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Tree Farm Licence #30
Management Plan #10

Timber Supply Analysis
Analysis Report

Prepared for:

Canadian Forest Products Ltd

All interested parties are invited to view and comment on the Draft Timber Supply Analysis Report for Management Plan #10, from March 13th, 2013 through to May 13th, 2013. Comments will be accepted until 4:00 pm May 13th, 2013.
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EXECUTIVE SUMMARY

The timber supply analysis in support of Management Plan #9 was completed in 2003, followed by the allowable annual cut (AAC) determination effective July 1st, 2003 in which the AAC was set at 330,000 m^3/year.

On April 4th, 2006 under a Postponement Order (Section 8 (3.1) of the *Forest Act*), Canfor provided a letter to the Chief Forester to have the next AAC determination postponed to June 12th, 2013. The Chief Forester concluded that the factors used to assess timber supply have not changed to the extent that they would have an impact on existing timber supply. Consequently, the next AAC determination is scheduled to occur by June 12th, 2013.

Canfor has initiated this timber supply analysis in support of Management Plan #10 and this document describes the results of the recently completed timber supply analysis for Tree Farm Licence (TFL) #30.

The base case harvest forecast presented demonstrates that the land base can support a harvest level of approximately 412,500 m^3/yr over the next 45 years before increasing to a sustainable long-term harvest level of approximately 537,000 m^3/yr.

The base case harvest level represents a substantial increase over the base case harvest forecast from Management Plan #9 (MP9) and the current AAC of 330,000 m^3/yr. This increase can be attributed to the following factors:

- An increase in the timber harvesting land base (THLB) of approximately 5,400 ha (4%) over the THLB from MP9.
- An accumulated undercut of almost 2.5 million m^3 over the last 10 years.
- The MP9 base case includes a significant reduction in harvest attributable to modelling patch size objectives. This impact has been eliminated in the current analysis.
- Changes to management objectives for seral stage[1] and caribou corridors have allowed for increased harvest.
- Improvement in the assumptions used to generate managed stand yield estimates.
- The use of a spatially explicit optimization model results in an optimized harvest schedule that is capable of minimizing the timber supply impact of harvesting constraints while ensuring that the harvest schedule is operationally feasible.

Sensitivity analysis conducted on TFL 30 seeks to quantify the degree to which uncertainty in data and assumptions might affect timber supply. Table 19 shows a summary of the harvest impacts of each scenario relative to the base case.

[1] *It is not clear from MP9 data package as to whether the 2/3 draw down to the seral stage targets was applied however, the Rationale document suggests that seral stage constraints where phased in over three rotations.*

Table i: Summary of Analysis Results

Scenario	Years 1 to 45		Years 46 to 250	
	m³/yr	% Change	m³/yr	% Change
Base Case	412,558		537,080	
Evenflow	409,551	-1%	411,360	-23%
Increased IHL	409,630	-1%	526,848	-2%
Reduced LTHL	412,913	0%	496,354	-8%
120 m3/ha MHA	408,360	-1%	537,305	0%
180 m3/ha MHA	410,830	0%	525,973	-2%
200 m3/ha MHA	405,653	-2%	517,039	-4%
Managed Stand Yields +10%	415,974	1%	588,812	10%
Managed Stand Yields -10%	399,387	-3%	484,903	-10%
Natural Stand Yields +10%	444,131	8%	537,900	0%
Natural Stand Yields -10%	373,497	-9%	534,776	0%
No Seral Draw Down	364,635	-12%	521,442	-3%
Phased In Full Seral; Age @ 140/250	392,419	-5%	527,494	-2%
2/3 Seral Draw Down; Old Age @ 140	426,724	3%	542,381	1%
2/3 Seral Draw Down; Age @ 140/250	415,072	1%	538,263	0%
ERA (>20% old)	407,887	-1%	535,561	0%
Patch Size Targets	401,035	-3%	521,319	-3%
Relaxed Patch Size Targets	412,024	0%	536,938	0%
Add 3.5% WTP Reduction	401,422	-3%	523,761	-2%
OAF1 @ 0.85	403,733	-2%	512,796	-5%
No Weevil Impacts	444,636	8%	534,832	0%
No Watershed Constraints	420,249	2%	545,405	2%
Remove FSW Constraints	418,644	1%	543,888	1%

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ACRONYMS

AAC	Allowable Annual Cut
AU	Analysis Unit
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
CFLB	Crown Forested Land Base
ECA	Equivalent Clearcut Area
ERA	Ecosystem Representation Analysis
FDU	Forest Development Unit
FPPR	Forest Planning and Practices Regulations
FRPA	Forest and Range Practices Act
FSP	Forest Stewardship Plan
FSW	Fisheries Sensitive Watershed
GWM	General Wildlife Measure
IHL	Initial Harvest Level
IWA	Interior Watershed Assessment
IWAP	Interior Watershed Assessment Procedures
LRDW	Land and Resource Data Warehouse
LTHL	Long-Term Harvest Level
M	Modification VQO Classification
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MHA	Minimum Harvest Age
MOE	Ministry of Environment
MOF	Ministry of Forests
MP	Management Plan
MPB	Mountain Pine Beetle
NCD	No Channel Defined
NDT	Natural Disturbance Type
NRL	Non-Recoverable Losses
NSR	Not Sufficiently Restocked
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Areas
PFI	Peak Flow Index
PFLB	Productive Forest Land Base
PSI	Potential Site Index
PR	Partial Retention VQO Classification
RESULTS	Reporting Silviculture Updates and Land status Tracking System
RMA	Riparian Management Area
RMZ	Riparian Management Zone
RRZ	Riparian Reserve Zone
SPH	Stems Per Hectare
TEM	Terrestrial Ecosystem Mapping
TFL	Tree Farm Licence
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation Program for Stand Yields
TSA	Timber Supply Area
TSM	Terrain Stability Mapping

VDYP	Variable Density Yield Prediction Growth and Yield Model
VEG	Visually Effective Green-up Height
VLI	Visual Landscape Inventory
VQO	Visual Quality Objectives
VRI	Vegetation Resource Inventory
VSU	Visually Sensitive Unit
WTP	Wildlife Tree Patch

1.0 INTRODUCTION

The timber supply analysis in support of Management Plan #9 (MP9) was completed in 2003, followed by the allowable annual cut (AAC) determination effective July 1st, 2003 in which the AAC was set at 330,000 m^3/year.

On April 4th, 2006 under a Postponement Order (Section 8 (3.1) of the *Forest Act*), Canfor provided a letter to the Chief Forester to have the next AAC determination postponed to June 12th, 2013. The Chief Forester concluded that the factors used to assess timber supply have not changed to the extent that they would have an impact on existing timber supply. Consequently, the next AAC determination is scheduled to occur by June 12th, 2013.

Canfor has initiated a timber supply analysis in support of Management Plan #10 (MP10) and this document describes the results of the recently completed timber supply analysis for Tree Farm Licence (TFL) #30.

The *Tree Farm Licence #30 Management Plan #10 Data Package* (Ecora, 2012) was published in July 2012 and contains a detailed description of the data and assumptions used in the timber supply analysis. This document, to be viewed in conjunction with the Data Package, provides the results of the timber supply analysis. Section 4.0 of this report presents the results of the base case analysis and Section 5.0 summarizes the results of the sensitivity analysis that has been completed.

2.0 LAND BASE DESCRIPTION

2.1 Location

Tree Farm Licence #30 is located east of Prince George in the Prince George Forest District (Figure 1). The western boundary of the TFL is located near highway 97 at Summit Lake and stretches eastward across the western foothills of the Rocky Mountains, predominantly north of the Fraser River. The TFL covers a total of 180,347 ha and is characterized by a mixture of rolling terrain with steeper slopes towards the Rocky Mountains to the north.

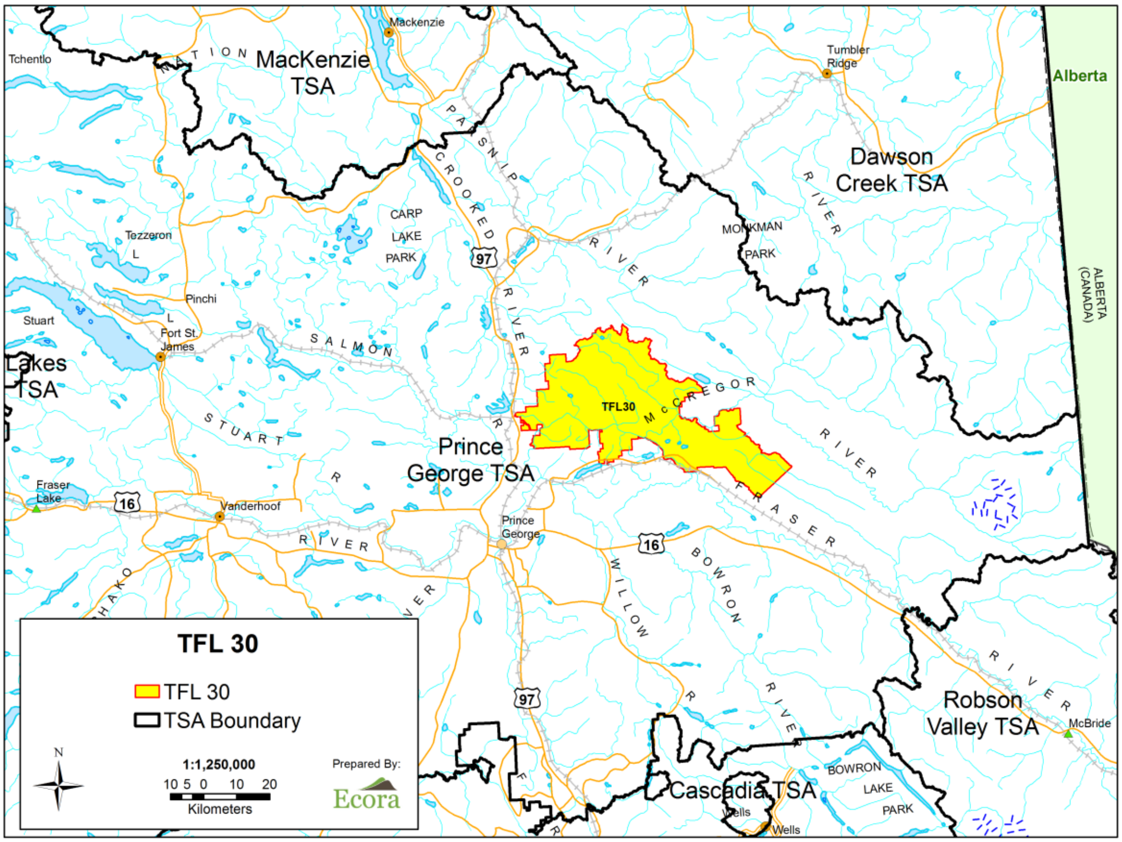

Figure 1: Location of TFL 30

2.2 Land Base Classification

The land base classification (netdown) process starts with the gross area of the land base and removes area in a stepwise fashion according to detailed classification criteria. A complete description of the data and assumptions used in the analysis is documented in in the Data Package. Through the netdown, area is systematically removed in order to establish both the productive forest and timber harvesting land base (THLB). Table 1 shows the area removed under each netdown category as well as the current and future THLB.

Table 1: Land Base Classification.

Land Classification	Gross Area Included in Classification (ha)	Area (ha)	% of the Productive Forest
Total Area	**180,347**	**180,346**	
Reductions to CFLB		-	
Non-TFL	-	0	
Private Land	-	-	
Non-Forest and Non-Productive	19,202	18,915	
Existing Roads and Trails	1,960	1,679	
Non-Commercial Cover	10,494	5,674	
Existing Unmapped Landings	1,252	1,079	
Unclassified Lands	958	77	
Total Reductions to CFLB		**27,425**	
Productive Forested Land Base (PFLB)		**152,921**	
Reductions to PFLB			
Parks and Protected Areas	-	-	0%
Unstable Terrain	3,739	2,729	2%
Caribou High Habitat	12,124	8,484	6%
Recreation Areas	3,383	830	1%
Recreation Sites	24	17	0%
Riparian Management	15,117	6,075	4%
Special Riparian Areas	4,341	1,033	1%
Difficult Regeneration	6,449	871	1%
Deciduous Leading Stands	4,653	3,686	2%
Non-Merchantable – Mature	16,033	2,896	2%
Non-Merchantable – Immature	12,269	2,353	2%
Low Productivity – Immature	697	-	0%
Wildlife Tree Patches	2,830	1,430	1%
Total Reductions to PFLB		**30,405**	20%
Current Timber Harvesting Land Base		**122,516**	80%
Future Roads Reduction	175	171	0%
Long-Term Timber Harvesting Land Base		**122,345**	80%

A map showing the location of the THLB and each netdown category is included in Appendix I

The netdown process also classifies the land base into three broad categories:

- **Non- Productive**: areas that are non-crown or non-forested and unable to grow viable timber;
- **Productive non-THLB**: the productive land base that is unlikely to be harvested for reasons such as inoperability or non-timber resource management; and
- **THLB**: the productive land base that is expected to be available for harvest over the long-term.

Figure 2 shows the distribution of these categories within the TFL. Of the TFL area, 122,345 ha (68% of the total area) falls within the THLB. Of the non-THLB area, 30,405 ha (15% of the total area) is productive forest lands with the remainder in non-productive or non-forested area.

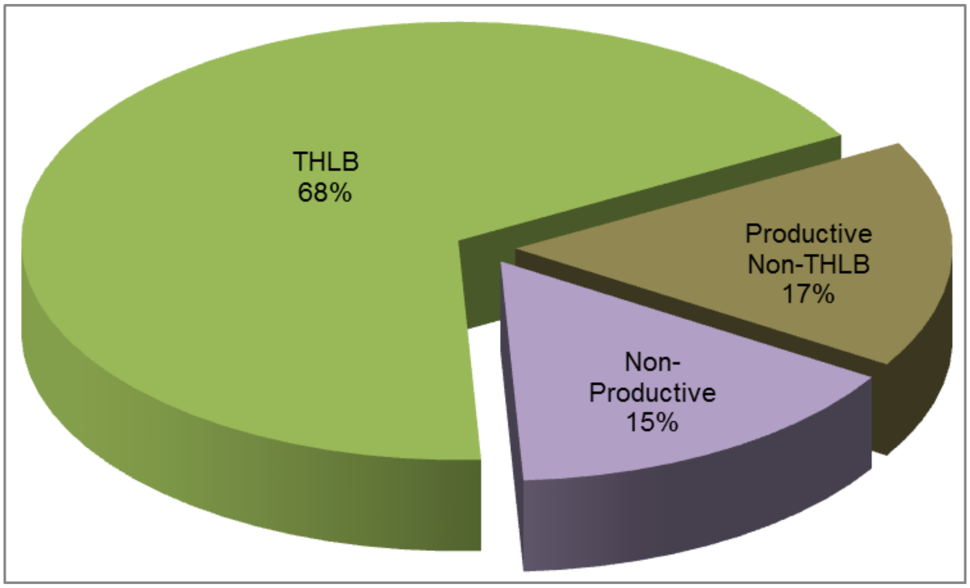

Figure 2: Area by Land Classification

2.2.1 Changes from the Data Package

There have been some minor changes to the data and assumptions described in the Data Package. The following reflects changes to netdown assumptions that affect the THLB:

- As described in the Data Package, the Phase II VRI Adjustment had not been completed at the time the Data Package was published and therefore the netdown information does not reflect the adjusted inventory attributes. Table 1 shows the final THLB used in the timber supply analysis and considers the Phase II Inventory Adjustment as described below.

