Slocan Group – Vavenby Division

TFL 18 Type 1 Incremental Silviculture Strategy

Project #00-509 Date: 12/13/2001 (Draft Report ver. 1.3)

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Slocan Vavenby Division

TFL 18 Type 1 Incremental Silviculture Strategy (Draft 1.3)

Executive Summary

General Strategy

The emphasis of the silviculture strategy for TFL 18 is to maximize the quantity and quality of their timber supply subject to available funding and market conditions for forest products. There were no strategies or working targets developed for habitat supply. It is expected that many of the strategies for timber quality will benefit habitat supply and the requirements to satisfy the coarse filter habitat supply through ongoing landscape unit planning and biodiversity management will also maintain habitat across the TFL. Currently, there are no identified wildlife or designated wildlife habitat areas in TFL 18.

The strategies presented in this report are investigational and have not been evaluated. As such, the proposed treatments may be considered as maximums and open to change until an analysis such as a type 2 can be completed. Until such time comments would still be welcome even as the type 1 product is completed.

WT 1 (Quantity)

Manage short, mid and long-term timber supplies to maximize potential yield.

WT 2 (Quality)

Manage regenerated stands to yield 10% premium logs by volume, with the majority of the remainder being of sawlog quality. This target has not been evaluated and finalized for TFL 18 and may change with further assessment and analysis.

WT 3 (Habitat)

No quantified working targets for habitat have been established for TFL 18. Slocan has proposed a wildlife habitat capability/suitability study as part of the terrestrial ecosystem mapping project. Following the completion of this study, working targets may be established for the TFL. Until then, Slocan will maintain habitat opportunities by following direction from the Kamloops LRMP and the biodiversity guidebook and landscape unit planning guidebook.

Product Objectives

Premium Log

- Douglas fir, clear, pruned 45 cm min dbh, pruned 5 m log.
- Douglas fir, large timber 45 cm min dbh, unpruned.
- Spruce, large timber 45 cm min dbh, unpruned.

- Cedar, large timber 35 cm min dbh, unpruned.
- Pine, clear, pruned 35 cm min dbh, pruned 5 m log.
- Pine, large timber 30 cm min dbh, unpruned.

Sawlog

- Minimum average stand dbh of 35 cm.
- Minimum stand volume of 300 m^3 per hectare.

Main Silviculture Strategies

Timber Supply – Quantity

1. Increase the size of the timber harvesting land base by converting approximately 1755 ha to productive forest land.
2. Achieve green up as soon as possible in constrained management zones (VQO and BEC variants) by site preparation, rapid planting of large stock and early brushing.
3. Increase the timber supply in the short- and mid-term by fertilizing existing stands that are scheduled for harvesting within the next 20-40 years.
4. Increase the mid- and long-term timber supply by repeat fertilizing all suitable existing stands that are scheduled for harvest 40 to 80 years from now.
5. Increase the timber supply using genetically improved seed.
6. Determine true site indices for the TFL.

Timber Supply – Quality

1. Increase the piece size and the clear wood component of timber supply through a combination of density control, pruning and fertilization.

Habitat

1. Create old growth conditions throughout constrained BEC variants with partial harvesting where feasible.

Visually Sensitive Areas

1. Reduce the time for harvested areas within VQOs to achieve visually effective green up height.

Bark Beetles

1. Continue to monitor and salvage log or fall/burn as required to reduce existing and future risk and maintain endemic levels.

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1 Introduction

This strategy is part of a province-wide initiative to develop a silviculture strategy for each management unit in the province by March 31, 2001. These strategies are limited to FRBC funded silviculture activities, that is, incremental silviculture.

Incremental silviculture forms a part of many possible strategies that are available today to improve future quality and quantity of habitat and timber supply. This document broadly analyzes a range of potential incremental silviculture activities to form a basis for an incremental silviculture strategy.

This analysis is a type 1 analysis using existing timber supply review (TSR) summary information to identify issues and opportunities for silviculture investments. It provides realistic targets, strategies and silviculture regimes that can be used to guide investments, and further as inputs in the more in-depth type 2 analyses. Readers should recognize that the proposed strategies that are presented in this report are untested and remain investigational until further analysis can be completed.

It is important not to confuse this initiative with timber supply review (TSR). TSR determines harvest levels that can be supported with current management practices and information. Incremental silviculture strategy assesses the impact of a variety of potential investments on the future quality and quantity of harvest levels as well as habitat supply.

Unfortunately, due to the project schedule provided by FRBC and existing time restrictions, the Slocan Group were not able to provide extensive participation of key staff. As such, some of the content may be lacking in detail that they could have otherwise provided. Slocan intends to improve the detail and content of strategic silvicultural planning for TFL 18 in a type 2 analysis. During this phase, Slocan staff will test out potential intensive silviculture regimes to meet forest level objectives.

1.1 Methodology

The following process was used to prepare this strategy:

1. A working session was held March 28, 2001 in Vavenby, attended by representatives of the Slocan Group (Slocan) and Ministry of Forests (MoF). Chris Niziolomski from Forest Ecosystem Solutions Ltd. led the session. The participants brought up issues, opportunities and priorities that are listed later in this document.

2. Forest Ecosystem Solutions Ltd. incorporated the results of the working session into the draft document and added forecasts of future harvest quantity and quality and of job outcomes.

3. After stakeholder review, Forest Ecosystem Solutions Ltd. submitted the completed strategy to the MoF.

1.2 Acknowledgements

The participation of the following organizations at the working session is acknowledged:

Dave Poole	Slocan Group – Vavenby Division
Dave Dobi	Slocan Group – Vavenby Division
Rowena Bryan	Slocan Group – Vavenby Division
Bill Lougheed	Ministry of Forests – Clearwater Forest District
Randy Harris	Ministry of Environment Land and Parks – Habitat Protection
Chris Niziolomski	Forest Ecosystem Solutions Ltd.

The project was managed for Slocan by Rowena Bryan and coordinated by Ron Newman with the MoF – Kamloops Forest Region. Forest Renewal BC provided funding for this project.

2 Higher Level Goals and Objectives

This incremental silviculture strategy is based on higher-level provincial goals and objectives, which are as follows:

2.1 Provincial Goals

Government's goals are (MoF, 1999):

- Sustainable Use
- Community Stability
- A strong Forest Sector
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2.1.1 Provincial Objectives

2.1.1.1 Guiding Principles

- Minimize risk and maintain options.
- BC's forests are important from the local to global levels and should be managed in this context.
- Each generation has a moral obligation to preserve the province's forest resources for future generations.

The Provincial Incremental Silviculture Strategy specifies a working target of increasing volume and maintaining or enhancing future premium wood quality supplies. More specific objectives are to:

1. Minimize interim reduction in timber supply so that the allowable annual cut is not less than 65 million cubic meters;
2. Increase timber supply over the mid-term to a long-term level of 75 million m^3; and
3. Maintain the production of premium quality logs at or above 10% of total harvest. (MOF, 1999c)

2.2 Regional Objectives

The Kamloops LRMP states as a timber objective to *maintain and/or enhance the sustainable supply of timber* by utilizing the following strategies:

1. Reforest all backlog not sufficiently restocked sites by year 2000.
2. Rehabilitate previously disturbed forest land (old landings and roads).
3. Enhance timber production through prompt reforestation and management practices to increase stand yields.
4. Encourage utilization of pulp components of stands that are currently being harvested.
5. Convert current pulp quality stands to new forests that will produce merchantable timber.

3 Issues and Strategies

3.1 Identification of Issues and Strategies

3.1.1 Issue 1: Timber Supply – Quantity (H)

Slocan wishes to increase the available harvest volume through incremental silviculture and other non-silviculture related investments. There are opportunities to mitigate the timber supply impacts of current visual quality rules using silviculture. Also, several silviculture regimes are available to increase the yields of existing and regenerated stands. These silvicultural activities must be linked to ongoing monitoring and collection of growth and yield information to ensure that future forest estate modeling utilizes stand level predictions that recognize actual treatment responses.

The issue of site indices and their accuracy, although not a silviculture matter, is of significant importance to Slocan. If the current site indices are underestimated, as has been the case throughout the province, the impact on timber supply can be significant. In other management units the costs of determining the correct site indices are moderate compared to the benefits through increased timber supply. As such, Slocan is currently undergoing a site index adjustment project in combination with predictive ecosystem mapping for TFL 18.

Strategies:

1. Investigate opportunities to increase the productive land base through the potential conversion of non-contributing stand types back to the THLB.

