Quesnel TSA – Type 4 Silviculture Strategy

Data Package

Version 2.0

July 2013

Project 419-23

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1 Introduction

The BC Ministry of Forests, Lands and Natural Resource Operations have initiated a Type 4 Silviculture Strategy for the Quesnel Timber Supply Area (TSA). A timber supply review (TSR) was recently completed and an allowable annual cut (AAC) was determined at 4,000,000 m^3 per year effective January 11, 2011. The Quesnel TSA Timber Supply Analysis Technical Report provides a good base from which to pursue strategy development and/or more fully explore critical issues such as shelf-life, mountain pine beetle (MPB) related salvage strategies, priorities, and post-beetle timber supply. For many years, the Quesnel Mitigation Committee has been an active group and has compiled an extensive library of analysis, documents and information that were integrated into the Type 4 Silviculture Strategy.

This data package is only partially complete. Missing from this document are details of the assumptions specific to silviculture strategies that will be explored during this project. This early version of the data package is primarily meant to present the data and assumptions behind the revised base case. Once silviculture strategy assumptions are finalized, they will be added to this document and ultimately exist as an appendix to the Quesnel Type 4 final report.

1.1 Project Objectives

The objectives of this project are to produce:

- A fully rationalized plan to guide the expenditure of public silviculture funds to help improve the mid-term and long-term timber supply of the Quesnel TSA;
- Reports with consistent format and content so that the information can be consolidated to regional and provincial levels as well as compared between units;
- Information that can be utilized by industry and government in related decision-making processes;
- Silviculture regimes and associated standards that may be adopted in forest stewardship plans as required standards for basic silviculture operations.

This data package aims to describe the information that is material to the analysis including data inputs and assumptions.

1.2 Study Area

1.2.1 Location

The Quesnel TSA is located just south of the center of British Columbia (Figure 1), in the Fraser Basin and Interior Plateau with the Coast Mountains to the west and the Cariboo Mountains to the east.

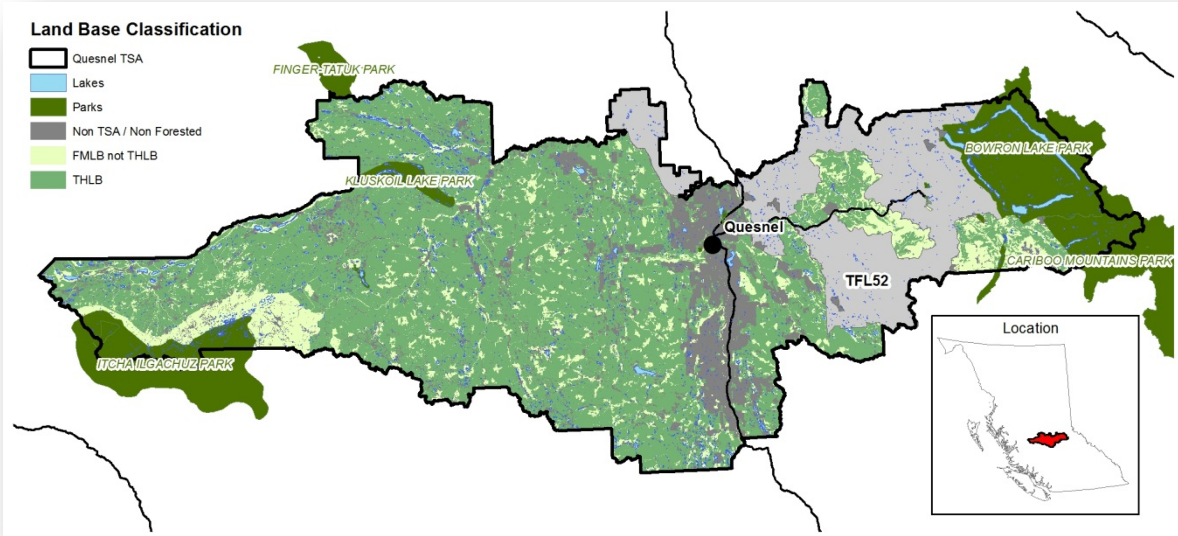


Figure 1 Quesnel TSA overview map

1.2.2 Land base

The TSA covers about 2.08 Million ha in total (including TFL areas) of which approximately 1.4 million is considered part of the Forest Management Land Base (FMLB). Areas set aside as parks, protected areas, Old growth Management Areas, Caribou no-harvest areas, and other areas considered unavailable for timber harvesting account for roughly 393,000 ha. The Timber Harvesting Land Base (THLB) considered for this project is approximately 1.01 million ha or 49% of the total area in the Quesnel TSA. More information on the land base determination can be found in Section 4.2.

1.2.3 Age class distribution

The age class distribution of the FMLB by contributing landbase classification is provided in Figure 2. There is relatively little area in the 21-40 and 41-60 year age classes which indicates relatively little disturbance 41-60 years ago. Even without considering the MPB impact, this age class gap indicates a potential timber supply shortage in the future. This presentation of age class distribution is slightly misleading because the full impact of the MPB epidemic and age of MPB-impacted stands have not been adjusted in the inventory to reflect mortality; only the volume. If the age had been altered, the <20 year age class would be much larger and the amount of area in the 81-250 year age classes would be correspondingly lower.

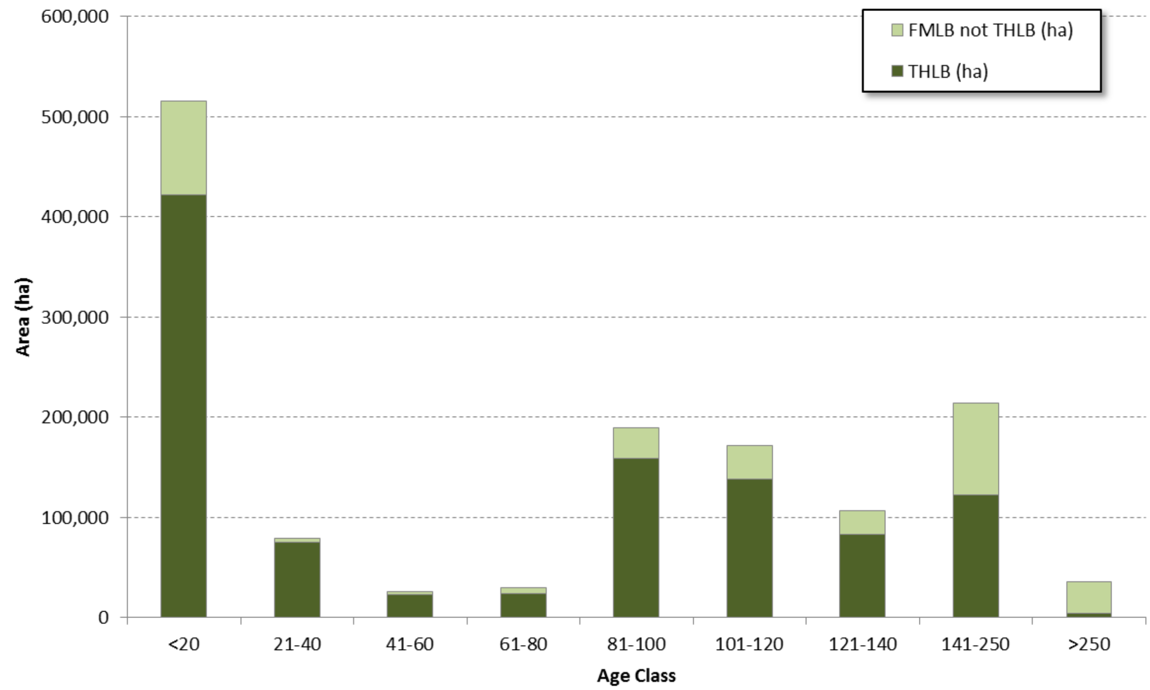


Figure 2 Age class distribution by contributing land classification

1.2.4 Leading tree species profile

Forests of the Quesnel TSA are dominated by pine leading stands (56%), followed by Spruce/Balsam (31.9%). Fir (6.4%), Deciduous (4.4%), and Cedar/Hemlock (1.2%) types make up a relatively minor component (12.0%). Figure 3 provides a breakdown of the forested area for the Quesnel TSA by leading species and contributing classification. By comparison, the THLB is comprised of approximately 62% Pine leading, 27% spruce/balsam, 6.1% Fir/Larch, and 4.9% deciduous leading types.

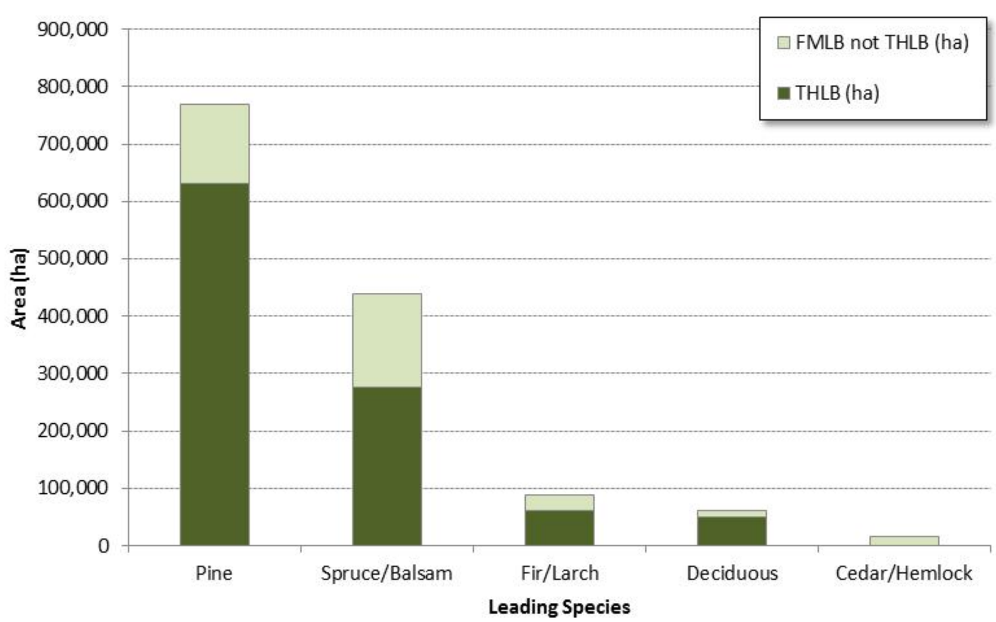


Figure 3 Area by leading species and contributing land classification

The age class structure by leading species for the THLB is shown in Figure 4.