- A new blocks layer was incorporated, updating logging disturbance to December 1st, 2012 and incorporating new planned blocks into the summer of 2014. This layer also included several older cutblocks that were not included in the initial data set.

- The Data Package states that future roads will be removed once they have been harvested for the first time. Due to the relatively small area occupied by future roads, these areas (171 ha) have been netted out at the start and are not available for the initial harvest in the model.

- Overall the final THLB is 526 ha larger than what was reported in the Data Package. This is due to the inclusion of additional older cutblocks as well as the impacts of the Phase II VRI adjustment on the netdown (discussed below).

In reviewing the Data Package, MFLRNO staff provided recommendations on changes to how managed stand yield curves are modelled. The Data Package (Table 27) describes the calculation of TEM-based OAF 1 values for each individual site series. These calculations results in some very high OAF values in some of the less productive site series and very low values in some of the more productive site series. In consultation with MFLNRO staff, these values have been averaged for each BEC variant as and applied to the yield tables as shown in Table 2.

Table 2: Revised OAF 1 Information

Silviculture Era	BEC Variant	THLB Area (ha)	NP Percent	Default OAF 1	OAF 1
d1	SBSvk	246	0.054	0.075	0.87
r1	ESSFwk	708	0.101	0.075	0.82
r1	ICHvk2	1,570	0.043	0.075	0.88
r1	SBSmk1	861	0.022	0.075	0.90
r1	SBSvk	17,990	0.015	0.075	0.91
r1	SBSwk1	10,843	0.049	0.075	0.88
r2	ESSFwk	612	0.118	0.075	0.81
r2	ICHvk2	456	0.056	0.075	0.87
r2	SBSmk1	1,343	0.012	0.075	0.91
r2	SBSvk	4,407	0.019	0.075	0.91
r2	SBSwk1	3,486	0.059	0.075	0.87
Existing Managed Stands		**42,522**	**0.032**	**0.075**	**0.89**
r3	ESSFwk	4,524	0.094	0.075	0.83
r3	ICHvk2	7,810	0.037	0.075	0.89
r3	SBSmk1	5,209	0.015	0.075	0.91
r3	SBSvk	58,862	0.016	0.075	0.91
r3	SBSwk1	45,940	0.056	0.075	0.87
Future Managed Stands		**122,345**	**0.035**	**0.075**	**0.89**

In addition a sensitivity analysis using default OAF 1 values of 0.85 has been completed and is reported in Section 4.8.

The impacts of leader weevil on the plantations has been modelled through the application of additional regeneration delay values based on the estimated weevil attack percentages as shown in Section 5.4 of the Data Package. The values reported Table 26 of the Data Package represent the expected additional regeneration delay for the spruce component of each managed stand yield table. However, because TIPSY is unable to apply different regeneration delays to individual species within the same curve, these values were pro-rated by the percentage of spruce within each curve and then applied to the entire curve. This approach was reviewed with MFLRNO staff and was accepted as a reasonable approximation of weevil impacts.

2.2.2 Vegetation Resource Inventory

The Vegetation Resource Inventory (VRI) was completed in 2000 using 1995 photos. This inventory has been updated for logging disturbances to December 1st, 2012 and has been projected to January 1st 2013. The inventory has been adjusted according to the *VRI Sample Data Analysis Procedures and Standards* (MOF, 2011) using 215 Phase II VRI plots established between 1997 and 2011. The results of the Phase II VRI analysis and adjustment are described in *Tree Farm Licence #30 Management Plan #10 Inventory Analysis* (Ecora, 2012).

The Phase II VRI adjustment was completed after the original data package was published. Once the Phase II VRI adjustment was complete, the netdown was re-run using the adjusted inventory attributes. Overall, the THLB increased by 298 ha as a result of the Phase II adjustment, with the non-merchantable-mature netdown decreasing by 553 ha and the non-merchantable-immature netdown increasing by 262 ha. There are some small changes in subsequent netdown steps that make up the difference in area.

Phase II VRI Adjustment

The Phase II VRI adjustment process uses randomly located plot data to statistically adjust Phase I inventory age, height, stems per hectare, basal area and volume per hectare estimates based on Phase II ground sample data. As shown in Table 3, the adjustment decreased overall stand volumes by approximately 3.1% with significant variations between strata. Average age decreased slightly and average height increased, resulting in a higher average inventory site index. Basal area and stems per hectare decreased with variations from strata to strata.

Table 3: Inventory Analysis Results

	Balsam-Immature	Balsam-Mature	Other-Immature	Other-Mature	Spruce-Immature	Spruce-Mature	Overall
N	32	37	6	13	12	115	215
Total Area	15,863	21,791	3,961	7,144	6,726	52,304	107,789
% of Land Base	15%	20%	4%	7%	6%	49%	
Age (years)							
n	30	35	6	12	12	103	198
Phase II Ground	114	160.1	131.8	118.9	106.9	147.9	129.4
Phase I Inventory	81	167.9	89.0	153.5	88.9	165.7	133.5
Ratio	1.4179	0.9537	1.4812	0.7746	1.2022	0.8922	0.9699
Sampling Error	20.0%	10.9%	23.4%	20.4%	15.3%	5.8%	5.6%
Height (m)							
n	29	35	6	12	12	103	197
Phase II Ground	19	27.5	23.4	28.2	24.4	29.0	24.5
Phase I Inventory	15	27.9	19.5	28.8	18.5	30.2	24.1
Ratio	1.2562	0.9849	1.2022	0.9809	1.3135	0.9591	1.0156
Sampling Error	11.5%	7.0%	25.1%	15.0%	10.5%	3.8%	3.4%
Basal Area (m2/ha) @7.5 cm+ dbh							
n	32	37	6	13	12	115	215
Phase II Ground	30	33.0	42.4	29.8	30.1	33.5	32.7
Phase I Inventory	24	34.4	35.2	41.5	27.8	35.7	33.6
Ratio	1.2192	0.9599	1.2069	0.7184	1.0825	0.9385	0.9725
Sampling Error	17.0%	11.9%	27.9%	23.5%	27.5%	6.7%	5.6%
Trees / ha @ 7.5cm+ dbh							
n	32	37	6	13	12	115	215
Phase II Ground	1,080	517	969	452	946	574	667
Phase I Inventory	1,501	951	1,127	849	1,306	821	991
Ratio	0.7196	0.5434	0.8600	0.5329	0.7242	0.6987	0.6727
Sampling Error	22.4%	19.6%	29.4%	70.2%	33.4%	13.8%	9.6%
Unadjusted Volume / ha (m^3/ha) @ 12.5 cm+ dbh (net dbw)							
n	31	37	6	13	12	115	214
Phase II Ground	169	256	255	224	187	264	240
Phase I Inventory	94	251	157	301	137	306	247
Ratio	1.7407	1.0199	1.6280	0.7466	1.3646	0.8626	0.9698
Sampling Error	24.6%	13.1%	44.3%	24.7%	44.2%	8.1%	8.4%
Attribute Adjusted Volume / ha (m^3/ha) @ 12.5 cm+ dbh (net dbw)							
n	28	37	6	12	12	115	210
Phase II Ground	169	256.1	255.0	224.4	186.7	263.9	239.8
Phase I Inventory	144	229.7	216.1	204.7	197.2	252.9	224.1
Ratio	1.1353	1.1151	1.1799	1.0960	0.9467	1.0434	1.0697
Sampling Error	21.4%	12.8%	42.5%	24.6%	38.2%	7.9%	6.5%
Lorey Height (m)							
n	31	37	6	13	12	115	214
Phase II Ground	17	22.3	20.6	25.9	19.8	23.8	21.8
Phase I Inventory	16	22.5	19.1	24.9	19.1	23.6	21.5
Ratio	1.0790	0.9920	1.0799	1.0391	1.0362	1.0057	1.0163
Sampling Error	9.8%	7.7%	30.4%	13.3%	19.8%	4.8%	3.7%

Leading Species

Figure 3 show the productive non-THLB and THLB areas by leading species. Most of the stands within the THLB are either spruce or balsam-leading. Deciduous-leading stands have been netted out of the THLB. There are approximately 6,021 hectares of THLB in the VRI with no leading species information. All of these stands have logging history information and have been assigned to a managed stand yield curve based on the stand's predominant site series. Ages for these stands have been adjusted based on the logging year information.

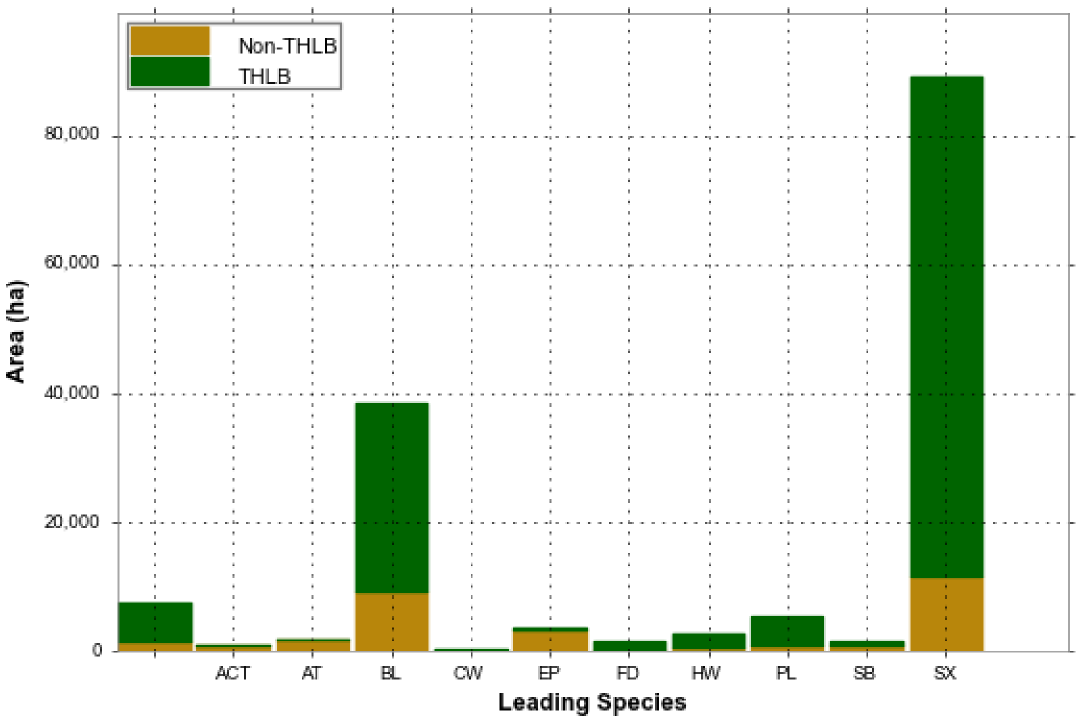

Figure 3: Leading Species Summary

Inventory Site Index

Figure 4 shows a summary of the adjusted inventory site index for the TFL with the majority of the THLB between 15 and 18 m. Similar to the stands without a leading species, stands that were recently harvested at the time the inventory was completed do not have site index information and are identified as 'NONE'. As managed stands, these areas will utilize SIBEC site index estimates (see below).

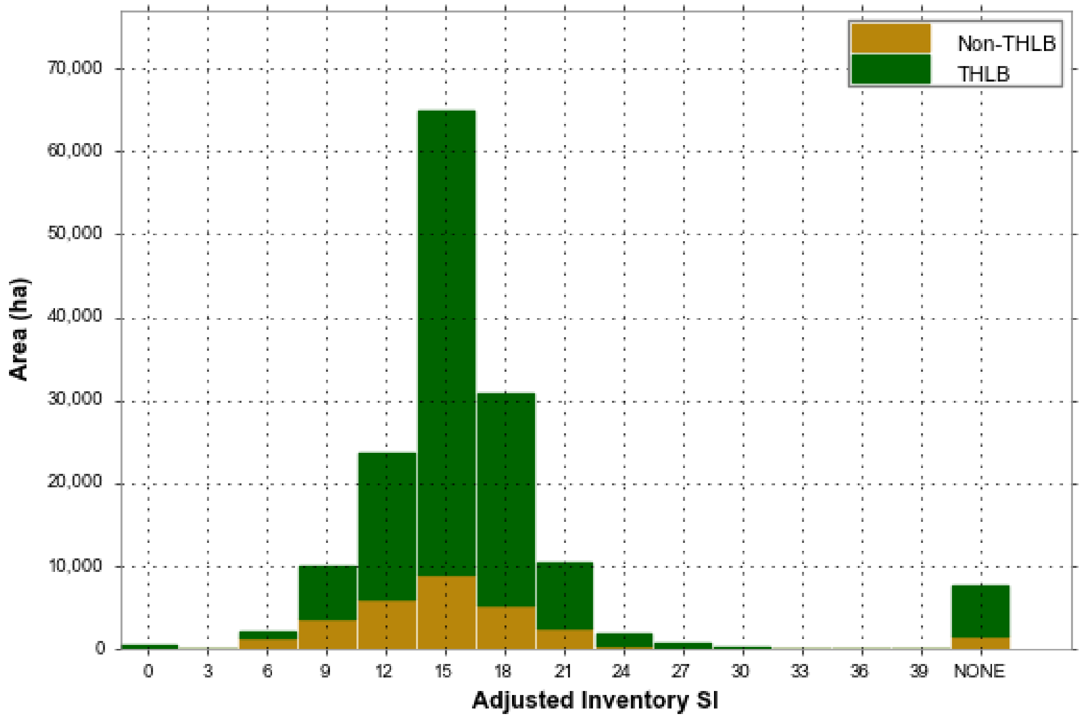

Figure 4: Adjusted Inventory Site Index Summary

2.2.3 Biogeoclimatic Ecosystem Classification (BEC)

The TFL is located in the western foothills of the Rocky Mountains and experiences heavy snowfall through the winter and substantial summer rain. Consequently the TFL is dominated by the very wet and wet-cool variants of the Sub Boreal Spruce (SBS) BEC zones as shown in Figure 5. Minor components of the Interior Cedar Hemlock (ICH) and Engelman Spruce Sub-Alpine Fir (ESSF) zones also exist.