2. As a maximum plant all harvested areas within 2 years of harvest. In most cases plant within 1 year.

3. Plant larger, genetically improved stock to reduce green-up periods and to meet VQOs.

4. Encourage natural fill in on plantations, including some deciduous species, where forest health or stand performance can be improved.

5. Use genetically improved stock, where available.

6. Juvenile space areas that are suppressed due to stand density or competing vegetation. Space to levels that will reduce competition or suppression while allowing for future commercial thinning opportunities and minimizing forest health risks, such as root rot.

7. Consider early and late rotation fertilization to mitigate the forecasted short-, mid- and long-term harvest level declines. Prior to this it is recommended that a fertilization assessment (weight and foliar analysis) be completed to appropriately identify candidate sites for treatment and the resulting increase in growth rates from those treatments.

3.1.2 Issue 2: Timber Supply – Quality (H)

Slocan wishes to maximize the quality of their timber supply subject to available funding and market conditions for forest products. Forest product prices have a direct impact on Slocan's ability to invest in incremental silviculture.

Strategies:

1. Manage for larger piece size.

2. Provide for more J grade product throughout the TFL.

3. Manage to develop more premium clear wood.

3.1.3 Issue 3: Habitat

The most recent timber supply analysis (Appendix 1) illustrated that timber supply is currently impacted by many forest values. The management of landscape biodiversity is one such value that must be accounted for through planning activities. While the actual timber supply impacts remain uncertain, the management of biodiversity does present a risk to the current and future harvest level for TFL18. As such, Slocan proposes to maintain or enhance stand and landscape biodiversity while minimizing impacts on timber supply.

Strategies:

1. Maximize the use of non-contributing and constrained areas to satisfy old forest retention objectives.

2. Encourage species diversity through mixed species planting and natural ingress.

3. Continue with the integrated timber supply and OGMA analysis for the Clearwater LU.

4. Utilize partial cutting in constrained areas to maintain desired OG attributes while achieving timber volume and value objectives.

3.1.4 Issue 4: Visually Sensitive Areas

Similar to biodiversity, the management for visual quality objectives (VQOs) in visually sensitive areas has a forecasted impact based on the most recent timber supply analysis for TFL18. Slocan proposes to achieve the VQOs while minimizing the impacts on timber supply.

Strategies:

1. Reduce the number of years required to meet visually effective green-up (VEG) condition.

2. Review modeled VQOs and identify where current practices fit within allowable disturbance ranges within the KLRMP.

3. Continue with landscape design techniques, partial cutting and retention silviculture systems, and landscape rehabilitation throughout the TFL.

4. Use 3D modeling techniques to assess visual quality over time in the perspective view.

3.1.5 Issue 5: Spruce or White Pine Weevil (*Pissodes strobi*)

The weevil has attacked many of the historic pure spruce plantations of TFL 18 primarily below 1400m potentially damaging these plantations for sawlog production.

Strategies:

1. Avoid pure spruce plantations below 1400m and exercise caution up to 1500m.

2. Delay spacing in stands with large components of spruce and no alternative leave species.

3. Reduce the spruce component during stand tending in stands below 1400m leaving up to 800 well spaced deciduous trees per hectare.

4. Plant genetically improved weevil resistant spruce where available (further encourage seed collection efforts and testing of resistant spruce seedlots).

5. Interplant established weevil attacked spruce plantations with alternate species while encouraging natural deciduous species. Consider interplanting in high-risk areas where weevil attack is anticipated to meet free growing conditions. Avoid brushing where it can cause increased level of weevil attack.

6. Lower elevations seedlots generally have greater resistance to the weevil and Slocan have been moving spruce seedlots up in elevation while avoiding moving spruce seedlots down in elevation.

3.1.6 Issue 6: Spruce, fir and mountain pine bark beetle

Generally, these beetles currently or have existed (in the past five years) at low or endemic levels throughout TFL18.

Strategies:

1. Continue to monitor pest activity during monitoring flights and operational activities.

2. Apply appropriate treatment control mechanisms including trap tree and salvage programs, pheromone baiting and salvage, or fall and burn to minimize volume loss due to mortality and minimize beetle spread to healthy stands.

3. Investigate opportunities to minimize the potential for beetle epidemics throughout the TFL.

4. Investigate opportunities to undertake windthrow management.

3.1.7 Issue 7: IU Balsam

The TFL contains a significant area of IU balsam residual (subalpine fir stands) which contain remnant mature balsam that was left on site following timber harvesting in the 1950s and '60s using intermediate utilization standards. Slocan has presented strategies in the past for this area including harvesting these stands. The base case assumes that harvesting in these stands continues through the planning horizon. There are at least two issues regarding these stands that should be considered:

1. These stands have generally low densities due to harvesting history. It is likely that they do not fully utilize their growing sites. There is an option to harvest these stands before maturity and regenerate the sites to achieve full site occupancy and potentially increase future yields.

2. There is uncertainty regarding the accuracy of the yield estimates that are currently used for these stands. This uncertainty has potential timber supply impacts that should be assessed.

Due to the uncertainty associated with these areas, Slocan proposes to undertake a new IU balsam plan which would include an inventory of these areas, aggregating them into IU balsam groups and assigning management treatments for each. Until this plan is completed, understanding the short-, mid- and long-term timber supply benefits is impractical.

4. Historical Basic and Incremental Silviculture

Over the term of Management Plan #8 the following basic silviculture activities were accomplished for TFL18:

- Reducing the amount of current NSR (1460ha – 914ha) and backlog NSR (2811ha – 339ha);

- Fill planting of 386 ha of marginally stocked stands;

- Transition of site preparation from broadcast burning to mechanical site preparation.

During the term of Management Plan 8, the following intensive treatments were accomplished:

- 604 ha of pruning;
- 574 ha of juvenile spacing; and
- a number of fertilization trials in spaced and pruned stands where foliar sampling indicated a deficiency in nitrogen levels.

For the year ending March 31, 2001, the following basic activities were accomplished for TFL18:

- 956.7 regeneration and 751.8 free growing surveys;
- 124.0 ha of mechanical site preparation;
- 538.6 ha planted with 677 164 trees planted;
- 23.1 ha of brushing; and
- no juvenile spacing, fertilization or pruning treatments.

5. Type 1 Assumptions

The following assumptions were used in the development of the strategies in this report.

Premium Log

Douglas fir, clear, pruned 45 cm min dbh, pruned 5 m log.

Douglas fir, large timber 45 cm min dbh, unpruned.

Spruce, large timber 45 cm min dbh, unpruned.

Cedar, large timber 35 cm min dbh, unpruned.

Pine, clear, pruned 35 cm min dbh, pruned 5 m log.

Pine, large timber 30 cm min dbh, unpruned.

Sawlog

Minimum average stand dbh of 35 cm. Minimum stand volume of 300 m^3 per hectare.

Timber Supply Analysis Minimum Merchantability Criteria

Current practice was 120 m^3/ha minimum harvest criteria for Pl and F leading stands and 150 m^3/ha minimum harvest criteria for other species leading stands. The Chief Forester did identify in the rationale that the licencee should review the assumptions for minimum harvest age prior to the next timber supply analysis.

Treatment and Land Base Criteria

All areas presented in this report and analysis represent the THLB area.

ESSFwc1 and ICHmk3 are both in deficit for old growth. There is approximately 24 000 ha and 1 000 ha of THLB in the ESSF and ICH, respectively. ESSFwc1 achieves the full old target in approximately 170 years and ICHmk3 achieves the full old target in approximately 120 years.

Over the short-term the average harvest volume is 375 m3/ha and the average harvest age is 225 years. The timber supply analysis identified 440 ha/year to be harvested in the short-term of the base case analysis (Slocan estimate is 500 ha/year). All calculations are based on a harvest of 440 ha. The current timber harvesting land base is 60 345 ha while the long-term timber harvesting land base is 60 066 ha of which 23% or 13 906 ha is in visually sensitive areas. Between year 20 and 40 (in the future) approximately 7200 ha would be harvested based on the base case timber supply analysis. For the late rotation fertilization regime this would equal approximately 360 ha to be fertilized every year for 20 years. Repeated early fertilization is assumed to have a response of 10% and single late rotation fertilization is assumed to be 5%. There is uncertainty associated with the benefits of fertilization. While there is often an increase in height growth or volume increment associated with fertilization, it could also result in less structurally desirable wood through an increase in juvenile wood and taper. The cost versus benefit of fertilization remains uncertain. This issue will require more research prior to adopting as a strategy for TFL 18.

