within T.F.L. # 53, all of the forest cover polygons comprising the T.H.L.B. were aggregated into analysis units based on site index and species. The yield curves are a representation of the entire T.F.L. Aggregation was not done on a zonal basis. Table 21 shows two columns for site index. The first is the area-weighted site index as a function of VDYP. The second column is the area-weighted Site Index based on the BEC system. It is important to note that the analysis units were NOT re-aggregated based on the BEC site index classification. The polygons originally allocated based on species and VDYP site index breaks remained in these analysis units. The area-weighted BEC site index is the resultant site index based on the subzone and site series for the polygons in each AU.

8.8.4 Regeneration Delay

Regeneration delay by analysis unit is shown in Table 21. The regeneration delay was not applied as an input into the WinTIPSY model in the creation of the managed stand yield tables. The values shown in Table 21 were applied directly into the FSSIM model.

8.8.5 Regeneration Assumptions

Table 21 describes the regeneration assumptions used to create managed stand yield tables. The BEC site index will be used for the creation of managed stands. As indicated in Table 21, two sets of managed stand curves are representative for the T.F.L. The first set applies to stands harvested between 1973 and 1997. The second set applies to all stands harvested after 1997. An OAF denoting a genetic gain in the white spruce component of each AU was applied to the second set of curves. This genetic gain will be applied directly in FSSIM model.

8.8.6 Species Conversion

Table 21 documents the T.F.L. management strategy of adding a pine component to stands where it is ecologically appropriate. The conversion of balsam I.U. stands to spruce is also reflected. The natural succession of deciduous leading stands with a coniferous component to coniferous leading stands is an ecological fact and is modeled in the base case. Appendix XIII contains the natural succession rationale.

Douglas-fir management is set towards maintaining the species as a component of the stands where it occurs. Douglas-fir is normally a minor component of our current harvesting practices. Where found, Douglas-fir leave trees serve a dual function of maintaining biodiversity and providing a natural seed source. This is supplemented by planting a component of Douglas-fir where ecologically appropriate (approximately 10,000 seedlings per year or 1-2% of trees planted). Douglas-fir are a minor stand component and not reflected in the regeneration assumptions.

If Douglas-fir is the leading component of the stand, it is modeled to be reforested to a leading Douglas-fir stand. Douglas-fir leading stands are a very small component of the T.F.L. and harvesting of these stands is rare.

Table 21: Regeneration Assumptions

Current AU/species			Future AU and Species regenerated to		% conversion	Initial Density (1)	Site Index (2)			Regen Delay (4)	Natural (n) or Planted (P)	O.A.F. 1 (5)	Genetic gain in Sw	Yield Table Source
nature	immature	species					VDYP	BEC (3) All stands	BEC stands immature (<25 yrs)					
1	22	Fir	101	Fd	100	1600	21.1	20.0	20.7	1	P	15	0	TIPSY
2	n/a	Bl-g	2	Bl	5	n/a	18.0	n/a		1	n	n/a	0	VDYP
			102	Sw	95 90	1600	18.0	17.6	n/a	1	P	12	16.2	TIPSY
				Pl	10									
3	n/a	Bl-m	103	Sw	75	1600	14.4	17.7	n/a	1	P	12	13.5	TIPSY
				Pl	25									
4	n/a	Bl-p	4	Bl	10	n/a	11.2	n/a		1	n	n/a	0	VDYP
			104	Sw	90 80	1600	11.2	17.6	n/a	1	P	12	14.4	TIPSY
				Pl	20									
5	n/a	Bl-IU	105	Sw	100	1600	13.6	18.5	n/a	0 (6)	P	12	18	TIPSY
6	27	Sw-g	106	Sw	100	1600	19.8	19.6	19.7	1	P	12	18	TIPSY
7	28	Sw-m	107	Sw	100	1600	15.8	19.1	18.7	1		12	18	TIPSY
8	29	Sw-p	108	Sw	76	1600	12.0	19.0	18.4	1	P	12	13.6	TIPSY
				Pl	24									
9	30	SwPl-g	109	Sw	76	1600	22.2	19.2	19.1	1	P	12	13.6	TIPSY
				Pl	24									
10	31	SwPl-m	110	Pl	40	1600	17.3	19.4	19.4	1	P	12	10.8	TIPSY
				Sw	60									
11	32	SwPl-p	111	Pl	40	1600	12.4	19.2	21.0	1	P	12	10.8	TIPSY
				Sw	60									
12	33	SwDec-g	112	Pl	50	1600	20.2	19.6	19.7	1	P	12	9	TIPSY
				Sw	50									
13	34	SwDec-m/p	113	Pl	50	1600	15.3	19.5	19.4	1	P	12	9	TIPSY
				Sw	50									
14	35	Pl-g	114	Pl	86	1600	23.0	20.6	20.3	1	p	10	2.5	TIPSY
				Sw	14									
15	36	Pl-m/p	115	Pl	86	1600	17.8	19.9	21.1	1	P	10	2.5	TIPSY
				Sw	14									
16	37	PlSw-g	116	Pl	86	1600	21.3	20.7	20.4	1	P	10	2.5	TIPSY
				Sw	14									
17	38	PlSw-m/p	117	Pl	86	1600	15.5	20.2	20.2	1	P	10	2.5	TIPSY
				Sw	14									
18	39	PlDec-g	118	Pl	80	1600	21.0	21.3	19.6	1	P	10	3.6	TIPSY
				Sw	20									
19	40	PlDec-m/p	119	Pl	80	1600	15.6	19.7	19.0	1	P	10	3.6	TIPSY
				Sw	20									
20	n/a	AtCon	120	Pl	80	1600	19.2	17.4	n/a	1	P	10	3.6	TIPSY
				Sw	20									
21		Excluded Forest	21	Never harvested										

(1) Initial density reflects mortality after planting approximately 1800 - 2000 seedlings per hectare

(2) This is the area-weighted site index calculated using the VDYP generated site index on the FIP file

(3) This is the site index used to calculate managed stand yields. The information was derived from a SIBEC report. See Section 8.1

(4) Regeneration Delay is consistent with an average regen delay from the commencement of harvesting a block until planting is completed. From 1994 to 1998 this delay averaged 14 months. In 1997 and 1998 the delay period has averaged less then 12 months.

(5) O.A.F. 1 values were derived from OAF surveys conducted on T.F.L. plantations and adjusted for insects and disease damage. See Section 8.4

(6) Balsam I.U. regen delay reflects the situation where approximately 10% of the sites are occupied by advanced spruce regen which is 15 to 30 years old

8.9 Silviculture History

8.9.1 Existing Managed Immature

All harvested stands after 1973 are growing on managed stand yield information. The purpose of Table 22 is to document, for each analysis unit, the area of existing managed second growth stands within the T.F.L.

Managed stands are accounted for in the analysis by doubling the initial number of current analysis units. Therefore, the first 21 analysis units will represent unmanaged stands growing on the VDYP curve. The next 20 analysis units are the managed stands shown in Table 22, growing on standard TIPSY curves. These analysis units will be assigned AU numbers from 22 to 42. This is shown in Appendix X.

When harvesting occurs, unmanaged stands will regenerate to TIPSY + genetic gain (i.e., AU 1 converts to AU 101). Similarly, when existing managed stands are harvested, they also convert to TIPSY + genetic gain (i.e., AU 22 converts to AU 101). The site index for these managed stands were generated using the area-weighted BEC classification based on the subzone and site series of each plantation polygon. The area-weighted site index for existing and managed stands are shown in Table 21.

Table 22: Immature Management History

Current AU/ species		Net Area Natural (ha) by Age			Net Area Planted (ha) by Age			Total Net Area (ha)
		1-10	11-20	21-25	1-10	11-20	21-25	
1	Fir				17.1	121.1		138.2
2	Bl-g	4.1	69.5	156.6				230.2
3	Bl-m		96.1	185.0				281.1
4	Bl-p		43.5					43.5
5	Bl-IU		110.4	96.6				207.0
6	Sw-g				1,226.0	2,109.5	914.5	4,250.0
7	Sw-m				1,706.1	2,400.6	385.9	4,492.6
8	Sw-p				297.4	254.2		551.6
9	SwPl-g				5.4			5.4
10	SwPl-m				971.7	1,395.0	366.3	2,733.0
11	SwPl-p				55.0	61.7		116.7
12	SwDec-g				159.9	486.9	231.5	878.3
13	SwDec-m/p				247.9	421.1	174.8	843.8
14	Pl-g							0.0
15	Pl-m/p				536.9	186.6	171.0	894.5
16	PlSw-g				1,297.4	354.4	109.9	1,761.7
17	PlSw-m/p				1,065.8	428.8	215.5	1,710.1
18	PlDec-g				8.3	61.5	142.0	211.8
19	PlDec-m/p				70.7	86.7		157.4
20	AtCon [7]				251.4	233.6	29.3-	514.3
Total		4.1	319.5	438.2	7,917.0	8,601.7	2,740.7	20,021.2

8.9.2 Backlog and Current NSR

Backlog NSR is any area that was denuded prior to 1987 and is not fully stocked. All other NSR is current NSR. NSR is added back to the timber harvesting landbase according to its location by NDT and by management zone (i.e., IRM, VQC M, VQC PR etc.) The area of NSR within these zones is then added to all analysis units on a prorate basis. A breakdown by geographic location is shown in Table 23.

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7 The net immature are in AU 20 (AtCon) converts to AU 14 through silviculutre treatment. See Table 14 for more information.

Table 23: Backlog and Current NSR

Group	Zone	Backlog NSR Area (ha)		Current NSR Area (ha)		Total Area (ha)	
		Gross	Net	Gross	Net	Gross	Net
NDT 1 ESSF wk1	IRM	205.6	196.6			205.6	196.6
	VQO M	3.9	3.9			3.9	3.9
	Total NDT 1	209.5	200.5	0.0	0.0	209.5	200.5
NDT 2 SBS wk1	IRM	591.6	537.2	148.5	141.1	740.1	678.3
	VQO PR			39.5	34.8	39.5	34.8
	Total NDT 2	591.6	537.2	188.0	175.9	779.6	713.1
NDT 3 SBS dw, mk1, mw	IRM	484.4	444.1	98.5	93.4	582.9	537.5
	VQO M	0.6	0.6			0.6	0.6
	Total NDT 3	485.0	444.7	98.5	93.4	583.5	538.1
Total		1,286.1	1,182.4	286.5	269.3	1,572.6	1,451.7

The Backlog and Current NSR within each group/zone combination will be added to managed stand analysis units on a pro-rata basis.

Current NSR is created from harvesting operations. It is treated under silviculture prescriptions. The regeneration delay of 1 year keeps the amount of current NSR relatively small.

NSR with a logging history before 1987 was considered backlog NSR. This results from logging where the reforestation method has not been successful. These areas are treated with a combination of mechanical and chemical site preparation followed by planting. Funding is provided by FRBC. Surveys also identify NSR areas that have regenerated naturally through time. In the past 5 years backlog NSR has been reduced from 2,540 ha to 1,286.1 ha. Of this remaining backlog NSR, 177 ha was planted in 1998, but is not reflected in the inventory data.

9.0 PROTECTION

9.1 Non-Recoverable Losses (NRLs)

In the Data Package for MP # 2, a calculated NRL number based on the forest cover inventory was summarized by non-logging disturbances:

Insect	15.2 ha @ 284m3/ha	4,316.8m3
Windthrow	115.2 ha @284m3/ha	32,716.8m3
Burn	100.5 ha @ 284m3/ha	28,542.0m3
Total		65,575.6m3

NRLs have accumulated over a 40-year period, for a yearly NRL figure of 1,639m3/year. In spite of this calculated NRL number, the AAC determination used an NRL figure of 3,400m3/year. This number overestimates NRLs for T.F.L. # 53.

For MP # 3 Dunkley proposes an NRL figure be set with consideration of the following information:

1. A reduction in the T.H.L.B. between MP # 2 and MP # 3 of approximately 3% will occur. Areas not contributing to the net landbase do not contribute to epidemic losses of merchantable timber. This is a downward pressure on NRLs.
2. The extreme reduction in broadcast burning (no area in 1996, 1997 or 1998) has eliminated the risk of NRL fringe damage. This is a downward pressure on NRLs.
3. The losses to wildfire in the last 10 years on the T.F.L. have been essentially non-existent. Reflecting the small size of the landbase, the good access, and Dunkley's quick response, this has resulted in no mappable fire damaged timber losses for the last ten years. This is a downward pressure on NRLs.
4. Insects are aggressively controlled through a trap tree program for Spruce Bark Beetle and Douglas-fir Bark Beetle and bait trees for Mountain Pine Beetle. A minimum of two overview flights per year identify individual and small patch attacks. Through helicopter salvage, these trees have been logged to control beetles and reduce NRLs. This is a downward pressure on NRLs.
5. Windthrow salvage is also aggressively addressed. Windthrow patches are salvaged as they are identified. The windthrow salvage program involves approximately 10,000-

20,000m3/year. As well, a pilot single tree salvage program along road right-of-ways has been implemented and Dunkley plans to expand this to the entire T.F.L. road system. This is a downward pressure on NRLs.

6. The current NRL figure of 3,400m3/year would result in approximately 12 hectares per year of non-recoverable timber. During the term of MP # 2 this would add up to 60 hectares of mappable losses. Losses to this extent are definitely not occurring on the T.F.L.

Given the outstanding effort that Dunkley Lumber Ltd. applies to minimize NRLs, the number of 3,400m3/year over-estimates NRLs based on current practices. A NRL number of 678m3/year should be used for MP # 3. This is approximately 2 hectares/year times the current average mature volume / ha of 339 m3/ha on the gross landbase of the T.F.L. The 2 hectares per year reflect an estimate of NRLs based on T.F.L. overview flights. The historic NRL summary on the T.F.L. and Dunkley's 5-year performance in pest management and salvage operations are included in Appendix XI.

T.F.L. # 53 Reduction for Non-Recoverable Losses: 678 m3/year

10.0 INTEGRATED RESOURCE MANAGEMENT

10.1 Forest Resource Inventories

Table 24: Forest Resources Inventory Status

Forest Resource Inventory	Standard	Date Completed	Date approved	Approved By	Status
Forest Cover	MOF	Feb 93	June 93	Regional Inventory Forester	Updated annually
Landscape	MOF	Nov 98	Dec 98	District Manager	Approved
Recreation	MOF	Feb 94	June 94	Regional Manager	Approved
Stream	RIC	ongoing			QA process
SIBEC	RIC	ongoing			Reviewed by A. Nussbaum
OAF	Draft MOF	ongoing			Reviewed by A. Nussbaum

10.2 Forest Cover Requirements

For the base case analysis, eight zones and three groups were established to deal with forest cover requirements . For details on forest cover requirements refer to Table 25. Specifics regarding how various management assumptions are addressed in the analysis are itemized below:

1. Years to minimum height requirement in management zones: Calculated using the area-weighted regeneration assumptions (Table 21) for each analysis unit as applied to TIPSY.

2. Regeneration delays: Applied directly in FSSIM.

3. Forested areas outside the T.H.L.B.: These areas are tracked as one analysis unit which incorporates all forest area in the productive forest landbase that was excluded from the T.H.L.B. The yield table for this analysis unit is set to zero. The area is defined by analysis unit # 21. Within the IRM zone, AU 21 will be removed and placed into its own zone to ensure the area does not impact adjacency, but does

contribute to biodiversity. Within VQO zones, AU 21 will contribute to forest cover constraints. Within the WTP Zone, AU 21 was excluded. See Appendix X for details.

4. Excluded forest area is modeled to contribute to old growth forest. That is to say, the excluded forest landbase, as it ages contributes more and more area to mature + old biodiversity. Catastrophic events or the mortality of these stands are not modeled.