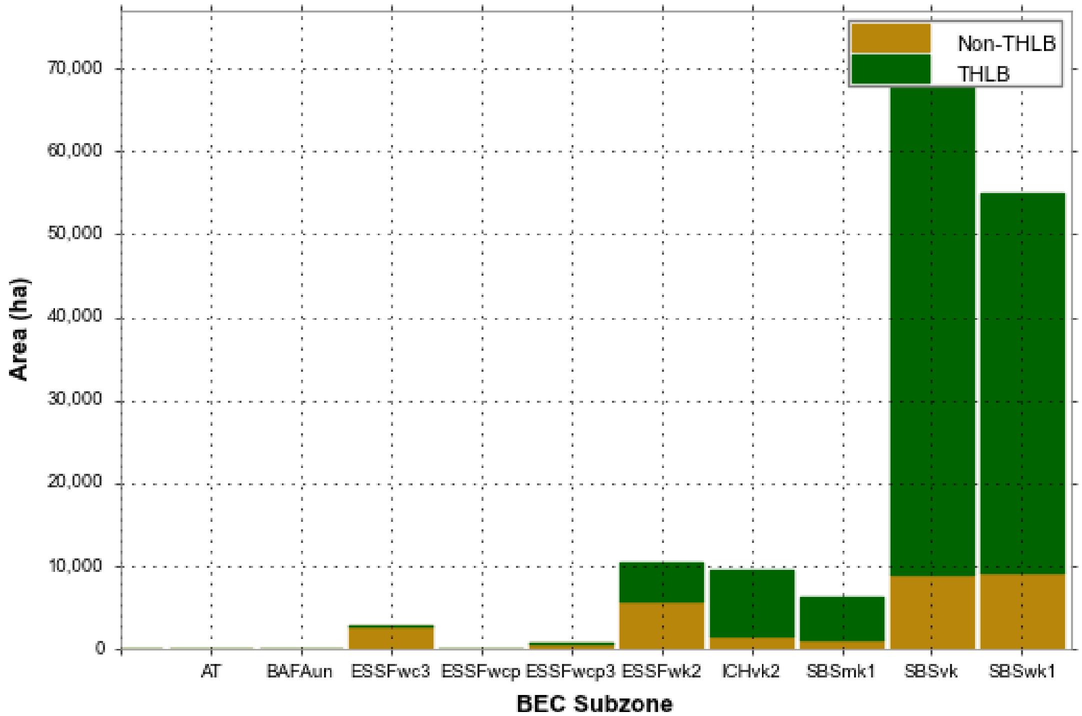

Figure 5: BEC Summary

2.2.4 Site Index

Terrestrial Ecosystem Mapping (TEM) across the TFL facilitates the use of Site Index by Biogeoclimatic Classification (SIBEC) estimates as measures of managed stand productivity. Inventory site index values are used for natural stands. Figure 6 shows the distribution of SIBEC values across the productive land base.

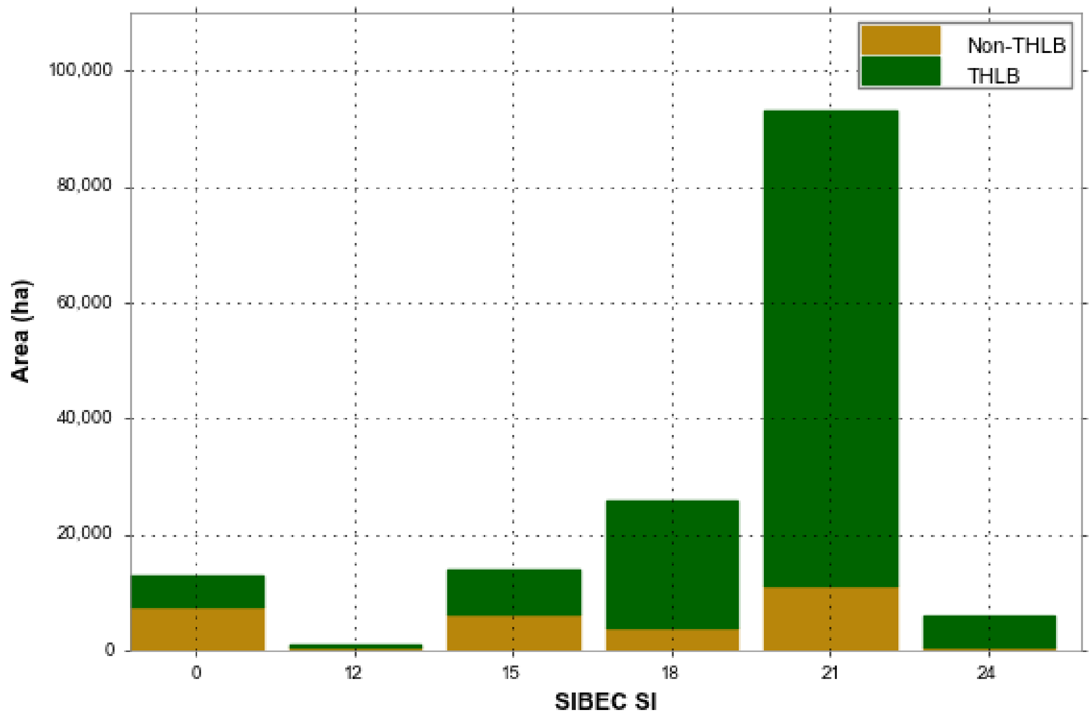

Figure 6: SIBEC Site Index Summary

Figure 7 shows the overall long-term site index values for the TFL. SIBEC site index values are used where they are available and inventory site index is used where SIBEC values aren't available.

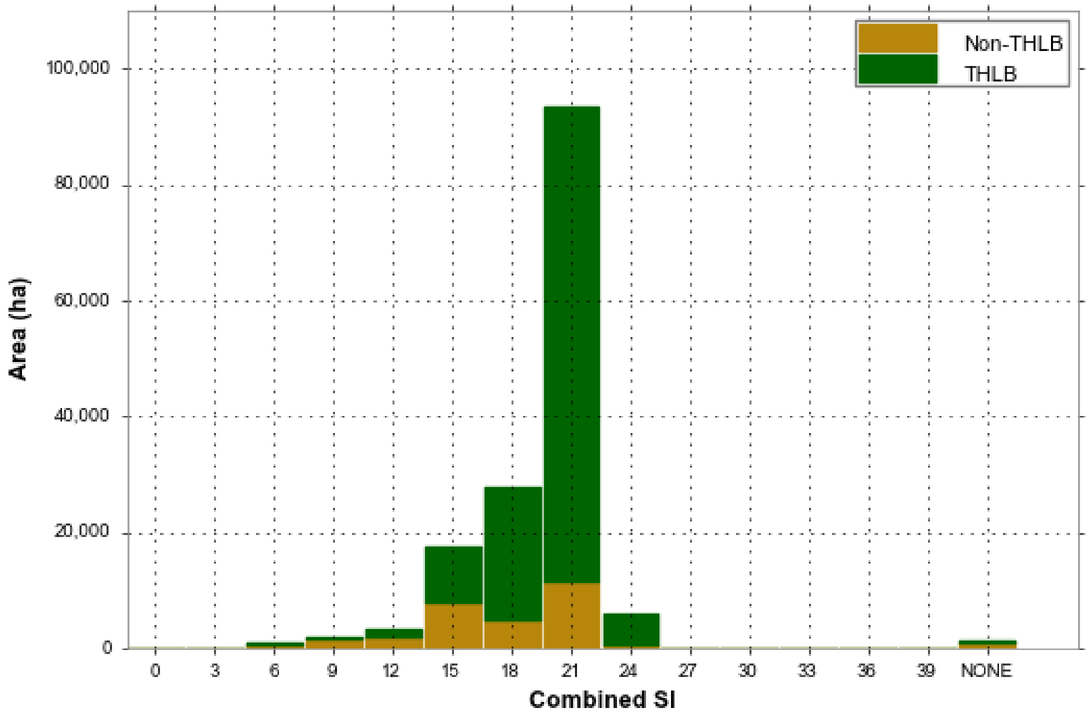

Figure 7: Combined Site Index Summary

2.2.5 Harvest History and Age Class Distribution

With the success of fire suppression across the province and a lack of large natural stand replacing events on this land base, the age class distribution of the forest is largely influenced by harvest history. Figure 8 summarizes the THLB and non-THLB by the decade of harvesting activities showing a history of forest management back into the 1940s. Harvesting activity on the TFL peaked in the 1980's and has gradually declined over the past three decades.

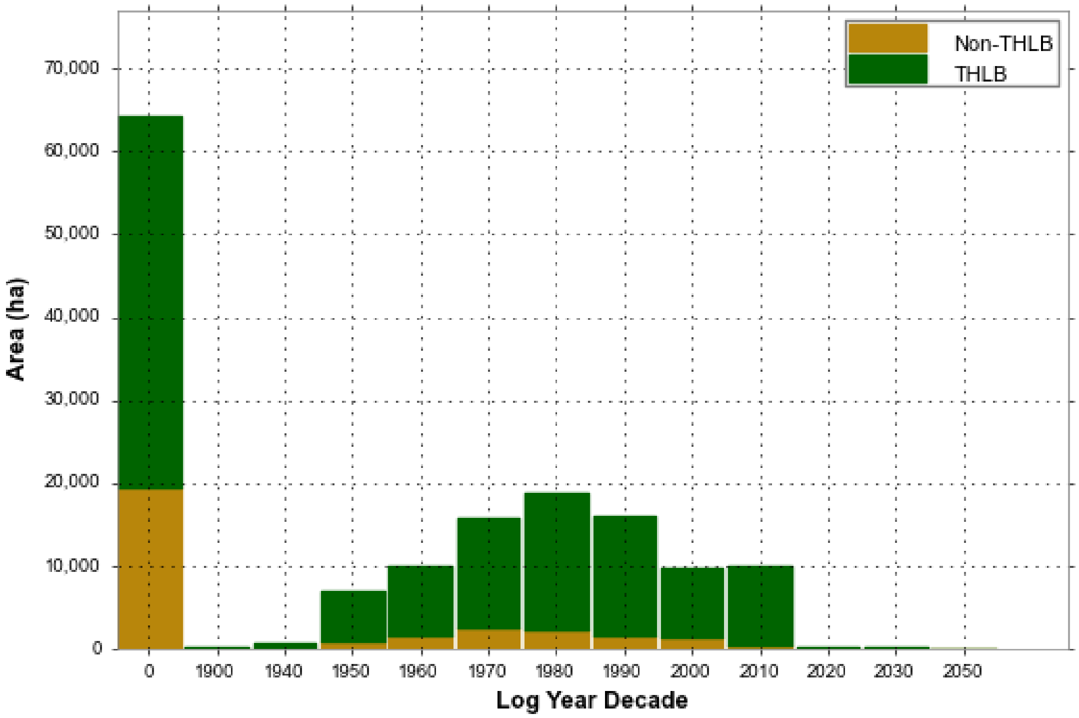

Figure 8: Harvest History

The current age class distribution of the forest is shown in Figure 9 with the area in age classes one and two largely a product of past harvesting activity. The predominance of age class eight stands demonstrates the rarity of large stand replacing events within these ecosystems. A shortage of age class nine stands in the TFL suggests that they have all been logged, they are not part of the natural range of variability for these ecosystems or, the current inventory has not adequately identify these stands. Targets for old seral retention in many of the wetter subzones (ICHvk2, ESSFwk2, and SBSvk) are based on maintaining stands older than 250 years meaning that all these targets are currently in a deficit.

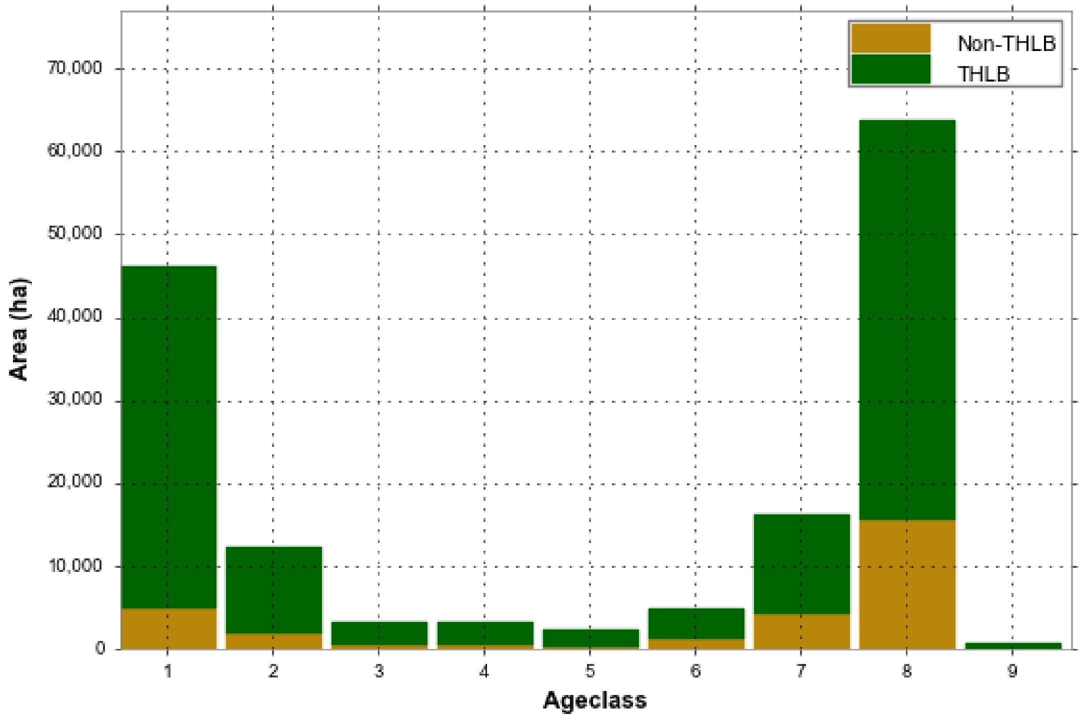

Figure 9: Initial Age Class Distribution

3.0 BASE CASE TIMBER SUPPLY ANALYSIS

The base case represents the best representation of 'current management' on the TFL. It contains the data and assumptions that combine to form our best estimate of timber supply on the TFL. Recognizing that uncertainty exists in both data and assumptions we undertake sensitivity analysis to attempt to quantify the impact of this uncertainty on the overall harvest level for the TFL.

This section presents the results of the base case timber supply analysis and provides background information on different aspects of the timber supply. The base case and all sensitivity analysis has been carried out using the forest estate model Patchworks. All harvest levels reported are net of non-recoverable losses. The forest estate model uses five-year planning periods over a 250-year planning horizon.

3.1 Harvest Forecast

Figure 10 shows the base case harvest forecast over the 250-year planning horizon. The harvest level starts at approximately 418,000 m^3/yr, declining slightly over the next 45 years before increasing the to the long-term harvest level (LTHL) of approximately 537,000 m^3/yr. Targets in Patchworks are not generally absolute – the levels of targets such as harvest volume are allowed to vary somewhat from the target value and therefore harvest levels may vary from period to period. Therefore, harvest volumes for each scenario have been summarized as average values for the first 45 years and from year 46 to year 250. Table 4 shows the average harvest levels over these periods for the base case.