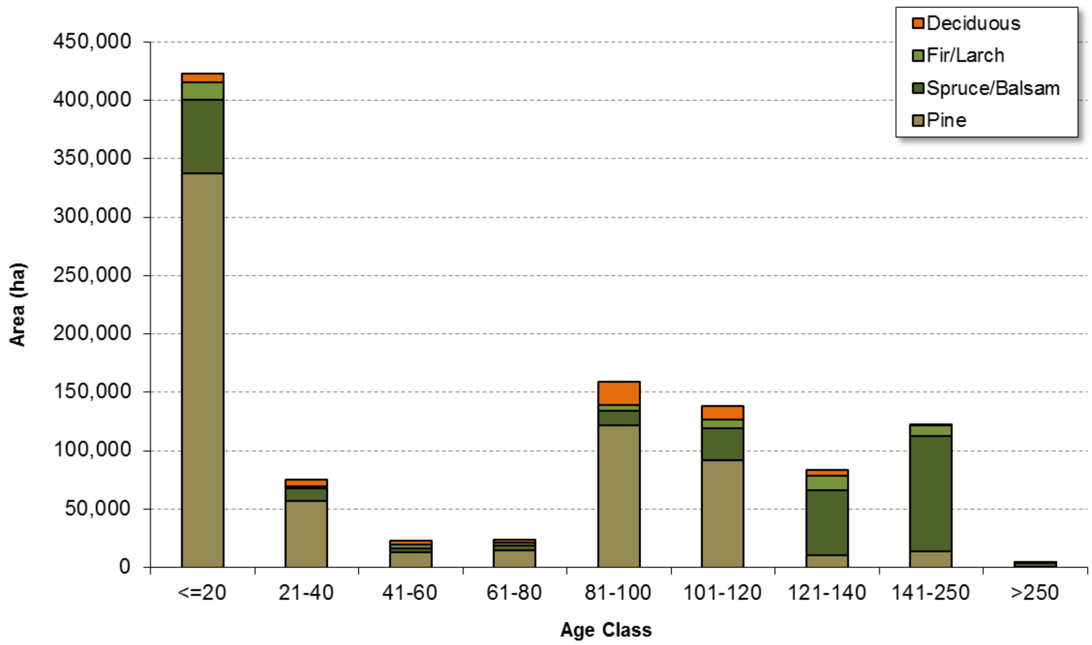
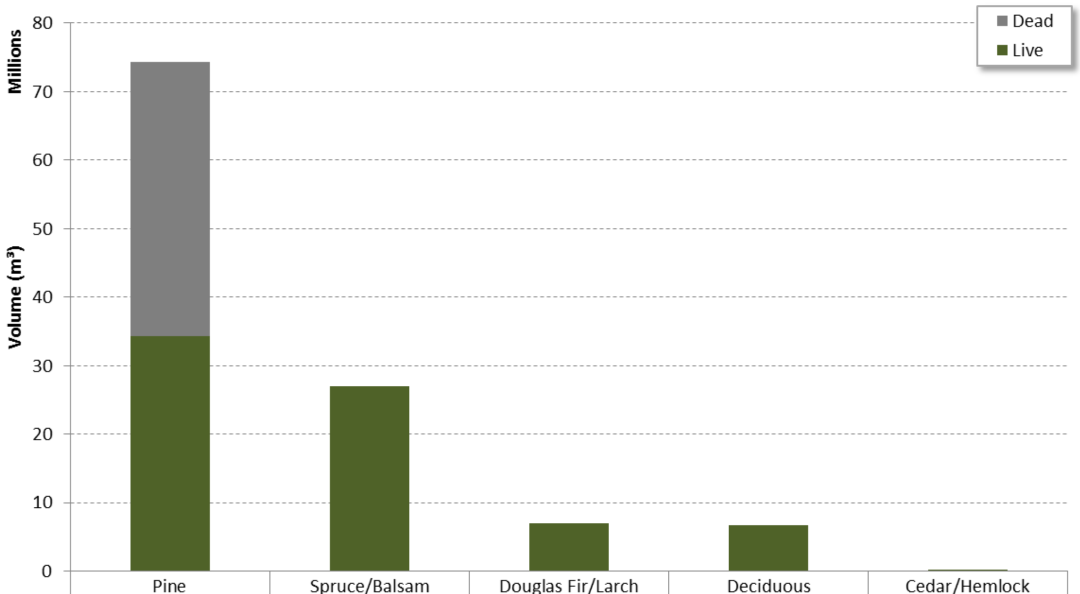


Figure 4 Age class distribution by leading species on the timber harvesting land base

1.2.5 Growing stock and volume profile

According to the consolidated forest inventory used for this analysis – a combination of recently completed LVI and Forest Vegetation Composition Rank 1 Forest Cover – there is approximately 75 million cubic metres (m^3) of live volume currently standing on the land base and 40 million m^3 of dead volume for a total of approximately 115 million m^3. Figure 5 shows the volume by species on the land base. Pine makes up the majority of the volume on the land base but over around 54% of this volume is dead.



	Pine	Spruce/Balsam	Douglas Fir/Larch	Deciduous	Cedar/Hemlock
Dead	39,997,000				
Live	34,285,000	26,985,000	6,978,000	6,711,000	189,000

Figure 5 Total growing stock on the timber harvesting land base by species

1.2.6 Site productivity profile

The distribution of site productivity (inventory site index) is shown in Figure 6 while the adjusted site index distribution (source: provincial managed stand site index) is shown in Figure 7. The inventory site index (Figure 6) is used as the site productivity input for existing natural stands while the managed site index forms the basis for site productivity input information of existing managed stands and future managed stand yield curve development. The area-weighted inventory site index of the Timber Harvesting Land Base (THLB) is 14 while the area-weighted managed site index of the THLB is 18.1.

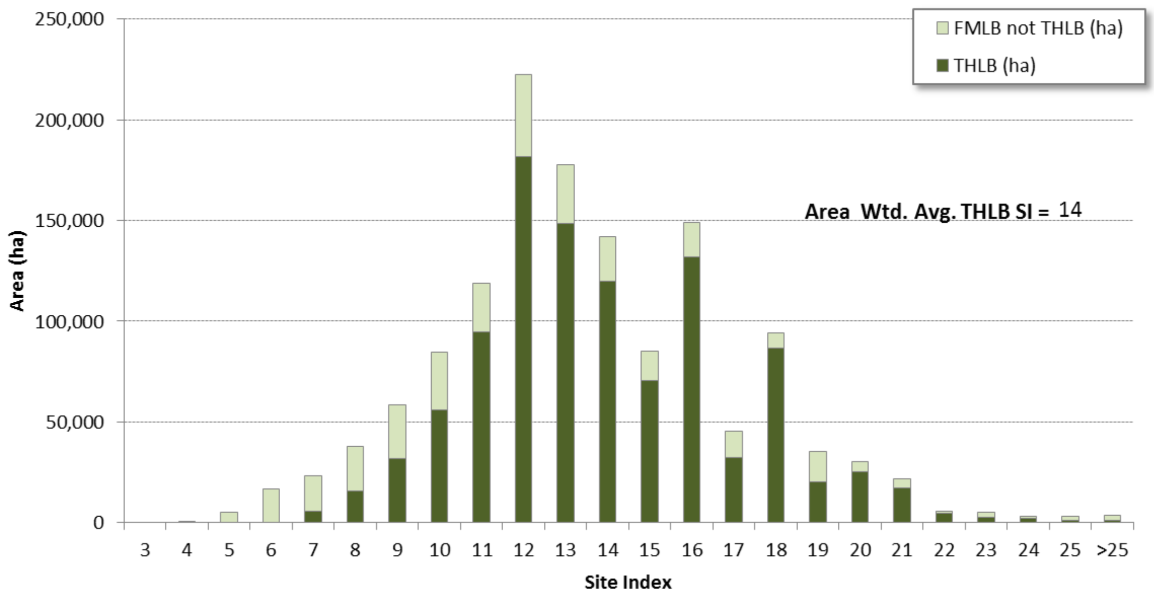


Figure 6 Site productivity area distribution by land base type (SI source = forest inventory)

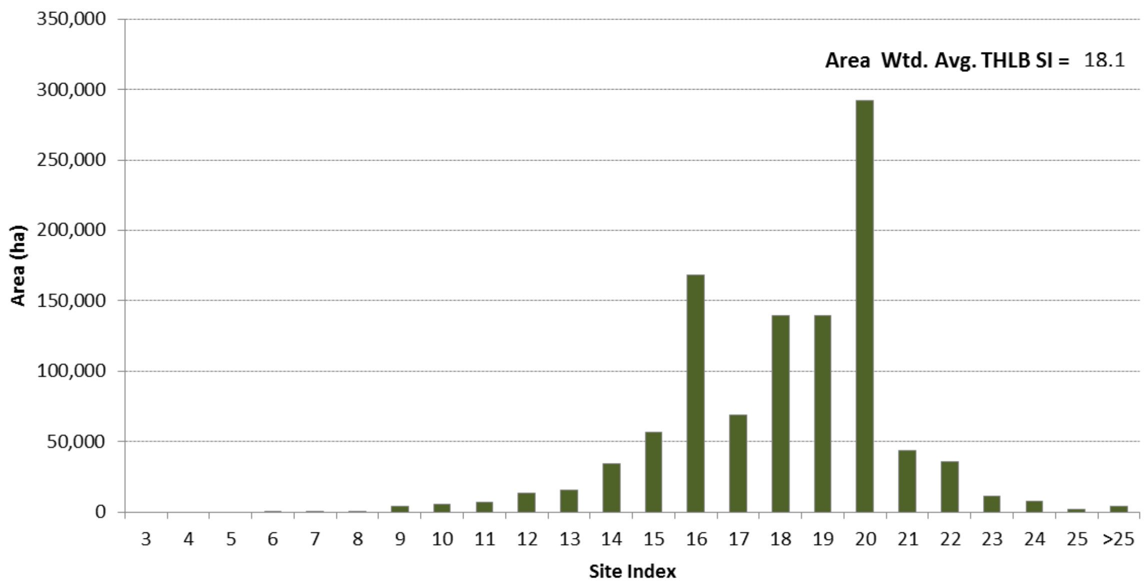


Figure 7 Site productivity area distribution on the THLB (SI source = Provincial managed site index)

2 Current Situation

2.1 Timber Supply Issues

The unprecedented MPB infestation is the dominant factor affecting forest management in the Quesnel TSA. Since the start of the epidemic, approximately 90,000,000 m^3 have been killed by the MPB.

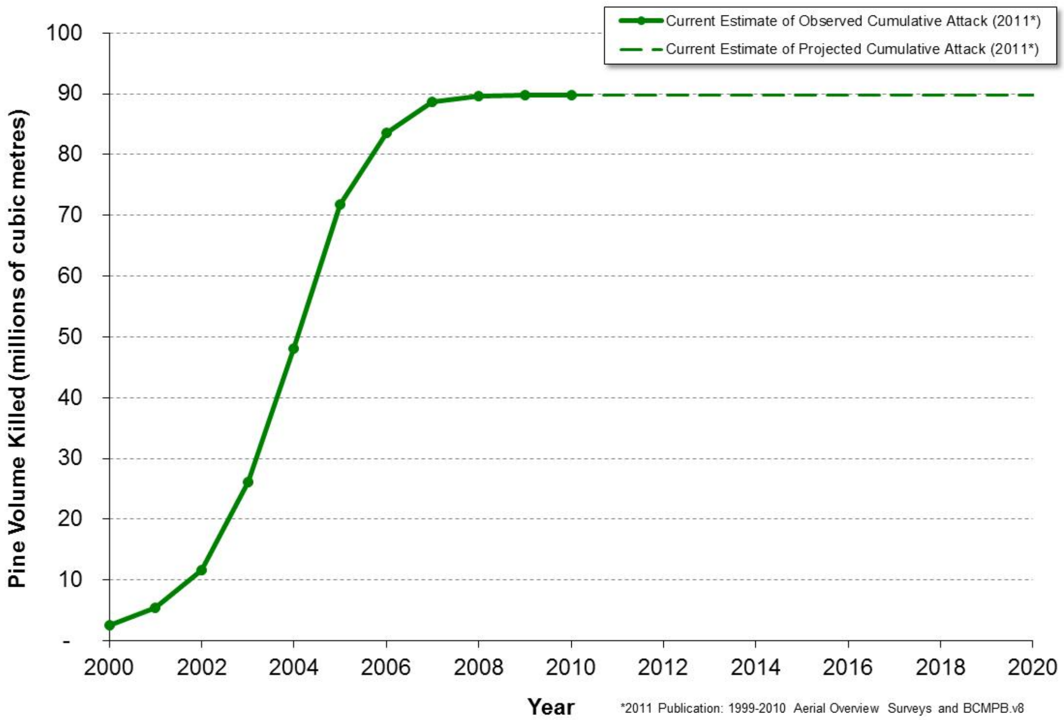


Figure 8 Estimate of observed and projected cumulative attack for the Quesnel TSA

The AAC for the TSA has been dynamic and reflects several MPB outbreaks, establishment of partition cuts, and inclusion of deciduous stands and problem forest types (PFT). The 2011 AAC of 4,000,000 m^3 per year remains in effect until a new AAC is determined which must take effect within 10 years. From this AAC, 650,000 m^3 per year is attributable to non-pine volume.