Approximately, 1 770 ha of existing natural stands are G & M Fd leading (AU 12, 13, 14) and 7 900 ha of are G & M Pl leading (AU 18-22). In the future there will be approximately 700 ha of future managed stands that will be G & M Fd leading and 4 600 ha of future managed stands that will be G & M Pl leading. There is approximately 700

ha of existing managed stands that are Fd leading and a further 4 600 ha of existing managed stands that are Pl leading.

Commercial thinning regimes are assumed to have no net cost (revenue received would cover the costs). When developing the commercial thinning strategies consideration should be given to higher planting densities to maintain pass opportunities in the future.

Potential Treatments and Treatable Area

Table 1 – Potential Treatments and Treatment Area

Treatment	Comment	Potentially Treatable Area
♦ Spacing	Spacing can be used to control species composition. Density management can affect sizes and average diameters of stands at harvest. Spacing is usually a prerequisite for pruning, unless densities are sufficiently low that no spacing is required.	Approximately 180 ha/year is proposed for spacing.
♦ Commercial Thinning	Little commercial thinning is practiced in the TFL. It is proposed for constrained areas of the TFL specifically within the visually sensitive areas and old deficit BEC variants. Higher planting densities may allow for future commercial thinning opportunities.	Approximately 110 ha/year is proposed for CT in constrained VQO and BEC variants.
♦ Pruning	Pruning is done only on good and medium Fdi and Pli sites.	Approximately 140 ha/year is proposed for pruning.
♦ Fertilization	Currently, there has been very little operational fertilization within the TFL. Based on foliar sampling, those sites that have been burned through broadcast burns or wildfires have shown deficiencies in nitrogen and trace elements and qualify as candidate stands for treatment. Further analysis should be undertaken to determine more accurately area eligible for fertilization. For this assessment a 10% response was assumed for fertilization for early rotation and 5% response was assumed for late rotation (at 80 years). The benefits of fertilization are currently unknown. Prior to the development of any fertilization program a thorough assessment should be undertaken.	Approximately 60 ha/year of managed stands and 360 ha/year of stands scheduled for harvest 20-40 years from now.

6. Potential Strategies by Response Time Frame

Tables 2 and 3 identify potential strategies and their estimated results by time frame; short-term = 0-20 years, mid term = 21-80 years, long term = 81+ years. This table is a summarized version of the silviculture strategies table.

Table 2 - Potential strategies by time frame to improve the quantity of timber supply

Response Time Frame	Objective/Action	Anticipated Results
Short Term	1. Achieve green-up ASAP in general management and constrained management zones by: a. Site preparation. b. Rapid planting of large stock. c. Early brushing. 2. Fertilize suitable existing stands 10-20 years prior to harvest for those stands to be harvested within the next 20-40 years. 3. Convert 1755 ha (300ha, 1000ha, 425ha, 30ha) of non-contributing stands (backlog, non-merch, deciduous and old landing/road rehab) to timber harvesting land base. 4. CT and partial harvesting in visually sensitive areas and the ESSFwc1. Consider higher planting densities in Pli to provide for CT opportunities in the future. 5. Complete site index adjustment studies. This could result in short-, mid- and long-term timber quantity improvement.	1. Current practice. 2. Approximately 360 ha/year must be fertilized to treat all stands harvested in 20-40 years. This 360 ha/year represents 80% of the 440 ha currently harvested (base case). Potential treatment area per year = 360 ha/yr. Assuming 10% volume gain from fertilization: 80 % X 5% = 4% increase timber in supply over the next 20-40 years. 3. This conversion represents a + 3% increase in the THLB, area multiplied by 3.0 m^3/ha/year or 5265 m3/year (1755 ha x 3.0). 4. Further modelling is required to estimate impact. 5. As identified by the Chief Forester, there is a high likelihood that future stand yields may be significantly underestimated; however, studies may prove neutral. For the purposes of this project, the OGSI sensitivity analysis results will be applied (11% improvement in the long-term).
Mid Term	1. Repeat fertilize all suitable existing stands scheduled for harvest 40 to 80 years from now to raise existing stand volumes. 2. Increase regenerated stand volumes by repeat fertilizing suitable stands. For this analysis we assumed 20% of harvested area would be suitable and a 10% response would be possible from repeated fertilization. 3. Convert 1755 ha (300ha, 1000ha, 425ha, 30ha) of non-contributing stands (backlog, non-merch, deciduous and old landing/road rehab) to timber harvesting land base.	1. Approximately 7200 ha will be harvested between 20-40 years. For the purposes of this analysis 5400 ha are assumed to be suitable for harvest, which represents about 75% of the area harvested within the next 20 years. Potential treatment area per year = 270 ha/yr. assuming a 5% volume gain for late rotation repeated fertilization: 75% X 10% = 7.5% increase in timber supply. These numbers should be validated by a fertilization assessment. 2. The long-term THLB is approximately 60 066 ha. Assume fertilization for 20% of all harvested areas, which = approximately 90 ha. Assume 10% increase in volume, 10% X 20% = 2.0% timber quantity increase due to repeated fertilization. These numbers should be validated by a fertilization assessment. 3. This conversion represents a + 3% increase in the THLB, area multiplied by 3.0 m^3/ha/year or 5265 m3/year (1755 ha x 3.0).

Long Term	1. Increase regenerated stand volumes by using genetically improved seed for all available species. Sw genetically improved seed is already being used. It is expected that genetic stock will be available in 2-5 years for Pli, Fdi, Lw and Pw. No definitive genetic gains are currently available for these species so will receive a conservative estimate of 3% (as in TSR) but actual gains are likely to be higher. 2. Increase regenerated stand volumes by repeat fertilizing suitable stands. For this analysis we assumed 20% of harvested area would be suitable and a 10% response would be possible from repeated fertilization.	1. A gain of 9.6% for Sw and default of 3% for Pli, Fdi, Lw and Pw is currently considered in the base case timber supply scenario and therefore no further gains are considered until the genetic improvement can be quantified for the other species. 2. The long-term THLB is approximately 60 066 ha. Assume fertilization for 20% of all harvested areas, which = approximately 90 ha/year. Assume 10% increase in volume, 10% X 20% = 2.0% timber quantity increase due to repeated fertilization. These numbers should be validated by a fertilization assessment.

Table 3 - Potential strategies by time frame to improve the quality of timber supply

Response Time Frame	**Objective/Action**	**Anticipated Results**
Short Term	None	None
Mid Term	1. Manage for increased piece size and clear wood through density control and pruning. Space and prune 60 ha/year of Pli and Fdi good and medium sites only. There are about 9 670 ha of existing good and medium Fdi and Pli sites in the THLB for TFL 18 representing 16% of the THLB. There will be approximately 5 300 ha of good and medium Fdi and Pli sites in the THLB for TFL 18 representing 9.0% of the future THLB. 60ha/year = approximately 14% of area harvested. 2. Manage for increased piece size and clear wood through density control, pruning and fertilization. Space and fertilize 60 ha/year and prune 80 ha/year of Pli and Fdi good and medium sites only. 3. Manage for increased piece size in all good and medium Fdi and Pli sites by spacing 60 ha/year. 4. Manage for J grade timber through future planting of weevil resistance spruce through appropriate stock provenance and genetics, mixed species planting and appropriate brushing treatments.	1. Assume 14% clear wood for Pli and Fdi from pruning (MoF 2000). Fdi was not provided in the MoF analysis so was assumed to be the same as Pli. If 16% of harvest areas are pruned = 14% x 16% = 2.2% clear wood. These spaced stands will also produce on average 15% larger average diameters (30cm+) for Pli @ 140 years and SI 18. Fdi spaced stands will also produce on average 50% larger average diameters (45cm+) @ 140 years and SI 15. These numbers were produced in TIPSY. 2. Assume 15% clear wood from pruning as above (MOF 2000). If 18% of harvest areas are pruned = 18% x 15% = 2.7% clear wood. The spaced stands in this regime will also produce larger diameters as described above. 3. The spaced stands in this regime will also produce larger diameters as described above. 4. This objective will require further research to identify the appropriate weevil resistance stock. The mixed species planting and brush maintenance is part of current management so is not expected to provide any further benefit beyond current condition.
Long Term	As above.	

7. Incremental Silviculture Strategy

This section synthesizes the preceding background information and analysis into an incremental silviculture strategy for the TFL.

7.1 General Strategy

The emphasis of the silviculture strategy for TFL 18 is to maximize the quantity and quality of their timber supply subject to available funding and market conditions for forest products. There were no strategies or working targets developed for habitat supply. It is expected that many of the strategies for timber quality will benefit habitat supply and the requirements to satisfy the coarse filter habitat supply through ongoing landscape unit planning and biodiversity management will also maintain habitat across the TFL. Currently, there are no identified wildlife or designated wildlife habitat areas in TFL 18.