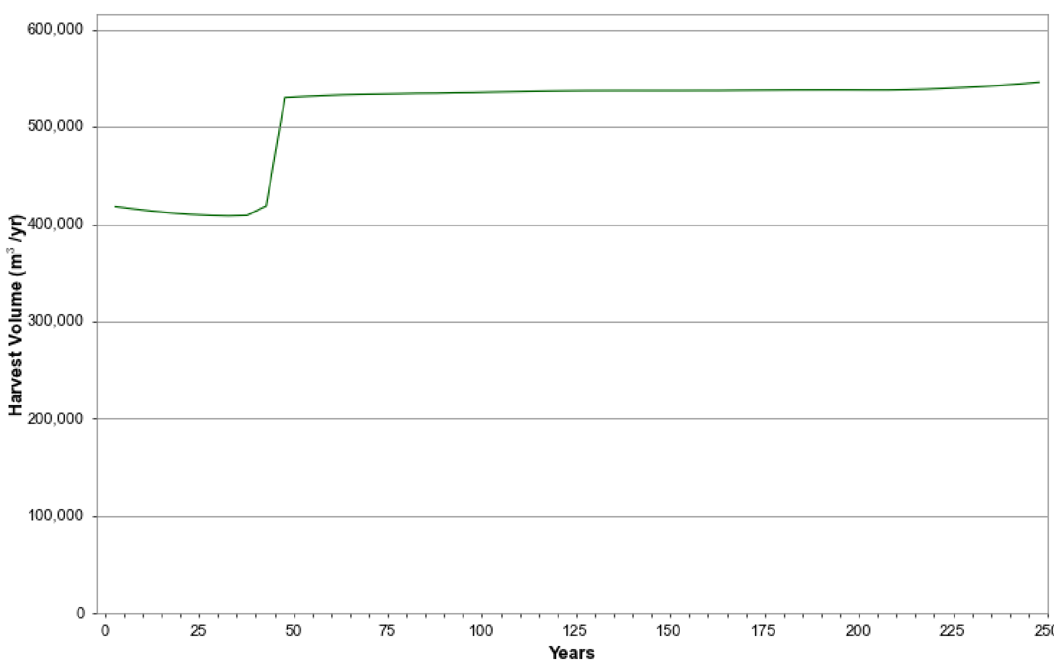

Figure 10: Base Case Harvest Forecast

Table 4: Base Case Harvest Forecast

Years	Base Case m^3/yr
1 to 45	412,558
46 to 250	537,080

Total merchantable growing stock on the THLB is shown in Figure 11. The starting growing stock of approximately 16 million m^3 decreases as the older, existing natural stand growing stock is harvested. The growing stock reaches its lowest point at year 25. At this point much of the existing natural growing stock has been harvested and many of the future managed stands have not yet reached harvestable age. Harvesting is most constrained at this point in time and this represents the 'pinch point' in the harvest schedule. As the more productive managed stands grow and become harvestable the growing stock begins to rise, facilitating the increase in the harvest level to the LTHL in year 46.

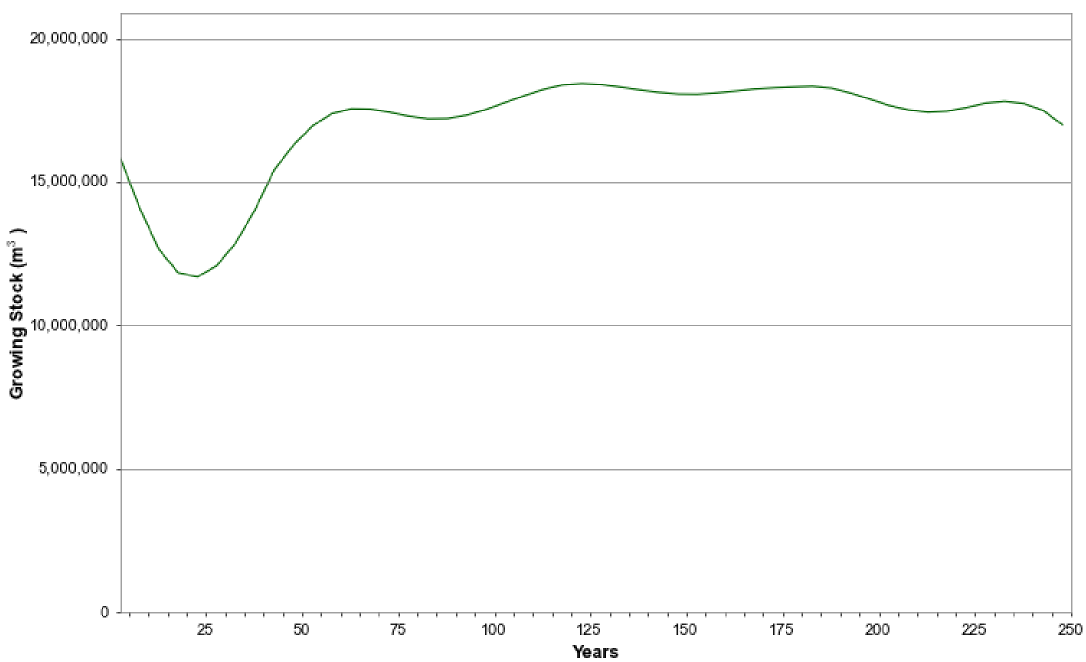

Figure 11: Base Case Growing Stock

3.2 Management Plan #9 Comparison

The timber supply analysis for Management Plan #9 (MP9) was completed in 2002 (McGregor Resource Analysis Group Ltd.) and produced a base case harvest level of approximately 350,000 m^3/yr for the first year (2001). The harvest level then drops to approximately 285,000 m^3/yr for the next nine years. The harvest level then declines by approximately 10% per decade until reaching a low of approximately 194,000 m^3/yr in 2032. The harvest level then increases over time until it reaches a long-term harvest level of approximately 509,000 m^3/yr. This differs considerably from the Management Plan #10 base case where the average initial harvest level of 412,500 m^3/yr remains relatively constant for the first 45 years of the planning horizon before increasing to the long-term level of approximately 537,000 m^3/yr. These two harvest forecasts are shown in Figure 12 and have been shifted to account for the different start date of each analysis. On average, the MP9 Base Case harvest level is approximately 43% lower for the first 50 years and 9% lower for the remaining 200 years.

There are number of factors contributing to the higher MP10 harvest levels. The following sections identify how differences in management policy, data and assumptions as well as analysis methodology have contributed to this increase in harvest level.

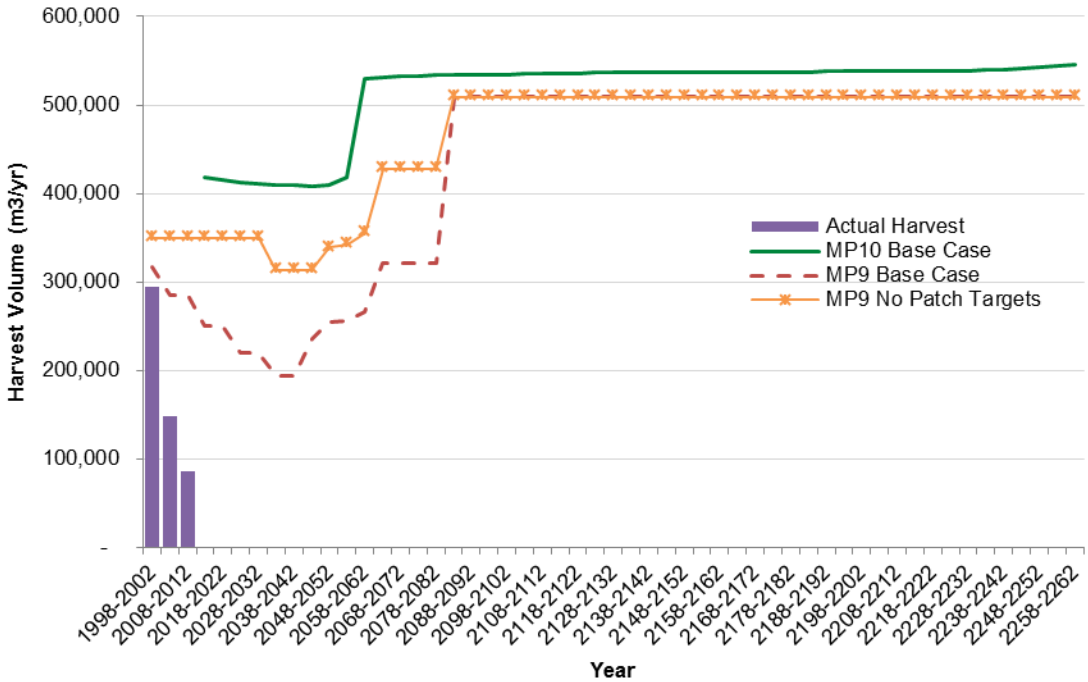

Figure 12: Harvest Forecast – MP #9

3.2.1 Timber Harvesting Land Base

Overall, the long-term THLB for the MP9 analysis is 5,393 ha (4.4%) less than this analysis. This is attributable to several small changes in data and netdown assumptions. Changes in data as well as differences in how the netdown was applied make it difficult to quantify the exact differences in each netdown category. The order in which each netdown has been applied is different and therefore the area available for a specific netdown is different.

Generally speaking the non-merchantable (or minimum economic yield) and wildlife tree patch reductions represent the largest differences in netdowns. The assumptions for the non-merchantable netdown are very similar to the MP9 analysis however, this analysis applies the netdown to the Phase II adjusted VRI whereas the MP9 analysis uses the unadjusted inventory. Furthermore, inventory volumes for this analysis were developed using VDYP version 7 while the MP9 inventory volumes came from VDYP version 6. The volume and age adjustments and the use of a different growth and yield model both have an impact on the amount of area removed under this category with approximately 12,000 ha less removed in this analysis. However, it is important to consider the fact that this netdown was applied as one of the first steps in the MP9 netdown but was applied as one of the last netdowns in MP10, contributing significantly to this difference. This significant difference impacts the area available for many of the subsequent netdown steps.

Under MP9, Canfor was required to maintain approximately 9% of the harvest blocks in wildlife tree patches (WTP). Under its current FSP, Canfor has committed to maintaining 3.5% of the gross cutblock area in WTP (7% annual average). Consequently, less area has been removed for WTP in this analysis, contributing to the larger THLB.

3.2.2 Model Constraints

The management for non-timber objectives through constraints on harvest in the forest estate model can have a significant impact on harvest levels throughout the planning horizon. As discussed below, the impact of these constraints are generally more pronounced in simulation models versus optimization model due to the ability of optimization model to plan for "pinch points" in the harvest schedule. There are several differences in how non-timber objectives have been accounted for in this analysis versus the MP9 analysis.

Patch Size

In the MP9 analysis, the removal of patch size objectives increases the short-term harvest level by an average of 99,000 m^3/yr (38%). The MP10 Base Case harvest level does not include patch size objectives. Comparing these two scenarios shows that the *MP9 – No Patch Size* scenario is on average, 94,000 m^3/yr (22%) less than the MP10 Base Case in the first 50 years and 44,000 m^3/yr (8%) less for the remainder of the planning horizon.

Seral Stage

The MP9 Data Package outlines a detailed process used to identify potential old growth management areas (OGMA) on the TFL in order to fulfill old seral objectives however it does not specify whether the 2/3 draw down was used to identify OGMA or how or if these areas were incorporated into the timber supply analysis. There is no netdown specified for OGMA in the MP9 suggesting that these constraints are addressed as forest cover constraints in the model. The 2003 Rationale document (page 22) indicates that in the base case old seral constraints were phased in over three rotations suggesting that seral stage targets in the first rotation are reduced by 2/3. The Rationale states that stands less than 2 ha in size do not contribute to old seral objectives however the impact of this is unknown.

If old seral targets in the MP9 base case are applied as spatial OGMA then the impacts will be greater than if non-spatial old seral targets where used. If the 2/3 draw down to seral stage target values was not used then the seral stage targets will have been significantly more constraining as is shown in our sensitivity analysis around this factor as described in Section 4.4 below. The exclusion of stands less than 2 ha in size from contributing to meeting old seral targets will also contribute to the lower MP9 harvest level.

Caribou Corridors

The MP9 Data Package specifies 20 different corridor unit / BEC subzone combinations and applies a minimum retention constraint of 70% mature (either > 100 years or > 120 years depending on BEC unit) whereas this analysis applies minimum retention targets of 20% > 100 years and maximum disturbance constraints of 20% < 3m to three different ungulate winter range (UWR) units as per UWR order #U-7-003. In is not clear whether the new caribou data represents a larger area than the MP9 analysis but the constraints used in MP9 are significantly more constraining than the MP10 UWR corridor constraints.

3.2.3 Managed Stand Yields

The following outlines some of the differences in managed stand yield assumption between MP9 and MP10 that contribute to increased MP10 harvest levels. Changes to managed stand yield assumptions do not generally affect the short-term harvest level as these stands are generally not available for harvest until several decades into the planning horizon. However, due to the long history of forest management on the TFL, many of the managed stands are currently between 20 and 30 years of age and may become harvestable in the next 30 to 50 years.

Leader Weevil Assumptions

Management Plan #9 applied yield curve volume reductions of 6.2% for existing managed stands and 4.9% for future managed stands to approximate the impacts of White Pine Leader Weevil on spruce plantations. In reviewing these assumptions in consultation with MFLNRO staff it was determined that the application of a regeneration delay to affected stands was more appropriate than a yield curve volume reduction. Based on this, an approach was developed in consultation with MFLNRO staff to calculate the regeneration delay attributable to leader weevil impacts and apply this to the spruce component of managed stand yields impacted by weevil.

Genetic Gains

In MP9 a 17.9% genetic gain was applied to the spruce component of managed stand yields. Since then the genetic gains on spruce have improved to 28%. In MP10, a genetic gain of 19% has been applied to the spruce component of stands harvest between 1998 and 2008 and a gain of 28% has been applied to stands harvested after 2008. No genetic gains have been applied for spruce in the ESSF. A small genetic gain has also been applied to pine however, the impact of this is minimal.

Fertilization

RESULTS records show that approximately 1,863 ha have been fertilized since 2006 and has been modelled accordingly in MP10 with a corresponding increase in managed stand yields. There was no fertilization applied to the MP9 analysis.

3.2.4 Historic Harvest Levels

Annual harvest levels for the last 12 years were compiled from a combination of the Harvest Billing System (HBS) and annual cut control (CC) statements as shown in Table 5. These figures are also shown in Figure 12 and demonstrate that harvest levels on the TFL since the last timber supply analysis have been substantially lower than the current AAC and lower than the projected harvest levels from the last analysis. In total there is approximately 2.5 million m^3 forecasted in the MP9 analysis but not actually harvested (undercut). If harvested over the next 45 years this undercut volume represents an additional 55,600 m^3/yr that is available to the model and contributes, along with the factor mentioned above, to the higher short-term harvest levels in MP10.

Table 5: Recent Harvest History

Year	Harvest Volume (m^3)	Source
2001	192,311	HBS
2002	396,827	HBS
2003	300,260	HBS
2004	201,714	HBS
2005	41,506	CC Statement
2006	46,218	CC Statement
2007	152,922	CC Statement
2008	110,866	CC Statement
2009	4,324	CC Statement
2010	62,680	CC Statement
2011	54,755	CC Statement
2012	311,756	HBS
Total	**1,876,139**	
Annual Average	**156,345**	

3.2.5 Forest Estate Model

According to the MP9 Analysis Report (McGregor Resource Analysis Group Ltd. 2002) the timber supply analysis was carried out using the spatial simulation model FPS / ATLAS. Because it is a spatial simulation model, harvest scheduling decisions are made on a period by period basis with little or no consideration into how decisions in one period might affect the available harvest volume in other periods. As additional constraints are applied to the model, the ability of a simulation model to maintain harvest levels is further compromised. This is exemplified in the difference between the long-run sustained yield and the actual harvest levels as shown in Figure 13 of the MP9 Analysis Report where the LTHL is almost 280,000 m^3/yr (35%) below the long-run sustained yield (LRSY). In comparison, the LTHL for this analysis is only 208,000 m^3/yr (28%) below LRSY.