Table 1 Historical and current AAC

	1981	1985	1989	1990	1992	1996	2001	2004	2011
AAC (000,000m^3)	2.3	3.45	3.5	2.45	2.35	2.34	3.248	5.28	4.0

2.1.1 Mid-term Analysis Base Case harvest forecast

Figure 9 shows the base case harvest forecast from the recently completed mid-term analysis. The initial harvest volume of 4.0 million m^3/year is maintained until 2024 until is drops to 3.6 for 5 years before dropping to the mid-term harvest level of 1.15 million m^3/yr. 70 years from now, the harvest rises to a long-term harvest level of approximately 2.52 million m^3/yr. By year 2069, the harvest level achieves a stable long-term harvest level of 1.6 million m^3/yr.

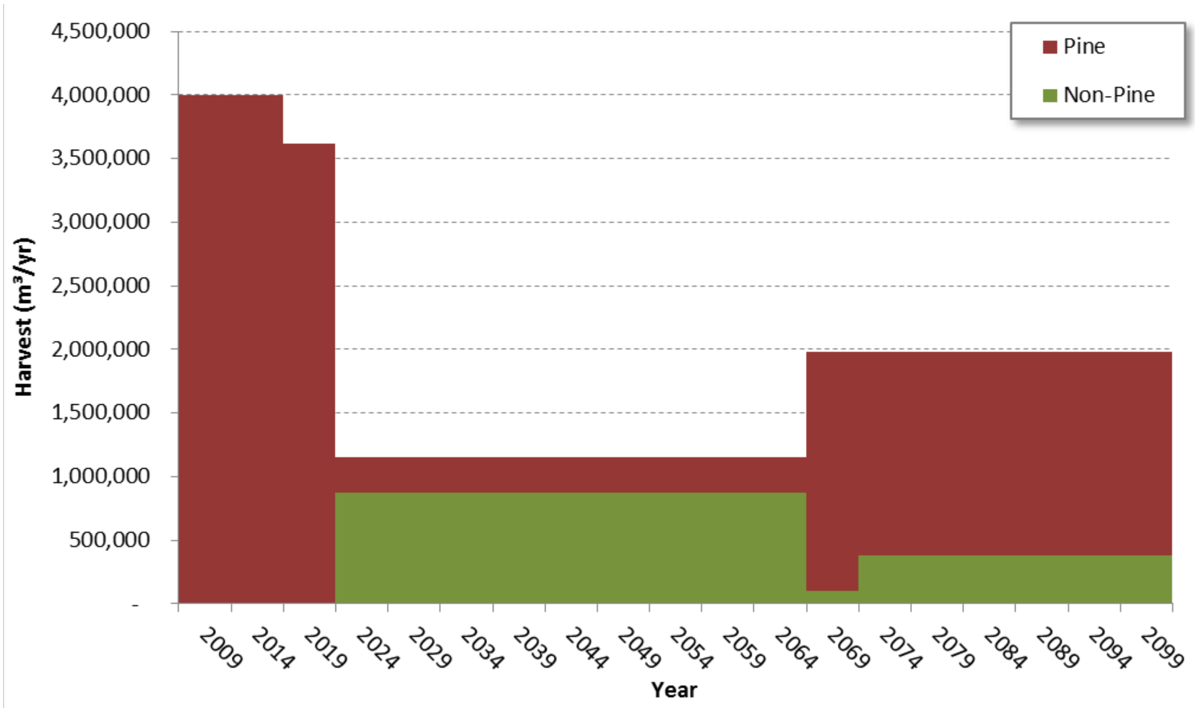


Figure 9 Mid-term Analysis Base Scenario harvest contribution leading species (Pine vs. Non-pine)

2.1.2 Mid-term dip in harvest levels

As a result of the severe outbreak and forecasted reduction in growing stock the harvest flow will likely exhibit a significant midterm trough for 40-60 yrs. Ultimately, the mid-term harvest level depends on the economic availability of timber supply and on the extent of young pine mortality. The speed at which managed stands can be brought online has a significant impact on the size and depth of this mid-term trough.

2.1.3 Unsalvaged MPB-killed timber with poor/no regeneration

Harvest is currently mostly focused on severely attacked stands in the TSA. However, it is likely that a large portion of the land base will die with no salvage harvesting. This could potentially result in a period of high fire hazard due to the high incidence of standing dead timber and/or impaired natural regeneration if fires are avoided.

Additionally, it is highly probably that many immature Pl stands have been/could be impacted by the mountain pine beetle. This area could also have little or no natural regeneration and require intervention to remove existing stems and get new trees growing.

2.1.4 Reliance on non-pine leading stands

Because of the losses expected in Pl stands and the current concentration of harvest in Pl stands, harvesting will be forced into other species during the mid-term period where timber availability is at its lowest. These stands will experience growing pressures as they are needed both for timber supply and their non-timber values.

2.1.5 Impacts on age class distribution

Given the magnitude of area affected by the mountain pine beetle across many age classes (as low as 30 years to 200+ years old) there will be a large shift of area into a narrow range of age classes. This area will, in turn, become available for harvest again at the same period in the future. If this area is once again dominated with pine, it will once again become susceptible to a major MPB infestation.

2.2 Timber Quality Issues

The current provincial target for premium logs to be produced is 10% of AAC. Premium logs need to be defined for each management unit but could be large clear sawlogs, peelers, house logs, Cw poles, logs capable of producing MSR lumber, etc.

Log size is one factor that can influence timber quality and can be directly correlated with harvest ages – longer rotations/old stands tend to produce larger logs. In general, the average age of harvested stands remains constant between 120 and 140 as the beetle wood is harvested, it reaches a peak at 180 for several years as the older non-pine timber is harvested, and then drops quickly to a low of 65 as larger proportions of regenerated stands are harvested. Log quality will change as the composition of the annual harvest changes. As the proportion of the overall harvest of non-pine stands increases, log quality will improve, however as greater proportions of regenerated stands are harvested, the impact on log-quality is less certain. Results from other areas indicate that the regeneration we are growing and expect to harvest within the next 20 to 40 years, will consist of smaller average log sizes, larger branches and heavier taper relative to current stands[1].

There is an opportunity to identify incremental silviculture activities that could mitigate negative impacts to timber quality. These activities could include a range of incremental silviculture activities aimed at increasing average piece size at harvest but not necessarily addressing taper, creating clear logs (lower knot density, smaller knots), managing for long rotation of some forest types (e.g. Douglas-fir), or increasing the heartwood to sapwood ratio (lumber density).

During the workshop, volume targets were identified for two different log sizes. TSA-wide targets of 200,000m^3/yr of peelers (Sx/Df 8”top, 17’2”) and 100,000m^3/yr of small sawlogs (Pl 4” top, 6-7” butt) were specified.

2.3 Other Issues

2.3.1 Context for Quesnel timber supply area (TSA) and a silviculture strategy

Climate change: The rate of change in climate over the last 100 years is equivalent to the rate of change of the preceding 1000 years. Rapid change in climate is an overarching pressure on the forests affecting both timber and environmental values. Collaborative work with UBC, and the ability to use previous climate change work (Kamloops Future Forest Strategy) can help identify pending vulnerabilities and potential management strategies

Land use planning: CCLUP/FRPA-FPPR/GAR/FSW/LU orders and FSP’s provide a framework for land use and forest management in the TSA. Mule Deer Winter Range and Caribou habitat are identified, and to be managed with a selection-type silviculture system. Multiple entries are assumed for both areas, with the return periods ranging from 40 to 70 years.

Ecosystem restoration: The vision of the Provincial ecosystem restoration program is to restore identified ecosystems to an ecologically appropriate condition creating a resilient landscape that

[1] Impacts of Juvenile spacing Lodgepole pine stands in the Merritt TSA, JS Thrower & associates, March 2004
Impacts of Juvenile spacing Lodgepole pine stands on TFL15, JS Thrower & associates, October 2003
Growth and yield attributes of three Lodgepole pine provenances in the BC tree improvement program, JS Thrower & Associates, March 2003

supports the economic, social, and cultural interests of British Columbia[2]. Ecosystem Restoration is defined as the process of assisting with the recovery of an ecosystem that has been degraded, damaged, or destroyed by re-establishing its structural characteristics, species composition, and ecological processes.

In the Quesnel TSA two Biogeoclimatic variants are identified as fitting the definition of the NDT4 fire-maintained ecosystems; IDFdk3 and the IDFxm. Together these ecosystems comprise 10,022ha of timber harvesting landbase and 3,091 of non-timber harvesting landbase. Specific restoration strategies were not examined in this analysis. For specific guidance see the 2009 Ecosystem Restoration Provincial Strategic Plan.

Land use planning challenges: Mountain Pine beetle impacts are not limited solely to areas available for timber harvest. Lands reserved to provide protection for sensitive species, riparian, wildlife tree recruitment, and old growth representation is also affected both directly by increased mortality of pine and indirectly by impacts of roads, water quality/quantity/ECA changes, and associated habitat impacts. Landscape units with low biodiversity emphasis will be a high risk of loss of species diversity because of reduced reserve areas. Species sensitive to changes in pine forest, or indirect forestry related impacts will also be at higher risk, particularly because the mountain pine beetle attack and salvage occurs within reserves designed to protect them.

Tree species diversity over time: Concerns have been expressed about what may be occurring to the diversity of tree species over time. A recent report from FLRNO[3] focuses on the harvested landbase and provides an assessment of the species distribution from a variety of data sources and points in time. Species distribution by leading species and by overall species will be tracked in the model to allow comparisons with this data as well as with other recent data that identifies draft species distribution targets Biogeoclimatic variant.

2.3.2 Landscape/Watershed values placed at increased risk

Aquatic ecosystems, species and supply of domestic water use: Changes in hydrology can be estimated by equivalent clear cut area (ECA) and road density. Significant increases in ECA, road density, kilometres of road ditches, and numbers of stream crossings, increase the risk of increased peak flows and changes in channel morphology. Risk can be reduced by accelerating hydrological green-up and an increased emphasis on maintaining vegetation within riparian ecosystems. This is especially important in the following areas:

- All fish-bearing streams
- Wetlands
- Fishery-sensitive watersheds
- Community watersheds

Loss of mature and old pine: The loss of mature and old forest (pine and pine mixed with other species) over the next 5 – 10 years will have significant impacts on associated aquatic, terrestrial and water values. Old growth areas have been created and silviculture strategies may provide an opportunity to improve current and/or future condition of OGMAs, while allowing timber extraction

Reduced landscape connectivity: Harvesting to remove infested pine from mixed stands, extensive clearcuts in pine-dominated watersheds without retention, and intensive large scale fires limit stand

[2] Ecosystem Restoration Provincial Strategic Plan, BC Ministry of Forests and Range. Neal, Allen 2009

[3] Species Monitoring Report Quesnel TSA, May 2012, MCMFLNRO Resource Practices Branch

structures that serve to connect habitats across a landscape. This loss can cause disproportionate impacts to species at risk or those confined to isolated pockets of suitable habitat. Connectivity is provided in the Quesnel TSA through various mechanisms including strategies that prescribe retention for specific resource management zones, conservation legacy areas, OGMAs, and riparian management provisions. Monitoring the impact to stand structure in these areas may be needed to ensure they provide required stand structure over time. Prescribing foresters can help enhance connectivity by increasing retention levels in large cutblocks and focusing silviculture strategies in riparian areas, gullies, connectivity corridors for Caribou and surrounding wildlife habitat features. Mapping pine stands, OGMAs, retained riparian areas, WTPs and other reserves by watershed and will help identify deficiencies and focus priorities for both retention and silviculture.