The strategies presented in this report are investigational and have not been evaluated. As such, the proposed treatments may be considered as maximums until an analysis such as a type 2 can be completed. Until this analysis can occur the proposed strategies should remain as draft.

TFL 18 has several options to utilize silviculture to improve both the quality and quantity of their timber supply. Pruning and spacing treatments combined with fertilization can result in quality improvements. Fertilization and genetic improvement will also be important tools to increase future harvest volumes and or minimize existing constraints on the forested land base.

7.1.1 Working Targets

7.1.1.1 WT 1 (Quantity)

Manage short, mid and long-term timber supplies to maximize potential yield.

7.1.1.2 WT 2 (Quality)

Manage regenerated stands to yield 10% premium logs by volume, with the majority of the remainder being of sawlog quality. This target has not been evaluated and finalized for TFL 18 and may change with further assessment and analysis.

7.1.1.3 WT 3 (Habitat)

No quantified working targets for habitat have been established for TFL 18. Slocan has proposed a wildlife habitat capability/suitability study as part of the terrestrial ecosystem mapping project. Following the completion of this study, working targets may be established for the TFL. Until then, Slocan will maintain habitat opportunities by

following direction from the Kamloops LRMP and the biodiversity guidebook and landscape unit planning guidebook.

7.2 Identification of Targets, Regimes and Activities

Table 4 documents the issues and strategies identified earlier in section 1.1.

Table 4 - Silviculture Strategies

Issue	Objective	Strategy	Target	Regime	Activities	Area (ha/yr)	Timber Supply Effects				Habitat Effects	Jobs (pd/ha)	Cost ($/ha)	Draft Rank
							S	M	L	Q				
Timber Supply Quantity	Maximize Possible Quantity	Increase THLB	Backlog	Restock Backlog	1. survey backlog 2. fill plant 3. brush for survival	2000/5yrs 400/5yrs 200/5yrs	+	+	+		-	0.05 2.00 4.00	20 900 700	
			Non-merchantable	Rehab non-merch	1. survey non-merch 2. rehabilitation 3. site prep 4. plant large stock 5. brush for survival	2200/5yrs 500/5yrs 750/5yrs 1000/5yrs 1000/5yrs	+	+	+		-	0.05 0.50 0.50 2.00 4.00	20 800 800 900 700	3
			Deciduous stands	Convert deciduous (where appropriate and markets allow)	1. survey deciduous leading stands 2. rehabilitation 3. site prep 4. plant large stock 5. brush for survival	600/2yrs 175/2yrs 425/5yrs 425/5yrs 425/5yrs	+	+	+		-	0.05 0.50 0.50 2.00 4.00	20 800 800 900 700	3

Issue	Objective	Strategy	Target	Regime	Activities	Area (ha/yr)	Timber Supply Effects				Habitat Effects	Jobs (pd/ha)	Cost ($/ha)	Draft Rank
							S	M	L	Q				
			Old landing/road rehabilitation	Rehabilitation	1. survey road/landing 2. rehabilitation 3. plant large stock 4. brush for survival	30/1 yrs 30/5yrs 30/5yrs 30/5yrs	+	+	+		-	0.05 0.50 2.00 4.00	20 800 900 700	1
		Genetically improved seed	As available for Pli, Fdi, Lw, and Pw (Sw already available)	Use genetically approved seed available within 5 years										1
		Rapid regeneration	All harvested sites as appropriate	Enhanced regeneration	Current management		+	+	+		+/-			
		Mitigate constrained management zones	VQOs (ESSFwc1 presented below)	CT or partial harvesting where feasible and appropriate	1. survey feasible areas for CT/partial harvest 2. CT/partial harvesting	250/5yrs 250/5yrs	+	+	+		+	0.05	20	1
		Enhance short/mid term volumes	Existing stands that are scheduled for harvest in the next 20-40 years	Increase current stand yields	1. fertilize once +/- 10 years prior to harvest	7200/20yrs	+	+				1.00	300	2
		Enhance mid/long term volumes	Existing stands that are likely to be harvested in the next 40-80 years	Increase future stand yields	1. repeat fertilize those suitable every 10 years	900/10yrs		+	+			1.00	300	2
Timber Supply Quality	Increase quality of future harvest	Manage to produce clear wood	All suitable good and medium Pli and Fdi sites (density control will include species control). Higher Pli planting densities may reduce need for future pruning.	Density control and pruning	1. density control spacing 2. prune (SFP proposes 1 lift)	300/5yrs 300/5yrs	-	-	-	+ +	+ +	4.00 4.00	1200 1200	2

Issue	Objective	Strategy	Target	Regime	Activities	Area (ha/yr)	Timber Supply Effects				Habitat Effects	Jobs (pd/ha)	Cost ($/ha)	Draft Rank
							S	M	L	Q				
				Density control, pruning and fertilization	1. density control spacing 2. prune 3. fertilization	300/5yrs 400/5yrs 300/5yrs	-	-	+/-	+	+/-	4.00 4.00 1.00	1200 1200 300	2
		Increase piece size	All suitable good and medium Pli and Fdi sites	Density control	1. density control spacing	300/5yrs	-	-	-	+	+/-	4.00	1200	1
		Manage for J grade	All suitable medium and good existing and future Sx plantations (ICH and ESSF)	Weevil control	1. weevil resistant stock 2. mixed species plant 3. brush maintenance	Research Current management								3
Biodiversity	Minimize impact on AAC	Maintain desired stand attributes	Mature and old stands in ESSFwc2 (in serious OG deficit and contains	CT or partial harvesting where feasible and appropriate	1. survey feasible areas for CT/partial harvest 2. CT/partial harvesting	300/5yrs 300/5yrs	+	+	+	-	+	0.05	20	1
	Encourage species diversity	Enhance stand level diversity	All harvested areas	Mixed species planting	Current management									
Visually sensitive areas	Achieve VQO while minimizing impacts on timber supply	Reduce time to achieve visually effective green up height	All harvested areas within visually sensitive areas when managing for VQO	Increased height growth in VQOs	1. immediate planting large stock 2. early brushing	500/5yrs 500/5yrs	+	+	+	+	+	2.00 4.00	900 700	
Spruce, fir and mountain pine beetle	Maintain endemic levels	Continue to monitor and salvage log or fall/burn to reduce risk	Attacked or stands at risk throughout TFL		Salvage harvest Mixed species planting As current management									

8. Silviculture Program

8.1 Tactical Priorities

As table 4 illustrates, there is a draft ranking provided for each of the incremental treatments. Several groups received the same ranking indicating their overall high priority. Ranking of the regimes is a subjective process and is expected to change over time as more information becomes available and objectives change. Prior to the implementation of any silviculture program the priorities of the treatments should be re-examined.

8.2 Program Costs and Benefits

The program costs and employment results are presented in Table 5, 6 and 7. Table 5 contains the area treated by each activity and year. Table 6 contains the expenditure by activity and year, based on the unit costs recorded in the treatment table. Table 7 contains the silviculture employment benefits associated with the program. The cost and employment assumptions used in creating the tables are listed in Appendix 2.

The results of the proposed silviculture strategies for TFL 18 are significantly larger than historical silviculture programs in terms of proposed treatments and their associated costs. As such, the total program has been split into two components: those activities associated with historic intensive silviculture activities (which were considered in the recent timber supply analysis) and those activities that are actually incremental to the others (Table 5).