Patchworks, a spatially explicit optimization model, examines the overall impact of harvest scheduling decisions across all periods and can evaluate tradeoffs based on their effect on the overall harvest level. In doing so, the model is able to overcome temporary shortages in available volume that simulation models cannot. Because Patchworks is a fully spatial model we are able to evaluate and implement these harvest schedules on the ground.

The initial ten years of spatial harvest schedules (SHS) from this analysis have undergone a preliminary review from an operational perspective. This review has confirmed that, in a general sense, the harvest schedule is operationally feasible. Furthermore, some harvest blocks from the SHS have already been modified slightly and incorporated in the current operational plan for the TFL.

3.3 Base Case Harvest Characteristics

Figure 13 shows the distribution of the harvest volume between natural and managed stands. For the first 45 year harvesting is almost exclusively in natural stands. It quickly transitions to managed stands over the next 20 years. Some existing natural stands do not get harvested for over 100 years because they are needed to meet old seral and other non-timber objectives.

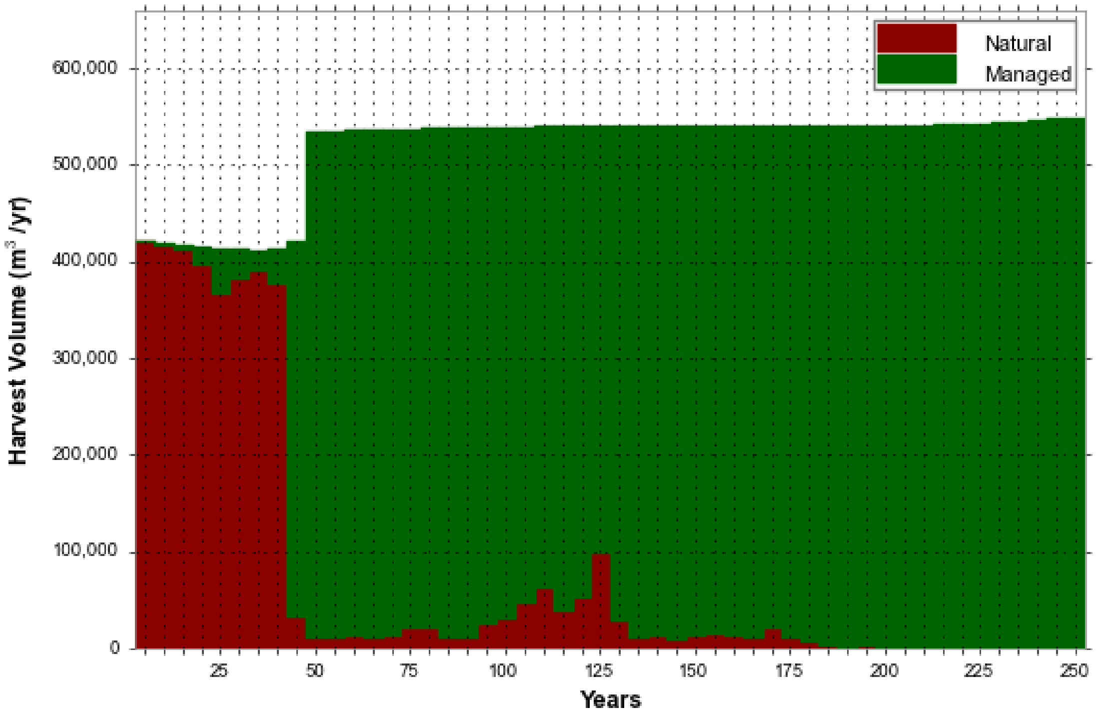

Figure 13: Base Case – Harvest from Natural and Managed Stands

Figure 14 shows how average harvest age changes over the planning horizon. It starts at approximately 170 years of age and remains relatively constant over the next 25 years as existing natural stands are harvested. As harvest transitions into younger, more productive managed stands the average harvest age drops to between 60 and 90 years of age.

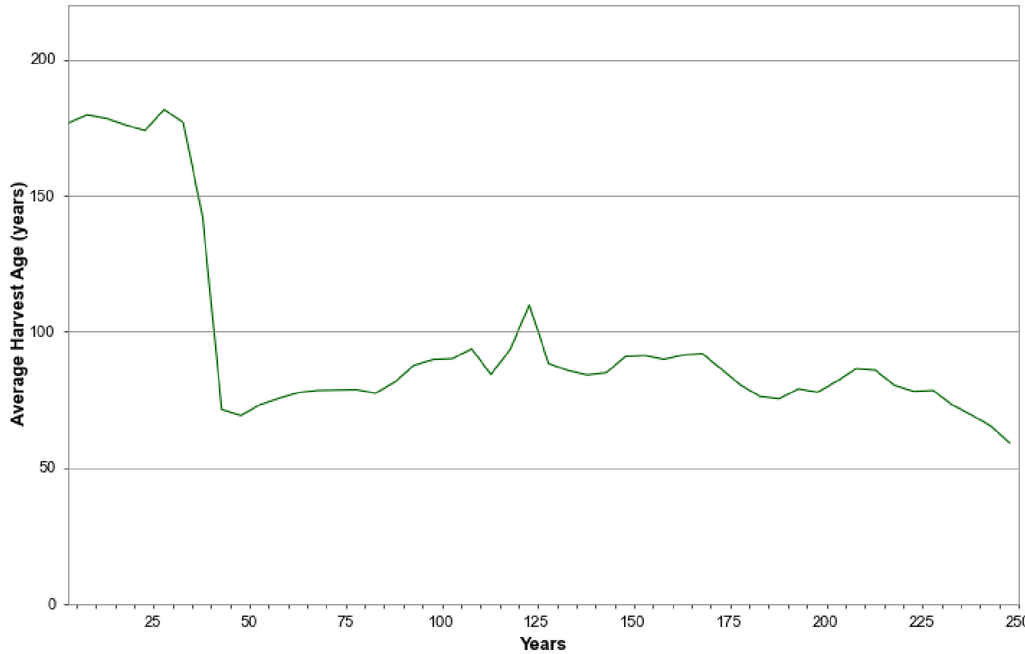

Figure 14: Base Case – Average Harvest Age

As shown in Figure 15, average volume per hectare starts off just below 300 m^3/ha. As harvest moves into more productive managed stands, the average harvest volume per hectare increases to around 400 m^3/ha.

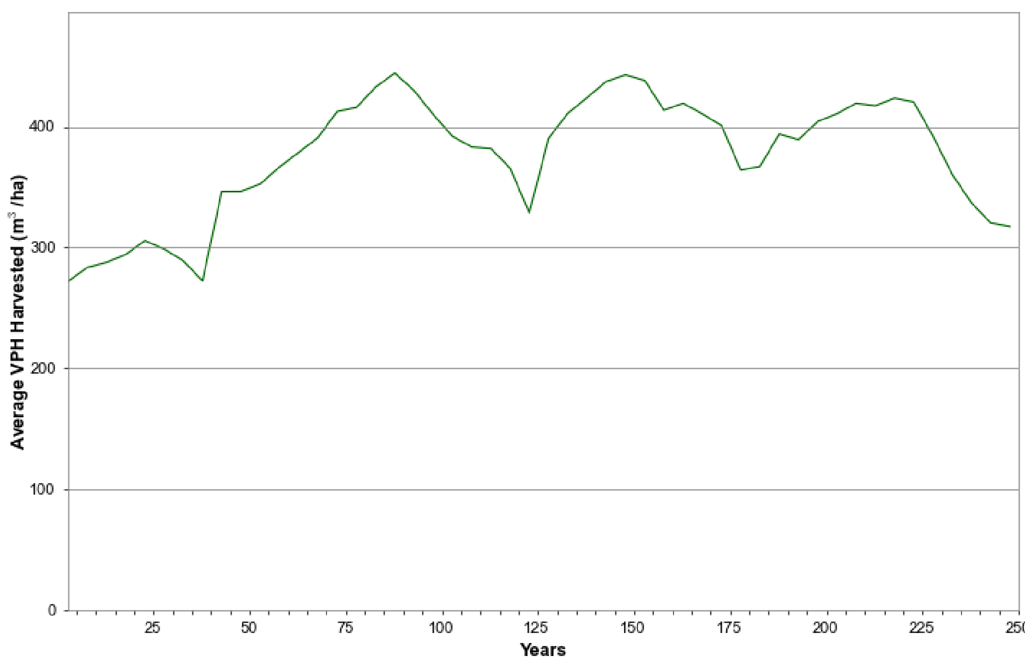

Figure 15: Base Case – Average Volume per Hectare Harvested

Figure 16 shows that, in the base case, the average area harvested per year generally remains between 1,200 ha and 1,500 ha per year.

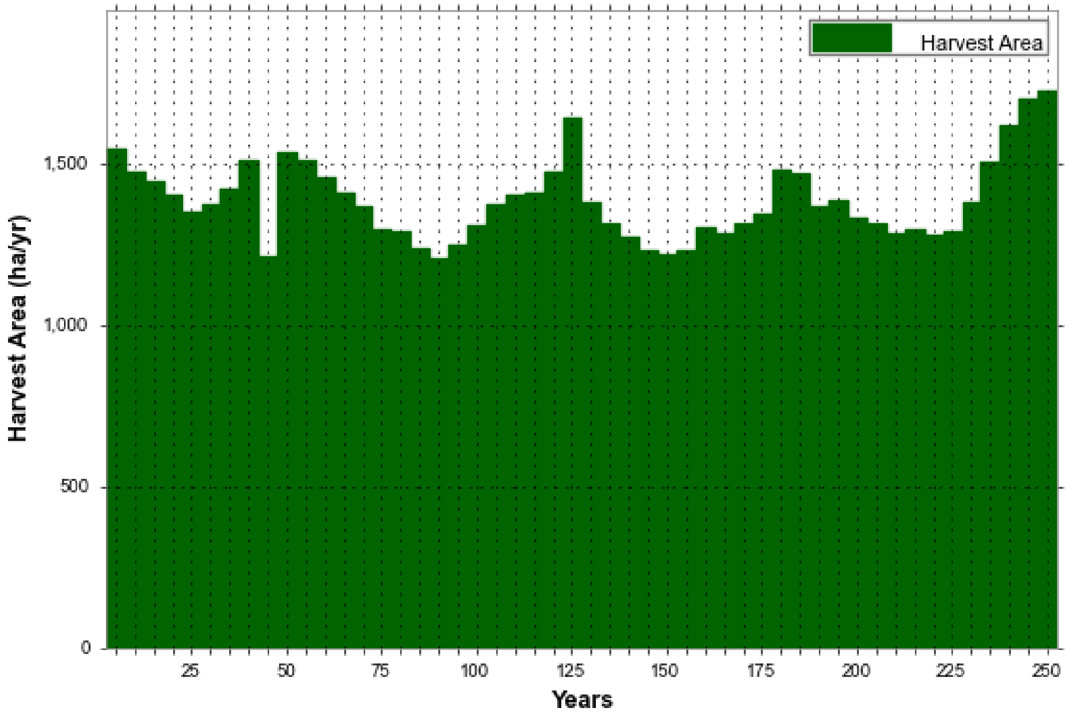

Figure 16: Base Case – Annual Harvest Area

3.4 Age Class Distribution

The age class graphs shown in Figure 17 describe the changing age class distribution of the forest over the 250-year planning horizon. Initially the age class distribution is skewed toward the oldest and youngest stands with very little area in age classes four to seven. As time progresses a more even age class distribution is created. Natural disturbances have been applied to the non-THLB portion of the land base and therefore we can see that these stands do not continually age throughout the planning horizon.

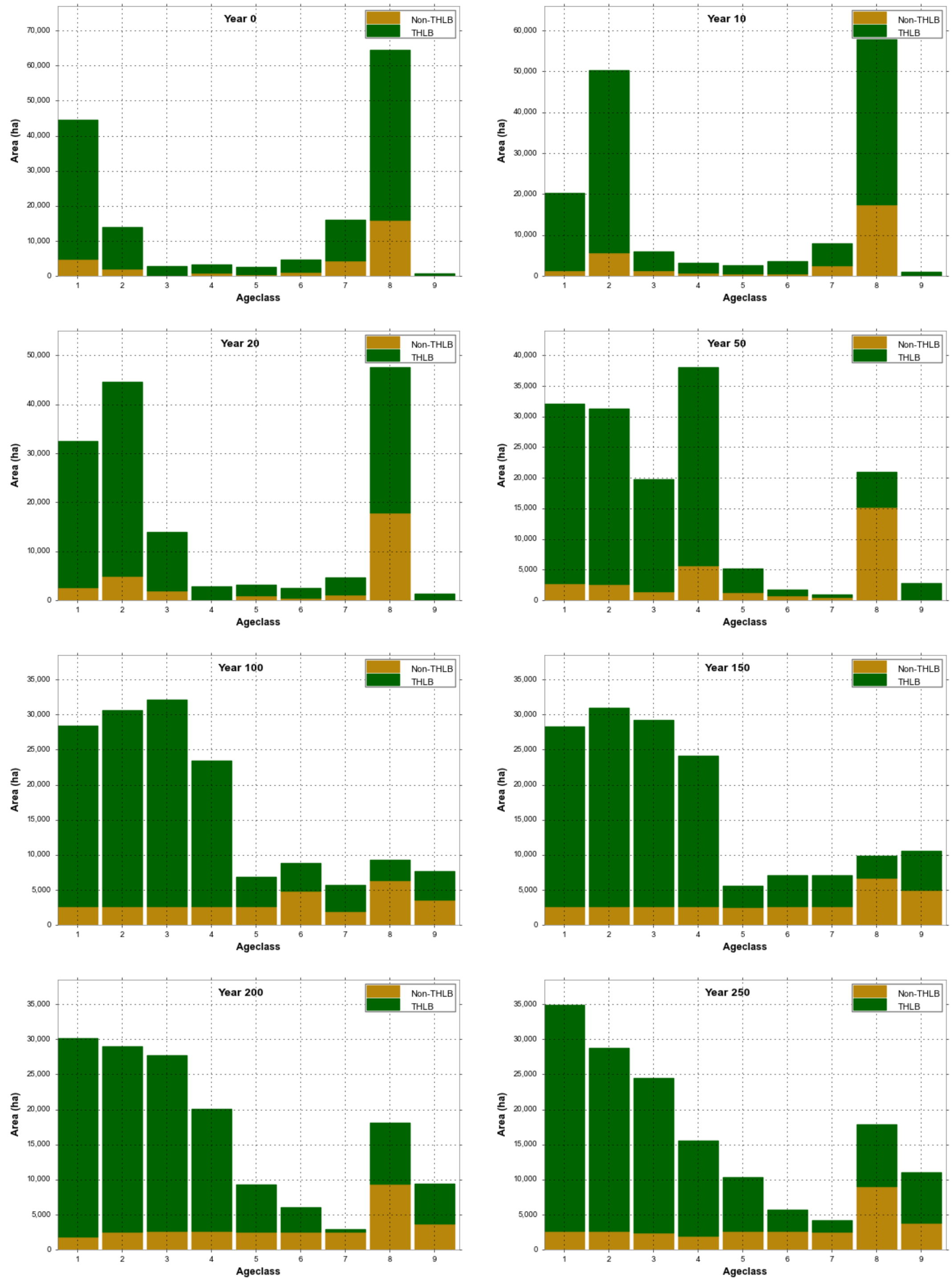

Figure 17: Age Class Distribution – Base Case

4.0 SENSITIVITY ANALYSIS

Sensitivity analysis provides information on the degree to which uncertainty in the base case data and assumptions might affect the proposed harvest level for the land base. The magnitude of the change in the sensitivity variable(s) reflects the degree of risk associated with a particular uncertainty – a very uncertain variable that has minimal impact on the harvest forecast represents a low risk. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results and provide information to guide management decisions in consideration of uncertainty.