Table 25: Zones and Groups

Zone/ Group	Name	Area (ha)			Criteria used to delineate zone/group	Forest Cover Requirements	
		Gross	Forest	T.H.L.B.			
Zone 1	IRM	73,966.2	63,395.3	63,395.3	No visually sensitive areas	Max 33% < 3.0 metres (15 years)	
Zone 2	VQO P	15.8	11.6	4.8	PVQO [8]	Max 1% < 5.4 metres[9] (21 years)	
Zone 3	VQO R	42.7	37.3	21.1	R VQO	Max 5% < 4.4 metres (19 years)	
Zone 4	VQO PR	1,996.3	1,889.8	1,600.4	PRVQO	Max 15% < 4.6 metres (19 years)	
Zone 5	VQO M	2,695.6	2,554.1	2,300.3	MVQO	Max 25% < 4.6 metres (19 years)	
Zone 6	VQO MM	15.4	14.7	14.7	MMVQO	Max 33% < 5.3 metres (21 years)	
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area [10]	Max 50% < 160 years	
Zone 8	IRM Excluded [11]	8,928.7	8,928.7	0.0	Excluded forest in the IRM zone	Not available for harvest	
Total All Zones		87,660.7	79,637.2	70,142.3			
Group 1	Balsam IU partition	2,728.3	1,819.5	1,819.5	Harvest 4,100 m3/year in Balsam IU stands	Not applicable	
Group 2	NDT1 ESSF wk1	8,606.1	8,406.6	7,803.5	Area-weight of seral stage requirements as per 45/45/10 directive.	Time 0 [12]	Min 14.2 % > 250 yrs
						Time 70	Min 17.0 % > 250 yrs
						Time 140	Min 19.9 % > 250 yrs
Group 3	NDT 2 SBS wk1	29,920.4	26,449.2	24,046.5		Time 0	Min 6.7 % > 250 yrs
						Time 70	Min 8.0 % > 250 yrs
						Time 140	Min 9.4 % > 250 yrs
Group 4	NDT3 SBS dw, mk1, mw	49,134.2	44,781.4	38,292.3		Time 0	Min 8.2 % > 140 yrs
						Time 70	Min 9.8 % > 140 yrs
						Time 140	Min 11.5 % > 140 yrs
Total Groups 2, 3, 4		87,660.7	79,637.2	70,142.3			

8 The % denudation value allowed by the VQO class reflects Dunkley's practice of iusing good visual landscape design in known scenic areas and the demonstrated preformance in non-clearcut harvesting in the Highway viewshed. It is consistent with the T.F.L. # 53 Visual Resource Mitigation Plan reviewed by the District Manager.

9 VEG heights are derived from slope analysis of the known scenic areas. The calculations are included in Appendix VI. These heights will be converted to a year equivalent using the area-weighted years to achieve VEG height by A.U.

10 Rationale for the method used to model Wildlife Tree Patches is provided in Appendix VIII. 4% of every stand in the T.H.L.B. is used to define this area. Therefore the area is not spatially identifiable and a gross area is not applicable.

11 Excluded forest within the IRM zone was removed from the forest cover in Zone 1 so that it would not impact the 33% "adjacency" constraint applied to Zone 1. It is included in its own zone (but is never harvested) so that the area could be incorporated in Groups 2, 3, and 4, which are used to model old-growth biodiversity.

12 Seral Stage Constraints are factored into the analysis over a 140 year period. Direction for this is provided by Timber Supply Branch. 33 percent of the target area in old growth must occur immediately (or no harvesting is allowed in the area within the group). Similarly, 66 percent of the old growth requirement must be met by age 70 through in-growth, and 100 percent must be met 140 years from present. See the calculations in Appendix III for more information.

10.2.1 Forest Cover Objectives – Rationale

10.2.1.1 Visual Quality Objectives

For the base case scenario, direction regarding the modeling of the visual landscape was provided by the District Manager. The base case includes the 1994 Visual Landscape Inventory. This is the same inventory used for Management Plan # 2. The scenic areas will be modeled using the maximum percent alteration for forest cover requirements, rather then the recommended method using the Visual Absorption Capacity ratings weighted by areas to refine percentages. The rationale for this, as agreed to by the District, is that with the implementation of the Forest Practices Code, all new harvesting proposed in visually sensitive areas has to be planned using the principles of visual landscape design. In addition, we have taken further actions that effectively address visual landscape management. These include:

- Block layout consistent with visual landscape design and biodiversity requirements which soften block appearance;
- The initial minimum target density on the T.F.L. is 1800 sph. This density exceeds that of the Regional well-stocked stand target of 1200 sph;
- Road and trail deactivation, grass seeding and an acute awareness of dispersed site disturbance have reduced site disturbance well below levels considered normal when VAC denudation percentages were calculated;
- Our site preparation methods now emphasize minimal disturbance of the duff in order to maintain a more natural look to the blocks. Broadcast burning has been eliminated and raw planting is common. This minimizes exposed rock and soil;
- A natural, mixed look to our plantations which avoids monocultures, and improves visual characteristics;
- The increased planting of pine where ecologically appropriate results in bushier trees at a younger age. We utilize this treatment in visually sensitive areas as part of our visual management strategy;

Over the past 5 years, Dunkley has demonstrated performance in partial cutting techniques, including commercial thinning and shelterwood

harvesting. Horse logging has also been utilized to manage for visual resources. These actions demonstrate our commitment to managing the visual resource. To reflect these practices, the high end of the range of denudation value in a VQO category will be used in the base case of the timber supply analysis, rather than the VAC area-weighting, in order to mitigate impacts on timber supply. Visually effective green-up (VEG) is based on the slope calculations presented in Appendix XI.

10.2.1.2 Recreation

The following recreation sites have been removed from the timber harvesting landbase:

Naver Creek	Stony Lake
Ahbau Lake	Teapot Lake
Genevieve Lake	

In addition, Hixon Falls is accounted for with a "Preservation" VQO for the visual landscape. The road to Hixon Falls is modeled as a corridor with a "Retention" VQO. Yardley Lake and Hay Lake have been included in the T.H.L.B. to reflect the permanent closure of these recreation sites.

10.2.1.3 Winter Range

There are no winter range concerns to be addressed.

10.2.1.4 Forest Ecosystem Networks

There are no forest ecosystem networks established for T.F.L. # 53.

10.2.1.5 Adjacent Cut blocks

Cut block adjacency is reflected through a maximum of 33% of the area less than 3 metres in height for the IRM Zone.

10.2.1.6 Landscape Level Biodiversity

Refer to Table 25 for details. Refer to Appendix III for calculations.

10.2.1.7 Wildlife Tree Patches

Refer to Table 25 and Appendix VIII for details and rationale.

10.2.1.8 Managing Identified Wildlife

Refer to the T.F.L. specific biodiversity plan (Scenario 1.3).

10.2.1.9 Higher Level Plans

There are no higher level plans established for T.F.L. # 53. The Prince George LRMP is in a draft stage and going through the approval process. At this time there are no modeling implications from the LRMP.

10.3 Timber Harvesting

Harvest methods are generally feller buncher/grapple skidder on the majority of the timber types scheduled for harvesting during the term of MP#3. Hand felling/line skidding occurs on a site specific basis as required.

As sensitive sites (e.g., for stream protection or steep slopes) are identified, logging methods are selected to best suit the site. Logging methods will continue to be prescribed on a site specific basis and carried out so as to minimize soil disturbance, soil compaction and other environmental concerns.

Dunkley will continue to use and develop innovative harvesting systems to address site specific concerns. Consistent with the highly productive sites on the T.F.L., minimum

volume requirements are not a factor in determining logging systems, but rather the harvesting system is chosen that best meet the site specific objectives. Examples of site specific harvest methods are:

- helicopter logging of windthrow in the Ahbau Lake viewshed to meet VQOs,
- helicopter logging of windthrow throughout the T.F.L. to minimize site disturbance and damage to existing plantations,
- cable yarding throughout the T.F.L. to minimize soil disturbance on steep ground and,
- horse logging in the highway viewshed to meet VQOs through understory retention.

10.3.1 Minimum Harvest Age Derivation

Minimum harvestable ages are simply minimum criteria. While harvesting may occur in stands at the minimum harvest age in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large inter-decadal changes in harvest levels), most stands will not be harvested until well past the minimum timber production ages because of other resource values taking precedence.

On T.F.L. #53 the minimum harvest age is set at regional priority cutting age for existing unmanaged stands and culmination age for all managed stands. This is consistent with the management strategies designed to maximize fibre production on the second growth stands. Full site occupancy, maximizing mai and culmination age harvesting will help to achieve our forest management, economic opportunity and employment objectives. Operationally, the cutting priority on T.F.L. #53 focuses on removing the oldest eligible stands, after meeting the needs of integrated resource management. On a more stand specific basis, cutting priority is highest on blowdown, insect attacked or fire damaged stands. To date, Forest Development Plans have placed priorities on harvesting stands affected by blowdown or pest damage, and stands with a high risk of blowdown or declining rates of growth. Table 26 shows the minimum cutting age by analysis unit.

Table 26: Minimum Merchantability Standards

Current AU/ species		Minimum Cutting Age [6]		Culmination					
		Age (years)	Volume (m3/ha)	Unmanaged Stands [1]		Existing Managed Stands [2]		Future Managed Stands	
				Age	Volume [3]	Age	Volume [4]	Age	Volume [5]
1	Fir	111	354	95	307	110	441	110	411
2	Bl-g	121	327	95	263	n/a	n/a	90	446
3	Bl-m	121	248	125	257	n/a	n/a	90	428
4	Bl-p	121	167	145	206	n/a	n/a	90	432
5	Bl-IU	121	224	125	232	n/a	n/a	90	494
6	Sw-g	101	321	95	303	80	404	80	473
7	Sw-m	101	238	115	276	90	424	80	455
8	Sw-p	101	161	145	258	90	399	80	421
9	SwPl-g	101	406	95	383	80	374	80	428
10	SwPl-m	101	278	125	353	80	375	80	415
11	SwPl-p	101	169	145	284	70	370	80	409
12	SwDec-g	101	312	105	324	80	379	80	410
13	SwDec-m/p	101	202	125	263	80	370	80	406
14	Pl-g	81	346	65	283	70	344	70	362
15	Pl-m/p	81	230	95	271	70	367	70	340
16	PlSw-g	81	296	75	277	70	347	70	365
17	PlSw-m/p	81	158	95	190	70	341	70	350
18	PlDec-g	81	249	75	231	70	324	70	388
19	PlDec-m/p	81	134	105	182	80	351	70	339
20	AtCon	161	140	95	217	n/a	n/a	80	311

(1) Culmination age and volume for unmanaged stands is not used in the base case. The Regional Priority Cutting Age is used in place of culmination age for the base case. Culmination age for unmanaged stands will be used in sensitivity analysis # 5.5.

(2) Existing managed stands from standard seedlings and seed-stock. Site index based on BEC data and generated through WinTIPSY 2.1d based on inputs in Table 21.

(3) Close utilization (C.U.) 12.5+ cm on pine, all other species 17.5+cm dbh, 30.0 cm stump, 10.0 cm top (dib), 50% firmwood.

(4) C.U. 12.5+ cm dbh all species

(5) Volume shown includes the predicted genetic gain in volume from superior spruce seedlots.

(6) Minimum cutting age applies to all unmanaged stands. The cutting ages show are the regional priority cutting age set by the Prince George Regional Office. Analysis unit 20 is the exception. These stands will be harvested after seral succession has occurred. See Appendix XIII for more information.

10.3.2 Operability

The majority of harvesting on the T.F.L. takes place with conventional, ground-based equipment. This reflects the generally favorable operating conditions in the area. Non- conventional methods such as overhead cable systems and helicopter logging are used as required, to harvest steeper ground or to meet terrain stability requirements. Horse logging is being utilized on a small scale to demonstrate the ability to carry out partial cuts, commercial thinning and to meet visual quality objectives through shelterwood cutting.

Utilizing any and all of these systems where applicable has resulted in there being no physically inoperable areas within the T.F.L.

Ecological operability has been addressed through reductions to the productive forest landbase via environmentally sensitive areas. A list of these areas is provided in Table 8.

Economic operability has been estimated using a combination of the age/height/stocking attributes of a forest stand, and an indication of site quality. Although these areas are excluded at this time from the timber harvesting landbase, this does not preclude Dunkley's harvesting within them some time in the future. Estimates of future market conditions are typically difficult to predict.

10.3.3 Initial Harvest Rate

Two harvest flow patterns are being considered. The first of these will mimic the harvest flow pattern of MP #2, which was a flat line harvest flow stepping up to managed stand harvest levels. The second pattern will show the maximum 20-year harvest attainable, before declining to an intermediate level and then stepping up to managed stand harvest levels. The second pattern will better meet our economic and employment objectives and result in a faster transition to the managed stand yields.

If the flat-line harvest level is less than the current AAC, an attempt will be made to maintain the current AAC for as long as possible in the base case and then

decline at a reasonable rate (<10% per decade) to the long-term harvest level. The long-term harvest level is the highest level that can be attained for the long-term with a stable (flat line) total inventory.

10.3.4 Harvest Rules

In general terms, harvesting priorities take into account forest profile considerations, forest health conditions, hydrologic considerations, wildlife and environmental issues. However, the principal emphasis will be placed on maximizing growth potential from the productive forest landbase.

After 40 years of harvesting, the cutting priority on T.F.L. #53 focuses on removing the oldest eligible stands, after meeting the needs of integrated resource management.

On a more stand specific basis, cutting priority is highest on blowdown, insect attacked or fire damaged stands. To-date, Forest Development Plans have placed priorities on harvesting stands affected by blowdown or pest damage, and stands with a high risk of blowdown or declining rates of growth. Consequently, Forest Development Plans may have variations which may not always reflect the complete profile of the existing mature inventory. The oldest first harvest rule is an appropriate modeling input for the harvest profile.

The harvest rule followed while running the FSSIM model will be "oldest first" for the base case and all sensitivity analysis.

10.3.5 Harvest Profile

Only one profile rule will be modeled in this analysis. The amount of Balsam IU stands logged will be set at 4,100 m3/year.

10.3.6 Silviculture Systems

Clearcutting is the system of choice on the T.F.L. The impact of other silviculture systems will be assessed in sensitivity analysis.

On the bench lands, in the western portion of the T.F.L., immature lodgepole pine stands predominate. In these stands, clearcutting will commonly be the prescribed harvesting system when these stands reach cutting age.

Mixed stands of lodgepole pine and Douglas-fir also occur at lower elevations in the western portion of the T.F.L.. In these stands, selective cutting may be prescribed. Significant levels of harvesting in these stands is not expected over the next decade.

Partial cuts have been carried out in riparian management areas during the term of MP #2. For the most part, these cuts have not been successful in meeting the objective of retaining windfirm trees. Partial cutting is not currently being prescribed to any significant extent.

Commercial thinning has been demonstrated in CP 95 on the T.F.L., as has a shelterwood overstory removal in CP 77. In the base case it is appropriate to model only clearcut silviculture systems, as this is the vast majority of the T.F.L. harvesting. This also reduces the uncertainty involved with modeling the growth and yield of partial cutting / commercial thinning in the base case.

10.3.7 Harvest Flow Objectives

Guidance in developing harvest flow objectives is taken from the current economic and social objectives of the Crown expressed by the Minister of Forests in a letter to the Chief Forester in 1994. He emphasized the importance of the continued availability of good forest jobs and to the long-term stability of communities that rely on forests. He stated that any decreases in allowable cut at this time should be no larger than necessary to avoid compromising long-run sustained yield. In this analysis, a harvest flow showing the maiximum non declining yield will be determined. The short term harvest level will then be increase just enough to indicate the time at which timber availability is of greatest constraint. Harvest flows which assess sensitivity options will maintain the base case harvest flow as long as possible before declining at a maximum rate of 10% per decade. If an initial increase is possible, a non-declining harvest flow will be shown

11.0 OPTION ASSUMPTIONS

The options and sensitivity analysis which will be assessed in the Timber Supply Analysis Report are summarized in Table 27. A brief description of how each scenario will be modeled follows, along with the changes to pertinent tables.