Loss of large older and mature sized forest patches: There are no objectives for managing patch size in the Quesnel TSA. FSP's, the Chief Forester's policy and other large cutblock related direction incorporates some of the concepts related to patch size, but these do not substitute for patch size management. MPB has the advantage of promoting larger patch sizes in landscapes that traditionally experienced large scale disturbances. However, salvage harvesting is in many ways different from what would occur in nature, and the extent and intensity of current infestations may be exceeding historical scales of disturbance. Managing to maintain a continuous supply of the various patch sizes over space and time poses a daunting task when overlaid by MPB patterns of infestation. Nevertheless, this deserves to be considered as part of silviculture planning.

Wildlife trees and coarse woody debris: Wildlife trees are managed through provisions in the FSP's, the Chief Forester's guidance, licence discretion and stewardship principles. Direct impacts of MPB infestation can enhance supplies of wildlife trees and CWD, at least in the short to medium term but, actions such as salvage, road building, and safety issues associated with roads, replanting and stand tending may result in the loss of non-pine wildlife trees and CWD. Wildlife trees and CWD are also vulnerable to intensive fires promoted by climate change and large supplies of MPB killed pine. Strategies to retain coarse woody debris, wildlife trees and wildlife tree supply through time are a critical part of silviculture planning.

Increase in roads and access: Many species at risk or of management concern are negatively affected by roads and roads will increase significantly to manage forest health and salvage MPB. Given the vulnerability of forest-dependent species and large areas of MPB impacted timber, increased emphasis on managing road impacts is warranted.

Cattle use: Cattle use particularly with riparian areas and newly planted areas will continue to be a concern for managing both habitat and timber supply. When designing silviculture treatments, consider, retain and enhance existing barriers to cattle access associated with riparian areas.

3 Modelling Approach

3.1 Model

The PATCHWORKS ™ modeling software was used for forecasting and analysis. This suite of tools is sold and maintained by Spatial Planning Systems Inc. of Deep River, Ontario (Tom Moore - www.spatial.ca).

PATCHWORKS is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets/goals defined by the user. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, CWD levels, ECAs, specific mill volumes by species, road building/hauling costs, delivered wood costs, net present values, etc. The PATCHWORKS model continually generates alternative solutions until the user decides a stable solution has been found. Solutions with attributes that fall outside of specified ranges (targets) are penalized and the goal seeking algorithm works to minimize these penalties – resulting in a solution that reflects the user objectives and priorities. Patchworks' flexible interactive approach is unique in several respects:

- PATCHWORKS' interface allows for highly interactive analysis of trade-offs between competing sustainability goals.
- PATCHWORKS software integrates operational-scale decision-making within a strategic-analysis environment: realistic spatial harvest allocations can be optimized over long-term planning horizons. Patchworks can simultaneously evaluate forest operations and log transportation problems using a multiple-product to multiple-destination formulation. The model can identify in precise detail how wood flows to mills over a complex set of road construction and transportation alternatives.
- Allocation decisions can be made considering one or many objectives simultaneously and objectives can be weighted for importance relative to each other. (softer vs. harder constraints)
- Allocation decisions can include choices between stand treatment types (Clearcut vs. partial cut, fertilization, rehabilitation, etc.).
- Unlimited capacity to represent a problem – only solution times limit model size.
- Fully customizable reporting on economic, social, and environmental conditions over time.

Reports are built web-ready to share analysis results easily – even comparisons of multiple indicators across multiple scenarios.

3.2 Data Sources

Much of the data used was also used in the preparation of the most recent TSR and Mid-term timber supply. Table 2 describes the data and sources used for this analysis.

Table 2 Spatial data sources

Spatial Data	Source	Feature Name
Consolidated Ownership	Forsite revised from GeoBC original	OWN
Landscape Units (LU)	GeoBC	RMP_LU_SVW
Old Growth Management Areas (OGMA)	GeoBC	OGMA_LEG_C
Grassland Benchmark Area	GeoBC	RMP_LG_PL
Watersheds	GeoBC	FWA_ASS_WS
Lake Management Zones (Buffers)	FAIB-Nienaber	LAKE_MANAGEMENT_ZONES_CAR_POLY
Stream Management Zones (Buffers)	FAIB-Nienaber	STREAM_MANAGEMENT_CAR_POLY
Critical Fish Habitat	GeoBC	RMP_LG_PL
Scenic Areas	GeoBC	RMP_LG_PL
Buffered Trail Areas	GeoBC	RMP_LG_PL
Birch Areas for First Nations	GeoBC	RMP_LG_PL
Terrain Stability Assessment	GeoBC	STTRSTBLTP
High Value Wetlands for Moose	GeoBC	RMP_LG_PL
Ungulate Winter Ranges (UWR)	GeoBC	WCP_UWR_SP
Wildlife Habitat Areas (WHA)	GeoBC	WCP_WHAPLY
Grizzly Bear Habitat	GeoBC	RMP_LG_PL
Biogeoclimatic Ecosystem Classification (BEC)	GeoBC	BEC_POLY
Fires (1991-2010)	GeoBC	H_FIRE_PLY
Consolidated Forest Cover	Forsite from GeoBC VEG R1 & LVI	VRI_LVI_Dissolve_Merge
Managed Site Index	GeoBC	Site_Prod_Quesnel.gdb

4 Revised Base Case Scenario

The following modelling assumptions summarize the assumptions used to model the base case. This base case is different than what was required in other silviculture analyses, in that new and improved data has been used, different than what was utilized in the mid-term analysis. A mid-term analysis-like base case was created, and is intended to provide a benchmark with which to compare other model runs. The assumptions largely reflect those used in the TSR and mid-term analysis, however, updates have been made for developments since the mid-term analysis and recent harvest and depletion information has been incorporated to reflect disturbances since the development of the mid-term analysis.

4.1 Key Assumptions

The following key assumptions are employed in this analysis:

- Silviculture opportunity evaluation is not limited by factors such as the availability of funding, funding source, or the ability to deliver a program. However, the final preferred strategy will be plausible.
- “Normal” market conditions will prevail in terms of demand and prices for timber and fibre.
- All portions of the thlb within the TSA are assumed to be economically viable, regardless of the quality of the fibre, or length of time the pine has been dead. Three “locales” were created – West, Central, East – that could be used to test the impacts of this assumption.
- Mountain pine beetle populations have moved from epidemic to endemic levels, and no additional large scale mortality will occur

4.2 Land Base Assumptions

Landbase assumptions define the forest management land base (FMLB) and timber harvesting land base (THLB). The THLB is designated to support timber harvesting while the FMLB is identified as the broader land base that can contribute toward meeting non-timber objectives (i.e. biodiversity).

The land base assumptions used in this project are primarily based on those used in TSR4 and the recent mid-term analysis. Updates have been made for new information such as changes in ownership. Deviations from TSR4 are noted. Further details regarding the landbase netdowns are provided in the TSR data package and technical report. Table 3 summarizes the landbase netdown, criteria and assumptions used for the Base Case run.

Table 3 Landbase assumptions

Netdown	Criteria	Assumption
Spatial	Non-TSA Ownership	Exclude 100% areas with ownership codes <> 62C, 69C, 60N, 40N, 63N; plus TFLs and woodlots. New tenure information since TSR4 included (e.g. TFL5, CFA, woodlot licenses)
	Non-Forest and Non-Productive	Exclude non-forested defined in VRI BCLCS in conjunction with recent harvest information to avoid excluding land classified as non-forest.
	Parks and Protected Areas	Excluded100% areas with ownership codes 60N,40N, 63N (keep as FMLB)
	No-Harvest Caribou Habitat	Excluded 100% no-harvest caribou habitat
	OGMA	Excluded 100% areas designated as OGMAs (Type = PERM, ROT, TRANS)
	Physically Inoperable Areas	Excluded 100% unstable and potentially unstable areas
	Non-Merchantable Species	Excluded stands identified as leading CH, B, PD and D but include pine-deciduous stands.
	Low productivity sites	Excluded stands < min Species/SI criteria: Douglas Fir < 9; Balsam fir < 7, Spruce < 7, Pine < 7, Deciduous < 8
	Birch Areas for First Nations (CCLUP)	Excluded 100% areas identified
	Buffered Trail Areas (CCLUP)	Excluded 100% areas identified
	Critical Habitat for Fish (CCLUP)	Excluded 100% areas identified
	Lakeshore Management Classes (CCLUP)	Excluded 100% areas identified as Class A, B, and C
	Scenic Areas (CCLUP)	Excluded 100% areas identified as Preservation VQOs
	Riparian Reserve Zones	Excluded 100% areas within RRZ
Aspatial	Riparian Management Zones	Excluded an additional 15% of the areas within RMZ
	Roads, Trails, and Landings	Applied netdowns for existing (3.0%) and future (1.0%) RTLs.

Table 4 provides a summary of the land base area by netdown category. The total area covered by the Quesnel TSA is approximately 2.08 million ha. Of this area, approximately 68% is considered part of the FMLB and 49% is considered THLB. By comparison, this THLB is approximately 0.4% larger that the reported TSR4 THLB (3,683 ha). For comparative purposes, the netdown areas associated with the Mid-term timber supply analysis are also provided in Table 4. Major sources of differences between the mid-term analysis and this analysis include:

- Different harvest depletion layer used to identify previously logged areas that were classified as non-forested in the inventory due to the lack of forest cover present on the regenerating site
- Updated Inventory (LVI) in a large portion of the TSA
- Two new Goal 2 parks included
- No exclusion for deciduous leading stands
- The exclusion of transitional and rotational OGMAs
- Differences in exclusions related to the Cariboo Chilcotin Land Use Plan

- No removals for Environmentally Sensitive Areas

Table 4 TSA land base area summary

	Area (Ha)	Percent of Total Area (%)	Percent of FMLB (%)	Mid-term Analysis Areas (ha)
Total Area	**2,082,528**	**100.0%**		**2,077,289**
less:		0.0%		
Non TSA (TFL 52, Woodlots, Private, other Non-Crown ownership)	458,293	22.0%		452,035
Non-Forest / Non-Productive	214,134	10.3%		225,151
Forest Management Land Base	**1,410,101**	**67.7%**	**100.0%**	**1,400,103**
less:		0.0%	0.0%	
Protected	108,491	5.2%	7.7%	108,066
Caribou No-Harvest	65,929	3.2%	4.7%	66,317
OGMA	108,635	5.2%	7.7%	83,139
Unstable	11,204	0.5%	0.8%	12,290
Excluded Species	4,901	0.2%	0.3%	5,570
Low Site Index	13,317	0.6%	0.9%	16,248
Riparian Reserve Zone	11,099	0.5%	0.8%	14,934
CCLUP	18,052	0.9%	1.3%	3,120
Environmentally Sensitive Areas	N/A	0.0%	0.0%	12,495
Roads, Trails, and Landings (Aspatial) 3%	32,054	1.5%	2.3%	42,003
Riparian Management Zone (Aspatial)	8,978	0.4%	0.6%	14,230
Timber Harvesting Land Base	**1,027,440**	**49.3%**	**72.9%**	**1,023,757**
less:				
Future Roads, Trails, and Landings (Aspatial) 1%	10,274	0.5%	0.7%	10,238
Future Timber Harvesting Land Base	**1,017,165**	**48.8%**	**72.1%**	**1,013,519**

4.3 Management Assumptions

Management assumptions define how non-timber values are reflected or addressed in the model and how forest management occurs. These are typically identified as harvesting and regeneration assumptions.