Each of the sensitivities shown in Table 6 test the impact of a specific variable (or variables) with impacts measured relative to the base case harvest forecast.

Table 6: Sensitivity Analyses.

Sensitivity	Range Tested
Alternate Harvest Flow	Increase initial harvest level No increase harvest level Maintain initial harvest level
Minimum Harvest Age	120 m^3/ha 180 m^3/ha 200 m^3/ha
Stand Volume	Managed Stand Yield +/- 10% Natural Stand Yields +/- 10%
Old Seral Retention	Examine impact of full old retention targets (no draw down) Reduce old seral age from 250 years to 140.
Ecosystem Representation Analysis (ERA) Targets	Enforce draft ERA targets as defined in Canfor's SFM Plan for the TFL.
Patch Size Objectives	Enforce as targets in the model.
Operational Adjustment Factor (OAF	Use OAF1 value of 0.85
Wildlife Tree Patches (WTP)	Apply an additional 3.5% WTP reduction
Leader Weevil	Remove Leader Weevil Impacts
Watershed Objectives	Remove Watershed Objectives Remove Fisheries Sensitive Watershed (FSW) Objectives

4.1 Alternative Harvest Flow Patterns

The goal of the base case harvest forecast is to maintain a non-declining harvest level for as long as possible before increasing to a sustainable LTHL. The scenarios in Figure 18 and Table 7 show the impacts of alternate harvest flow patterns. The *Evenflow* scenario maintains the same harvest level over the 250-year planning horizon. As discussed above, the harvest *pinch point* occurs around year 25 and therefore this represents a low point in the harvest schedule of approximately 409,000 m^3/yr. In the *Increase Initial Harvest Level (IHL)* scenario, the initial harvest level can be increased to approximately 459,000 m^3/yr, gradually decreasing to a low point of approximately 368,000 m^3/yr in year 40 before increasing the LTHL. In the Reduced LTHL scenario the LTHL is reduced to confirm that the short-term harvest in base case cannot be increased further. The values in Table 7 show the average harvest levels over the first 45 years and from year 46 to year 250 and provide a comparison of each scenario relative to the base case.

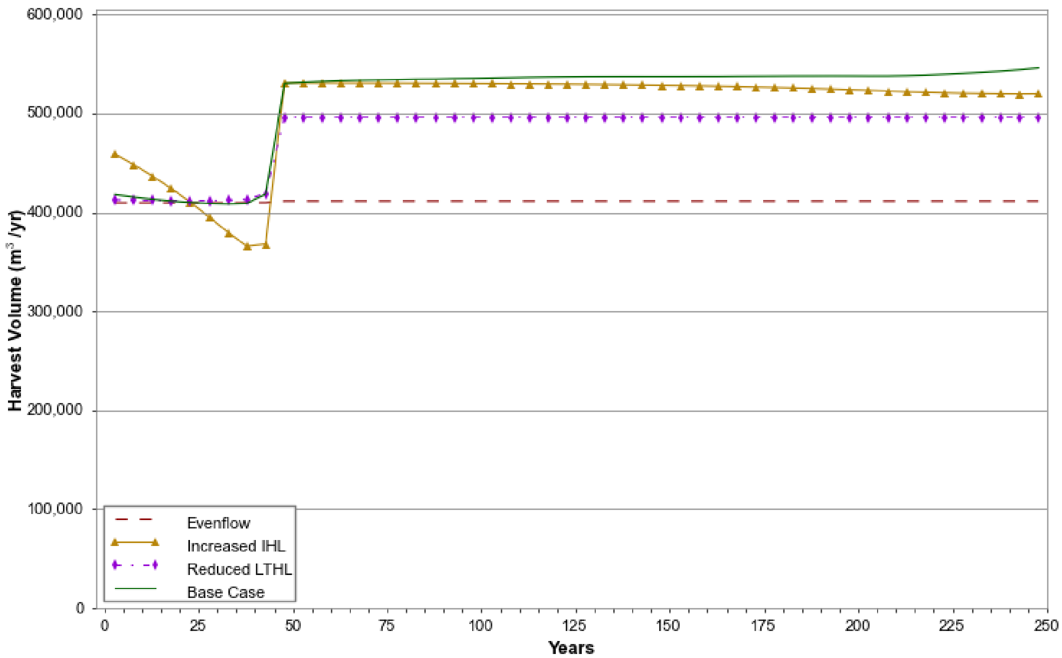

Figure 18: Alternative Harvest Flow Patterns

Table 7: Alternate Harvest Flow Patterns

Years	Base Case	Evenflow		Increased IHL		Reduced LTHL	
	m^3/yr	m^3/yr	% Change	m^3/yr	% Change	m^3/yr	% Change
1 to 45	412,558	409,551	-1%	409,630	-1%	412,913	0%
46 to 250	537,080	411,360	-23%	526,848	-2%	496,354	-8%

4.2 Minimum Harvest Age

For the base case, the minimum harvest age (MHA) was set at the earliest point where stand volume reaches 140 m^3/ha and 95% of culmination MAI is achieved. For this set of scenarios the volume per hectare limit was adjusted to 120, 180 and 200 m^3/ha. As shown in Figure 19 and Table 8, increasing the minimum volume requirement to 180 m^3/ha and 200 m^3/ha drops both the short and long-term harvest levels by 2% and 4% respectively. There is no significant change in harvest levels when the limit is reduced to 120 m^3/ha due to the fact that the culmination MAI, not volume per hectare, determines the minimum harvestable age in this scenario.

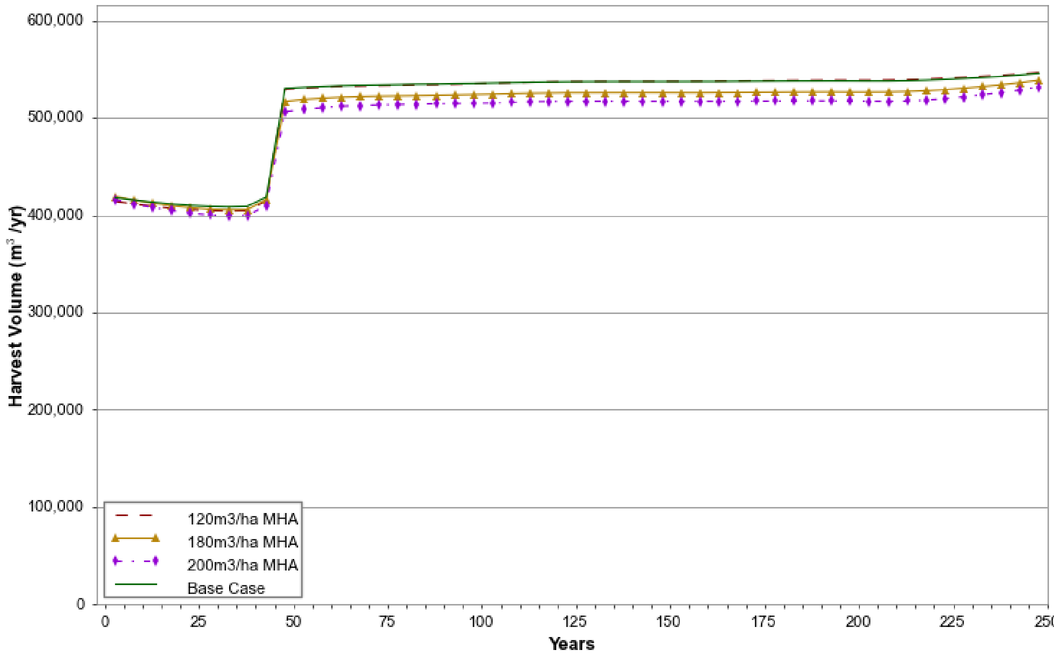

Figure 19: Minimum Harvest Age

Table 8: Minimum Harvest Ages

Years	Base Case	120 m³/ha MHA		180 m³/ha MHA		200 m³/ha MHA	
	m³/yr	m³/yr	% Change	m³/yr	% Change	m³/yr	% Change
1 to 45	412,558	408,360	-1%	410,830	-0%	405,653	-2%
46 to 250	537,080	537,305	0%	525,973	-2%	517,039	-4%

4.3 Natural and Managed Stand Yields

Figure 20 and Table 9 show the impact on timber supply if managed stand yields are increased and decreased by 10%. Decreasing managed stand yields reduces the short-term harvest level by an average of 3% with a 10% impact in the long-term harvest level. When managed stand yields are increased by 10% the short-term increases by 1% with a 10% increase in the long-term harvest level.

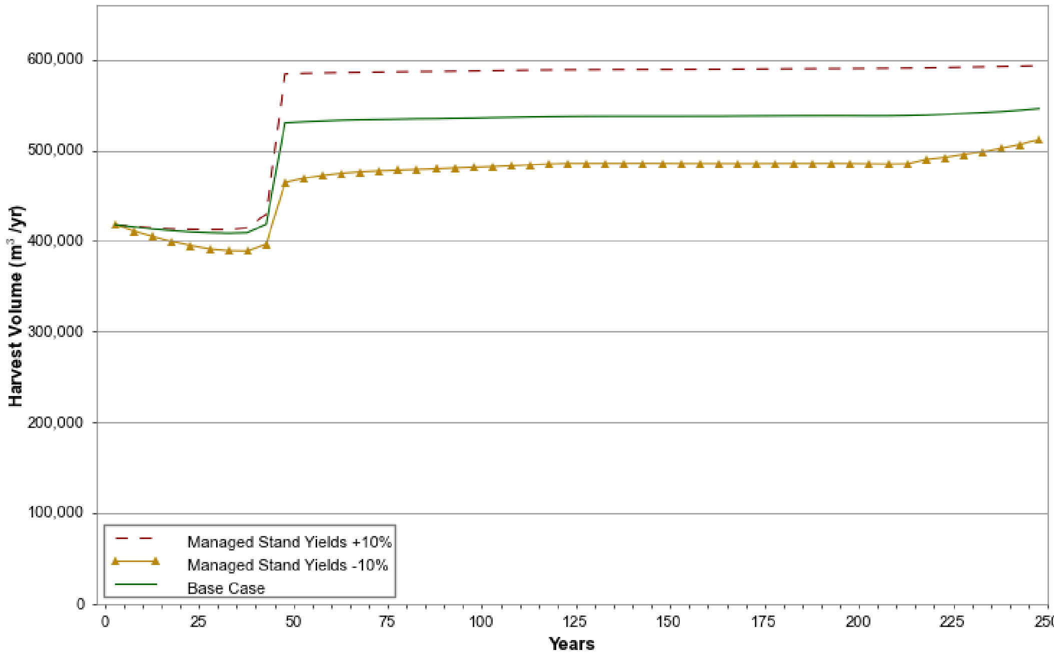

Figure 20: Managed Stand Yields +/- 10%

Table 9: Managed Stand Yields +/- 10%

Years	Base Case	Managed Stand Yields +10%		Managed Stand Yields - 10%	
	m^3/yr	m^3/yr	% Change	m^3/yr	% Change
1 to 45	412,558	415,974	1%	399,387	-3%
46 to 250	537,080	588,812	10%	484,903	-10%

Figure 21 and Table 10 demonstrate that the average short-term harvest level increases by 11% and the long-term increases by 2% when natural stand yields are increased. When natural stand yields are decreased the initial harvest level decreases by 9% with no significant change in the long-term harvest level.

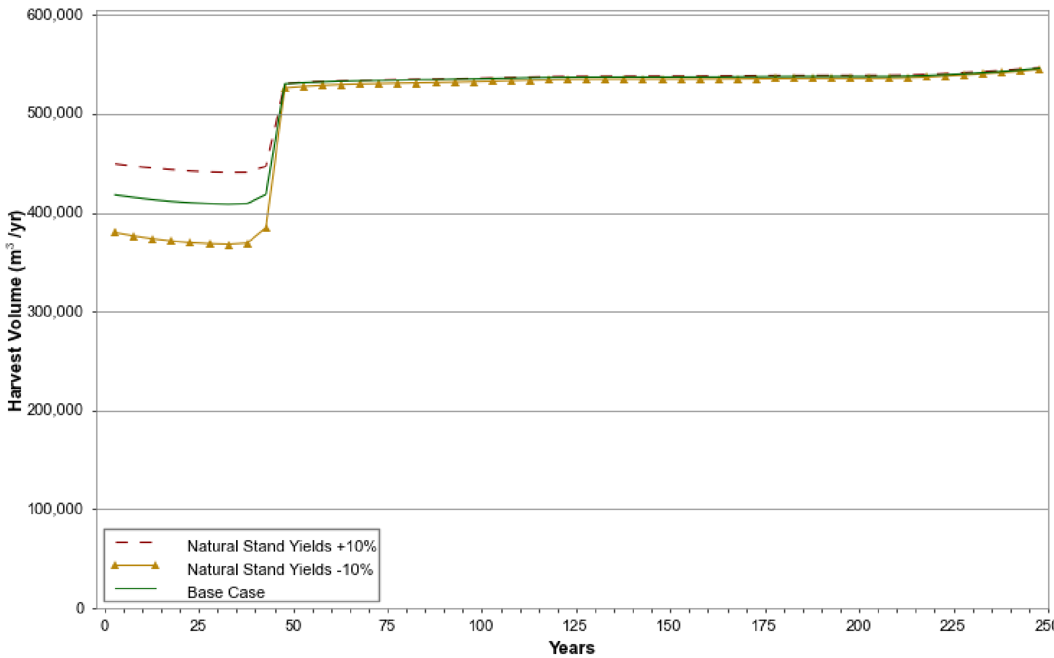

Figure 21: Natural Stand Yields +/- 10%

Table 10: Natural Stand Yields +/- 10%

Years	Base Case	Natural Stand Yields +10%		Natural Stand Yields -10%	
	m³/yr	m³/yr	% Change	m³/yr	% Change
1to45	412,558	444,131	8%	373,497	-9%
46to250	537,080	537,900	0%	534,776	-0%

4.4 Old Seral Objectives

There are no legally established OGMA on the TFL and therefore landscape level biodiversity is modelled aspatially through a set of retention constraints applied at the landscape unit / BEC variant level. In the base case a 2/3 drawdown to the full seral stage targets is enforced with old seral defined as greater than 250 years of age in the ICHvk2, ESSFwk2, and SBSvk variants and greater than 140 years in the remaining BEC variants. As shown in the age class graph in Figure 9 above there is very little area in age class nine (>250 years) either inside or outside the THLB and therefore many of these seral targets are currently in a significant deficit.