Table 5 – Proposed Program Split for Historic Incremental and New Incremental Treatments

Historic Incremental or AAC Considered Activities	**New Incremental Activities**
Restock Backlog	Rehab non-merch
Old landing/road rehab	Convert deciduous
Use genetically improved seed	CT or partial harvest in VQOs
Enhanced regeneration	Single/repeat fertilization
Mixed species planting	Density control/pruning
Immediate planting large stock	Weevil control

Salvage harvest, mixed species planting	CT or partial harvest in BEC

Table 6 - Area (ha) treated by activity and year

Year	Surveys	Site Prep	Rehab	Plant	Brush	Space	Fertilize	Prune	Total
1	1 280	335	141	565	531	180	360	140	**3 532**
2	1 250	335	141	565	531	180	360	140	**3 502**
3	950	335	141	565	531	180	360	140	**3 202**
4	950	335	141	565	531	180	360	140	**3 202**
5	950	335	141	565	531	180	360	140	**3 202**
Subtotal	**5 380**	**1 675**	**705**	**2 825**	**2 655**	**900**	**1 800**	**700**	**16 640**
Yr. 6-10	700	500	30	1 030	1 030	900	1 800	700	**6 690**
Total	**6 080**	**2 175**	**735**	**3 855**	**3 685**	**1 800**	**3 600**	**1 400**	**23 330**

Table 7 - Expenditure ($) by activity and year

Year	Surveys	Site Prep	Rehab	Plant	Brush	Space	Fertilize	Prune	Total
1	23 840	268 000	112 800	508 500	371 700	216 000	108 000	168 000	**1 776 840**
2	23 300	268 000	112 800	508 500	371 700	216 000	108 000	168 000	**1 776 300**
3	17 900	268 000	112 800	508 500	371 700	216 000	108 000	168 000	**1 770 900**
4	17 900	268 000	112 800	508 500	371 700	216 000	108 000	168 000	**1 770 900**
5	17 900	268 000	112 800	508 500	371 700	216 000	108 000	168 000	**1 770 900**
Subtotal	**100 840**	**1 340 000**	**564 000**	**2 542 500**	**1 858 500**	**1 080 000**	**540 000**	**840 000**	**8 865 840**
Yr. 6-10	12 600	400 000	24 000	927 000	721 000	1 080 000	540 000	840 000	**4 544 600**
Total	**113 440**	**1 740 000**	**588 000**	**3 469 500**	**2 579 500**	**2 160 000**	**1 080 000**	**1 680 000**	**13 410 440**

Table 8 - Short-term employment benefits (person-days) by year and activity

Year	Surveys	Site Prep	Rehab	Plant	Brush	Space	Fertilize	Prune	Total
1	64	167.5	70.5	1 033	2 124	720	360	560	**5 099**
2	62.5	167.5	70.5	1 033	2 124	720	360	560	**5 097.50**
3	47.5	167.5	70.5	1 033	2 124	720	360	560	**5 082.50**
4	47.5	167.5	70.5	1 033	2 124	720	360	560	**5 082.50**
5	47.5	167.5	70.5	1 033	2 124	720	360	560	**5 082.50**

Subtotal	**126.5**	**837.5**	**352.5**	**5 165**	**10 620**	**3 600**	**1 800**	**2 800**	**25 444**
Yr. 6-10	35	250	15	1 854	4 120	3 600	1 800	2 800	**14 474**
Total	**161.5**	**1 087.5**	**367.5**	**7 019**	**14 740**	**7 200**	**3 600**	**5 600**	**39 775.50**

9. Remaining Issues and Research Requirements

The following list represents the issues that remain following this analysis:

1. Due to time restrictions of the participants, a full review and comment regarding the type 1 document was not possible. As such, comments would still be welcome and the participants are encouraged to continue refining the document in preparation for the type 2 analysis.

2. The regimes presented here represent the use of current information (recent Management Plan and timber supply analysis) combined with existing growth and yield tools. Further work should be undertaken to better understand silviculture regimes and their responses on timber quantity and quality. It is suggested that a fertilization assessment be completed for the TFL to identify stands as a priority for fertilization. The benefits of fertilization have not been quantified and it is possible that less structurally desirable wood may result due to increasing juvenile wood and taper.

3. Default densities were used in this analysis to assess the regimes but it is suggested that they be reviewed to ensure that they are suitable to produce the desired quality objectives. Higher planting densities may be considered to provide for future commercial thinning opportunities and reducing the need for pruning.

4. Responses for the strategies and regimes proposed in this analysis are limited to their quantification at the forest level. Only through a type 2 analysis can the strategies be quantified and the cost and benefits of proposed regimes understood.

5. The issue around the IU Balsam area has been removed from this analysis as Slocan is preparing a new strategy for this area. Results from this strategy should be incorporated into the type 2 analysis and the next timber supply analysis.

6. The type 2 analysis should also consider the requirements of ongoing effort around landscape unit planning and assist that process where possible.

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Appendix 1

The Timber Supply Context of Silviculture in TFL 18

This section provides information on the timber supply history and dynamics within TFL 18. The objective is to identify the factors that shape timber supply within the TFL and identify opportunities for the use of silviculture to mitigate shortfalls in timber supply. Background information was drawn from Management Plan #9 (2000), Timber Supply Analysis Report (2000) and the Rationale for Allowable Annual Cut Determination (2000) for TFL 18.

History of the Allowable Annual Cut

TFL 18 was originally awarded to Clearwater Timber Products Ltd. in 1954 and was assigned to Slocan Forest Products Ltd. in 1987. The most recent TFL agreement was issued in 1996.

The Allowable Annual Cut (AAC) was set at 70,792 m^3 in 1955 and increased over time to 210,000 m^3 by 1983. The increased use of lodgepole pine as a commercial species, closer utilization standards, and improved inventory information were responsible for the AAC increase. In 1993, the AAC was then reduced to 187,000 m^3 to manage for the transition to the long-term harvesting level. As of October 25, 2000 the AAC for TFL 18 was set at 177,650 representing a 5% decrease.

Figure 1.1 shows the base case harvest forecast of the Timber Supply Analysis conducted for MP9. The base case forecasts significant declines in timber volume. The current harvest level of 187,000 m^3 can only be maintained for the next five years, after which it drops by 15% to 160,000 m^3 and further by approximately 10% per decade to a mid-term low of 124,000 m^3. The harvest forecast remains at this lower level until year 105 where it starts a gradual increase up to the long-term harvest level of 152,000 m^3 at year 125. The rate of decline forecasted in the base case is greater than in previous analyses due to increases in land base constraints resulting from changes in forest management, as well as the exclusion of non-merchantable types and a more detailed assessment of road reductions. In addition, adjacency constraints were modeled spatially for this timber supply analysis, which may cause a decrease in timber availability.

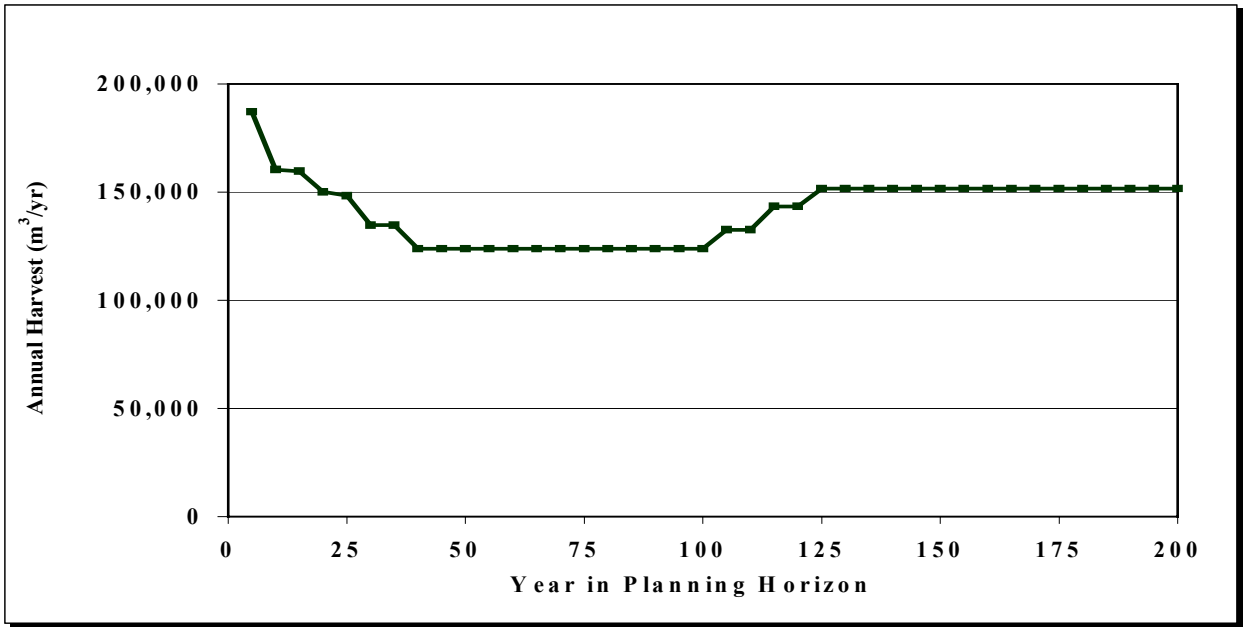

Figure 1.1: Base case timber supply forecast

Alternative Timber Flows

The base case timber supply forecast attempts to preserve the current harvest level, while avoiding excessive changes over time and sacrificing timber availability and the productivity of the forest in the future. While the base case attempts to meet these objectives, there are many potential harvest flows, initial harvest levels and rate of harvest tradeoffs over the short, medium and long-term and through alternative harvest flows provide insight to the timber supply dynamics for the management unit and the respective pinch points that shape the timber supply.