Table 27: Summary of Scenarios

Scenario #	Description
1	Base Case
1.1	Impact of excluding Lakeshore guidelines and not modeling WTPs
1.2	Only low Biodiversity emphasis is applied to the 3 NDT groups
1.3	T.F.L. specific biodiversity plan
1.4	Reduce the old seral age definition for NDT 1 and 2
2.1	Use the revised Highway VQC line work
2.2	As per 2.1 but include the Ahbau Lake VQC line work
2.3	As per 2.2 but include recreation site line work (ignore the VQCs in the Rec Sites)
2.4	As per 2.3 but apply the VQCs to the Rec Sites
2.5	Model partial cutting in Hwy VQCs as per scenario # (to be determined)
2.6	Reduce VEG height in scenario #(to be determined)
3.1	Not modeled
3.2	Not modeled
3.3	Convert the deciduous stands (au20) to coniferous stands by harvesting the deciduous
4.1	Model commercial thinning
4.2	Model fertilization through an increase in the managed stand VACs
4.3	Model an expanded road deactivation program through a reduction in losses to future roads
4.4	Model a reduced green-up height due to increased stocking
4.5	Reduce O.A.F.s by 1/3 for Spruce and 1/2 for Pine
5.1	Increase landbase 5%
5.2	Decrease landbase 5%
5.3	Increase empirical stand VACs 10%
5.4	Decrease empirical stand VACs 10%
5.5	Use culmination age as the minimum harvest age for unmanaged stands
5.6	Use the mid-range VAC instead of the high for each VQC
5.7	Increase all age group 1 constraints by 10%
5.8	Decrease all age group 1 constraints by 10%
5.9	Model for mature + old seral targets and just show the results
5.10	Model full old seral targets at time 0 and just show results
5.11	Increase managed stand yields by 10%
5.12	Decrease managed stand yields by 10%

11.1 Scenario 1.1

In this scenario the net landbase increases when the P.G. Forest District guidelines for additional reserves around lakeshores are not preformed. Reserves are applied as per the FPC only. As well, the WTP zone is not created. The 4% area which went into the WTP zone remains in its original zones. Table 28 shows the change in the net operable landbase. All other management assumptions are modeled as per the base case.

Table 28: Timber Harvesting Landbase for Scenario 1.1

Classification	Area (ha)	Percent of Productive Forest
Total Area (incl. Water)	87,660.7	
Less: Non -forest	4,881.0	
Potentially Productive Area	82,779.7	100.00%
Reductions to T.F.L. Forest Area:		
Non-productive	1,462.0	1.77%
Non-commercial cover	330.3	0.40%
Environmentally Sensitive Areas	1,366.3	1.65%
Recreation Sites	160.2	0.19%
Legislated Lakeshore Reserves	70.5	0.09%
Legislated Wetland Reserves	322.2	0.39%
Stream Riparian Reserves	1,856.8	2.24%
Wetland Management Zones	229.3	0.28%
Stream Riparian Management Zones	1,362.6	1.65%
District Policy Lake Mgmt Area	0.0	0.00%
Low Sites (based on site index)	542.0	0.65%
Problem Forest Types (merchantability)	3,428.7	4.14%
Existing roads, trails and landings	1,288.5	1.56%
Plantations with incorrect Site Index	736.0	0.89%
N.S.R.	1,452.2	1.75%
Total Reductions to Productive Forest	14,607.6	17.65%
Net Landbase	68,171.5	82.35%
Merchantable Forest Types	66,351.8	80.15%
Balsam I. U. Stands	1,819.7	2.20%
N.S.R.	1,452.2	1.75%
Plantations with incorrect SI	736.0	0.89%
Initial Timber Harvesting Landbase	70,359.7	85.00%
Losses to Future Roads	766.9	0.93%
Future Timber Harvesting Landbase	69,592.8	84.07%

Table 29: Zones and Groups for Scenario 1.1

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements	
Zone 1	IRM	74,224.2	66,296.4	66,241.9	No visually sensitive areas	Max 33% < 3.0 metres (15 years)	
Zone 2	VQO P	15.8	11.9	5.1	PVQO	Max 1% < 5.4 metres (22 years)	
Zone 3	VQO R	42.7	38.2	22.0	R VQO	Max 5% < 4.4 metres (19 years)	
Zone 4	VQO PR	1,996.3	1,956.0	1,680.0	PRVQO	Max 15% < 4.6 metres (19 years)	
Zone 5	VQO M	2,695.6	2,648.7	2,395.4	MVQO	Max 25% < 4.6 metres (19 years)	
Zone 6	VQO MM	15.4	15.3	15.3	MMVQO	Max 33% < 5.3 metres (22 years)	
Zone 7	IRM Excluded	8,670.7	8,670.7	0.0	Excluded forest in the IRM zone	Not available for harvest	
Total All Zones		87,660.7	79,637.2	70,359.7			
Group 1	Balsam IU partition	2,728.3	1,819.5	1,819.5	To reflect current harvest 4,100 m3/year partition in Balsam IU stands	Not applicable	
Group 2	NDT1 ESSF wk1	8,606.1	8,406.6	7,804.0	Area-weight of seral stage requirements as per 45/45/10 directive.	Time 0	Min 14.2 % > 250 yrs
						Time 70	Min 17.0 % > 250 yrs
						Time 140	Min 19.9 % > 250 yrs
Group 3	NDT 2 SBS wk1	29,920.4	26,449.2	24,176.3	Area-weight of seral stage requirements as per 45/45/10 directive.	Time 0	Min 6.7 % > 250 yrs
						Time 70	Min 8.0 % > 250 yrs
						Time 140	Min 9.4 % > 250 yrs
Group 4	NDT3 SBS dw, mk1, mw	49,134.2	44,781.4	38,379.4	Area-weight of seral stage requirements as per 45/45/10 directive.	Time 0	Min 8.2 % > 140 yrs
						Time 70	Min 9.8 % > 140 yrs
						Time 140	Min 11.5 % > 140 yrs
Total Groups 2,3,4		87,660.7	79,637.2	70,359.7			

11.2 Scenario 1.2

Scenario 1.2 is modeled such that low biodiversity emphasis is applied to the three NDT groups. The calculations differ from the base case which used 45% low, 45% intermediate and 10% high biodiversity emphasis to determine the percent area required in old growth. The time delay to reach 100% of the target area in old growth is the same as for the base case. Thirty-three percent of the target area in old growth must occur immediately (or no harvesting is allowed in the area within the group). Similarly, sixty-six percent of the old growth requirement must be met by age 70 through in-

growth, and one hundred percent must be met 140 years from present. The calculations are as follows:

NDT 1	Low emphasis = 19%
Time 0	19% x 0.33 = 6.3%
Time 70	19% x 0.66 = 12.5%
Time 140	19% x 1.00 = 19.0%

NDT 2	Low Emphasis = 9 %
Time 0	9% x 0.33 = 3.0%
Time 70	9% x 0.66 = 5.9%
Time 140	9% x 1.00 = 9.0%

NDT 3	Low Emphasis = 11%
Time 0	11% x 0.33 = 3.6 %
Time 70	11% x 0.66 = 7.3 %
Time 140	11% x 1.00 = 11.0 %

Forest cover requirements in Table 25 are changed to reflect the following as shown in Table 30.

Table 30: Scenario 1.2 Groups

Group	Name	Gross Area (ha)	Forest Cover (ha)	Net Area (ha)	Criteria used to delineate zone/group	Forest Cover Requirements	
Group 2	Landscape level biodiversity NDT1	8,606.1	8,406.6	7,803.5	Low biodiversity emphasis only	Time 0	Min 6.3 % > 250 yrs
						Time 70	Min 12.5 % > 250 yrs
						Time 140	Min 19.0 % > 250 yrs
Group 3	Landscape level biodiversity NDT 2	29,920.4	26,449.2	23,332.9	Low biodiversity emphasis only	Time 0	Min 3.0 % > 250 yrs
						Time 70	Min 5.9 % > 250 yrs
						Time 140	Min 9.0 % > 250 yrs
Group 4	Landscape level biodiversity NDT3	49,134.2	44,781.4	39,005.9	Low biodiversity emphasis only	Time 0	Min 3.6 % > 140 yrs
						Time 70	Min 7.3 % > 140 yrs
						Time 140	Min 11.0 % > 140 yrs
Total		87,660.7	79,637.2	70,142.3			

11.3 Scenario 1.3

The T.F.L #53 specific biodiversity plan has not been completed as of the submission of this IP. It was not included in the timber supply analysis.

11.4 Scenario 1.4

The old definition for NDT 1 and 2 will be changed to reflect local T.F.L. conditions. The Biodiversity Guidebook defines old seral conditions as stands greater than 250 years old. The age class summary for the T.F.L. shows that almost no stands are greater than 250 years old.

The terrestrial ecosystem mapping project on the T.F.L. shows that old growth characteristics (structural stage 7) are found in many of the stands greater then 180 years old. This age may be more appropriate to model old seral conditions on the T.F.L., which is transitional between NDT's 1, 2 and 3. For this run, the seral stage constraints in Groups 2 and 3 will be changed to >180 years old. The forest cover % requirement will remain as per the base case. Table 31 reflects this change.

Table 31: Scenario 1.4 Groups

Group	Name	Gross Area (ha)	Forest Cover (ha)	Net Area (ha)	Criteria used to delineate zone/group	Forest Cover Requirements	
Group 2	Landscape level biodiversity NDT1	8,606.1	8,406.6	7,803.5	Area-weight of seral stage requirements as per 45/45/10 directive	Time 0	Min 14.2 % > 180 yrs
						Time 70	Min 17.0 % > 180 yrs
						Time 140	Min 19.9 % > 180 yrs
Group 3	Landscape level biodiversity NDT 2	29,920.4	26,449.2	23,332.9	Area-weight of seral stage requirements as per 45/45/10 directive	Time 0	Min 6.7 % > 180 yrs
						Time 70	Min 8.0 % > 180 yrs
						Time 140	Min 9.4 % > 180 yrs
Group 4	Landscape level biodiversity NDT3	49,134.2	44,781.4	39,005.9	Area-weight of seral stage requirements as per 45/45/10 directive	Time 0	Min 8.2 % > 140 yrs
						Time 70	Min 9.8 % > 140 yrs
						Time 140	Min 11.5 % > 140 yrs
Total		87,660.7	79,637.2	70,142.3			

11.5 Scenario 2.1

In this scenario, the new visual areas for the highway corridor will be incorporated into the analysis. As a result, the area in VQCs change and the VEG height also changes to reflect different slope/polygon configurations. Table 32 reflects the changes to these zones.

Table 32: Zones applied to Scenario 2.1

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	75,369.7	64,613.6	64,613.6	No visually sensitive areas	Max 33% < 3.0 metres (15 years)
Zone 2	VQC P	15.8	11.6	4.8	PVQC	Max 1% < 5.4 metres (22 years)
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Max 5% < 4.4 metres (19 years)
Zone 4	VQC PR	1,271.0	1,208.3	1,022.9	PRVQC	Max 15% < 4.4 metres (19 years)
Zone 5	VQC M	1,861.1	1,774.1	1,574.7	MVQC	Max 25% < 5.0 metres (21 years)
Zone 6	VQC MM	15.4	101.6	99.5	MMVQC	Max 33% < 4.8 metres (20 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	9,085.0	9,085.0	0.0	Excluded forest in the IRM zone	Not available for harvest
Total		87,660.7	79,637.2	70,142.3		

11.6 Scenario 2.2

In this scenario the new visual areas for the highway corridor and Ahbau Lake will be incorporated into the analysis. As a result, the area in VQC zones change and the VEG height also changes to reflect different slope/polygon configurations. Table 33 reflects the changes to these zones.

Table 33: Zones applied to Scenario 2.2

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	73,805.3	63,231.2	63,230.7	No visually sensitive areas	Max 33% < 3.0 metres (15 years)
Zone 2	VQC P	15.8	11.6	4.8	PVQC	Max 1% < 5.4 metres (22 years)
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Max 5% < 4.4 metres (19 years)
Zone 4	VQC PR	2,096.5	1,979.7	1,700.4	PRVQC	Max 15% < 4.6 metres (20 years)
Zone 5	VQC M	2,179.9	2,081.4	1,783.1	MVQC	Max 25% < 4.9 metres (21 years)
Zone 6	VQC MM	634.8	604.6	596.5	MMVQC	Max 33% < 4.4 metres (19 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	8,885.7	8,885.7	0.0	Excluded forest in the IRM zone	Not available for harvest
Total		87,660.7	79,637.2	70,142.3		

11.7 Scenario 2.3

This scenario builds on Scenario 2.2 but with the inclusion of recreation site visual areas into the analysis. The visual quality classes will not be applied to the recreation sites, only the VEG height. As a result, the area in VQCs do not change from scenario 2.2, but a new zone is created representing the area in recreation sites. The VEG height requirement within recreation sites reflects the different slope/polygon configurations. Table 34 reflects the changes to these zones.

Table 34: Zones applied to Scenario 2.3

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	73,252.1	62,738.8	62,738.8	No visually sensitive areas	Max 33% < 3.0 metres (15 years)
Zone 2	VQC P	15.8	11.6	4.8	PVQC	Max 1% < 5.4 metres (22 years)
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Max 5% < 4.4 metres (19 years)
Zone 4	VQC PR	2,096.5	1,979.9	1,700.4	PRVQC	Max 15% < 4.6 metres (20 years)
Zone 5	VQC M	2,179.9	2,082.2	1,783.1	MVQC	Max 25% < 4.9 metres (21 years)
Zone 6	VQC MM	634.8	604.6	596.5	MMVQC	Max 33% < 4.4 metres (19 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	8,766.1	8,766.1	0.0	Excluded forest in the IRM zone	Not available for harvest
Zone 9	Recreation	672.8	609.4	491.9		Max 33% < 4.4 metres (19 years)
Total		87,660.7	79,635.6	70,142.3		

11.8 Scenario 2.4

This scenario builds on Scenario 2.3, but with the inclusion of the VQCs attributable to the recreation sites. As a result, the area in VQCs change from scenario 2.2. The areas in Modification and Maximum Modification increase and the recreation zone is merged with these two VQC zones. The VEG height requirement within recreation sites reflects the different slope/polygon configurations. Table 35 reflects the changes to these zones.

Table 35: Zones applied to Scenario 2.4

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	73,252.1	62,739.1	62,739.1	No visually sensitive areas	Max 33% < 3.0 metres (15 years)
Zone 2	VQC P	15.8	11.9	4.8	PVQC	Max 1% < 5.4 metres (22 years)
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Max 5% < 4.4 metres (19 years)
Zone 4	VQC PR	2,096.5	1,979.6	1,700.4	PRVQC	Max 15% < 4.6 metres (20 years)
Zone 5	VQC M	2,319.8	2,216.6	1,866.9	MVQC	Max 25% < 4.8 metres (20 years)
Zone 6	VQC MM	1,167.6	1,080.9	1,004.3	MMVQC	Max 33% < 4.4 metres (19 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	8,766.1	8,766.1	0.0	Excluded forest in the IRM zone	Not available for harvest
Total		87,660.6	79,637.2	70,142.3		

11.9 Scenario 2.5

This scenario will work off of scenario 2.2. The long term impact of partial cutting will be modeled by applying a partial cutting silviculture system to retention VQCs and partial retention VQCs in both the highway corridor and Ahbau Lake . Harvesting in the remaining visual areas will proceed with the same assumptions for VEG and maximum denudation. Partial cutting within partial retention VQCs will be modeled such that 30% of the original volume of the partial cut stands are removed at first entry. Subsequent re-entries extract a fixed volume per hectare. The volume extracted will be calculated as the average TIPSY MAI (averaged between age 40 years and culmination age) multiplied by a thirty-year re-entry period . In modeling partial cutting, two points are implicit in the assumptions. These are: 1) partial cutting can occur across an entire visual landscape polygon, regardless of size; and 2) partial cutting will occur in these stands every thirty years. Table 36 reflects the changes to these zones.

Table 36: Zones applied to Scenario 2.5

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	73,805.3	63,231.2	63,230.7	No visually sensitive areas	Max 33% < 3.0 metres (16 years)
Zone 2	VQC P	15.8	11.6	4.8	PVQC	Partial cutting Therefore no forest cover requirement
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Partial cutting Therefore no forest cover requirement
Zone 4	VQC PR	2,096.5	1,979.7	1,700.4	PRVQC	Partial cutting Therefore no forest cover requirement
Zone 5	VQC M	2,179.9	2,081.4	1,783.1	MVQC	Max 25% < 4.9 metres (21 years)
Zone 6	VQC MM	634.8	604.6	596.5	MMVQC	Max 33% < 4.4 metres (19 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	8,885.7	8,885.7	0.0	Excluded forest in the IRM zone	Not available for harvest
Total		87,660.7	79,637.2	70,142.3		

The future volumes obtained from partial cut stands was calculated based on the TIPSY MAI averaged between 40 years and culmination age. The volumes, by analysis unit are provided in Table 37.