The management assumptions used in this project are very similar those used in the TSR. Updates have been made and in some cases, due to inherent differences in model architecture between SELES and PATCHWORKS, the way in which management assumptions were modeled was modified. Further details regarding the TSR modelling assumptions are provided in the TSR data package and technical report. Table 5 summarizes the management criteria and assumptions used for the Base Case run.

Table 5 Management assumptions –base case

Criteria	Assumption
Green-up	Applied a green-up constraint similar to TSR4 (max 35% <3m ht) except that it was applied to the THLB by Landscape unit. Only applied after 30 years as per TSR4. Also, since visuals are more restrictive, it was not necessary to exclude green-up constraints from overlapping with visuals (the model will adhere to the most restrictive constraint applied). Applied to THLB.
Visuals	Applied same disturbance limits as TSR4 (P-0.5%; R-1.9%; PR-10.1%, M-20.5%) and used a VEG height of 4.0 m. Applied to CFLB.
Wildlife Tree Retention	Applied a 3.5% yield reduction at the time of harvest to represent WTR.

Criteria	Assumption
Conservation Legacy Areas	A seral constraint was applied at the landscape unit level to ensure that at least 15% of each Landscape Unit must be >60 years old at any time for the first 30 years to reflect the intent of the Conservation Legacy Area. Applied to THLB.
Caribou	Within Caribou modified harvest areas, only selection harvest treatments were applied. Cover constraints applied similar to TSR4 (Min. 33% <140). Applied to CFLB.
Ungulate Winter Range	Within Ungulate winter ranges, only selection harvest treatments were applied. Cover constraints applied similar to TSR4 (Min. 33% <140). Applied to CFLB.
Landscape-Level Biodiversity (Old)	OGMA's were used as the mechanism for ensuring landscape level biodiversity was represented.
Landscape-Level Biodiversity (Mature+Old)	Mature+Old seral targets were implemented in this analysis as directed in the CCLUP. As per the requirements, stands with >70% PL were exempted from this requirement for the first 30 years of the planning horizon, after which no exemptions were modelled. Applied to the CFLB of each Landscape-Biogeoclimatic variant.
Watershed ECA	Watershed ECA was tracked in the model for reporting purposes only (no constraint or targets implemented). The provincial Freshwater Atlas Assessment Watersheds were used as the assessment unit (limited to assessment watersheds >100 ha). A single weighted average ECA recovery curve was calculated based on managed yields for the THLB, while the NTHLB used the weighted average ECA curve of natural yields for the entire CFLB. MPB impacted stands (>=60% dead) had an ECA curve of 50% at the reset age 0 in order to acknowledge credit for dead standing trees.
Initial Harvest Rate	The initial harvest rate was set at the current AAC for the Quesnel TSA (4.0 million m^3/yr)
Harvest Rule	Harvest Rules are only relevant in simple simulation models. The model used for this analysis (Patchworks) uses a goal seeking optimization heuristic approach to find a solution that best meets user defined objectives for timber and non-timber values.
Harvest Flow Targets	Short-term (1-20yrs): Concentrated harvest from salvageable MPB-impacted pine stands as much as possible (no more than 75% of harvest profile) for the first decade of the planning horizon. Mid-term: Minimized the depth and duration of the mid-term timber supply short-fall resulting from the MPB-pine mortality. Placed controls on the contribution of harvest from non-pine volume similar to that used in the TSR4 base case (Minimum 600,000 m^3/yr). Long-term: Adjusted the long-term harvest flow until a harvest level was found that reflected managed stand yields in order to produce growing stock that neither declined nor increased in the long-term (past 150 years into the future).
Timber Quality Targets	Originally intended to apply the following timber quality targets: Minimum of 200,000m^3/yr of peelers (Sx/Df 8"top, 17'2") and minimum 100,000m^3/yr of small sawlogs (Pl 4" top, 6-7" butt). For existing managed stands, coastal log grades I and H were used as a surrogate for Peelers and Grade U was for small sawlogs. For existing natural stands, the following assumptions were used for Peelers: In Fir stands, if >80 years old then 25% of the fir volume, In spruce stands then 25% of the spruce volume. However, results from these assumptions were considered too simplistic to be responsible to influence model decisions and these specific targets were dropped. Thus, the only consideration of timber quality was that stands had to have a minimum of 120 m^3/ha. A sensitivity was designed that showed the timber supply and to an extent the timber quality implications (volume by diameter class) from extending minimum harvest ages to culmination mean annual increment (CMAI).

4.4 Growth and Yield Assumptions

Growth and yield assumptions define the net volumes that are realized when natural and managed stands are harvested. They also describe various tree and stand attributes over time (i.e., height, diameter, presence of dead trees, etc.).

The growth and yield assumptions used in this project are significantly different than those used in TSR4. However, the primary tools used to create the yields are the same (TIPSY v.4.2, VDYP v.7) as well as the base assumptions for developing the yields (i.e. utilization, decay, waste, breakage, OAFs). The major differences arise because existing natural stands yields are not aggregated and the site index and MPB mortality assumptions for existing and future managed stands reflect updated site index and mortality data. Existing natural stands were not aggregated in order to more accurately reflect MPB and take advantage of the LVI. Assumptions for existing and managed stands needed to be changed in order to allow control over regeneration strategies and better reflect conditions for existing managed stands and licensee practices for future managed stands. Table 6 summarizes the growth and yield criteria and assumptions used for the Base Case run.

Table 6 Growth and yield assumptions – base case

Criteria	Assumptions
Analysis Units	All stands were stratified for the purpose of assigning yields, reflecting MPB impacts and assigning treatments and transitions (yield curve post-harvest). See Section 4.4.1 for further details on how this was done.
Stand Projection Models	VDYP7 was used for natural stands and TIPSY 4.2 for existing and future managed yield
Managed Stand Definition	Stands established after 1960 were considered managed (excluding fire origin stands)
Utilization Levels	Applied sawlog specifications for pine (12.5 dbh) and others (17.5 dbh)
Decay, Waste, and Breakage	Applied VDYP7 default reductions to stand volume for DWB according to BEC Zone; Quesnel Lakes includes FIZ D,G,H
Minimum Harvestable Age Criteria	In order to be considered merchantable, a stand had to have at least 120 m³/ha merchantable sawlog volume. The age at which this was achieved was used as the minimum harvest age.
Products	TISPY was used to derive product profile for existing and future managed stands.
TIPSY OAFs	Applied provincial default and Operational Adjustment Factors (OAF1 - 15%; OAF2 - 5%)
Existing Inventory	Provincially maintained forest cover (comprised of both VRI and FIP Rollover) and Landscape Level Inventory (LVI) where available.
Site Index Assignments	Area-weighted adjusted site index was applied to all stands. Source: Site Index raster dataset used to adjust site index in TSR4.
Volume Reductions	No volume exclusions were made for mixed stands as in TSR4. This allowed tracking and reporting of wood type (deciduous vs. coniferous). Controls were placed on the amount of coniferous and deciduous contributing to the harvest profile. Harvest forecast for each type was controlled and managed for separately.
Genetic Gains	TSR4 genetic worth assumptions were applied (Existing: Fdi 0.3%, Pli 0.3%, Sx 2.7%; Future: Fdi 16.5%, Pli 9.4%, Sx 21.4%)
Regeneration Assumptions	Specific assumptions based on leading species, site quality, and licensee practices (see Section 4.4.6)
Selection harvesting	Selection harvesting modeled with deer winter range and caribou modified harvest areas. Apply natural yields to model selectively harvested stands (see Section 0)
Not satisfactorily restocked (NSR)	Current and backlog NSR were not modeled (same as TSR4). All NSR areas were assumed to be stocked with a starting age of 0.
Unsalvaged Losses	An unsalvaged loss rate 48,000 m³/yr representing endemic levels of fire, insect, and wind was assumed (same as TSR4) and removed from the total harvest.
MPB impacted stand yields, Unsalvaged MPB impacted timber, and shelf-life	If un-harvested, the dead portion of the stand dropped down to 0% of the pre-attack volume after 14 years with a straight declining line between 2 and 14 years (first 2 years left at 100%). The remaining live portion did not grow (static curve) and the regenerating volume (natural VDYP7 curve factored by attack severity %) was added to the static post-attack live volume with a 20 year regeneration delay. Additional details provided in Section 4.4.2.
Condition of MPB-Impacted Young Stands	Existing managed stands yield curves were factored down based on work completed by Lorraine MacLauchlan (age 21-30=-13%, age 31-40=-23%, age 41-52=-40%)
Fire Impacted stand yields	All salvage opportunities within recent fires (fires not reflected in inventory) were assumed to have expired. Ages of all stands within fire boundaries were reset to age 0 at time of disturbance. Regenerated volume estimated over time using natural VDYP7 curves based on pre-existing stand attributes. Additional details found in Section 4.4.4.
Peeler and Small sawlog volumes	For existing managed stands, coastal log grades I and H were used as a surrogate for Peelers and Grade U was for small sawlogs. For existing natural stands, the following assumptions were used for Peelers: In Fir stands, if >80 years old then 25% of the fir volume, In spruce stands then 25% of the spruce volume.

4.4.1 Analysis Unit Stratification

Stands were grouped into analysis units (AU) and had weighted average yield curves generated for each analysis unit. The following summarizes the stratification criteria used to group stands into analysis units for existing natural, existing managed, and future managed stand types:

Existing Natural Stand Stratification (100,000 series) based on:

- BGC Group
- Leading species group as per the following table

Species Code	Species Group
AC	DECID
AT	DECID
EP	DECID
FD	FD
LW	FD
PL	PL
BL	BL
SX	SX

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- Site index class (inventory) – Varied by leading species group but were group into three productivity classes (Good, Medium, and poor):

SPECIES GROUP	Class	MAX	MIN
BL	G	20+	20
BL	M	17-20	17
BL	P	0-17	0
DECID	G	100	21
DECID	M	21	18
DECID	P	18	0
FD	G	100	20
FD	M	20	16
FD	P	16	0
PL	G	100	20
PL	M	20	17
PL	P	17	0
SX	G	100	20
SX	M	20	17
SX	P	17	0

o

- Age class – 20 year age classes
- Dead percent class – 10 % range classes

Future Managed Stand Stratification (10,000 series) for Existing natural stands based on:

- BGC Group
- Leading species group

- Site index class (inventory)

<u>Existing Managed Stand Stratification (101-274 series) based on:</u>

- Leading Species
- Species composition range
- Site index class (managed)
- Density
- Age Class (primarily for MPB adjustment)

Each existing managed AU had a future managed AU associated with it and utilized the same species composition assumptions but assumed a planted regeneration density of 2000 sph rather than the weighted average inventory density and also had genetic worth estimates of future managed stands rather than genetic worth estimates for existing managed stands. Further details of analysis unit attributes can be found in Appendix 1.

4.4.2 Modeling of MPB Impacted Stand Dynamics

The severity of MPB impact was used to determine how MPB impact was reflected in the model:

Stands with >= 60% Dead volume*

- Age was adjusted to 0 at attack year
- Yield if harvested consisted of:
    - Dead standing volume (declining to 0% of pre-attack volume by 14 years; see Figure 10)
    - Post-attack live volume (assumed no further increment), and
    - Volume from regenerating cohort – VDYP yield shifted by 20 years (to simulate a long regeneration lag cause by slow stand breakup).