Figure 1.2 presents four harvest flow alternatives to the base case harvest forecast. The opportunity to start at a higher initial harvest level was not possible so three different starting points were attempted as well as increasing to the steady long-term level 15 years earlier.

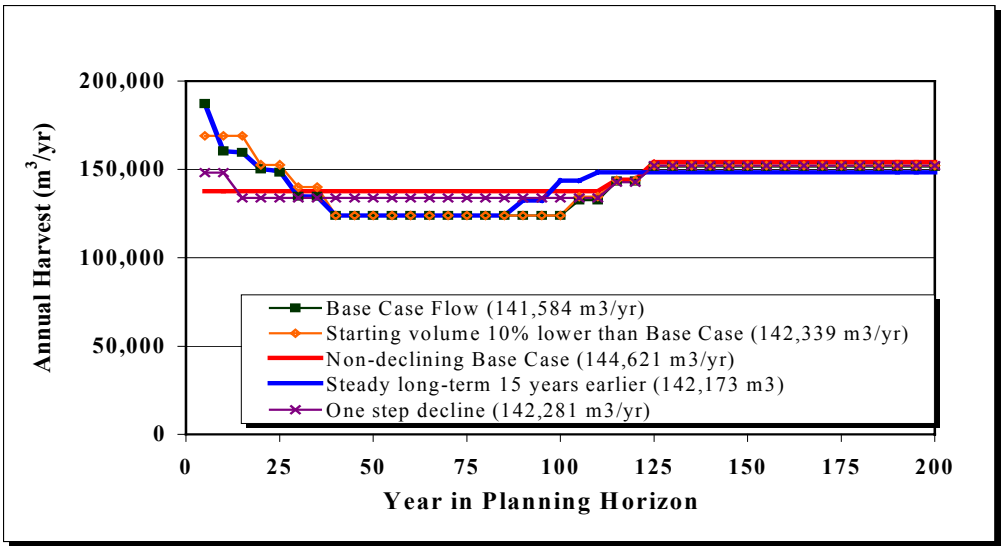

Figure 1.2 Alternative timber flows

A short-term flow policy or non-declining yield with no allowable decrease throughout the planning horizon was tested. The rate of harvest must immediately be reduced by 27% from the current level if no declines are allowed in the future forecast. The initial harvest rate could not be set at the long-term harvest level and maintained in a non-declining condition throughout the 200 years as a shortfall would occur near year 50 to 60 when harvest must change from principally older stands to younger managed stands. The non-declining flow does increase the mid-term harvest beyond VDYP LRSY to 137 000 m^3/year.

Due to the significant mid-term drop in the base case scenario an initial 10% drop to 170 000 m^3/year was tested (Figure 8.1). This initial decrease in harvest produced some short-term relief by maintaining 170 000 for 3 periods as compared to one period for the current harvest level in the base case. During years 6 – 15 it is possible to achieve a harvest level 6% higher than the base case during the same period of time. The next four periods had some minor relief with no mid or long-term harvest flow increases.

Starting approximately 20% lower (~150 000 m^3/year) and then stepping down results in a mid-term even flow level of 133 819 m^3/year produced no real difference in the timber flow.

The final alternative harvest flow sensitivity tested the increase in the rate of harvest to the long-term level 15 years earlier than in the base case harvest forecast (85 years versus 100 years). Increasing the rate of harvest to the long-term level 15 years earlier than the base case resulted in a 2% lower long-term harvest level.

The alternative flow sensitivity analyses produced no other scenario that significantly improved the mid-term trough or long-term harvest level as compared to the base case harvest forecast. The overall long-term harvest level is relatively unchanged and as such is less influenced by harvest flow alternatives and more influenced by the size and productivity of the timber harvesting land base and the applied cover constraints, as represented by the similarity between the harvest flow sensitivities.

Age Class and Species Distribution

Figure 1.2 shows the current age class distribution within the timber harvesting land base for TFL 18. The current age class distribution shows a high concentration of young stands in the TFL due to past harvesting and natural disturbances. Approximately 24% of the THLB is less than or equal to 20 years old and 31% younger than 40 years. Ignoring the less than 20-year-old stands, there is a relatively even distribution throughout the remainder of the age class groups. Twelve percent of stands are between 40 and 80 years old and 24% are between 80 and 140 years. Almost 27% of the THLB is between 140 and 260 years with 6% greater than 260 years.

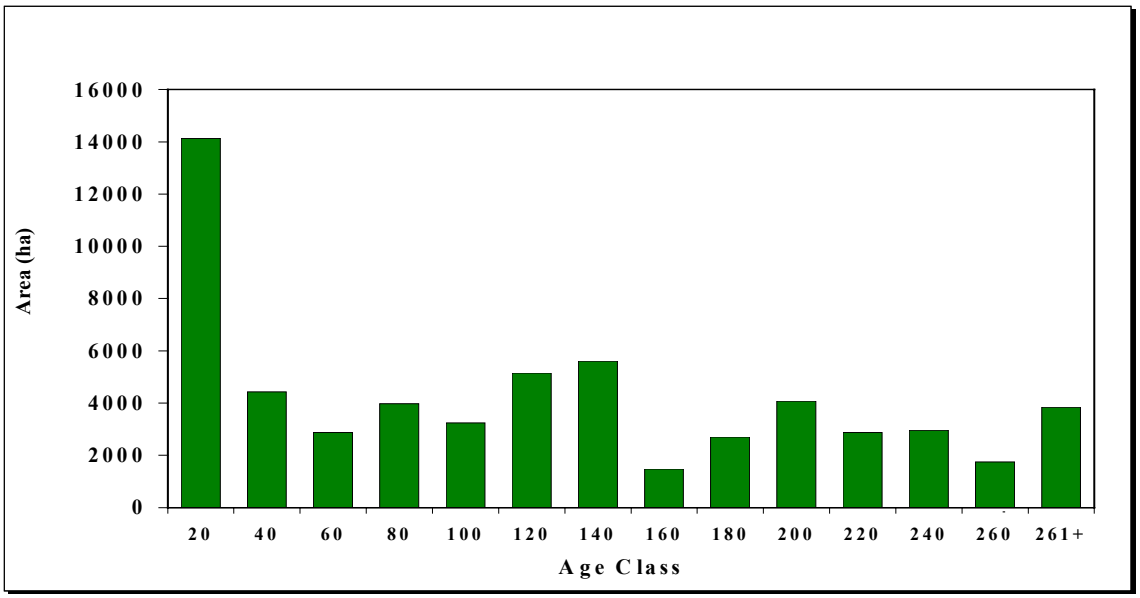

Figure 1.3: Current age class distribution (THLB)

Most of the TFL (48%) is dominated by spruce leading stands with pine, balsam and Douglas-fir forming 26, 20 and 5 percent of the timber harvesting land base, respectively. Cedar/hemlock leading stands exist as a minor component totalling approximately 1% of the remaining timber harvesting land base. Based on age class the spruce and pine leading stands represent the bulk of older and younger stands while balsam-leading stands comprise the 20 – 60 year range.

Transition from Natural to Managed Stands

The transition of harvest from natural origin stands to future managed is illustrated in Figure 1.4. This graph identifies the point at which the harvest is predominately dependent on future managed stands and forms the response time for the Type 1 Silviculture Analysis. This point occurs in year 135 years from now.