Table 37. Scenario 2.5 Volume removed from partial cut stands upon re-entry

Analysis Unit #	Volume	Analysis Unit #	Volume	Analysis Unit #	Volume	Analysis Unit #	Volume
1	93	11	58	21	112	31	126
2	83	12	92	22	127	32	149
3	61	13	63	23	113	33	131
4	43	14	130	24	110	34	127
5	55	15	85	25	121	35	145
6	95	16	111	26	126	36	156
7	72	17	60	27	149	37	146
8	53	18	92	28	131	38	144
9	121	19	52	29	127	39	135
10	85	20	68	30	145	40	125

Modeling will occur via the following steps:

5. The partial cut zone will be defined with no distinction between current VQCs.
6. The existing unmanaged and existing managed stand yield curves representing the analysis units in the partial cut zone will be reduced by 30% of their original volume.
7. The analysis units in the partial cut zone will convert to a new VAC which is 'flat-lined' at a fixed volume/hectare.
8. A high priority will be placed on harvesting the stands in the partial cut zone.

11.10 Scenario 2.6

This scenario will build off scenario 2.2. A reduced VEG height will be modeled to reflect greater planting densities which should result in a reduced time delay to remove adjacency constraints. A 22% reduction in VEG height will be modeled. The rationale for the

reduction is as follows (note: further detail is available from Industrial Forestry Service Ltd):

1. The average slope in VQOs on T.F.L. #53 is 18%.
2. The MOF's standard 1200 sph spacing results in trees being located approximately 2.8m from one another.
3. For this rationale we will assume that most VQOs are viewed from a flat (0%) slope.
4. On an 18% slope, trees planted at a 2.8 m spacing require a VEG height of 4.5 metres. This equates to a "screening density" of 6 stems when the line of site is 0%. See figure below.
5. If planting density was increased to 1800 sph, the spacing of trees would be 2.35 m. A VEG height of 4.5 m on an 18% slope would result in a screening density of 8 stems (2 stems more then required to meet visual quality objectives). VEG height can be reduced to 3.5 m and still maintain a screening density of 6 stems. This is a 22% reduction in VEG height.

Changes to the VEG height in VQC zones are shown in Table 38.

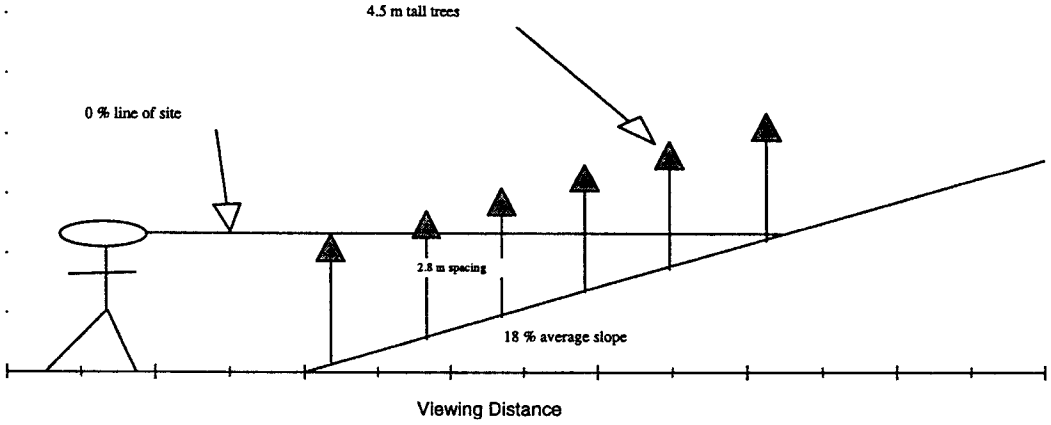

Table 38: VEG heights applied to Scenario 2.6

Zone/ Group	Name	Gross Area (ha)	Forest Cover (ha)	T.H.L.B. (ha)	Criteria used to delineate zone/group	Forest Cover Requirements
Zone 1	IRM	73,805.3	63,231.2	63,230.7	No visually sensitive areas	Max 33% < 3.0 metres (15 years)
Zone 2	VQC P	15.8	11.6	4.8	PVQC	Max 1% < 4.2 metres (19 years)
Zone 3	VQC R	42.7	37.3	21.1	R VQC	Max 5% < 3.4 metres (17 years)
Zone 4	VQC PR	2,096.5	1,979.7	1,700.4	PRVQC	Max 15% < 3.6 metres (17 years)
Zone 5	VQC M	2,179.9	2,081.4	1,783.1	MVQC	Max 25% < 3.9 metres (18 years)
Zone 6	VQC MM	634.8	604.6	596.5	MMVQC	Max 33% < 3.4 metres (17 years)
Zone 7	WTP	n/a	2,805.7	2,805.7	4 % of net area	Max 50% < 160 years
Zone 8	IRM Excluded	8,885.7	8,885.7	0.0	Excluded forest in the IRM zone	Not available for harvest
Total		87,660.7	79,637.2	70,142.3		

11.11 Scenario 3.3

This scenario will assess the impact of harvesting analysis unit 20 before it converts to coniferous through seral succession. A minimum harvest age of 61 years is applied to these stands. The 50% OAF which was applied to these stands in the base case analysis is removed. After harvesting, the stand will convert to pine 60% and spruce 40%.

11.12 Scenario 4.1

This scenario will assess the impact of a commercial thinning program on timber supply. All good site lodgepole pine stands (i.e., AU 14) aged 40 to 80 years will be targeted within the IRM zone. The method used to model commercial thinning will be on a volume basis. Analysis units will be available for harvest after they reach a minimum cutting age of 40 years. The yield curves for these stands will be reduced by the percentage removed (i.e., 30% volume removal). After harvesting, the analysis unit will keep the same age and convert to a new analysis unit. After a 40 year delay, 100 percent of the volume attributed to the original analysis unit is available for harvest.

11.13 Scenario 4.2

This scenario assesses the impact of fertilization on plantation yield. The scenario will build on the base case. The site index for spruce and pine analysis units in existing managed stands is increased by 5%. Only stands which are currently 15 to 25 years of age are targeted for fertilization

11.14 Scenario 4.3

This scenario will assess the impact of an expanded road deactivation program. Reductions for roads, trails and landings will be reduced by 25% (i.e., 0.82 percent of the area in stands > 31 years will be converted to road after harvesting)

11.15 Scenario 4.4

This scenario will assess the impact of reducing the greenup height in all zones due to increase stocking in plantations. This scenario will build on scenario 2.6 which reduced the VEG height in VQCs and will be expanded to include the IRM zone. Greenup within the IRM zone will be modeled at 2.5 metres rather than 3.0 metres,

11.16 Scenario 4.5

This scenario will assess the impact of reducing the OAF 1 for spruce leading stands by 1/3 and for pine leading stands by 1/2. The adjustment will be made in TIPSY and the curves adjusted in the FSSIM model.

11.17 Scenarios 5.1 - 5.10

Scenarios 5.1 through to 5.10 are standard MOF sensitivity runs. Details regarding modeling assumptions can be acquired from Industrial Forestry Service Ltd.

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Appendix I

Natural Stand Yield Tables

Existing Species Distribution by Analysis Unit

The following table describes the species component of existing unmanaged stand analysis units based on the area-weighted inventory label in the Forest Inventory and Planning (FIP) file for T.F.L. # 53.

Analysis Unit / Species		Existing Percent Species Component in Unmanaged (Natural) Stands							
		Spruce	Pine	Balsam	Douglas fir	At	Ep	Ac	Total %
1	Fir	17	19	1	56	7			100
2	Bl-g	31	1	68					100
3	Bl-m	21	1	78					100
4	Bl-p	28	2	69			1		100
5	Bl-IU	21	3	74			2		100
6	Sw-g	67	3	6	2			22	100
7	Sw-m	73	3	9		15			100
8	Sw-p	76	1	23					100
9	SwPl-g	60	29		5	5	1		100
10	SwPl-m	69	25	2	1	3			100
11	SwPl-p	62	27	6		5			100
12	SwDec-g	68	6			21	3	2	100
13	SwDec-m/p	47	6	19		19	4	5	100
14	Pl-g	2	97		1				100
15	Pl-m/p	4	95			1			100
16	PlSw-g	27	67		4	2			100
17	PlSw-m/p	19	60	18		3			100
18	PlDec-g	5	64	3	3	19	6		100
19	PlDec-m/p	7	60			22	6	5	100
20	AtCon	22	16			59	2	1	100
21	Excluded	39	17	32	1	8	2	1	100

Natural Stand Yield Tables for TFL 53

AU #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
species	D-fir	Balsam	Balsam	Balsam	Balsam	Spruce	Spruce	Spruce	Spruce Pine	Spruce Pine	Spruce Pine	Spruce Deciduous	Spruce Deciduous	Pine	Pine	Pine Spruce	Pine Spruce	Pine Deciduous	Pine Deciduous	Aspen Coniferous
site	gmp	good	medium	poor	IU	good	medium	poor	good	medium	poor	good	med/poor	good	med/poor	good	med/poor	good	med/poor	gmp
Age Range																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1	1	0	0	0	0	0	0	0	0	0	0	0	17	2	9	1	5	0	0
30	20	17	5	1	3	3	1	0	7	0	0	3	0	72	24	52	8	34	4	2
40	65	57	25	6	17	30	7	1	51	10	0	25	2	145	70	116	33	85	21	13
50	115	103	57	21	42	88	35	9	126	44	5	74	16	207	117	172	68	134	51	32
60	164	146	93	43	74	149	82	31	196	96	26	133	49	259	159	219	101	177	81	52
70	209	185	126	68	95	202	128	63	259	148	61	186	91	304	195	259	130	214	108	71
80	251	218	154	91	100	247	169	97	313	195	97	233	131	343	227	293	156	246	132	87
90	289	249	180	112	100	285	205	130	361	237	133	274	167	379	257	323	179	275	153	102
100	323	276	204	131	100	318	236	159	403	275	166	309	199	412	285	351	200	300	173	114
110	352	301	226	149	100	346	263	185	439	308	197	337	227	443	311	376	219	323	190	124
120	377	325	247	166	100	369	287	208	470	339	225	362	252	471	335	398	237	344	206	131
130	400	347	267	182	100	390	308	229	495	365	251	382	273	496	356	418	252	360	219	137
140	421	369	286	198	100	407	327	249	516	387	274	399	291	514	372	433	264	373	229	141
150	438	389	304	213	100	422	343	266	532	405	293	413	306	526	383	444	273	382	236	145
160	453	408	322	227	100	435	358	282	545	420	310	424	317	535	391	451	280	387	241	148
170	466	426	338	241	100	447	370	296	556	433	325	433	327	539	395	456	285	390	244	149
180	477	442	354	254	100	457	381	309	564	443	337	440	335	539	396	458	288	391	246	150
190	487	458	369	266	100	465	391	321	570	452	348	446	342	537	396	459	290	391	246	151
200	497	473	383	278	100	473	400	331	576	460	358	452	349	537	396	461	292	391	247	152
210	507	487	396	290	100	479	408	341	582	468	368	458	355	540	399	463	295	393	249	153
220	516	501	409	301	100	485	415	350	588	474	377	462	360	542	402	466	297	395	250	154
230	524	514	421	312	100	491	422	358	593	480	385	466	365	545	404	469	300	396	252	155
240	532	526	433	322	100	496	428	365	597	486	392	470	369	548	407	472	302	398	254	155
250	538	536	442	330	100	500	433	372	601	491	399	474	373	550	409	474	305	400	255	156
260	540	540	446	334	100	503	437	377	604	495	405	476	377	553	411	476	307	402	256	156
270	540	541	447	335	100	505	440	381	607	499	410	478	380	555	413	478	308	403	258	157
280	540	543	449	337	100	507	443	385	609	503	414	480	382	558	415	480	310	405	259	157
290	539	544	450	338	100	509	446	388	612	506	418	482	384	560	417	482	312	406	260	157
300	539	545	451	339	100	510	447	390	614	508	420	484	386	561	418	483	313	407	261	157

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Appendix II

Managed Stand Yield Tables

Future Managed Stand Yield Tables for TFL 53

AU #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
species	D-fir	Balsam	Balsam	Balsam	Balsam	Spruce	Spruce	Spruce	Spruce Pine	Spruce Pine	Spruce Pine	Spruce Deciduous	Spruce Deciduous	Pine	Pine	Pine Spruce	Pine Spruce	Pine Deciduous	Pine Deciduous	Aspen Coniferous
site	gmp	good	medium	poor	IU	good	medium	poor	good	medium	poor	good	med/poor	good	med/poor	good	med/poor	good	med/poor	gmp
Age Range																				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	1	1	1	1	2	2	5	4	5	4	6	3	0
30	15	6	11	9	2	8	5	18	19	29	28	36	35	69	57	70	61	77	53	29
40	68	50	61	56	60	85	73	87	91	105	101	116	113	155	141	157	148	168	135	88
50	120	137	143	140	160	196	179	179	185	193	187	199	196	236	213	239	222	258	207	151
60	176	228	228	225	261	297	281	270	277	279	273	282	279	305	286	309	294	328	282	207
70	225	306	301	301	345	391	368	346	354	351	343	351	348	362	340	365	350	389	339	267
80	277	381	370	371	433	473	455	421	428	416	409	410	407	403	384	405	393	428	385	312
90	325	446	428	432	494	523	510	470	476	458	452	448	445	433	414	435	422	458	418	350
100	370	490	468	474	531	556	545	502	507	485	481	475	472	455	438	458	445	482	441	380
110	411	519	495	501	557	579	570	526	531	507	503	496	494	475	456	477	464	498	461	403
120	448	540	514	522	578	599	590	544	548	525	521	512	510	488	473	490	480	512	477	420
130	477	558	531	538	595	612	604	559	562	538	534	525	523	498	484	500	490	512	489	433
140	503	572	544	551	607	623	616	569	573	548	545	535	533	506	492	508	498	512	498	444
150	529	581	554	562	616	623	622	577	578	553	551	538	537	506	498	508	504	512	503	454
160	551	589	562	570	620	621	621	577	578	554	552	541	540	506	504	508	504	512	512	462
170	568	595	566	575	617	620	618	577	578	556	553	541	542	506	504	508	504	512	512	469
180	583	594	565	574	615	620	617	577	579	556	555	541	542	506	504	508	504	512	512	473
190	596	591	565	573	614	618	616	577	579	556	555	541	542	506	504	508	504	512	512	476
200	606	590	564	572	611	617	615	577	579	556	555	541	542	506	504	508	504	512	512	477
210	616	589	563	571	610	616	614	577	579	556	555	541	542	506	504	508	504	512	512	478
220	624	588	563	570	609	611	612	577	579	556	555	541	542	506	504	508	504	512	512	480
230	631	586	562	570	609	608	608	577	579	556	555	541	542	506	504	508	504	512	512	480
240	638	586	562	569	605	605	604	577	579	556	555	541	542	506	504	508	504	512	512	481
250	644	584	561	567	601	602	601	577	579	556	555	541	542	506	504	508	504	512	512	482
260	649	584	561	567	597	599	598	577	579	556	555	541	542	506	504	508	504	512	512	483
270	653	584	561	567	594	599	596	577	579	556	555	541	542	506	504	508	504	512	512	483
280	657	584	561	567	591	599	592	577	579	556	555	541	542	506	504	508	504	512	512	483
290	660	584	561	567	588	599	592	577	579	556	555	541	542	506	504	508	504	512	512	483
300	660	584	561	567	588	599	592	577	579	556	555	541	542	506	504	508	504	512	512	483