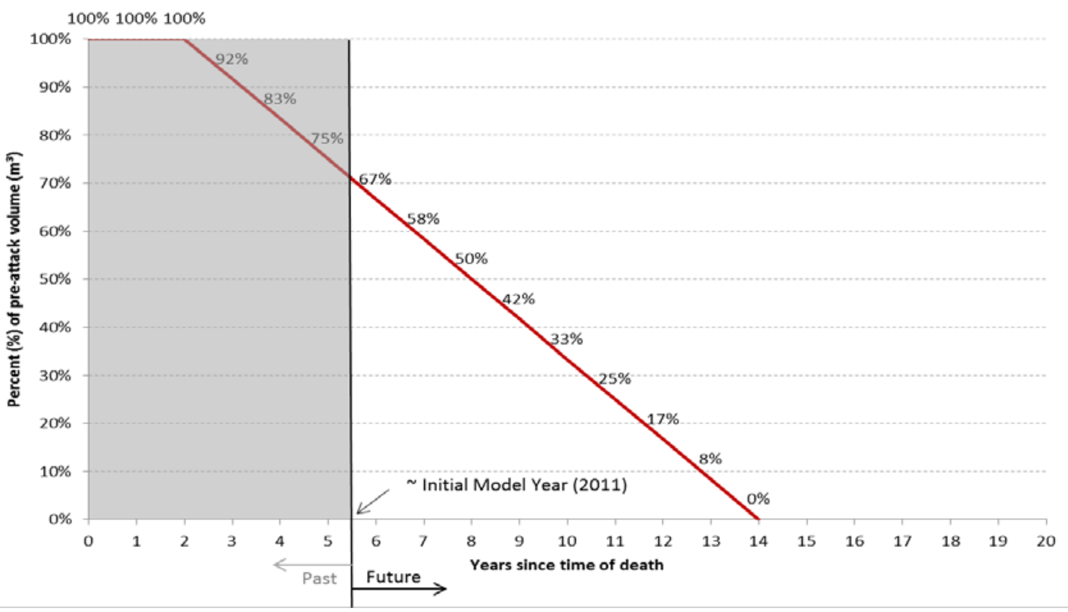

Figure 10 Shelf-life curve assumed for MPB-killed Volume (m³/ha)

Stands with <60% Dead Volume

- Age was unadjusted
- Yield if harvested consisted of:
  - Dead standing volume (declining to 0% of pre-attack volume by 14 years; see Figure 10)
  - Post attack live (assumed regular increment) - VRI and LVI used as is because VDYP input database attributes for VRI and LVI attributes reflect mid/post-MPB attack but FIP yields needed to be reduced by dead percent because attributes in VDYP input database reflect pre-MPB conditions (inventoried prior to the MPB outbreak).
  - Assumed no regenerating cohort

*****Percent dead was calculated by:

$$\frac{[\text{Dead\_stand\_volume\_125}]}{\text{Sum}([\text{Live\_stand\_volume\_125}]+[\text{Dead\_stand\_volume\_125}])}$$

Table 7 Approach to reflect MPB impacts in modeling yields by inventory source

Input Assumption	FIP	VRI/LVI
Attack Year/Year of Death	As provided in FIP(VRI)	As provided in VRI or LVI otherwise 2005 if not provided
MPB Attack Severity	Dead Volume/(Live Volume+ Dead Volume)	Dead Volume/(Live Volume+ Dead Volume)
Species Proportion	As provided in FIP(VRI)	As provided in VRI or LVI
Post-Attack Live Volume (m^3/ha)	As provided in VDYP7 input database if VRI or Factored by attack severity if FIP Rollover	As provided in in VDYP7 input database if VRI or LVI (Static) for >=60% Dead Analysis Units and CLASS 36 yields for <60% Dead Analysis Units
Post-Attack Dead Volume (m^3/ha)	VDYP yield based on pre-attack FIP(VRI) conditions X Attack Severity %. Subsequently factored by she	As provided in VRI or LVI and factored by shelf-life curve (Figure 10)
Post-Attack Regenerating Yield	VDYP yield based on pre-attack FIP(VRI) with 20 year regeneration delay factored by live ratio X Attack Severity %	VRI and LVI (Class 36) yields with 20 year regeneration delay factored by live ratio X Attack Severity %

4.4.3 Treatment Eligibility of MPB Impacted stands

The only criteria used to assess minimum merchantability of stands for this project was based on when (if at all) stands contained at least 120 m^3/ha (live or dead) of merchantable **Sawlog** volume. If volumes curves were such that the stand volume never reached 120 m^3/ha then those stands were given an MHA age of 999 and were essentially removed from the operable land base.

Post-Attack live volume <120 m^3/ha - If the post-attack live volume was <120m^3/ha, then it was assumed it was not eligible for a harvest treatment and the stand became unavailable until the composite post-attack volume + regenerating curve reached 120 m^3/ha.

Post-Attack live volume >=120m^3/ha – If the post-attack live volume is >=120m^3/ha, then the stand was still considered operable even after the dead volume is no longer available and the treatment eligibility goes straight from salvage treatment option to a clear cut treatment option.

In order to ensure stands minimum harvest ages were correctly applied for MPB impacted stands after the assumed 20 year shelf life, a succession event was created using built-in Patchworks functionality to transition stands onto a new track that had minimum harvest ages specifically calculated for based on the remaining live stand volume.

The volumes reported out of TIPSY are net **merchantable** volumes and in order to better reflect the approximate the achievement of net sawlog volume, 10 years were added to the derived MHAs. This decision was based on a short study conducted by Jim Thrower using TASS and its associated bucking algorithms.

4.4.4 Handling of recent fires

Historical fire boundaries were used to identify areas that have been impacted by fire over the last 20 years. The fire date was used to adjust ages to reflect those fires that have occurred after the inventory capture date or have yet to be reflected in the inventory. In the case of one large fire in the North Eastern portion of the TSA, a large fire occurred the day after the satellite capture for the LVI imagery capture. Regenerating yields were modelled using VDYP yields with attributes of pre-fire and/or pre-MPB stand conditions. This approach likely overestimated the area and volume impacted by the fires due to the erratic and variable fire conditions (i.e. skips and intensity) and therefore also overestimated the potential for rehabilitation candidate treatment areas.

4.4.5 Silviculture systems

The majority of the harvesting implemented on the TSA (in the model) was “clearcut with reserves”. Within Mule Deer Winter Range (MDWR) and modified harvest Caribou, a “Selection” harvesting system was implemented. VDYP natural yield curves were used to represent future managed stands resulting from selection harvest system treatments. In TSR4, separate Analysis Units were generated in order to represent selection harvest treatments. However for this project, differences in modeling environments allowed selection harvest treatments to be applied as distinct treatments with unique treatment responses.

4.4.6 Regeneration assumptions

To reduce the complexity and volume of information in the timber supply model, individual stands were aggregated into ‘Analysis Units” based on dominant tree species, composition, site productivity and density. For pine analysis unit age classes were added in the stratification in order to apply MPB impacts[4]. Existing managed stands or stands established after 1960 were aggregated differently than natural stands for the purpose of assigning future managed stand analysis units. Appendix 1 provides analysis units for both existing managed yields and future managed yields as well as stratification criteria and a summary of the TIPSY inputs associated with each.

The assumptions for future managed stands are the result of licensee consultation and have been summarized at the Biogeoclimatic variant level. When applied to the landbase the same site productivity breaks by leading species were used to further stratify the land base into species and productivity classes. Additionally, the only input assumption that changes from the additional stratification criteria is the weighted average site index for each grouping. The majority of TIPSY assumptions along with notes are provided in Appendix 1. Other requisite TIPSY inputs such as operational adjustment factors and genetic gain assumptions can be found in Table 6.

4.5 Natural Disturbance Assumptions

Natural disturbance assumptions define the extent and frequency of natural disturbances across the land base. The natural disturbance assumptions used in this project are different than those used in TSR4. In TSR4, the non-THLB was assigned to an AU that did not age (growth=mortality) and assumed a

[4] Status of MPB attack in young Lodgepole pine stands in Central BC, Report prepared for the Chief Forester. L MacLauchlan et. al, January 2006.

static contribution from the non-timber harvesting land base towards cover constraints (i.e. minimum old requirements/maximum young requirements).

For this analysis, a constant area was disturbed annually in each LU/NDT combination. The amount of disturbance in each LU/NDT combination was based on the BGC variants present and their associated natural disturbance intervals and old seral definitions as outlined in the Biodiversity Guidebook (B.C. Ministry of Forests and B.C. Ministry of Environment, Lands and Parks 1995) and Table 8 below.

Table 8 Calculation of area to be disturbed annual in forested non-THLB by BGC Zone/NDT

BGC ZONE	NDT	Disturbance Interval (yrs)	"OLD" Defn (yrs)	% Area > OLD*	Effective Rotation Age (yrs)*	Contributing Non-THLB Area (ha)	Annual Area Disturbed (ha) (area/rot age)
ESSF	1	350	250	49%	490	60,568	124
ESSF	2	200	250	29%	350	11,919	34
ESSF	5	350	250	49%	490	852	2
ICH	1	250	250	37%	395	46,792	118
IDF	4	250	250	37%	395	3,102	8
MS	3	150	140	39%	231	81,379	352
SBPS	3	100	140	25%	186	74,088	398
SBS	2	200	250	29%	350	10,280	29
SBS	3	125	140	33%	208	55,046	265
Grand Total						**344,029**	**1,330**

* % area old = exp (-[old age / disturbance interval]), Effective rotation age = old age / (1 – % area old)

This method is similar to Option 4 in Modeling Options for Disturbance Outside of the THLB – Working Paper (Forest Analysis Branch 2004). Modeling of disturbance at the LU/BEC variant level was simplified to the LU/NDT level in order to minimize the number of modeled zones while ensuring that each zone would have a single, old seral age. No minimum amount of old was implemented because disturbance was selected randomly - independent of modeled harvest priority.

The disturbance is implemented in the model using a random uniform probability. Each NDT is 'turned over' once during a period equal to its effective rotation age and then once again over the next effective rotation age, etc. There is no guarantee that any particular portion of the landbase will actually be disturbed in any one year. Across the NCLB, approximately 1330 ha is disturbed each year (0.23%), resulting in an average 'turning over' of the landbase every ~ 295 years (range is 186 to 490 years).

4.6 Modeling Assumptions

Modeling assumptions are assumptions made throughout the modeling process from setup to implementation that are more or less specific to the type of model used or aide in some way to producing more operationally realistic tactical plans. Table 9 provides a summary of modeling assumptions implemented for this project.

Table 9 Modeling assumptions

Criteria	Assumption
Minimum / Maximum Polygon Size	Polygons less than .25 Ha in size were minimized by conducting a GIS eliminate process. All polygons in the modeling resultant >50 ha were split

Criteria	Assumption
Blocking	Polygons were grouped together into blocks (where possible) with a target block size of 25 ha.
Patch Size	Patch size targets were implemented in order to create reasonably sized blocks.
Planning Horizon	The planning horizon used for this project was 200 years.
Planning period length	The first 20 years were modeled in 5 year periods while the remaining 180 years were modeled in 10 year periods.

5 Silviculture Scenarios/Strategies

Six different treatments and one optimization scenario will be examined in the analysis; each will be constrained to an annual budget of $5,000,000. The regimes are:

- Single fertilization;
- Multiple fertilizations;
- Pre-commercial thin;
- Rehabilitation of Severely MPB-Impacted stands (post shelf-life);
- Partial Cutting / Commercial thin of currently constrained stands,
- Enhanced Basic Reforestation; and
- Optimized implementation of the above five strategies.