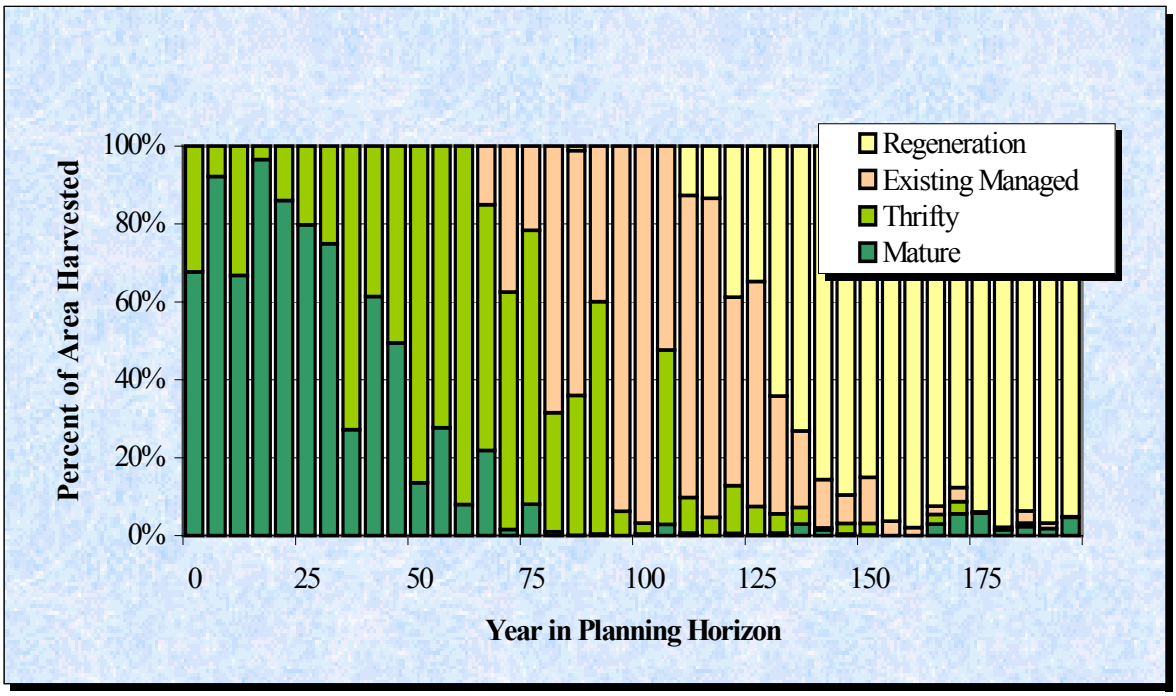

Figure 1.4 Harvest distribution

Harvest in periods 1 – 14 is exclusively drawn from the thrifty (age < 141) and mature (age > 140) existing natural stand types. Shifts between the thrifty and mature proportions are largely driven by the status of the old growth across the TFL, predominately within NDT 1 due to the > 250 year old growth requirement. Significant future harvest in existing and future managed stand types commences in period 17 and period 26 respectively, as these types attain minimum harvestable age.

As shown in Figure 1.4 there is insufficient mature timber to maintain the harvest level until future managed stands are eligible for harvest. As a result the timber supply forecast must be decreased as shown in Figure 1.1. Lower volume thrifty and existing managed stands are required to fill in the gap until future managed stands become available. This impact is increased in TFL 18 due to the retention and recruitment required for old growth and landscape biodiversity.

Average Harvest Age

The average harvest age declines throughout the planning horizon as harvesting shifts from natural to managed stands.

Average Figure 1.3: Average harvest age.

Harvest Volume

A steadily decreasing average harvest volume occurs through the mid-term as there is a lack of available merchantable volume and the harvest within the existing mature is reduced for old growth requirements. Therefore, the existing managed and future managed stands are harvested as soon as they reach merchantable condition with lower average volumes (see Figure 1.3). In the long term, a similar phenomenon occurs as we shift from harvesting older existing managed stands to almost exclusively harvesting second growth managed stands between year 125 – 150 years. As the land base reaches an even distribution at about 160 years, the average volume per hectare does not vary significantly through the rest of the planning horizon.

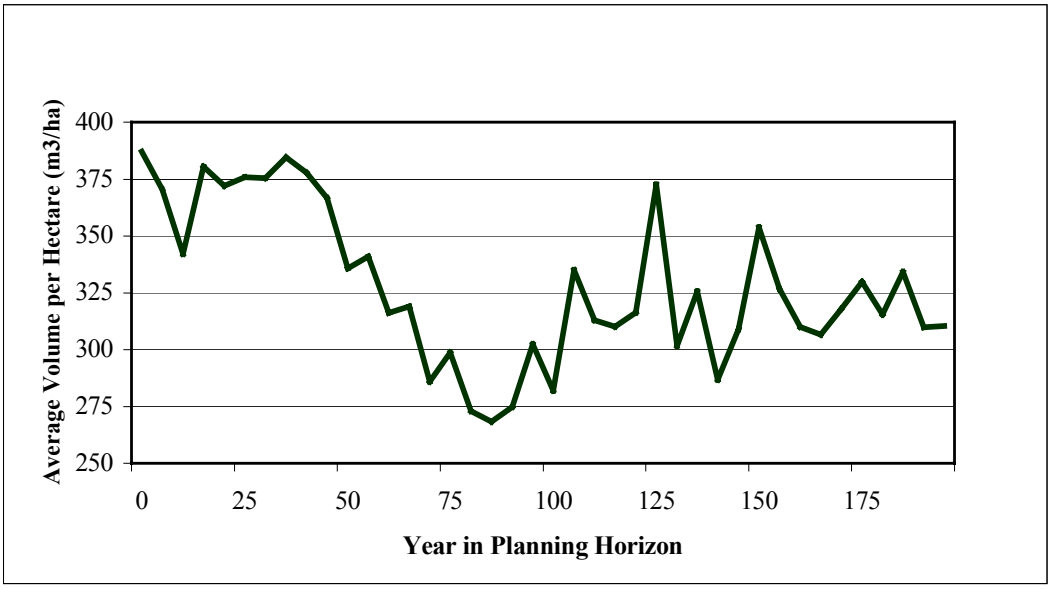

Figure 1.4: Average harvest volume.

Sensitivity Analyses

Sensitivity to Implementation of Old Growth Management Areas

TSR II base case was modeled using old seral requirements based on the low emphasis biodiversity option and a 1/3 draw down.

Timber supply is highly sensitive to implementing draft OGMAs. Sensitivity analysis showed that using draft OGMA's for the Clearwater LU forces the current harvest level

to drop by 28% to 135,616 m^3/year. The harvest level then follows the base case through the mid-term and rises to the long-term harvest level 15 years later than in the base case.

Sensitivity to Adjacency in IRM Zone

Timber supply is moderately sensitive to changes in forest cover requirements. The current green up height is 3 metres and is modeled as age at which the stand reaches that height.

If adjacency is applied as a maximum forest cover requirement (which is not constraining at all) the current harvest level can be maintained for the first 3 periods with later step downs to the mid-term low. Mid-term harvest level adjustments were negligible while in the long-term there was a 5% increase in the harvest level.

If green-up ages were 5 years less than estimated for the base case, the current harvest level could still only be maintained for 1 period but would then only decline by 10% to 170,000 m^3/year versus 160,000 m^3/year in the second period in the base case. Mid-term harvest level adjustments were negligible but in the long-term there was a 5% effective increase.

If green-up age was increased by 5 years the current harvest level could be maintained for 1 period and then would drop 30% to 129,853 m^3/year. This level is basically maintained throughout the mid-term and increases to 144,000 m^3/year which is 5% lower than the base case long-term harvest forecast.

Sensitivity to Visual Quality Constraints

Short-, mid- and long-term timber supply is sensitive to the uncertainty around the constraint threshold for VQOs in TFL 18. If the requirements are decreased 5% there is an immediate timber supply improvement whereby the current harvest level could be maintained for 10 years.

With no VQO requirements, the long-term harvest level increases 11% to 168,696 m^3/year while increasing the VQO class 5% resulted in a 6% increase to 161,642 m^3/year. Decreasing the VQO class by 5% (resulting in full reserve status for retention and preservation layers) resulted in significant declines in the short-term to a mid-term low of 101,734 m^3/year. The long-term harvest level also decreased 6% to 142,134 m^3/year.

Sensitivity to Changes in Minimum Harvest Ages

The base case uses a minimum harvest age of 80 years for fir and pine, and 100 years for all other species. A minimum harvest volume is also applied for each analysis unit and is 150 m^3/ha for all stands but lodgepole pine leading stands, which have a minimum harvest volume of 120 m^3/ha.

Increasing the age by 10% resulted in an enhanced rate of decline, a 10% reduction through the mid-term trough, and a slight difference in the long-term.

The effect of reducing minimum harvest ages by 10% has very little effect on the starting harvest level and the short-term timber supply as compared to the base case harvest forecast. The mid-term does receive a 6% benefit raising the harvest forecast to 131,438 m^3/year. Overall, the long-term harvest level is increased 5% from the base case harvest forecast.

Sensitivity to Adjustments of Site Indices

From field reconnaissance it is believed that inaccuracies in the forest inventory exist and that site indices may be underestimated in the TFL. The effect of applying a site index adjustment ranging from 0 to 6m, depending on current site index, would result in profound increases in the timber supply. The current AAC could be sustained for 35 years, with a 10% drop in the mid-term. The long-term sustainable level would increase to over 212 000 m^3/year.