includes genetic gain for Spruce component

Existing Managed Sta[illegible] Yield Tables for TFL 53

AU #	22	27	28	29	30	31	32	33	34	35	36	37	38	39	40
species	D-fir	Spruce	Spruce	Spruce	Spruce Pine	Spruce Pine	Spruce Pine	Spruce Deciduous	Spruce Deciduous	Pine	Pine	Pine Spruce	Pine Spruce	Pine Deciduous	Pine Deciduous
site	gmp	good	medium	poor	good	medium	poor	good	med/poor	good	med/poor	good	med/poor	good	med/poor
Age Rang															
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	1	1	2	2	2	4	5	4	4	3	2
30	20	7	3	12	16	26	40	34	31	61	75	63	60	50	43
40	77	74	54	65	79	95	126	107	102	146	162	147	144	128	117
50	132	169	141	143	161	174	220	186	178	220	245	223	217	197	183
60	190	255	227	221	241	252	297	262	254	290	312	293	287	270	252
70	243	335	298	287	309	317	370	325	315	344	367	347	341	324	305
80	300	404	374	352	374	375	417	379	370	385	405	388	383	369	351
90	350	445	424	399	416	413	448	413	406	414	434	417	412	400	385
100	399	473	454	429	444	438	471	438	431	437	457	439	434	424	409
110	441	493	476	451	465	458	489	457	451	455	474	458	453	443	428
120	476	509	493	468	480	474	502	472	466	470	486	472	468	458	444
130	507	520	507	481	493	486	510	484	478	480	496	482	478	470	456
140	536	530	516	492	503	495	510	492	487	488	496	490	486	479	467
150	561	528	525	500	509	499	510	495	492	494	496	490	492	484	474
160	580	527	525	504	509	500	510	498	494	494	496	490	492	489	478
170	597	526	523	504	509	502	510	498	496	494	496	490	492	489	482
180	611	525	522	504	509	502	510	498	496	494	496	490	492	489	485
190	623	524	520	503	509	502	510	498	496	494	496	490	492	489	485
200	634	524	519	503	509	502	510	498	496	494	496	490	492	489	485
210	644	522	518	503	509	502	510	498	496	494	496	490	492	489	485
220	652	518	517	503	509	502	510	498	496	494	496	490	492	489	485
230	660	516	516	503	509	502	510	498	496	494	496	490	492	489	485
240	666	513	512	503	509	502	510	498	496	494	496	490	492	489	485
250	672	511	509	503	509	502	510	498	496	494	496	490	492	489	485
260	678	508	506	503	509	502	510	498	496	494	496	490	492	489	485
270	683	508	504	503	509	502	510	498	496	494	496	490	492	489	485
280	688	508	501	503	509	502	510	498	496	494	496	490	492	489	485
290	692	508	499	503	509	502	510	498	496	494	496	490	492	489	485
300	692	508	499	503	509	502	510	498	496	494	496	490	492	489	485

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Appendix III

Biodiversity Calculations

Factoring Biodiversity into the Timber Supply Analysis

Seral Stage Constraints are factored into the analysis over a 140 year period. Direction for this is provided by Timber Supply Branch. The calculations are based on *Appendix III Incorporating Biodiversity and Landscape Units into the Timber Supply Review*, found in the *Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licenses* Version 3 February 1998. Thirty-three percent of the percent area target for old growth must occur immediately (or no harvesting is allowed in the area within the group). Similarly, sixty-six percent of the old growth requirement must be met by age 70 through in-growth, and one hundred percent must be met 140 years from present.

The following calculation were used to derive the seral stage stages for the Groups found in Table 25 of the IP. The seral stage targets were obtained from the Forest Practices Code Biodiversity Guidebook (September 1995).

Group 1: NDT 1 ESSF wk1

	Low % = 19		Intermediate % = 19			High % = 28
Time 0	28	x	0.10		=	2.8
	19	x	0.45		=	8.55
	19	x	0.33	x 0.45	=	2.8215
					total =	14.1715
Time 70	28	x	0.10		=	2.8
	19	x	0.45		=	8.55
	19	x	0.66	x 0.45	=	5.643
					total =	16.993
Time 140	28	x	0.10		=	2.8
	19	x	0.45		=	8.55
	19	x	0.45		=	8.55
					total =	19.9

Group 2: NDT 2 SBS wk1

	Low % = 9		Intermediate % = 9			High % = 13
Time 0	13	x	0.10			= 1.3
	9	x	0.45			= 4.05
	9	x	0.33	x	0.45	= 1.3365
						total = 6.6865
Time 70	13	x	0.10			= 1.3
	9	x	0.45			= 4.05
	9	x	0.66	x	0.45	= 2.673
						total = 8.023
Time 140	13	x	0.10			= 1.3
	9	x	0.45			= 4.05
	9	x	0.45			= 4.05
						total = 9.4

Group 3: NDT 3 SBS dw, mk1, mw

	Low % = 11		Intermediate % = 11			High % = 16
Time 0	16	x	0.10			= 1.6
	11	x	0.45			= 4.95
	11	x	0.33	x	0.45	= 1.6335
						total = 8.1835
Time 70	16	x	0.10			= 1.6
	11	x	0.45			= 4.95
	11	x	0.66	x	0.45	= 3.267
						total = 9.817
Time 140	16	x	0.10			= 1.6
	11	x	0.45			= 4.95
	11	x	0.45			= 4.95
						total = 11.5

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Appendix IV

Rationale for Future Road Determination

Calculations as submitted from MP# 2

Road Right Of Way Measurements

Tree Farm License No. 53

Dunkley Lumber Ltd.

By:Baseline Prescriptions Ltd.
Date:November, 1993

Purpose: As part of the current re-inventory of TFL 53, measurements of road right of way widths were done to determine the losses to productive forest land caused by road and landing construction. These measurements would be used to estimate the area reduction for unclassified roads, trails and landings on TFL 53.

Methodology: On map sheet 93G.040, the harvested area and the length of constructed road were determined. In addition, the number of landings used to harvest this area were counted. Thus the total area logged, total amount of road, and the total number of landings were compiled for this map sheet.

Once the length of road and the number of landings had been determined, measurements of right of way widths and landing sizes were taken. Roads were classified into three separate categories. These categories are:

1) Forest Service Roads - major transportation corridors expected to be in use for perpetuity.

2) Operational Roads - roads used to develop major timber areas with an expected life span of 20 or more years.

3) On Block Roads - roads which were constructed specifically for harvesting a block of timber with an expected life span of 5 to 10 years.

Measurement Protocols:

1) Forest Service Roads - these roads were measured every one half kilometre and included the cleared width from original construction. It was assumed that even though these cleared areas were presently growing trees, these trees would be brushed out to maintain visibility and therefore, could not be classified as productive forest land.

2) Operational Roads - these roads were measured every 300 meters. Productive forest land was not included in the measurements.

3) On Block Roads - these roads and trails were measured every one half kilometre and included all non-productive land. Where these roads were totally brushed in or the right of way and the road grades were growing trees, the width was classified as zero. Thus some roads, particularly winter grades had returned to full production.

Right of Way Widths:

Forest Service Roads

	Width	Length	Area
1000 Road	24.37 m	5,200 m	12.67 ha
900 Road	14.60 m	1,200 m	1.75 ha
700 Road	20.12 m	13,800 m	27.77 ha
Average Width	20.89 m	20,200 m	42.19 ha

Operational Roads

	Width	Length	Area
Goldmine Rd.	13.3 m	7,000 m	9.31 ha
735 Rd.	8.3 m	2,000 m	1.66 ha
727 Rd.	11.4 m	6,400 m	7.30 ha
43A Rd.	13.6 m	3,470 m	4.72 ha
Average Width	11.7 m	18,870 m	22.99 ha

On Block Roads

	Width	Length	Area
All Roads	4.33 m	81,530 m	35.30 ha

Landings

All Landings	.240 ha/landing x 254 landings =	60.96 ha

Area Summary for Map Sheet 93G.040 (Excluding FSRs)

Operational Roads	=	23.0 ha
On Block Roads	=	35.3 ha
Landings	=	61.0 ha
Total Area	=	**119.3 ha**

Data Interpretations

Assumptions: In order to interpret the data for the area reductions, certain assumptions have to be made for future operations on TFL 53. These assumptions are:

1) All road and landing areas are assumed to reduce the productive land base. No deductions have been made for non-productive ground as defined in the current inventory. In other words, it is assumed that all roads and landings will be constructed on productive forest land.

2) There will not be any further construction of Forest Service Roads within the TFL. All future roads will be either operational or on block roads.

3) Map sheet 93G.040 is a representative sample of operations within the TFL.

4) The present road construction on map sheet 93G.040 is complete for all the area harvested. Future harvesting will require construction of operational and on block roads. This slightly exaggerates the amount of road to be built since some operational roads have developed timber that has yet to be harvested.

5) All the productive forest land within the TFL will be harvested.

Area Deductions by Road Type

1. Area for unclassified roads, trails and landings on TFL 53

Mapsheet 93G040 area of productive forest land	9,084.2 ha
Mapsheet 93G040 area of harvested land	3,805.7 ha
Percentage of harvested to productive forest land	39%
TFL 53 Net Productive Land Base (NPL)	73,819.0 ha
TFL 53 Area of Harvested Land	28,974.2 ha
Percentage of harvested to net productive land	39%

a) Forest Service Roads

20.89 m average width x 151,000 m length = 315.4 ha

Total length consists of <u>all</u> FSR roads on the TFL as measured by planimeter. FSR roads include:

700 Road	1500 Road
800 Road	2900 Road
900 Road	3800 Road
1000 Road	NWI Road (Genevieve Lake Rd.)
	Yardley Lake Road

This initial deduction of 315.4 ha. (or 0.42% of the net productive land base) will be applied as a percentage of the TFL Net Productive Land Base by analysis unit. As such it will incorporate both the harvested and unharvested portions of the NPL. No timber will be harvested before the deduction.

Note: Since there will be no further construction of FSRs, the above deduction will not require future adjustments.

b) Operational, On Block Roads and Landings

Category	Area (ha)	Percent Mapsheet Harvested Area	Percent Mapsheet Forest Land
Operational Roads	23.0	0.60%	0.25%
On Block Roads	35.3	0.93%	0.39%
Landings	61.0	1.60%	0.67%
Totals	119.3	3.13%	1.31%

This deduction will be applied as a percentage of the Net Productive Land Base by analysis unit. It will deduct from both timbered and harvested polygons. No timber will be harvested before the deduction.

2. Area Reductions for Future Roads, Trails and Landings on TFL 53

Category	Mapsheet Current Area	Undeveloped Land as a Percentage of NPL	Mapsheet Future Area Deductions	Percentage Mapsheet Forest Land
Operational Rds	23.0 ha	100 - 39 = 61%	37.7 ha	0.42%
On Blocks Rds.	35.3 ha	100 - 39 = 61%	37.9 ha	0.64%
Landings	61.0 ha	100 - 39 = 61%	100.0 ha	1.10%
Totals	**119.3 ha**		**195.6 ha**	**2.16%**

This percentage will be applied as percentage of the TFL Net Productive Land Base by analysis unit. The timber will be harvested before making this deduction.

Road Construction

1996

Road Permit Roads Constructed

Road Permit	KMS	ha	Perm (ha)	
R8805	0.8	0.9	0.0	
R3888	0.6	0.7	0.0	
R6805	3.3	3.9	0.0	
R09072	1.8	2.1	0.0	
R09098	1.3	1.5	0.0	
R8484	1.6	1.9	0.0	
Total	**9.4**	11.0	0.0	

CP Roads Constructed

100	1.1	0.5		
81	0.8	0.3		
48	2.4	1.0	0.3	
103	1.6	0.7	0.7	
92	2.7	1.2	0.8	
132	0.8	0.3		
53	1.8	0.8		
95	0.9	0.4		
Total	**12.1**	**5.2**	**1.9**	**11.5 % of Perm**

1997

Road Permit Roads Constructed

Road Permit	KMS	ha	Perm (ha)	
R07241	2.0	2.3	0.0	
R07634	11.9	13.9	0.0	
R06805	2.8	3.3	0.0	
R09099	3.7	4.3	0.0	
R04601	0.5	0.6	0.0	
Total	**20.9**	**24.5**	**0.0**	

CP Roads Constructed

115	1.1	0.5	0.3	
91	1.8	0.8	0.8	
119	1.4	0.6	0.6	
107	1.8	0.8	0.8	
109	2.8	1.2	1.2	
120	1.0	0.4	0.2	
Total	**9.9**	**4.3**	**3.9**	**13.5 % of Perm**

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Appendix V

Data for Buffering RMZ widths around Streams and Lake Shores

Biodiversity Area Summary

CP BLK	Gross Area	Type	Length	Area	% Retention	Equivalent Area	Comments
137-1		WTP		2.8	100	2.8	WTP;wildlife tree patch
138-1		WTP		2.4	100	2.4	
59-1		WTP		0.9	100	0.9	
82-1		WTP		1.9	100	1.9	
77-1		WTP		1.7	100	1.7	
99-1	71.3	WTP		0.9	100	0.9	
92-3		WTP		0.6	100	0.6	
92-1	54.1	WTP		4.8	100	4.8	
114-1	38.3	WTP		2	100	2	
109-1	58.2	WTP		1.1	100	1.1	
107-1	58.4	WTP		0.5	100	0.5	
106-1		WTP		3.3	100	3.3	
120-2		WTP		4.5	100	4.5	
119-1	36.2	WTP		0.25	100	0.25	
115-3		WTP		1.3	100	1.3	Wildlife tree patches % of gross landbase
115-4		WTP		0.6	100	0.6	2%
115-2		WTP		2.2	100	2.2	
115-1	47.3	WTP		0.6	100	0.6	
115-1		WTP		1.6	25	0.4	
subtotal						**32.75**	
99-1		W5 rmz	1000	4	0	0	W5 rmz % retention: 0%
99-1		W5 rz	1000	3.6	100	3.6	W5 rz % retention: 100%
65-1	64.5	W3 rmz	400	3	0	0	W3 rmz % retention: 28%
91-1		W3 rmz	900	3.1	0	0	
114-1		W3 rmz	300	2.7	100	2.7	
114-1		W3 rmz	400	3.8	0	0	
111-2	28.3	W3 rmz	200	1.7	100	1.7	
109-1		W3 rmz	200	0.8	100	0.8	
104-1		W3 rmz	300	1.2	0	0	
119-1		W3 rmz	250	0.8	50	0.3	
subtotal			**2950**				
85-1		W1 rz	1600	1.6	100	1.6	W1 rz % retention: 100%
93-1	49.7	W1 rz	3000	3	100	3	
120-2	53.7	W1 rz	700	0.7	100	0.7	
subtotal			**5300**				
85-1		W1 rmz	1600	6.4	0	0	W1 rmz % retention: 0%
93-1		W1 rmz	3000	12	0	0	
120-2		W1 rmz	700	2.8	0	0	
subtotal			**5300**				
77-1		uniform		79.3	24	19.3	Doug-fir & decid retention
115-1		uniform		47.3	6	2.8	Doug-fir retention
subtotal						**22.1**	**Uniform retention: 1%**
138-1	66.8	S8 rmz	400	1.6	100	1.6	
138-2		S8 rmz	900	3.6	0	0	
150-1		S8 rmz	600	1.2	0	0	S8 rmz % retention: 3%
84-1		S8 rmz	1300	5.2	0	0	
59-1		S8 rmz	2900	10.1	0	0	
86-1		S8 rmz	500	2	0	0	
77-1	79.7	S8 rmz	1000	4	0	0	
107-1		S8 rmz	1000	4	0	0	
106-1		S8 rmz	1100	3.2	0	0	
104-1		S8 rmz	350	1.4	0	0	
119-1		S8 rmz	600	2.4	0	0	
116-2		S8 rmz	1800	7.2	0	0	
subtotal			**12450**				