5.1 Single fertilization

This silviculture strategy examined the impact to harvest flows from applying a single fertilization treatment applied any time between 25 and 80 yrs of age. Responses to fertilizer were assumed to decline beyond age 80. The responses are based on fully stocked stands however we applied these numbers for all levels of stocking in this analysis.

Table 10 Fertilization criteria and response for single fertilization

	Lodgepole pine	Spruce	Douglas-fir
Site index range	17+	17+	16+
Age	30-80	25-80	30-80
Maximum Density (sph)	<10000	<10000	<10000
Response m^3/ha	12	15	15
Efficiency Assumed	100%	100%	100%

The time delay from fertilization until harvest is 5 years for spruce and 10 years for pine and fir. The minimum harvest ages were dropped by 5 years relative to the non-fertilized stands. It was assumed that the fertilization response is independent of the age of the stand when fertilization occurs and the same response was obtained from stands between the ages of 25 and 80.

Approximately 226,278 ha of existing regeneration stands were identified as potential area to fertilize (not regarding age eliligibility) and roughly 34,122 ha of future regenerating stands will be available in the future. When the optimized mix of strategies scenario (Section 5.7) is performed, any stand that underwent the PCT treatment (Section 5.3) will also be considered for this treatment with a potential to add approximately 5000 ha of candidate area. **NOTE: There are also approximately 20,300**

ha of existing natural stands that match the basic eligibility criteria for this treatment (<80 years, >17 managed SI, and < 10,000 sph) but so far have not been considered.

5.2 Multiple fertilizations

This silviculture strategy examined the impact to harvest flows from applying an intensive fertilization program to Sx (every 5 years) and successive fertilizations to Pl and Fd stands (every 10 years). Treatment windows for these multiple fertilization treatments were between 25 and 80 years. The modelled cumulative fertilization responses are shown in Table 11. These response values were derived from information provided by the MFLNRO in the document "Intensive fertilization graphs.xlsx".

This strategy should provide additional volume in the midterm periods by increasing stand volumes or allowing harvest to occur sooner.

Table 11 Fertilization response for spruce

Fertilization Application	Spruce Regime			Pine and Douglas fir Regime			
	Stand Age at Treatment	Cumulative Fertilization Response (5 yrs after treat)	Reduction to MHA	Stand Age at Treatment	Cumulative Pl Fertilization Response (10 years after treat)	Cumulative Fd Fertilization Response (10 years after treat)	Reduction to MHA
1	25	15	-2	25	12	15	-5
2	30	49	-5	35	24	30	-5
3	35	89	-5	45	36	45	-5
4	40	132	-5	55	48	60	-5

The following modelling assumptions were incorporated for the multiple fertilization strategy:

- Stands are assumed to be fully stocked and healthy.
- Responses were assumed to follow the same progression regardless of the stand age when the first fertilization was applied;
- Table 11 shows the reduction to minimum harvest ages for each application;
- Harvest eligibility was delayed for 5 years following the fertilizer application for spruce and 10 years following the final fertilizer application for Pl and Fd;
- The candidate area for this treatment is the same subset of the land base as the single fertilization regime; and
- Application costs for Sx treatment were increased to $600 per hectare as different fertilizer blends are required to ensure an appropriate mix of micro-nutrients. Pl and Fd remain at $450/ha.

5.3 Pre-Commercial Thinning

This silviculture strategy examined the benefits to the mid-term timber supply from conducting pre-commercial thinning on dense Pl stands (>10,000 sph) down to a target density of 3000 sph. Approximately 5,000 hectares were identified as candidates for this treatment. The thinning functionality within TIPSY 4.2 was used to generate the treated yield curves. Minimum harvest ages of the treated stands were calculated according to the same criteria as the base case merchantability specifications (>= 120 m^3/ha of sawlog volume). PCT costs assumed are $1100/ha.

Due to limitations with the model TIPSY, the multi-species stand compositions limited the maximum stems per hectare to be thinned to 10,000. As a result, the stand characteristic in the TIPSY model likely overestimates diameter and taper relative to those on the ground. The impact of thinning to 3,000 sph relative to the actual response on the ground is likely underestimated as a result.

The priority for this type of treatment is in repressed fire-originated stands (i.e. fires burned from the 1970-90's with very high densities such as >50,000 sph). However, the current inventory has limitations with identifying these stands and also the growth and yield models used for this analysis have limitations in terms of representing the conditions actually occurring within these stands. Therefore, the base case assumption doesn't include any representation of pine repression and this specific strategy cannot be adequately represented in the model.

5.4 Rehabilitation of Severely MPB-impacted Stands (post shelf-life)

Due to the range of stand conditions such as species composition, percent stand volume killed by MPB, pre-attack stand age, proximity to mills, site productivity (both inventory derived as well as SIBEC), and years since death combined with the modelled shelf-life and minimum merchantability criteria, there is a range of stands on the Quesnel land base that essentially fall off the land base after the shelf-life expires because they no longer recover to pre-attack conditions (at least not for a very long time) and no longer meet merchantability criteria (>120 m^3 sawlog volume). There is a continuum within this profile that ranges from marginal economic value recovery (some green volume large enough to produce lumber + pulp chips and potentially bio-fuel feed stocks) to essentially no economic value (younger, smaller diameter, higher percent dead). Not only do these stands not contribute to the mid-term but because of the longer natural recovery assumed, they no longer contribute to the long-term.

Due to the range of stand conditions and potential economic recovery value, the treatment costs for this treatment were scaled according to the amount of recoverable sawlog volume contained in the stand (Table 12). In addition, an additional distance costs were also included (shown below table).

Table 12 MPB stand Rehabilitation Costs

Activity	Marginal Economic Value (75-120 m^3/ha)	Little Economic Value (50-75 m^3/ha)	No Economic Value (<50m^3/ha)
Knockdown and site prep costs	0	500	1000
Silviculture costs	1000	1000	1000
Total Rehab. Cost	**$1000/ha**	**$1500/ha**	**$2000/ha**

Additional Distance cost:	**East =**	$100/ha
	Center =	$250/ha
	West =	$500/ha

For the purpose of this analysis, eligible stands included all unlogged MPB-killed stands (>40% dead) that, prior to attack, were 40 years or more in age. The base case identified that approximately 48,000 ha never become eligible to be harvested during the modelled planning horizon.

Rehabilitating these stands will allow access to the remaining green volume contained within, potentially increase harvest flows near the back end of the mid-term, and increase the long-term harvest levels.

Rehabilitation of fire-killed stands was also investigated but discussions with District staff indicated that these fires have had tremendous natural regeneration success. Some reservations were expressed that more recent fires in MPB killed timber may not be as successful due to poor seed viability however this is currently evident and additional monitoring is needed before a stand intervention prescription is required.

5.5 Partial Cut within Constrained areas

This silviculture strategy examined the impact to harvest flows from a single removal of 1/3 of the volume within stands currently constrained for visuals, lakeshore management, and mature-plus-old seral requirements.

This strategy is expected to increase the mid-term harvest level as operating within these otherwise constrained areas should effectively increase the harvestable landbase and volume available during this heavily constrained timeframe.

The low removal level was assumed to maintain sufficient stand conditions to satisfy the non-timber values present.

Eligible stands for this strategy include THLB areas with forest cover constraints applied to maintain specific conditions (limit disturbance, maintain older age classes) and have at least 230 m^3/ha. These include mature-plus-old seral constraints and visuals. While it is conceivable that this strategy can be applied within Parks, WHAs and OGMAs, fostering public support to alter these constraints was considered highly unlikely and these areas were disregarded.

This treatment was implemented by giving stands in the identified areas a treatment option that removed 1/3 of the stands existing volume but retained the existing stand age. This allowed volume to be removed without impacting the non-timber objective. For example, a visual requirement might limit stands less than 25 yrs of age to less than 15% of the forested area. If the selection harvest option is selected by the model, volume can be removed without having any impact on the visually disturbed area. The incremental cost of implementing the partial harvest treatment over clear cutting is estimated at \$15/m^3. These costs will be considered as part of the TSA budget for silviculture strategies for purposes of exploring cost effective treatments, but in reality this cost would be borne by licensees (or government through stumpage allowances).

5.6 Enhanced Basic Reforestation

Free growing guidelines set minimum standards for establishing stands with appropriate species selection, stocking, and specified requirements. This silviculture strategy examined the impact to harvest flows from enhancing basic reforestation practices where current performance is not optimal (achieving minimum well-spaced trees/ha versus target well-spaced trees/ha). The objective of this approach is to increase timber volume and quality when these stands are harvested rather than focusing on meeting minimum standards at free growing.

This strategy is unlikely to increase the mid-term harvest level as it will only influence stands regenerated in the future that will not be harvested for at least 45-50yrs from now. There may be some benefit to the back end of the midterm trough but this strategy is expected to increase long-term harvest levels by improving well-spaced densities, reducing stocking gaps (OAF1) and achieving the benefits of Class A seed. This is expected to reduce minimum harvest ages, improve product quality, and help to address climate change concerns through species selection.

The following assumptions were used for this strategy:

Good Sites (>=17 Site Index) currently using natural Regeneration

- Plant to 1700 sph with Class A Seed
- Genetic worth benefits
- shorter regeneration delay (2)
- Increase planting method to 100% where it isn't already
- OAF1 @ 10%, OAF2 @ 5%
- Treatment Cost =$300/ha for higher density class A and $150/ha for disk trenching = $450/ha

Good Sites (>=17 Site Index) currently being planted

- Plant to higher densities (1800 sph)
- Increase planting method to 100% where it isn't already
- OAF1 @ 10%, OAF2 @ 5%
- Treatment Cost =$300/ha

Approximately 250,000 ha have been identified as candidate areas for this enhanced silviculture regime.

5.7 Full mix of treatments

The Patchworks model was designed for this analysis to include the ability to choose from the full suite of the previous seven treatments to maximize wood flow subject to an annual budget constraint. For this scenario, the model was allowed to select any combination of the above treatments, in any sequence subject to the specific treatment limitations and annual budget of $5,000,000.

6 Preferred Scenario

The preferred scenario will be developed and finalized after reviewing the above scenarios with the district staff.