Sensitivity to Application of Old Growth Site Index Adjustment

There is increasing evidence that estimating future productivity from the existing mature forest is difficult and may result in a significant underestimation. The measured productivity of the regenerated stands is generally higher than the estimated future productivity of the mature and old growth stands.

Adjustment of future forest productivity has a significant effect on the long-term harvest level. Results show that the long-term harvest level is potentially increased by 11% over the base case harvest forecast when future managed stand productivity is adjusted subject to old growth site index improvement.

Sensitivity to Volumes in Existing Stands

The short and mid-term timber supply is highly sensitive to adjustments in existing stand volumes due to the fact that the existing stands constitute most of the timber harvest during this time.

If existing stand volumes are overestimated by 10%, the short-term harvest level drops similarly by close to 10%.

Conversely, if the existing volumes are actually 10% greater than those used for the base case the current harvest could be maintained for 10 years with supply decreasing by 10% in three steps down to an increased mid-term harvest level of 138,381 m^3/year (11% increase). The long-term harvest level is 6% higher than the base case harvest forecast.

Sensitivity to Volumes in Future Stands

Uncertainty of regenerated stand volume estimates has a significant effect on the long-term harvest level.

If regenerated stand volumes were increased by 10%, the long-term harvest level would increase approximately 7.2% from the base case forecast. If future managed stand volumes were overestimated by 10% the long-term harvest forecast would decrease by 10% to 137,892 m^3/year.

Summary of Timber Supply Dynamics

Short Term (1 – 20 years)

The major factors contributing to the projected decline in the base case harvest forecast over the short term are:

- Reductions in the timber harvesting land base due to the Forest Practices Code (specifically inclusion of riparian reserve zones and protected areas) and the exclusion of non-merchantable types.
- The significant recent changes in forest management, including the requirement for landscape biodiversity, updated visual landscape inventory, moose winter range and riparian management zones.
- The short –term timber supply is sensitive to changes in forest cover constraints; an increase in green-up ages produces an immediate drop in short-term timber supply while a decrease in the green-up age produces a short-term benefit. Similarly, uncertainty of VQO class has a significant effect on timber supply over the short term.
- Short-term timber supply is very sensitive to establishment of draft OGMAs and it is also sensitive to decreases in existing stand volumes.
- Overall site index adjustment would have a significant impact on timber supply in the short, medium and long term.

Mid Term (21-120 years)

- Uncertainty of VQO class has a moderate effect on timber supply over the mid-term.
- A 10% increase in minimum harvest ages results in a 10% decrease in the mid-term timber supply, while a similar decrease in minimum harvest ages would produce a 6% timber flow increase in the mid term.
- Overall site index adjustment would have a significant impact on timber supply in the short, medium and long term.

Long Term (120 + years)

The long-term timber supply is sensitive to several factors:

- Increasing the green-up age reduces the long-term harvest forecast by 5%.
- Changing the VQO class by 5% results in a 6% increase or decrease in the long-term harvest level. With no VQO requirement the long-term harvest level increases by 11%.
- Decrease in minimum harvest age of 10% increases the long-term harvest level by 5%.
- Applying OGSI adjustments results in an 11% volume increase in the long term.
- The long term is sensitive to changes in regenerated stand volumes. A 10% increase or decrease in volume results a corresponding 10% change to the long-term harvest.
- Overall site index adjustment would have a significant impact on timber supply in the short, medium and long term.

Other impacts

Landscape unit planning with old growth management area requirements, general biodiversity requirements and the Forest Practices Code area likely to have future impacts on timber supply.

TFL 18 Management Unit Issues

Timber Related Issues

Decreasing timber supply

Issue: Based on the recent timber supply analysis, timber supply for TFL 18 is in a critical state of decline.

Minimum harvest age

Issue: Impact of varying minimum harvestable ages on medium-term timber supply is significant. Chief Forester recommendation: to review assumptions concerning the MHA giving due consideration to operational practice including volume and value criteria. Any results should be incorporated into further determinations).

Uncertainty with respect to forest cover site productivity

Issue: The base case site index values based on leading species, age and height were assigned to natural stand polygons based on the standard BCFS site index curves using an area weighted average of site indices to generate the yield table for each analysis unit. In several areas of the province studies have shown that site productivity has generally been underestimated with managed forest stands growing faster than projected by inventory based site index estimates from old stands.

Uncertainty with respect to operational adjustment factors

Issue: Future managed yield curves were developed from TIPSY derived projections. TIPSY forecasts are based on ideal site conditions and require operational adjustment factors to account for losses of timber volume due to stand openings for unproductive areas (OAF1) and for age dependent factors such as pests, decay, disease, breakage and waste (OAF2). The precise significance of OAF1 and 2 is uncertain and requires further investigation. Chief Forester recommendation: the licensee further examine and refine the OAFs before the next analysis.

Uncertainty with respect to residual balsam stands

Issue: The TFL contains a significant area where subalpine fir stands (balsam) are known to be residual stands. These stands contain remnant mature balsam that was left on site following timber harvesting in the 1950s and '60s using intermediate utilization standards. The licensee is committed to harvesting these stands as per their management plan. The base case assumes that harvesting in these stands continues through the planning horizon. There are at least two issues regarding these stands that should be addressed:

- These stands have generally low densities due to harvesting history. It is likely that they do not fully utilize their growing sites. There is an option to harvest these stands before maturity and regenerate the sites to achieve full site occupancy and potentially increased yields.
- There is uncertainty regarding the accuracy of the yield estimates that are currently used for these stands. This uncertainty has potential timber supply impacts that should be assessed as well.

Forest product objectives

Issue: In the SMOOP (January 16, 1998) Slocan identifies as an overall management objective "to manage the forest land base for the production of timber to produce high quality sawlogs and shorten harvest rotations.

Non-Timber Related Issues

Visually Sensitive Areas

Issue: In the base case projection Slocan used the BCFS approach to determine the proportion of allowable disturbance for visually sensitive areas based on each visual quality class (modification, partial retention, retention, and preservation). Visually effective green-up was determined through BCFS procedures and the average height was calculated at 4.2 metres. Based on the relatively gentle topography of TFL 18, it is feasible that the allowable disturbance for each visually sensitive area may be greater than that modelled in the base case forecast. Chief Forester recommendation: I encourage the licensee in cooperation with BCFS district and regional staff to review the recommended VQOs and identify where current practices fit with the allowable disturbance ranges recommended in the Kamloops LRMP.

Riparian Habitat

Issue: TFL 18 contains a significant area of riparian reserve areas (1786 net ha) and operations in these areas must meet the standards set by the *Forest Practices Code* and the *Kamloops LRMP*.

Wildlife Habitat

Issue: Besides critical moose winter range identified in the Kamloops LRMP no specific identified wildlife species or species "at risk" were recognized and therefore were not accounted for in the base case timber supply forecast. Future IWMS requirements including WHAs and GWMs are expected to have a provincial timber supply impact of one percent but local impacts have not been quantified.

Biodiversity

Issue: The forecasted impact of landscape biodiversity specifically old forest retention in NDT 1 is considerable given the district manager's interim direction and the interpretation of the *Kamloops LRMP* to meet old seral targets immediately. Furthermore, the Kamloops LRMP provides a limit on the impacts of landscape unit BEOs to no more than four percent of the timber harvest in the LRMP area. Sensitivity analysis of immediate recruitment of the full old seral target resulted in a reduction in the short-term timber supply of 23% from the base case forecast. Furthermore, a sensitivity analysis of the draft OGMAs resulted in a reduction in the short-term timber supply of 11% from the base case forecast.

Spruce Weevil

Issue: Spruce weevils are endemic throughout TFL 18.

Employment Issues

Issue: None

First Nations Issues

Issue: None

Appendix 2

Cost and Employment Assumptions

Table 9 – Cost and employment assumptions

Activities	Area[1] (ha)	Cost ($/ha)	Jobs (person days/ha)	Source
IA Surveys	2 225	18	0.05	Slocan
Survey Backlog	2 000	20	0.05	Slocan
Site Prep (IA)	114.6	800	0.5	Slocan
Site Prep (Backlog)	20	800	0.5	Slocan
Planting (IA) – includes seedling cost	610	900	1.8	Slocan
Planting (Backlog) – includes seedling cost	70	900	2.0	Slocan
Brushing Survival	70	700	4.0	Slocan
Brushing Free to Grow	160	860	4.0	Slocan
Spacing	60	1200	4.0	Slocan
Fertilization	100	300	1.0	Slocan
Pruning	80	1200	4.0	Slocan

[1] current treatments as of 2000