CP BLK	Gross Area	Type	Length	Area	% Retention	Equivalent Area	Comments
132-1	15.3	S4 rmz	100	0.2	0	0	Windthrow block
137-1		S4 rmz	600	3.6	0	0	
137-3		S4 rmz	250	1.5	0	0	S4 rmz % retention
138-2		S4 rmz	1200	6	0	0	31%
86-1	57.1	S4 rmz	1200	7	70	4.9	
99-1		S4 rmz	200	0.6	67	0.4	
99-1		S4 rmz	500	3	30	0.9	
99-1		S4 rmz	700	2.1	0	0	
92-3	39	S4 rmz	400	1.4	50	0.7	
92-3		S4 rmz	400	2.2	100	2.2	
114-1		S4 rmz	400	1.2	0	0	
109-1		S4 rmz	350	1	67	0.7	
107-1		S4 rmz	250	1.5	0	0	
108-1	50.4	S4 rmz	400	1.2	50	0.6	
108-1		S4 rmz	300	0.9	0	0	
120-2		S4 rmz	300	0.7	25	0.2	
120-2		S4 rmz	500	3	0	0	
119-1		S4 rmz	650	2	50	1	
115-2	27.1	S4 rmz	500	1.5	50	0.75	
subtotal			9200				
137-1	52	S3 rrz	500	1	100	1	S3 rrz % retention
137-3	56.3	S3 rrz	1250	2.5	100	2.5	100%
138-2		S3 rrz	500	1	100	1	
65-1		S3 rrz	500	1	100	1	
64-1	59.9	S3 rrz	900	3.6	100	3.6	
59-1	58.4	S3 rrz	1100	2.2	100	2.2	
82-1		S3 rrz	500	2	100	2	
99-1		S3 rrz	300	0.6	100	0.6	
91-1	58.1	S3 rrz	2200	6.6	100	6.6	
109-1		S3 rrz	850	2.5	100	2.5	
107-1		S3 rrz	700	2.8	100	2.8	
104-1	51.2	S3 rrz	600	3.8	100	3.8	
120-2		S3 rrz	250	0.8	100	0.8	
119-1		S3 rrz	400	0.8	100	0.8	
116-1	34.9	S3 rrz	600	1.2	100	1.2	
subtotal			11150				
137-1		S3 rmz	500	1	100	1	S3 rmz % retention
137-3		S3 rmz	1250	2.5	100	2.5	45%
138-2		S3 rmz	500	1	50	0.5	
65-1		S3 rmz	500	1	40	0.4	
64-1		S3 rmz	900	3.6	0	0	
59-1		S3 rmz	1100	2.2	100	2.2	
82-1		S3 rmz	500	1	0	0	
99-1		S3 rmz	300	0.6	0	0	
91-1		S3 rmz	2200	3.8	25	1	
109-1		S3 rmz	850	1.7	60	1	
107-1		S3 rmz	700	1.4	50	0.7	
104-1		S3 rmz	600	1.2	0	0	
120-2		S3 rmz	250	0.5	50	0.25	
119-1		S3 rmz	400	0.8	50	0.4	
116-1		S3 rmz	600	1.2	0	0	
subtotal			11150				

CP BLK	Gross Area	Type	Length	Area	% Retention	Equivalent Area	Comments
65-1		S2 rrz	1100	3.3	100	3.3	S2 rrz % retention 100%
65-1		S2 rmz	1100	2	40	0.8	S2 rmz % retention
108-1		S2 rmz	200	0.4	0	0	34%
subtotal			1300				
108-1	48.2	S1 rrz	1200	6	100	6	S1 rrz % retention
116-1		S1 rrz	1900	10.6	100	10.6	100%
116-2	46.2	S1 rrz	1600	9.1	100	9.1	
subtotal			4700				
108-1		S1 rmz	1200	2.4	100	2.4	S1 rmz % retention
116-1		S1 rmz	1900	1.1	25	0.6	61%
116-2		S1 rmz	1600	2	75	1.5	
subtotal			4700				
132-1		none				0	Windthrow block
132-2	23.3	none				0	Windthrow block
133-10	9.6	none				0	Windthrow block
148-3	6.3	none				0	Windthrow block
148-4	17.9	none				0	Windthrow block
148-5	3.7	none				0	Windthrow block
148-6	5.3	none				0	Windthrow block
148-7	5	none				0	Windthrow block
150-2	3.5	none				0	Windthrow block
150-3	1.4	none				0	Windthrow block
150-4	6.3	none				0	Windthrow block
150-5	3	none				0	Windthrow block
151-1	3.9	none				0	Windthrow block
138-1		L1 rrz	900	2.7	28	0.7	Existing rd through rrz
138-2	38	L1 rrz	1100	4.5	100	4.5	L1 rrz retention
82-1	72.4	L1 rrz	700	18.4	100	18.4	75%
subtotal			2700				
138-1		L1 rmz	900	6.3	0	0	L1 rmz retention
138-2		L1 rmz	1100	7.7	14	1.1	6%
82-1		L1 rmz	700	3.5	0	0	
subtotal			2700				

Riparian management zone retention summary

Riparian class	% retention	
S1	61	Wildlife tree patches 2% of gross landbase
S2	34	Uniform retention in net productive landbase 1%
S3	45	
S4	31	
S5	none	
S6	3	
W1	0	
W3	28	
W5	0	
L1	6	

Calculation Example: S1 rmz

CP BLK	Gross Area	Type	Length	Area	% Retention	Equivalent Area
108-1		S1 rmz	1200	2.4	100	2.4
116-1		S1 rmz	1900	1.1	25	0.6
116-2		S1 rmz	1600	2	75	1.5
subtotal			4700			

% Retention= sum of (length * % retention / Subtotal length)

108-1	25.53191
116-1	10.10638
116-2	25.53191
Rmz % Retention	61.17021

TFL 53
Calculation of Riparian Widths

A riparian inventory on TFL 53 covered 95500.54 metres of stream length (approx 73 % of the total stream length of 1 304 435 m).

The proportion of stream types on the total TFL was assumed to be the same as the inventoried area.

RRZ - inventoried stream area

Stream class	Stream length (m)	RRZ width (m)	RRZ % excluded	RRZ % prorate	Prorated RRZ width
s1					
s2	8516	30	100	8.92	2.676
s3	30377	20	100	31.81	6.362
s4	40795			42.72	
s5	376			0.39	
s6	15436			16.16	
Total	95500.54			100	

RRZ - total stream area

Stream class	Stream length (m)	RRZ width (m)	RRZ % excluded	RRZ % prorate	Prorated RRZ width	Total reduced (m)	Total area reduced (ha)
s1							
s2	116355.602	30	100	8.92	2.676	3490668.06	698.133612
s3	414940.7735	20	100	31.81	6.362	8298815.47	1659.763094
s4	557254.632			42.72			
s5	5087.2965			0.39			
s6	210796.696			16.16			
Total	1 304 435						Total 2357.89 ha

The total value of 2357.89 ha calculated above for RRZ is 10 ha more than the value of 2348 ha provided in Table 4 of the IP.
In the IP the value was calculated by adding the prorated RRZ widths (2.68 + 6.36 = 9.04 m) and applying the total prorated width to the total stream length as follows: (1 304 435 m * 9 m)/10000 m/ha *2 (both sides of stream) = 2348 ha.

The RRZ net area is less than the total RRZ area due to overlap in the netdown table.

RMZ - inventoried stream area

Stream class	Stream length (m)	Riparian management width (m)	RMZ % excluded (from SP data)	Max. % from RMA guidebook	RRZ prorate %	Prorated RRZ width
s1	0			50		
s2	8516	20	34	50	8.92	0.60656
s3	30377	20	45	50	31.81	2.8629
s4	40795	30	31	25	42.72	3.97296
s5	376	30	31	25	0.39	0.03627
s6	15436	20	3	5	16.16	0.09696

RMZ - total stream area

Stream class	Stream length (m)	Riparian management width (m)	RMZ % excluded (from SP data)	etres excluded from harvestin	RRZ prorate %	Prorated RRZ width	Total reduced (m)	Total area reduced (ha)
s1	0							
s2	116355.602	20	34	6.8	8.92	0.60656	791218.0936	158.24361872
s3	414940.7735	20	45	9	31.81	2.8629	3734466.9615	746.8933923
s4	557254.632	30	31	9.3	42.72	3.97296	5182468.0776	1036.49361552
s5	5087.2965	30	31	9.3	0.39	0.03627	47311.85745	9.46237149
s6	210796.696	20	3	0.6	16.16	0.09696	126478.0176	25.29560352
						7.57565		
	1304435							Total 1976.38 ha

Dunkley Lumber Ltd. is well within the maximum % required by the Riparian management guidebook (p. 31 Table 4) for riparian management.

The hectares calculated for RMZ are 111 ha less than Dunkley's calculation of 2087.1 ha.

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Appendix VI

VEG Height Slope Calculation Procedure

Area-weighted Tree Heights in VQO areas.

The rationale for calculating tree heights was obtained from the MoF manual: *Procedures for Factoring Visual Resources into Timber Supply Analysis (March 1998)*. The procedure used in this analysis involved merging the TRIM information with VQO polygons to derive the average slope class within each VQO polygon. The slope classes were then area-weighted by polygon and VQO class to derive an average slope for each VQO zone. The slope classes were applied to the following table to derive minimumVEG height.

Slope Class %	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-45	46-50	51-55	56-60	61+
Tree Height	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5

Specific calculations were done by computer. The logic followed was:

- Slope polygons were created from TRIM DEM data.
- Slope polygons were then intersected with Recreation, Biogeoclimatic, Natural Disturbance Types, T.F.L. project boundary, Forest Cover, and VQO polygons from the Base Case Scenario.
- Slope values were compared to a look-up table containing Slope value ranges, and Tree Heights.
- Tree Heights were then assigned accordingly to each record with a slope value.
- Records not assigned a VQO value or an Inventory Type group number, were purged.
- A record field was populated with the product of the area * tree height.
- The data was then summarized by VQO categories, area * tree height product, and area, to a new table.
- A new field was populated with the area * tree height product / sum area.
- The new field contains the weighted tree height values.

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Appendix VII

SIBEC Table used to Calculate Site Indices for Managed Stands

7. APPENDIX III - COMPARISON OF SITE INDEX ESTIMATES

Table 8. Preliminary and ground sample site indices.

Site Series	Lodgepole Pine Site Index (m)					Spruce Site Index (m)				
	SBSmw	SBSmk1	SBSdw1	SBSwk1	ESSFwk1	SBSmw	SBSmk1	SBSdw1	SBSwk1	ESSFwk1
01	22 (22.0)	21 (21.3)	20 (21.9)	21 (21.1)	18	20 (20.7)	19 (21.1)	18	19 (20.2)	16 (16.3)
02	13	12	12	12	13	10	10	10	10	12
03	15	13	15	15 (17.4)	17	13	12	13	13	15
04	19 (16.2)	18	18	19	19	16	16	16	17	17
05	20	20 (19.7)	19	21 (20.2)	19	18	18	17	19 (17.9)	19
06	23 (22.4)	16	22	20	14	21 (21.7)	15	20	18	12
07	24 (24.8)	22	21	23	17	22	21 (21.2)	19	22	16
08	26	25	24	23	7	24	24	22	22	6
09	17	16	17	18	19	17	16	17	18	19
10	10	10		25		10	10		24	
11				10					10	
12				16					15	

Sample size for field sampling estimates range from five to 30 observations. Numbers in brackets are the ground sampled site indices by site series.

Table 9. Adjusted site index estimates by site series for TFL 53 (rounded to nearest meter).

Site series	SBSmw				SBSmk1				SBSdw1				SBSwk1				ESSFwk1			
	Sx	Pl	Bl	Fd	Sx	Pl	Bl	Fd	Sx	Pl	Bl	Fd	Sx	Pl	Bl	Fd	Sx	Pl	Bl	Fd
01	20	22	19	21	19	21	18	20	18	20	17	19	20	21	19	20	16	18	16	18
02	10	13	10	13	10	12	10	12	10	12	10	12	10	12	10	12	12	13	12	13
03	13	15	13	15	12	13	12	13	13	15	13	15	13	15	13	15	15	17	15	17
04	16	19	16	18	16	18	16	18	16	18	16	18	17	19	16	18	17	19	16	18
05	18	20	17	19	18	20	17	19	17	19	16	18	19	21	18	20	19	19	18	18
06	21	23	20	22	15	16	15	16	20	22	19	21	18	20	17	19	12	14	12	14
07	22	24	21	23	21	22	20	21	19	21	18	20	22	24	21	23	16	17	16	17
08	24	26	22	25	24	25	22	24	22	24	21	23	24	26	22	25	6	7	7	7
09	17	17	16	17	16	16	16	16	17	17	16	17	18	18	17	18	19	19	18	18
10	10	10	10	10	10	10	10	10					24	25	22	24				
11													10	10	10	10				
12													15	16	15	16				

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Appendix VIII

Rationale for the Area in WTPs and the Modeling Assumptions Used

Rationale for Modeling Wildlife Tree Patches

A review of silviculture prescriptions and MLSIS submissions from blocks harvested on T.F.L. #53 after the implementation of the FPC was undertaken. This resulted in the determination that an average of 2% of the merchantable stems in each cut block were being reserved as Wildlife Tree Patches (WTPs). Additional area was reserved through riparian reserves, coarse woody debris and unmerchantable forest types. Dunkley forecasts that they will be able to remove these trees when they return to harvest the plantation they created around these WTPs, 80 years from the initial time of harvest. These patches would then be removed and replaced with WTPs from the growing plantation.

Rather than reduce the net landbase or reduce the yield curves to account for the 2% area that was left in WTPs, the following logic was derived.

Dunkley's current cut is based on 204700 m3/year from MP#2. This harvest is supported on a landbase of approximately 70,142 ha. The resultant average MAI for the T.F.L. is therefore 2.918 m3/ha/year.

- If it takes 80 years for a stand to become mature then 80 years x 2.918 m3/ha/year = an average volume harvested (over the long-term) of 233.44 m3/ ha.
- This average volume per hectare is considerable lower then what Dunkley is cutting now for two reasons: 1) Dunkley is currently harvesting old growth with more vol/ha than managed stands 2) visuals, recreation, biodiversity and wildlife constrain the landbase which reduces the MAI.
- The <u>average</u> amount of area harvested annually over the long-term (e.g., 300+ years) is 204,700 m3/year (Dunkley's current AAC) ÷ 233.467 m3/ha = 876.783 ha/year
- Add to this the area left in WTPs (2%) you get 876.783
- ha x 1.02 = 894.319 ha
- Thus 894.319 - 876.783 = 17.536 ha is reserved for WTPs every year
- Over 80 years the area reserved for WTPs is 80*17.536 = 1402.9 ha.

To model this realistically:

1) double the initial area in the WTP zone to 4% so that approximately 2805.6 ha is in the WTP zone.

2) assume that half of this area would always be a WTP and the other half would be growing in a plantation to eventually become a WTP.

3) the total area in WTPs is fixed at 2805.6 ha which accounts for the replacement WTPs growing as part of the plantation.

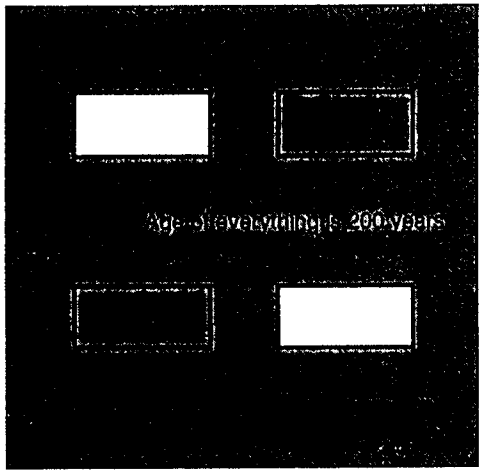
4) when you harvest a block you remove the old WTP and leave a portion of the plantation in its place.

5) model this as a double rotation of 80 years such that 1402.9 ha is always older then 80 years of age.

6) In FSSIM, this is a Group 1 constraint which says that a maximum of 50% of the zone can be less then 80 years of age.

7) See attached diagram to visualize the concept.

Addendum: Concern was expressed by the MOE that 80 years is insufficient time for a plantation to acquire the attributes of a WTP. In this analysis, the Group 1 constraint was increase such that 50% of the area in WTPs was always greater than 160 years. The net area within the WTP zone remained the same (i.e., 4%). This is double the merchantable area required.