With this information an analysis was undertaken to assess the degree to which old seral characteristics might be exhibited in stands less than 250 years of age. The analysis, utilizing 1,034 tree measurements from 281 phase II VRI plots (Ecora, 2013), shows that stands between 140 and 250 years of age contain a wide range of tree ages consistent with the characteristics of "old seral" stands.

Based on this analysis and discussion with MFLNRO staff, the base case old seral stage objectives were modified to consider stands with an inventory age of >140 as meeting old seral requirements. In addition, the 2/3 draw down to old seral stage requirements afforded by the Provincial Aspatial Old Growth Order were removed such that full seral stage target levels (no draw down) are enforced throughout the planning horizon.

The *2/3 Seral Draw Down; Age @ 140/250* scenario reflects the requirements outlined in Canfor's FSP and the Provincial Aspatial Old Growth Order with the 2/3 draw down to seral stage targets and old seral age defined by BEC variant as either 140 or 250 years. This scenario results in a slightly higher short-term harvest with no significant impact in the long-term.

The *2/3 Seral Draw Down; Old Age @ 140* scenario shown in Figure 22 and Table 11 demonstrates that reducing the old seral age to 140 years for all BEC variants increases the initial harvest level by approximately 14,000 m^3/yr (3%) for the first 45 years with a small increase over the long-term.

When the full seral stage constraints are applied using standard old seral ages (>250 years in the ICHvk2, ESSFwk2, and SBSvk variants) (*Full Seral; Age @ 140/250*) the short-term harvest level drops by 12% and the long-term harvest levels drops by 3%.

The *Phased In Seral Stage Constraints @ Age 140/250* scenario gradually increases the seral stage targets up to the full levels by implementing a 2/3 draw down for the first 80 years, a 1/3 draw down between years 81 and 160 and full seral stage constraints for years 161+. This reduces the initial harvest level by approximately 5% and reduces the long-term harvest level by 2%.

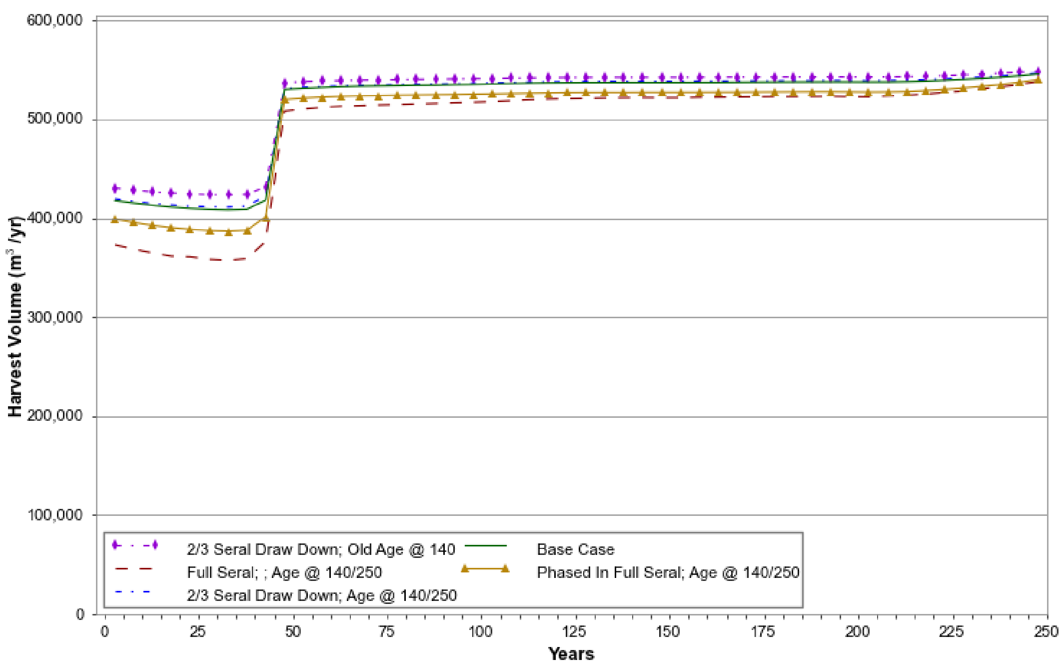

Figure 22: Seral Stage Objectives

Table 11: Seral Stage Objectives

Years	Base Case	Full Seral; Age @ 140/250		Phased In Full Seral; Age @ 140/250		2/3 Seral Draw Down; Old Age @ 140		2/3 Seral Draw Down; Age @ 140/250	
	m^3/yr	m^3/yr	% Change	m^3/yr	% Change	m^3/yr	% Change	m^3/yr	% Change
1 to 45	412,558	364,635	-12%	392,419	-5%	426,724	3%	415,072	1%
46 to 250	537,080	521,442	-3%	527,494	-2%	542,381	1%	538,263	0%

4.5 Ecosystem Representation Analysis

An ecosystem representation analysis (ERA) was conducted in 2011 as part of Canfor's Prince George / TFL30 Sustainable Forest Management Plan. The objective of the ERA is to provide a coarse-filter tool for biodiversity conservation, by spatially identifying potentially rare ecosystems that are then field-confirmed and reserved from harvest, if assessed as a good representation of the ecosystem by a qualified professional.

This scenario examines the timber supply impact of applying a retention target (minimum of 20% greater than 140 years) to all ecosystem groups identified as 'rare' in the ERA. As shown in Figure 23 and Table 12 there is little or no impact of applying these retention targets.

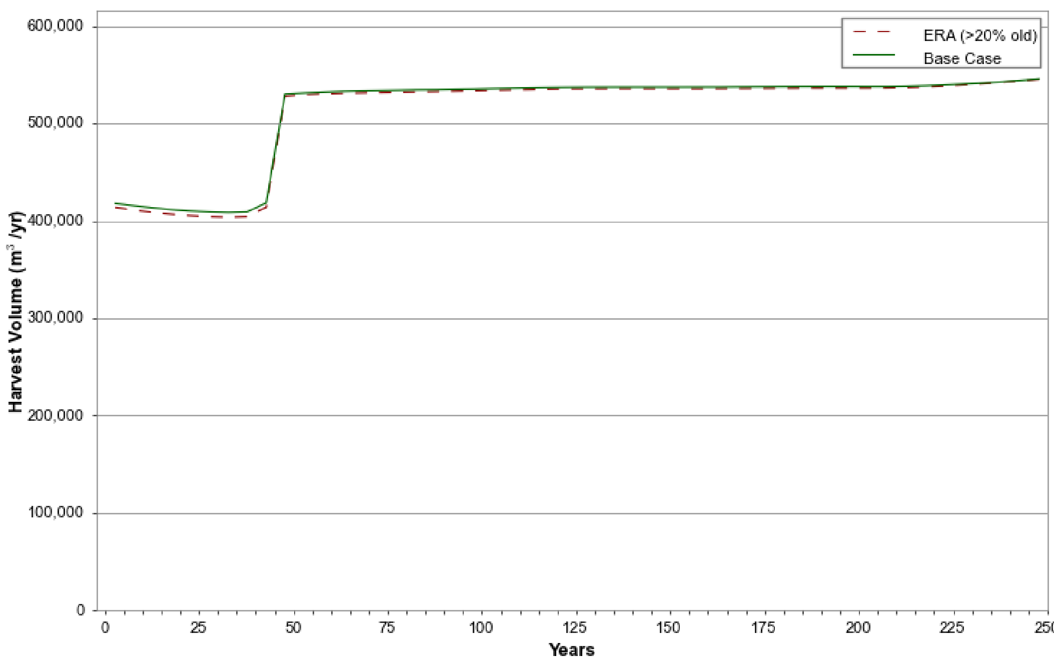

Figure 23: Ecosystem Representation Objectives

Table 12: Ecosystem Representation Objectives

Years	Base Case m³/yr	ERA (>20% old) m³/yr	% Change
1 to 45	412,558	407,887	-1%
46 to 250	537,080	535,561	-0%

4.6 Patch Size Objectives

Canfor's Forest Stewardship Plan (FSP) identifies targets for patch size distribution by landscape unit (LU) and natural disturbance type (NDT) groups. The FSP states that, *"At the end of the term of this FSP* [2006 – 2016] *the young forest patch size categories found in TFL 30 will trend towards or fall within the desired target ranges"*. Operationally, the management of patches is a very fluid process, as certain rates of harvest must be maintained in order to create the desired distributions and the ability to achieve a certain patch size distribution is greatly influenced by past harvesting practices as well as past and future natural disturbances. Patch size distribution is monitored annually and reported as part of the Annual Report for the Prince George/TFL30 Sustainable Forest Management Plan, with the results being used to guide operational plans.

For the base case, the patch size objectives from Table 13 have been monitored but not enforced as hard targets. These targets are applied to patches less than 20 years age. In order to be considered part of the same patch, two polygons must have their closest point less than 20 m apart.

Table 13: Patch Size Objectives.

Landscape Unit	Patch Size Category	Patch Size Class (ha)	Target Distribution Range (%)
Averil (grouped into NDT 3)	Small	< 40	10 – 20
	Medium	40 – 250	10 – 20
	Large	250 – 1000	60 – 80
	Extra Large	> 1000	0
Seebach (grouped into NDT 2)	Small	< 40	30 – 40
	Medium	40 – 80	30 – 40
	Large	80 – 250	20 – 40
	Extra Large	> 250	0
Woodall (grouped into NDT 1,2)	Small	< 40	30 – 40
	Medium	40 – 80	30 – 40
	Large	80 – 250	20 – 40
	Extra Large	> 250	0

Figure 24 and Table 14 show that the application of the full patch size targets results in an average decrease in timber supply of 3%. Because patch size targets are applied to stands less than 20 years of age, the model must increase the harvest level in the first period in order to achieve the targets as soon as possible. When the targets are relaxed slightly, patch size targets are achieved over a longer period of time and the timber supply impact is reduced to almost nil.

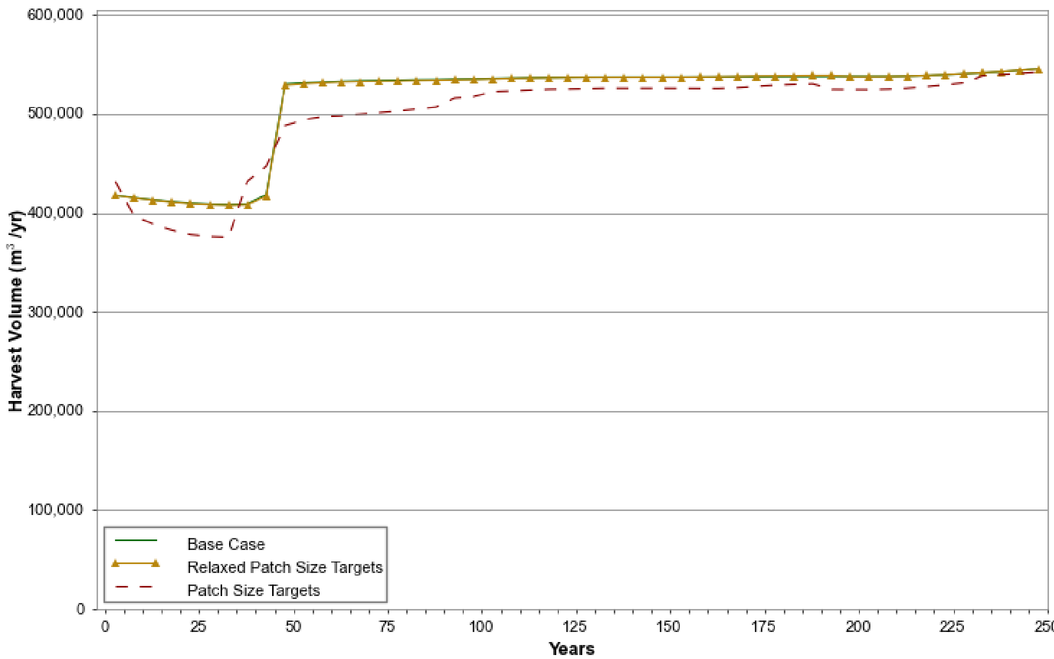

Figure 24: Patch Size Objectives

Table 14: Patch Size Objectives

Years	Base Case	Patch Size Targets		Relaxed Patch Size Targets	
	m³/yr	m³/yr	% Change	m³/yr	% Change
1 to 45	412,558	401,035	-3%	412,024	-0%
46 to 250	537,080	521,319	-3%	536,938	-0%

4.7 Wildlife Tree Patches

With respect to stand-level biodiversity and wildlife tree patches (WTP), Canfor's FSP commits to ensuring that at least 7% of the total area of cutblocks harvested over a 12 month period will be covered by wildlife tree retention and that at least 3.5% of each individual cut block will be covered by wildlife tree retention. Operationally, retention requirements are first met using portions of the stand that don't typically contribute to timber supply (riparian areas, deciduous stands, unstable terrain, non-merchantable areas, and retention for visual quality and wildlife habitat). Existing wildlife tree patches (WTP) represent 2,830 ha within the TFL and have been removed from the THLB.

A review of the portion of the productive forest that will require future WTP shows that 21.3% of this area is non-THLB indicating that there is sufficient non-THLB to fulfill future WTP requirements without the need for an additional netdown to address this. Even if we exclude large contiguous netdowns (i.e. caribou high habitat) based on the assumption that this area will only contribute to meeting WTP requirements in blocks directly adjacent to it, the proportion of productive non-THLB within the remainder of the land base is approximately 16.5% non-THLB. This information strongly suggests that future WTP requirements will be met without removing additional area from the THLB.

Furthermore, management for old forest objectives, visual quality and other habitat requirements increase the amount of stand level retention and contribute to meeting WTP requirements without removing additional areas from the THLB.

However, given this information, Figure 25 and Table 15 show that applying an additional 3.5% WTP netdown results in a 3% reduction in the initial harvest level and a 2% reduction in the average LTHL.