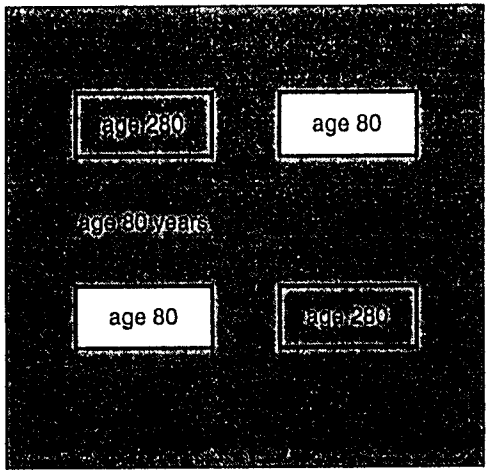


Year 0 Block 69 CP 888

grey = area harvested

cut block=

WTP =

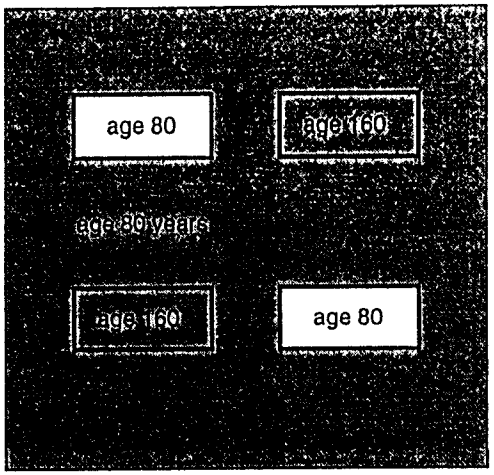


Year 80 Block 69 CP 888

grey = area harvested

cut block=

WTP =



Year 160 Block 69 CP 888

grey = area harvested

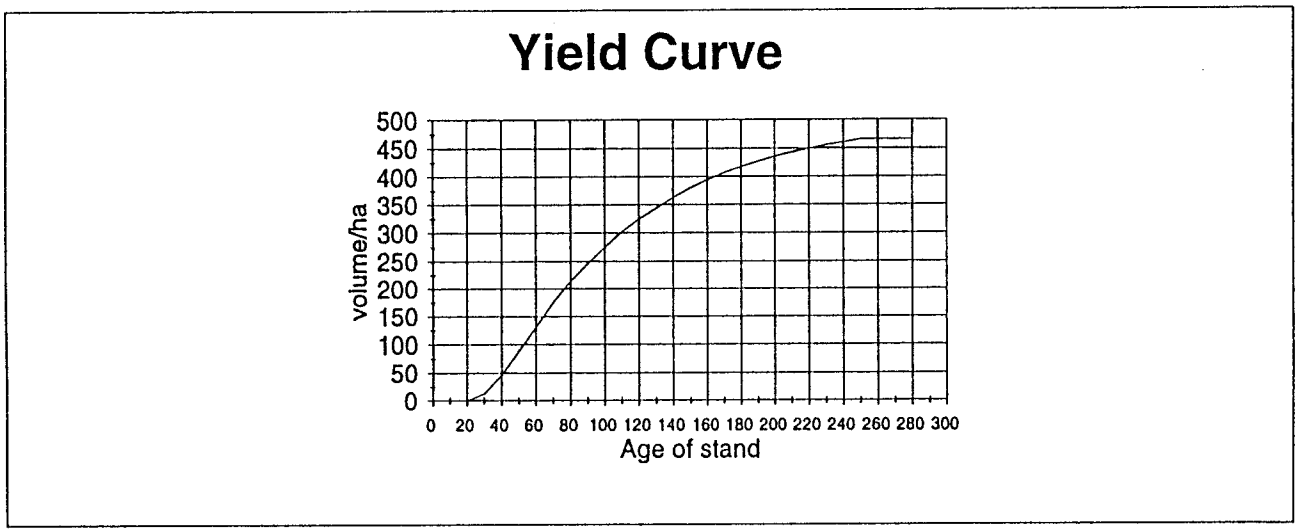
cut block=

WTP =

At Year 0 the initial volume from harvested area is 430 m3/ha

At Year 80 the volume from harvested area is 450 m3/ha from WTPs and 225 m3/ha from block area

At Year 160 and beyond, the volume from harvested area is 400 m3/ha from WTPs and 225 m3/ha from the remainder



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Appendix IX

Rationale used in the Calculation of OAF 1

Rationale used in the Calculation of OAF 1

Operational adjustment factors for managed stands were derived using field procedures detailed in the recent Ministry of Forest publication on assessing O.A.F.1 in the field:

O.A.F. 1 Project Report 1 MOF BC, FRBC September 1997, and

O.A.F. 1 Project Report 2 MOF BC, FRBC January 1998.

The O.A.F. 1 Project Report 2 is required to extrapolate the results shown in Table A against the estimate of O.A.F. 1 tables appended to the Report 2.

No sample information was collected for Douglas fir, Balsam, or aspen leading stands. In these areas, the provincial average OAF 1 of 15% will be used.

Concerns were expressed by the MOF research branch that the OAF 1 survey did not adequately assess losses to stand productivity due to pathogens (e.g. blister rust). To address these concerns and to model the growth of managed stands with a conservative factor, a 4% addition was applied to the results shown above. The net result is a 7% OAF 1 for leading Pine stands and a 10% OAF 1 for leading Spruce stands.

Dunkley feels that the results from this survey along with the additional adjustment factor are more than reasonable for several reasons:

- the higher planting densities which occur on T.F.L. # 53, single tree mortality does not create a hole in the OAF survey. The same is not true using regional stocking standards
- Excessive weevil and rusts are factored into the OAF Survey results in that measured trees must meet crop tree criteria
- The OAF results are applied to managed stands only. Poorer preforming plantations are modeled as natural stands. Stand density and holes in stocking were a factor in categorizing a stand as natural or managed. Since only the 'best' natural stands are modeled through TIPSY, the calculated OAF 1 is reasonable.

O.A.F. SURVEY

Table A: O.A.F. 1 Summary of Field Data

Mapsheet	Polygon	Opening	Area (ha)	Species	Site Index	Density (TPH)	Year Logged	Distance Between Plots (m)	Group	Occupied	Unoccupied	PEP	Z Value	OAF 1
93G.029	1135	16	61	Pl(At)	21.0	1968	58-70	78.1	2	81	7	8	5	4
93G.039	1521	14	56	Sw(BlCtAtPl)	14.0	1150	72	74.8	1	88	5	5	3	
93G.039	1069	64	11	Pl	21.0	1309	87	23.0	4	98	0	0	0	0
93G.039	62	60	39	Pl	22.0		70-71	62.4	2	89	7	7	4	4
93G.039	318	32	15	PlSw(At)	22.0	4400	84	38.7	4	84	2	2	0	0
93G.040	1039	22	86	SwBl(Pl)	20.0	2085	83	92.7	3	79	14	15	12	10
93G.040	34	32	70	Sw(Bl)	24.0	2629	79-82	83.7	1	88	8	8	5	4
93G.040	79	40	118	SwBl(CtAt)		2784	82	108.6	3	not surveyed				
93G.050	1612	13	55	Sw(BlPl)	20.0	2500	73-76	74.2	1	83	9	10	7	6
93G.041	1187	6	44	Sw(AtBlPl)	20.0	2350	83	66.3	3	82	4	5	3	2
93G.041	282	5	32	PlSw(BlAt)	24.0	1344	72	57.0	2	80	3	4	1	1
93G.048	27	16	42	Pl(AtBlSw)	21.5	6028	84	64.1	4	85	7	8	5	4

Preferred and acceptable species are Sw, Pl, Bl

Minimum tree height = 20 cm

PEP = Percent Empty Plots

Roads are not part of the polygon.

Critical distance = 2.7 m

Countable tree > = 20% of height of surrounding canopy

TPH = Trees Per Hectare

Landings are not part of the polygon.

Opening #	Leading Species	Area	% of total Area	O.A.F. 1	Area- weighted O.A.F. 1
93G.029 16	Pine	61	0.305	4	1.220
93G.039 64		11	0.055	0	0.000
93G.039 60		39	0.195	4	0.780
93G.039 32		15	0.075	0	0.000
93G.041 5		32	0.160	1	0.160
93G.048 16		42	0.210	4	0.840
Total Pine Leading Stands		200	1.000		3.000
93G.039 14	Spruce	56	0.180	2	0.360
93G.040 22		86	0.277	10	2.765
93G.040 32		70	0.225	4	0.900
93G.050 13		55	0.177	6	1.061
93G.041 6		44	0.141	2	0.283
Total Spruce Leading Stands		311	1.000		5.370

No sample information was collected for Douglas-fir, Balsam, or aspen leading stands. In these areas, the Provincial average O.A.F. 1 of 15% will be used.

Addendum

Concerns were expressed by the MOF Research Branch that the O.A.F. 1 survey did not adequately assess losses to stand productivity due to pathogens (e.g. blister rust). To address these concerns and to model the growth of managed stands with a conservative factor, an additional factor was applied to the results shown above. The net result is a 10% O.A.F. 1 for leading Pine stands and a 12% O.A.F. 1 for leading Spruce stands.

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Appendix X

Modeling Flow Diagram - Interaction between Groups, Zones and Analysis Units

Group	Zone	Analysis Units	
		No logging histrory from 1973-98	logged between 1973-1998
NDT 1 ESSF	Zone 1 IRM	1 Fir	22 Fir
		2 Bl g	23 Bl g
		3 Bl - m	24 Bl - m
		4 Bl - p	25 Bl - p
		5 Bl - IU	
		6 Sw - g	26 Sw - g
		7 Sw - m	27 Sw - m
		8 Sw - p	28 Sw - p
		9 SwPl - g	29 SwPl - g
		10 Sw Pl - m	30 Sw Pl - m
		11 SwPl - p	31 SwPl - p
		12 SwDec - g	32 SwDec - g
		13 SwDec - mp	33 SwDec - mp
		14 Pl - g	34 Pl - g
		15 Pl - mp	35 Pl - mp
		16 PlSw - g	36 PlSw - g
		17 PlSw - mp	37 PlSw - mp
		18 PlDec - g	38 PlDec - g
		19 PlDec - mp	39 PlDec - mp
		20 AtCon	40 AtCon
	Zone 5 VQO Modification	AUs 1 to 40 same as zone 1 but with AU 21 included	
	Zone 6 VQO MM	AUs 1 to 40 same as zone 1 but with AU 21 included	
	Zone 7 WTP	AUs 1 to 40 same as zone 1 but with AU 21 excluded	
	Zone 8 IRM Excluded forest	21 Excluded forest	
NDT 2 SBS wk1	Zone 1 IRM	AUs 1 to 40 same as zone 1 in NDT 1	
	Zone 4 VQO PR	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 5 VQO Modification	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 6 VQO MM	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 7 WTP	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 excluded	
	Zone 8 IRM Excluded forest	21 Excluded forest	
NDT3 SBS dw1, mw, mk1	Zone 1 IRM	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 excluded	
	Zone 2 VQO Preservation	AUs 1 to 40 same as zone 1 in NDT 1but with AU 21 included	
	Zone 3 VQO Retention	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 4 VQO PR	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 5 VQO Modification	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 6 VQO MM	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 included	
	Zone 7 WTP	AUs 1 to 40 same as zone 1 in NDT 1 but with AU 21 excluded	
	Zone 8 IRM Excluded forest	21 Excluded forest	

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Appendix XI

Rationale for NRL Data

Includes:

1) Summary of five year salvage and pest management activity to document the aggressive T.F.L. salvage program.

2) The NRL inventory data and calculation of NRLs for Management Plan #2. This shows the trend in NRL reduction on T.F.L. #53

Appendix V

Estimation of Non-Recoverable Losses

1. Non Recoverable Loss Disturbance Area

Disturbance Type	Area (ha)
Insect	15.2
Windthrow	115.2
Burn	100.5

This is based on an inventory file read of the history attribute file. The figures presented are gross area without an allowance for ESA's or merchantability netdown. As a result these figures may slightly over-estimate the non recoverable loss area as it is based on the gross landbase rather than the net productive landbase.

Burn area includes polygons where burn was the only activity.

2. Total Non Recovered Volume

Disturbance Type	Area (ha)	Vol/ha (m3/ha)	Total Non Recovered Volume (m3)
Insect	15.2	284	4,315.8
Windthrow	115.2	284	32,716.8
Burn	100.5	284	28,542.0
			65,575.6

The volume per hectare was derived from the non-recoverable loss determination volume per hectare used for Management and Working Plan #1.

3. Non-Recovered Volume/Year

Disturbance Type	Total NRL Volume	Years Disturbance	Yearly NRL m3/yr	Rounded NRL m3/yr
Insect	4,316.8	40	107.9	100
Windthrow	32,716.8	40	817.9	800
Burn	28,542.0	40	713.6	700
				1600

The years of disturbance was derived using the recorded disturbance history date on the TFL and the current inventory date (1952-1992).

The estimated N.R.L. figure of 1600 m3/yr is considerably less than the estimated N.R.L. of 15,000 m3/yr used in Management and Working Plan #1. However, the current estimated N.R.L. is consistent with the aggressive program of windthrow and burn salvage carried out by Dunkley since the inception of T.F.L.#53. The large trap tree and insect salvage programs carried out by Dunkley also support this reduction in N.R.L.'s.

MAPPOL	POLY	MAPNO	POLYGON	HI	OPENNO	ATTRIBUT	ACTIVITY	ACT_YR1	SE	ACT_YR2	AC	PE	DIST_CD	PL_	PL_	HIST_LBL
330301170	1170	093G030	1170	1	0	DI	B	84		0						B84
330391063	1063	093G039	1063	1	0	DI	B	87		0						B87
330401071	1071	093G040	1071	1	0	DI	B	0		0						B
330480711	711	093G048	711	1	0	DI	B	81		0						B81
330480842	842	093G048	842	1	0	DI	B	81		0						B81
330500590	590	093G050	590	1	0	DI	B	88		0						B88
330500597	597	093G050	597	1	0	DI	B	88		0						B88
330480720	720	093G048	720	1	13	DI	B	81		0						B81
330480720	720	093G048	720	S	13	DI	B	81		0						B81
330480846	846	093G048	846	1	13	DI	B	81		0						B81
330480846	846	093G048	846	S	13	DI	B	81		0						B81
330390365	365	093G039	365	1	17	DI	B	79		0						B79
330390365	365	093G039	365	S	17	DI	B	79		0						B79
330391082	1082	093G039	1082	1	17	DI	B	79		0						B79
330391082	1082	093G039	1082	S	17	DI	B	79		0						B79
330390081	81	093G039	81	1	33	DI	B	85		0						B85
330390081	81	093G039	81	S	33	DI	B	85		0						B85
330390083	83	093G039	83	1	33	DI	B	85		0						B85
330390083	83	093G039	83	S	33	DI	B	85		0						B85
330490562	562	093G049	562	1	71	DI	B	89		0						B89
330391059	1059	093G039	1059	1	76	DI	B	87		0						B87
330391060	1060	093G039	1060	1	76	DI	B	87		0						B87
330390238	238	093G039	238	1	0	DI	I	0		0			3			I3%
330400174	174	093G040	174	1	0	DI	I	0		0			8			I8%
330400175	175	093G040	175	1	0	DI	I	0		0			1			I1%
330400186	186	093G040	186	1	0	DI	I	0		0			8			I8%
330401122	1122	093G040	1122	1	0	DI	I	0		0			5			I5%

330301139	1139	093G030	1139	1	0	DI	W	80	0	8	W8%80
330380898	898	093G038	898	1	0	DI	W	0	0		W
330381736	1736	093G038	1736	1	0	DI	W	0	0		W
330390531	531	093G039	531	1	0	DI	W	77	0	8	W8%77
330391117	1117	093G039	1117	1	0	DI	W	81	0	4	W4%81
330391564	1564	093G039	1564	1	0	DI	W	89	0	6	W6%89
330400007	7	093G040	7	1	0	DI	W	87	0	8	W8%87
330400181	181	093G040	181	1	0	DI	W	0	0	8	W8%
330400182	182	093G040	182	1	0	DI	W	0	0	8	W8%
330400570	570	093G040	570	1	0	DI	W	0	0	9	W9%
330400579	579	093G040	579	1	0	DI	W	0	0	7	W7%
330400605	605	093G040	605	1	0	DI	W	0	0	8	W8%
330401072	1072	093G040	1072	1	0	DI	W	0	0	8	W8%
330490667	667	093G049	667	1	0	DI	W	0	0		W
330500071	71	093G050	71	1	0	DI	W	90	0	3	W3%90
330500105	105	093G050	105	1	0	DI	W	91	0	7	W7%91
330500608	608	093G050	608	1	0	DI	W	0	0	3	W3%
330500610	610	093G050	610	1	0	DI	W	0	0	7	W7%
330500620	620	093G050	620	1	0	DI	W	87	0	7	W7%87
330500644	644	093G050	644	1	0	DI	W	87	0	7	W7%87

BRITISH COLUMBIA

File: TFL 53, Forest Development Plan

November 25, 1998

Dunkley Lumber Ltd.
Box 173
Prince George, British Columbia
V2L 4S1

Dear Licensee:

This letter is meant to summarize the results of the meeting between your staff, Al Wiensczyk, Zone Forester, and Bruce Doerksen, Forest Health Officer, that took place on November 5, 1998. Areas of forest health concern were previously identified and mapped in joint overview flights of your operating areas (Reference letter dated July 31, 1998). The attached table outlines the actions and/or forest health assessments required for each of the identified polygons. Please consider this letter as instruction under Section 13(b) of the Operational Planning Regulation to conduct the assessments as indicated in the attached table.

If you have any questions regarding the above please contact Al Wiensczyk, Zone Forester at (250) 565-7181.

Yours truly,

T. P. (Phil) Zacharatos, R.P.F.
District Manager

Attachment

Ministry of Forests

Prince George Forest District

Address:
2000 South Ospika Boulevard
Prince George, British Columbia
V2N 4W5

Tel: (250) 565-7100

Mapsheet/Area	Polygon	Pest	Action Required	Comments
93G049/050	1	Windthrow	Dunkley to suggest Small Scale Salvage opportunity to contractor.	Outside TFL - adjacent to block on the border.
93G050	2	Windthrow	Covered by CP 152 block 5	Harvest in progress
93G040	3	Windthrow	Covered by CP 152 block 7	Harvest complete
93G040	4	Windthrow	Covered by CP 168 block 2	Harvest in progress
93G040	5	Windthrow	Covered by CP 168 block 1	Planned for harvest
93G039	6	Windthrow	Covered by CP 105 block 1	Harvest in progress
93G029	7	Windthrow	Covered by CP 151 block 1	Harvest complete
93G039	8	Windthrow	Covered by CP 150 block 4	Harvest in progress
93G049	9	Windthrow	Covered by CP 888 block 98J and 98K.	CP 888 - 98J planned for harvest this winter. CP 888 98K may also be harvested this winter.
Various	10	Mountain Pine Beetle	Covered under CP 168 blocks 3-11 Measures - harvest of direct attack - CP 168 blocks 3-11. Forest Health Assessment post harvest.	Exemption sites
93G038	11	Mountain Pine Beetle	none	covered by Small Business block S (A47951)
93G038	12	Mountain Pine Beetle	none	covered by Small Business Block A58411-B1 (AA) Section 21 sale scheduled for harvest 2002.

Salvage and Pest Management Five Year History December 2,1998

Year	Salvage Activity	Area (ha)	Number of Salvage sites	Spruce trap tree sites	Pine bait tree sites	Douglas - fir trap tree sites
1993	Two of eight harvest units were windthrow or insect related. These units were not coded separately in MLSIS in 1993	160.5	5	18	0	0
1994	Windthrow salvage - clearcut	6.3	2	10	19	3
1995	Windthrow salvage - clearcut	19.5	4	26	13	5
	Windthrow salvage - select cut	1	1			
	Pest salvage - select cut	2.2	1			
1996	Windthrow salvage - clearcut	63.1	7	17	8	3
1997	Windthrow salvage - clearcut	16.7	5	11	6	2
	Windthrow salvage - select cut	22.3	2			
1998	Windthrow salvage - clearcut	60.3	12	14	6	1
	Windthrow salvage - select cut	28.6	9			
	Pest salvage - single tree	0	166 (1)			

(1): 166 mountain pine beetle individual and group attack sites have been identified and are being helicopter salvage logged. The trees are harvested with a Silviculture Prescription exemption. This results in no area being attributed to these trees.

In 1994 31 individual trees were bucked and burnt to control mountain pine beetle. These are the only documented NRLs in the past five years.

Harvest methods are a combination of ground based equipment and helicopter logging.

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Appendix XII

Determination of the Start Year for Managed Stand Yields

HARVEST SUMMARY
Determination of Managed Stand Yield Table Starting Point

Year	Opening	Area (ha)	Managed Stand Performance	Natural stand Performance
1972	G38-005	67	67	
	G39-012	85	85	
	G39-014	60	60	
	G39-017	10	10	
	G49-016	94	94	
	H41-005	63	63	
	H41-016	186	186	
	H41-019	269	269	
	H41-015	106	106	
	Subtotal	**940**	**940**	**0**
1973	G39-055	74	74	
	G40-011	60	60	
	G49-018	47	47	
	G49-020	64	64	
	G49-021	36		36
	G49-028	100	100	
	G50-013	107	107	
	H41-008	87	87	
	H41-011	63	63	
	H41-014	65	65	
	H41-031	32	32	
	Subtotal	**735**	**699**	**36**
1974	G39-046	36		36
	G40-013	73	73	
	G40-026	84	84	
	G40-027	60	60	
	G50-026	55	55	
	H41-041	84	84	
	G39-051	169		169
	Subtotal	**561**	**356**	**205**
1975	G39-033	67	67	
	G40-019	99	99	
	G40-023	136	136	
	G40-031	73	73	
	G49-017	76	76	
	G49-023	63		63
	G49-024	35		35
	G50-010	67		67
	H41-002	68	68	
	G49-025	65	65	
	G29-006	58	58	
	Subtotal	**807**	**642**	**165**
1976	G40-015	72	72	
	G40-017	58	58	
	G40-021	86	86	
	G40-022	91	91	
	G40-033	62	62	
	G49-015	88		88
	H41-003	45	45	
	H41-004	25	25	
	H41-010	45	45	
	H41-012	40	40	
	H41-037	75	75	
	G39-042	53	53	
	H41-001	76	76	
	H41-007	89	89	
	Subtotal	**905**	**817**	**88**

Year	Opening	Area (ha)	Managed Stand Performance	Natural stand Performance
1977	G29-013	88	88	
	G30-002	64	64	
	G39-048	89		89
	G39-049	48		48
	G40-028	66	66	
	G50-006	154	154	
	G50-008	87	87	
	G50-031	93	93	
	G50-007	110	110	
	G50-036	61	61	
	Subtotal	**860**	**723**	**137**
1978	G39-017	59	59	
	G48-013	134		134
	G48-014	11	11	
	G48-015	27	27	
	Subtotal	**231**	**97**	**134**
1979	G29-014	55	55	
	G39-006	81	81	
	G39-010	65		65
	G39-011	63	63	
	G39-044	28		28
	G49-022	76		76
	G50-021	75	75	
	G40-018	106	106	
	G39-015	51	51	
	G40-032	152	152	
	G50-011	107	107	
	Subtotal	**859**	**690**	**169**
1980	G40-014	63	63	
	G40-016	71	71	
	G49-014	60	60	
	G50-002	173	173	
	G39-013	87	87	
	Subtotal	**454**	**454**	**0**
1981	G49-029	46	46	
	G50-030	105	105	
	G49-026	68	68	
	H41-021	57	57	
	H41-023	41	41	
	Subtotal	**317**	**317**	**0**
1982	G30-001	245	245	
	G40-040	128	128	
	G50-019	236	236	
	G50-034	78	78	
	G50-035	64	64	
	H41-006	75	75	
	H41-009	68	68	
	G50-014	57	57	
	Subtotal	**951**	**951**	**0**
	Total	**7620**	**6686**	**934**

The total area of stands harvested between 1972-1982 exhibiting natural growth performance is equal to the total area harvested in 1972.
Stands were assessed on density,growth performance,silviculture regimes(spaced,brushed) and height/age relation to determine natural or managed growth performance.
NSR was not factored into the decision as this is dealt with separatly in the information package.
Stands harvested in 1972 are assigned to natural growth curves. Stands hrvested 1973-1982 are assigned to managed stand curves.
Stands harvested prior to 1972 are mostly IU harvested areas and assigned to natural stand curves.

Stands harvested after 1982 have legislated stocking and ,after 1987, free growing requirements.
Post 1982 stands also benefit from improved planting stock and more aggressive silviculture regimes.
The post 1982 stands are assigned to managed stand curves.

Information Package

Appendix XIII

Rationale for Seral Succession

Rationale for the Inclusion of Type Group 41 Stands through Seral Succession

To justify the conversion of type group 41 stands to conifer, two reports were examined. The first is a report entitled *Changes in Forest Structure and Floral Composition in a Chronosequence of Aspen Mixedwood Stands in Alberta*[13]. The report provided sufficient information to justify the concept of seral succession in aspen-conifer stands when several conditions were met.

1) The presence of a coniferous understory, as a result of nearby seed sources from conifer,
2) Sufficient stand age (120+ years) to allow senescence and mortality to occur within the post-fire cohort of trees, which results in gaps in the canopy,
3) The inability of neighboring trees to fill canopy gaps,
4) The recruitment into gaps from the subcanopy.

Attached is an excerpt from this report showing the reduction in the density of aspen and the increase in the density of white spruce over time.

A second report, specific to the Prince George TSA (inclusive of T.F.L. #53) was a proposal by Vanderhoof Pulp and Paper for a Pulpwood Agreement[14]. Page 52 of the report indicated that the volume distribution of stands classified as inventory type group 41 stands within the TSA comprised 47.7% conifer by volume (represents stands 61+ years of age; 17.5+ cm dbh; C.U.; Net DW2B). The report included a field assessment of 300 aspen trees for measures of decay and stain, and 219 sample plots to assess the shift in the inventory as a result of seral succession. The report sited that as high as "67% of some type group, age and site class combinations of aspen stands were confirmed in the field to have made the shift from being dominant aspen to dominant spruce or lodgepole pine stands."

Within the type group 41 stands located on T.F.L. # 53, the current species proportions are: Aspen 59% Pine 16%, Spruce 22%, Birch 2%, Cottonwood 1%. Dunkley is confident that, given sufficient time, these stands will succeed to conifer leading. The question which then remains is how to model this transition?

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[13] Found in: Stelfox, J.B. (Editor) 1995. Relationships between stand age, stand structure, and biodiversity in aspen mixedwood forests in Alberta. Jointly published by Alberta Environmental Centre (AECV95-R1), Vegreville, AB, and Canadian Forest Service (Project No. 0001A) Edmonton, AB. Pp. 308,

[14] Proposal for Pulpwood Agreement No. 18, Vanderhoof Pulp and Paper February 1990.

For this analysis, type group 41 stands which have a current age less than 41 will be converted to coniferous through silviculture treatment. Stands 41 years of age or older will grow along the VDYP yield curve. They will be available for harvest after sufficient time has passed to ensure seral succession. In this analysis, the minimum cutting age will be 161 years. By this time, the majority of the pioneer aspen would have died and the spruce understory would have aged sufficiently to become merchantable in terms of age and volume.

To moderate future yields, due to the forecasted low number of stems per hectare in these stands as a result of aspen mortality and snags, an OAF will be applied to the FSSIM model. This will reduce the merchantable volume of these 'newly converted' coniferous stands. An OAF of 50% will be applied to the existing unmanaged stands in analysis unit 20. This will reduce the volume of these stands to approximately 140 m3/ha at 160 years of age.

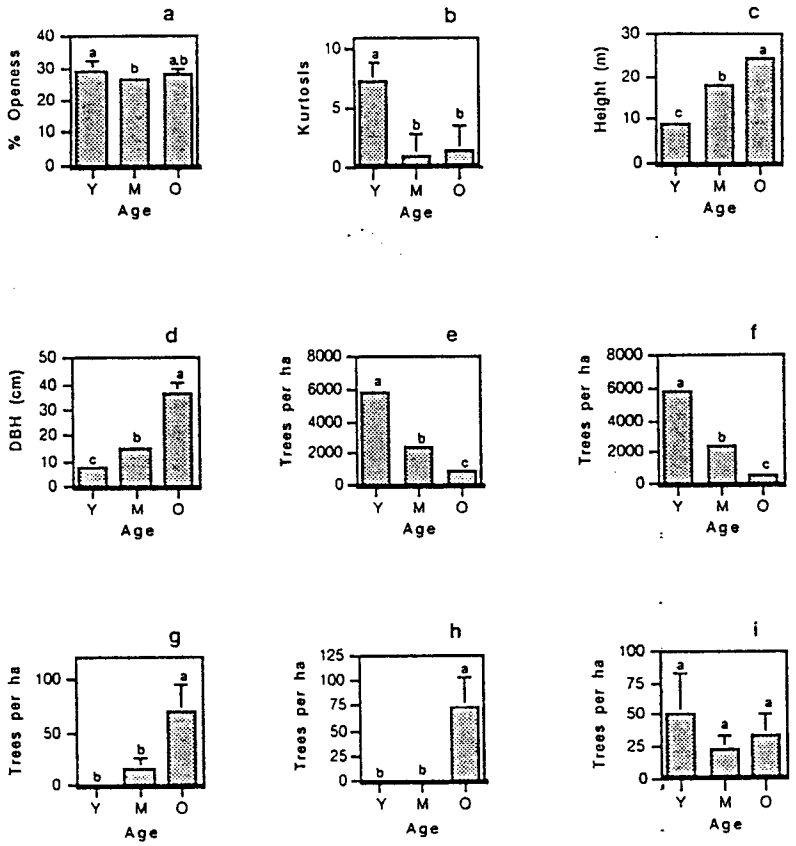

FIGURE 3.2a–i. Mean values (± S.E.M.) for canopy openness and canopy tree variables among stand ages in a chronosequence of aspen mixedwood stands in Alberta. Y=young stands (20–30 years), M=mature stands (50–65 years), O=old stands (120+ years). a) canopy openness, b) kurtosis of canopy openness, c) tree height, d) tree DBH, e) overall density of canopy trees, f) density of aspen, g) density of white spruce, h) density of paper birch, and i) density of balsam poplar.

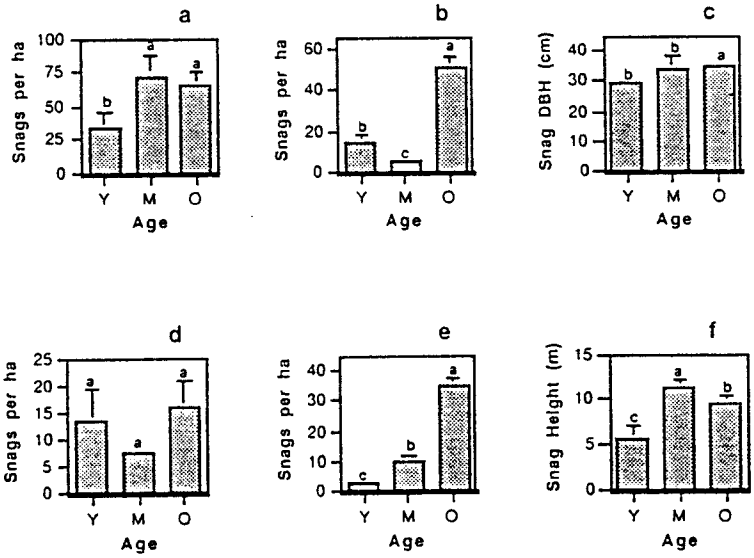

FIGURE 3.3a–f. Mean values (± S.E.M.) for snag variables among stand ages in a chronosequence of aspen mixedwood stands in Alberta. Y=young stands (20–30 years), M=mature stands (50–65 years), O=old stands (120+ years). a) density of snags > 10 cm DBH, b) density of snags > 20 cm DBH, c) DBH of snags > 20 cm DBH, d) density of snags in decay stages 4 and 6, e) density of snags with conks, and f) height of snags > 10 cm DBH.