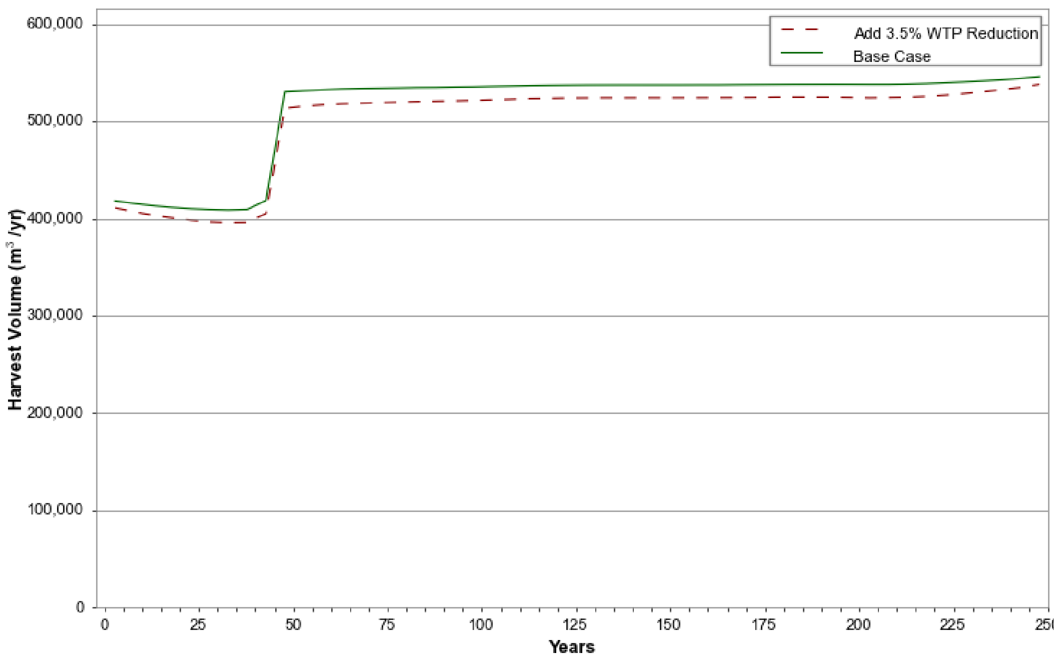

Figure 25: Additional 3.5% WTP Reduction

Table 15: Additional 3.5% WTP Reduction

Years	Base Case	Add 3.5% WTP Reduction	
	m³/yr	m³/yr	% Change
1 to 45	412,558	401,422	-3%
46 to 250	537,080	523,761	-2%

4.8 Operational Adjustment Factor

Operational Adjustment Factors (OAF) are applied to managed stand yield curves to adjust the curve to account for stands not realizing the full volume potential indicated by TIPSY. OAF 1 is used to represent reduced yield due to gaps in stocking; and OAF2 is used to represent decay and losses due to disease and pest. OAF1 is a constant reduction factor that shifts the yield curve down whereas the influence of OAF2 increases with age and therefore alters the shape of the curve.

Under the MP9 analysis an average OAF 1 value of 14.6% was calculated using a 7.5 % default OAF 1 value and adding the percentage of the THLB occupied by non-productive site series from the TEM. A similar approach has been used for base case in this analysis, calculating the non-productive portion for each productive site series as shown in Table 2.

Figure 26 and Table 16 show the impact of using the default OAF 1 value of 0.85 as opposed to the TEM-based OAF 1 estimates. Because OAF 1 values only affect managed stand yields there is only a small (2%) impact in the short-term harvest. The average LTHL is 5% lower when the default OAF 1 estimates are used.

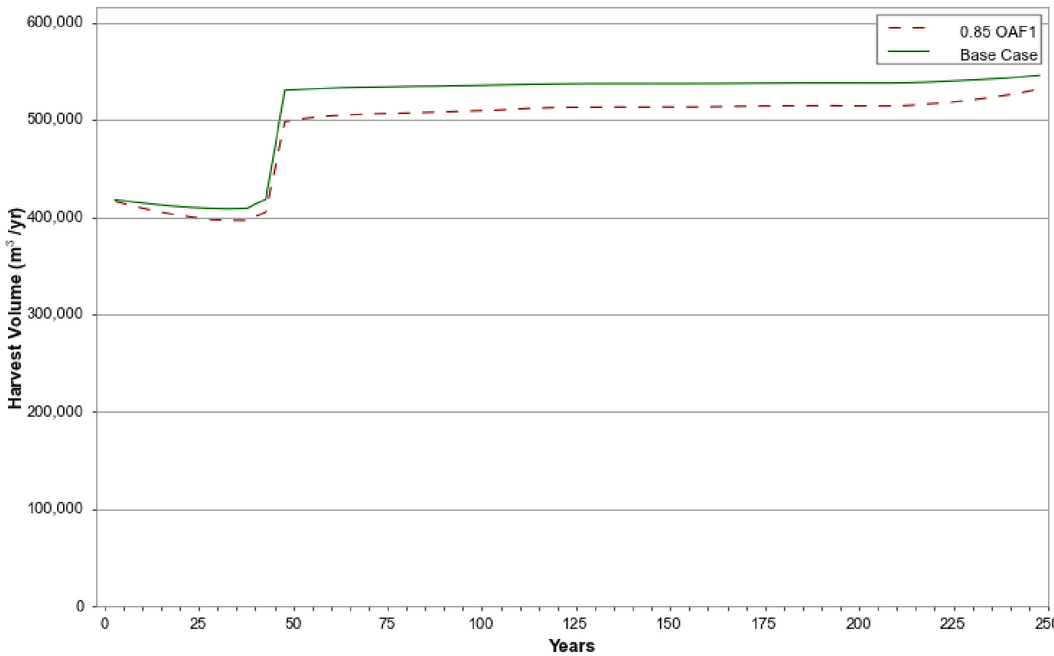

Figure 26: OAF1 @ 0.85

Table 16: OAF1 @ 0.85

Years	Base Case m^3/yr	OAF1 @ 0.85 m^3/yr	OAF1 @ 0.85 % Change
1 to 45	412,558	403,733	-2%
46 to 250	537,080	512,796	-5%

4.9 Leader Weevil

White pine leader weevil attacks the newly formed leaders of young spruce trees. Depending on the attack intensity and frequency, the attacks will destroy the current year's growth and reduce the overall wood quality for the years it affects. The impacts of leader weevil on the plantations has been modelled through the application of additional regeneration delay values based on the estimated weevil attack percentages as shown in Section 5.4 of the Data Package. The values reported Table 26 of the Data Package represent the expected additional regeneration delay for the spruce component of each managed stand yield table and have been pro-rated based on the spruce percentage within each yield curve and then applied to the curve in TIPSY.

Figure 27 and Table 17 show that removing the additional regeneration delay's used to account for leader weevil result in an 8% increase in the short-term harvest level with very little impact on the LTHL.

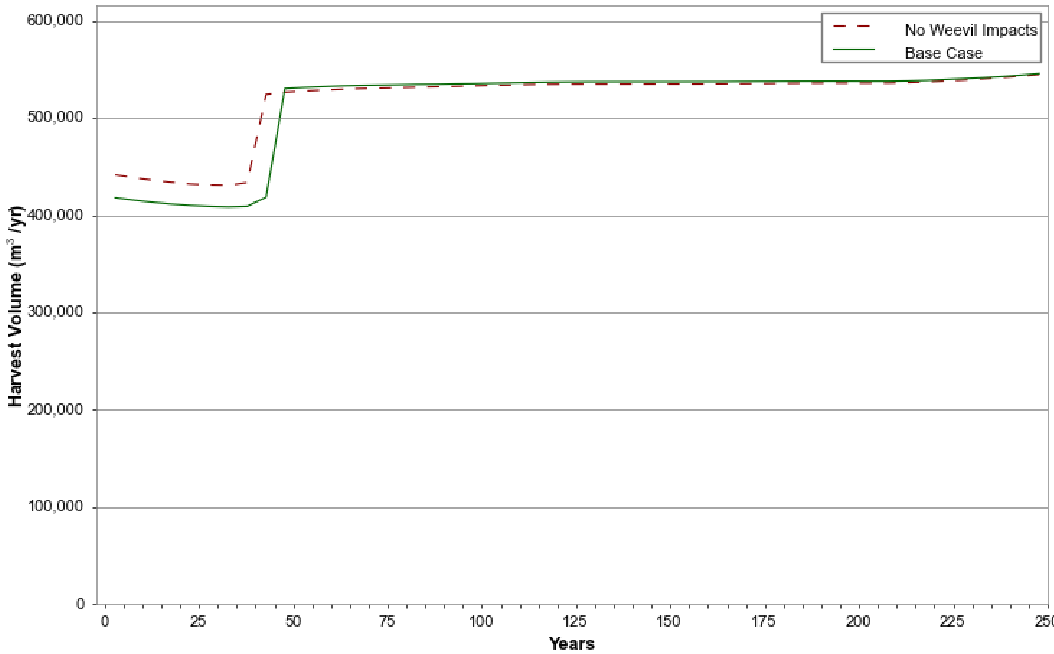

Figure 27: Remove Leader Weevil Impacts

Table 17: Remove Leader Weevil Impacts

Years	Base Case m³/yr	No Weevil Impacts m³/yr	No Weevil Impacts % Change
1 to 45	412,558	444,636	8%
46 to 250	537,080	534,832	-0%

4.10 Watershed Objectives

Watershed objectives in the base case are modelled through the application of peak flow index (PFI) targets applied to each watershed. These targets include enhanced PFI threshold values in the Seebach Creek watershed as prescribed in the fisheries sensitive watershed order for the Seebach Creek watershed. The scenarios shown in Figure 28 and Table 18 explore the impact of removing the FSW objectives as well as all the watershed PFI targets. Overall, removing all of the watershed targets increases the harvest level by 2% with 1% attributable to just the FSW objectives on the Seebach Creek watersheds.

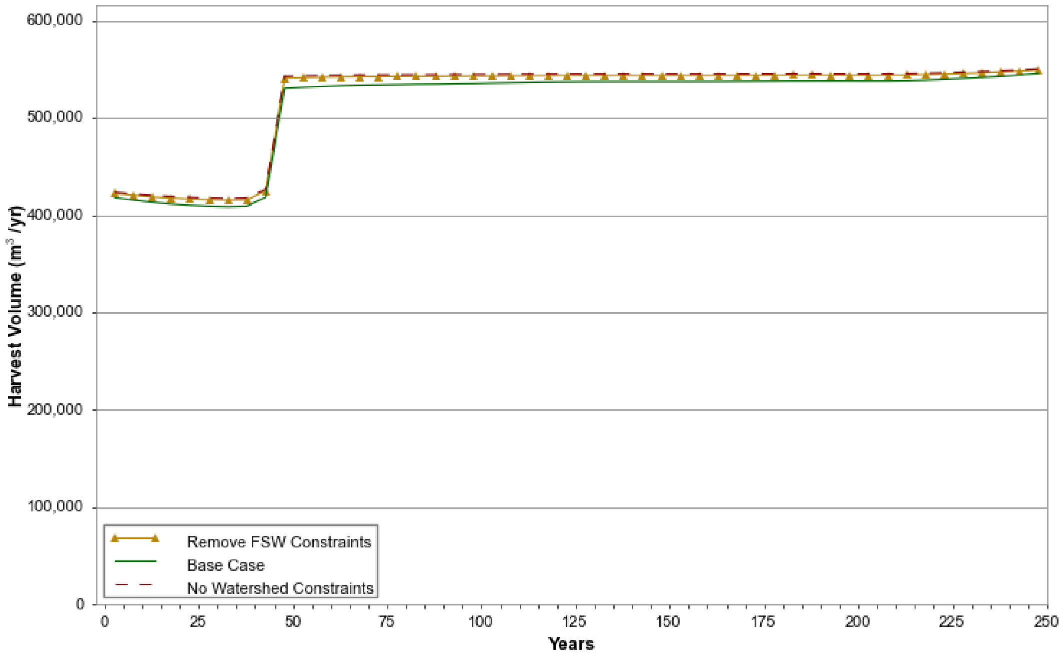

Figure 28: Watershed Objectives

Table 18: Watershed Objectives

Years	Base Case	No Watershed Constraints		Remove FSW Constraints	
	m^3/yr	m^3/yr	% Change	m^3/yr	% Change
1 to 45	412,558	420,249	2%	418,644	1%
46 to 250	537,080	545,405	2%	543,888	1%

5.0 DISCUSSION

The role of the base case in timber supply analysis is to present the set of data and assumptions that best reflects current management on the TFL. The base case harvest forecast presented above provides the best representation of timber supply on the TFL over the next 250 years. This scenario demonstrates that the land base can support a harvest level of approximately 412,500 ^{m3}/yr over the next 45 years before increasing to a sustainable long-term harvest level of approximately 537,000 ^{m3}/yr.

The initial harvest level of 412,500 m^3/yr represents a substantial increase over the base case harvest forecast from MP9 and the AAC of 330,000 m^3/yr. This increase can be attributed to the following factors:

- An increase in the THLB of approximately 5,400 ha (4%) over the THLB from MP9.
- An accumulated undercut of almost 2.5 million m^3 over the last 10 years, representing an increase in the short-term annual harvest level of approximately 55,600 m^3/yr (over a 45 year period).
- Removal of patch size objectives from the base case in MP9 resulted in an average increase of almost 99,000 m^3/yr (38%) over the first 80 years of the planning horizon. We have not included patch size objectives in the MP10 base case but have demonstrated through sensitivity analysis that these objectives can be achieved over time without impacting the harvest level.
- Modification to management objectives for seral stage[2] and caribou corridors have allowed for increased harvest.
- The application of improved assumptions on the impacts of leader weevil, the application of improved genetic gains estimates and the application of a fertilization program in the TFL have all contributed towards higher managed stand yield estimates.
- The use of a spatially explicit optimization model in MP10 has likely increased harvest levels over MP9. Timber supply analysis for MP9 was conducted using a simulation model that can have difficulty achieving optimal harvest schedules, especially in a highly constrained land base. This is supported by the fact that the LRSY for the TFL has not substantially increased in MP10 however the ability of the model to schedule that volume has dramatically increased. Furthermore, the significant increase in harvest from removing patch size targets in MP9 further suggests that the model has difficulty with these types of constraints.

Sensitivity analysis seeks to quantify the degree to which uncertainty in data and assumptions might affect timber supply. Table 19 shows a summary of the average harvest impacts of each scenario relative to the base case.

[2] It is not clear from MP9 data package as to whether the 2/3 draw down to the seral stage targets was applied however, the Rationale document suggests that seral stage constraints where phased in over three rotations.

Table 19: Summary of Analysis Results

Scenario	Years 1 to 45		Years 46 to 250	
	m^3/yr	% Change	m^3/yr	% Change
Base Case	412,558		537,080	
Evenflow	409,551	-1%	411,360	-23%
Increased IHL	409,630	-1%	526,848	-2%
Reduced LTHL	412,913	0%	496,354	-8%
120 m3/ha MHA	408,360	-1%	537,305	0%
180 m3/ha MHA	410,830	0%	525,973	-2%
200 m3/ha MHA	405,653	-2%	517,039	-4%
Managed Stand Yields +10%	415,974	1%	588,812	10%
Managed Stand Yields -10%	399,387	-3%	484,903	-10%
Natural Stand Yields +10%	444,131	8%	537,900	0%
Natural Stand Yields -10%	373,497	-9%	534,776	0%
No Seral Draw Down	364,635	-12%	521,442	-3%
Phased In Full Seral; Age @ 140/250	392,419	-5%	527,494	-2%
2/3 Seral Draw Down; Old Age @ 140	426,724	3%	542,381	1%
2/3 Seral Draw Down; Age @ 140/250	415,072	1%	538,263	0%
ERA (>20% old)	407,887	-1%	535,561	0%
Patch Size Targets	401,035	-3%	521,319	-3%
Relaxed Patch Size Targets	412,024	0%	536,938	0%
Add 3.5% WTP Reduction	401,422	-3%	523,761	-2%
OAF1 @ 0.85	403,733	-2%	512,796	-5%
No Weevil Impacts	444,636	8%	534,832	0%
No Watershed Constraints	420,249	2%	545,405	2%
Remove FSW Constraints	418,644	1%	543,888	1%

6.0 REFERENCES

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APPENDIX I – NETDOWN MAP

A PDF map of the netdown areas can be downloaded here:
https://dl.dropbox.com/u/24626685/netdown.pdf