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Appendix 1 – Analysis Unit Details

Existing Managed TIPSY Inputs

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]	[L]	[M]
AU	Species Composition	Managed Site Index Range	Density Range	Age Range	TIPSY Input Species Composition	Area Wtd. Avg. Deciduous (%)	Input Regeneration Method	Area Wtd. Avg. Managed Site Index	Area weighted Average Age (years)	Area Weighted Average Density (sph)	Initial Density (sph) used in TIPSY	THLB area (ha)
101	PL >=80%	>=20 SI	<2000 sph	<20 years old	PL95FD3S2	0	NATURAL	20.2	3	977	700	17,886
102	PL >=80%	>=20 SI	<2000 sph	>=20 and <30 years old	PL93S4FD3	3	NATURAL	20.5	25	800	900	3,798
103	PL >=80%	>=20 SI	<2000 sph	>=30 and <40 years old	PL90S10	2	NATURAL	20.3	33	925	1000	2,355
104	PL >=80%	>=20 SI	<2000 sph	>=40 and <52 years old	PL91S6FD3	3	NATURAL	21.2	46	1038	1300	584
105	PL >=80%	>=20 SI	>= 2000 sph and < 5000 sph	<20 years old	PL91FD4S4BL1	2	NATURAL	20.2	14	3064	2500	6,211
106	PL >=80%	>=20 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL93FD7	4	NATURAL	20.2	22	3381	3500	3,178
107	PL >=80%	>=20 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL94S6	2	NATURAL	21.2	31	2872	3000	131
108	PL >=80%	>=20 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL95S5	0	NATURAL	20.2	46	2729	2500	33
109	PL >=80%	>=20 SI	>= 5000 sph and < 10000 sph	<20 years old	PL99FD1	3	NATURAL	20.2	13	6739	7500	1,847
110	PL >=80%	>=20 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL90S10	4	NATURAL	20.2	21	6705	6000	1,575
113	PL >=80%	>=20 SI	>= 10000 sph and < 25000 sph	<20 years old	PL93S7	3	NATURAL	20.3	14	12450	10000	731
114	PL >=80%	>=20 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL100	4	NATURAL	20.2	22	13329	10000	202
121	PL >=80%	>=17 SI and <20 SI	<2000 sph	<20 years old	PL91S9	0	NATURAL	18.9	3	902	1000	48,112
122	PL >=80%	>=17 SI and <20 SI	<2000 sph	>=20 and <30 years old	PL93S6BL1	2	NATURAL	18.8	24	772	1000	8,295
123	PL >=80%	>=17 SI and <20 SI	<2000 sph	>=30 and <40 years old	PL94S5BL1	2	NATURAL	18.7	33	775	800	3,841
124	PL >=80%	>=17 SI and <20 SI	<2000 sph	>=40 and <52 years old	PL97S3	1	NATURAL	18.3	48	1201	1000	1,210
125	PL >=80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	<20 years old	PL94S5BL1	2	NATURAL	19	14	2947	3000	15,239
126	PL >=80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL94S5BL1	3	NATURAL	18.8	22	3194	3500	5,293
127	PL >=80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL97S2BL1	7	NATURAL	18.8	30	2706	3500	401
128	PL >=80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL98S2	1	NATURAL	18.1	48	2565	3000	686
129	PL >=80%	>=17 SI and <20 SI	>= 5000 sph and < 10000 sph	<20 years old	PL96S2FD1BL1	3	NATURAL	18.8	12	6813	7000	3,102
130	PL >=80%	>=17 SI and <20 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL97S2BL1	6	NATURAL	18.9	21	6852	7500	1,740
133	PL >=80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	<20 years old	PL97S3	2	NATURAL	19.1	12	12528	10000	809
134	PL >=80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL99BL1	2	NATURAL	18.9	21	13512	10000	521
135	PL >=80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	>=30 and <40 years old	PL89S11	10	NATURAL	18.9	30	10636	10000	56
137	PL >=80%	>=17 SI and <20 SI	>=25000 sph	<20 years old	PL98S2	0	NATURAL	17.7	13	30543	10000	5
141	PL >=80%	<17 SI	<2000 sph	<20 years old	PL91S9	0	NATURAL	15.8	5	1094	1300	11,007
142	PL >=80%	<17 SI	<2000 sph	>=20 and <30 years old	PL95S5	1	NATURAL	16.1	25	695	900	4,410
143	PL >=80%	<17 SI	<2000 sph	>=30 and <40 years old	PL95S5	1	NATURAL	16	34	717	800	1,961
144	PL >=80%	<17 SI	<2000 sph	>=40 and <52 years old	PL99S1	0	NATURAL	15.3	46	847	800	4,890
145	PL >=80%	<17 SI	>= 2000 sph and < 5000 sph	<20 years old	PL96S4	1	NATURAL	15.9	15	3023	3000	4,872
146	PL >=80%	<17 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL96S4	1	NATURAL	15.9	21	3163	3000	2,725
147	PL >=80%	<17 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL97BL2S1	10	NATURAL	15.6	30	3124	4000	0

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]	[L]	[M]
AU	Species Composition	Managed Site Index Range	Density Range	Age Range	TIPSY Input Species Composition	Area Wtd. Avg. Deciduous (%)	Input Regeneration Method	Area Wtd. Avg. Managed Site Index	Area weighted Average Age (years)	Area Weighted Average Density (sph)	Initial Density (sph) used in TIPSY	THLB area (ha)
148	PL >=80%	<17 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL99S1	0	NATURAL	15.4	49	2807	3000	1,602
149	PL >=80%	<17 SI	>= 5000 sph and < 10000 sph	<20 years old	PL96S3BL1	2	NATURAL	15.9	16	7244	7000	1,653
150	PL >=80%	<17 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL93S7	2	NATURAL	16	22	7290	7000	2,278
151	PL >=80%	<17 SI	>= 5000 sph and < 10000 sph	>=30 and <40 years old	PL95S5	0	NATURAL	15.8	36	5000	5000	8
153	PL >=80%	<17 SI	>= 10000 sph and < 25000 sph	<20 years old	PL97S3	3	NATURAL	16.1	15	12396	10000	616
154	PL >=80%	<17 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL100	1	NATURAL	15.9	21	11886	10000	1,086
157	PL >=80%	<17 SI	>=25000 sph	<20 years old	PL98S2	1	NATURAL	16.3	14	31934	10000	70
158	PL >=80%	<17 SI	>=25000 sph	>=20 and <30 years old	PL100	0	NATURAL	16.3	25	25168	10000	44
161	PL <80%	>=20 SI	<2000 sph	<20 years old	PL58S32FD10	5	NATURAL	21.5	8	1431	1500	6,569
162	PL <80%	>=20 SI	<2000 sph	>=20 and <30 years old	PL65S21FD8BL6	17	NATURAL	21.6	24	702	800	2,462
163	PL <80%	>=20 SI	<2000 sph	>=30 and <40 years old	PL67S19FD9BL5	13	NATURAL	20.8	33	1137	1400	1,771
164	PL <80%	>=20 SI	<2000 sph	>=40 and <52 years old	PL65S20FD12BL3	21	NATURAL	21.8	44	1116	1100	986
165	PL <80%	>=20 SI	>= 2000 sph and < 5000 sph	<20 years old	PL60S22BL11BL7	20	NATURAL	21	10	2958	3000	2,923
166	PL <80%	>=20 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL80S12FD8	18	NATURAL	20.6	23	2952	2500	890
167	PL <80%	>=20 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL60FD24S16	17	NATURAL	20.5	33	2387	2000	155
168	PL <80%	>=20 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL42S39BL19	5	NATURAL	21.3	44	2209	2500	25
169	PL <80%	>=20 SI	>= 5000 sph and < 10000 sph	<20 years old	PL74S12FD10BL4	29	NATURAL	20.6	11	6971	7000	541
170	PL <80%	>=20 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL62S14BL12FD12	29	NATURAL	20.6	22	6695	7000	431
173	PL <80%	>=20 SI	>= 10000 sph and < 25000 sph	<20 years old	PL87S13	31	NATURAL	20.1	15	14506	10000	177
174	PL <80%	>=20 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL67FD22S10BL1	11	NATURAL	21.4	23	12045	10000	65
178	PL <80%	>=20 SI	>=25000 sph	>=20 and <30 years old	PL95S5	26	NATURAL	20.2	23	33201	10000	10
181	PL <80%	>=17 SI and <20 SI	<2000 sph	<20 years old	PL69S24FD4BL3	7	NATURAL	18.9	9	1382	1500	10,864
182	PL <80%	>=17 SI and <20 SI	<2000 sph	>=20 and <30 years old	PL70S20BL6FD4	10	NATURAL	18.9	25	737	800	4,362
183	PL <80%	>=17 SI and <20 SI	<2000 sph	>=30 and <40 years old	PL66S19FD9BL6	11	NATURAL	18.9	33	1086	1100	3,049
184	PL <80%	>=17 SI and <20 SI	<2000 sph	>=40 and <52 years old	PL67S15FD15BL3	11	NATURAL	19.2	44	1244	1300	938
185	PL <80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	<20 years old	PL74S16BL7FD3	17	NATURAL	18.9	12	3058	3500	6,674
186	PL <80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL73S16BL7FD4	18	NATURAL	18.8	22	3465	3500	2,037
187	PL <80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL70S18BL6FD6	11	NATURAL	18.9	34	2483	2500	493
188	PL <80%	>=17 SI and <20 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL54FD31S15	9	NATURAL	19.5	42	2187	2500	56
189	PL <80%	>=17 SI and <20 SI	>= 5000 sph and < 10000 sph	<20 years old	PL82S9FD5BL4	26	NATURAL	19.2	14	6485	7000	1,948
190	PL <80%	>=17 SI and <20 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL73BL15S10FD2	19	NATURAL	18.9	23	6279	6500	559
193	PL <80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	<20 years old	PL81S12BL5FD2	29	NATURAL	19.5	13	13607	10000	343
194	PL <80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL85S15	14	NATURAL	19.2	24	18075	10000	131
195	PL <80%	>=17 SI and <20 SI	>= 10000 sph and < 25000 sph	>=30 and <40 years old	PL60S30BL10	0	NATURAL	18.6	31	12073	10000	12
198	PL <80%	>=17 SI and <20 SI	>=25000 sph	>=20 and <30 years old	PL93S7	26	NATURAL	18.5	23	33201	10000	34
201	PL <80%	<17 SI	<2000 sph	<20 years old	PL73S25FD2	6	NATURAL	16.1	10	1527	1500	1,668

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]	[L]	[M]
AU	Species Composition	Managed Site Index Range	Density Range	Age Range	TIPSY Input Species Composition	Area Wtd. Avg. Deciduous (%)	Input Regeneration Method	Area Wtd. Avg. Managed Site Index	Area weighted Average Age (years)	Area Weighted Average Density (sph)	Initial Density (sph) used in TIPSY	THLB area (ha)
202	PL <80%	<17 SI	<2000 sph	>=20 and <30 years old	PL73S20BL6FD1	4	NATURAL	15.9	25	757	700	1,013
203	PL <80%	<17 SI	<2000 sph	>=30 and <40 years old	PL78S17BL5	18	NATURAL	15.4	33	737	900	267
204	PL <80%	<17 SI	<2000 sph	>=40 and <52 years old	PL68S30BL2	1	NATURAL	15.3	45	732	800	293
205	PL <80%	<17 SI	>= 2000 sph and < 5000 sph	<20 years old	PL85S13FD2	13	NATURAL	16.1	15	3199	3500	969
206	PL <80%	<17 SI	>= 2000 sph and < 5000 sph	>=20 and <30 years old	PL86S8BL4FD2	7	NATURAL	15.6	21	3631	4000	498
207	PL <80%	<17 SI	>= 2000 sph and < 5000 sph	>=30 and <40 years old	PL55S37BL8	0	NATURAL	15.5	36	2472	3000	3
208	PL <80%	<17 SI	>= 2000 sph and < 5000 sph	>=40 and <52 years old	PL60S40	0	NATURAL	14.6	50	2448	2500	17
209	PL <80%	<17 SI	>= 5000 sph and < 10000 sph	<20 years old	PL89S11	37	NATURAL	16	12	7292	6500	142
210	PL <80%	<17 SI	>= 5000 sph and < 10000 sph	>=20 and <30 years old	PL66BL28S6	10	NATURAL	16.1	21	6628	6500	493
213	PL <80%	<17 SI	>= 10000 sph and < 25000 sph	<20 years old	PL100	39	NATURAL	15.7	10	11084	10000	20
214	PL <80%	<17 SI	>= 10000 sph and < 25000 sph	>=20 and <30 years old	PL100	48	NATURAL	16.3	22	11270	10000	11
221	SX >=80%	>=20 SI	<2000 sph	<52 years old	S100	0	NATURAL	21.9	7	314	1000	26,238
222	SX >=80%	>=20 SI	>= 2000 sph and < 10000 sph	<52 years old	S98SX2	6	NATURAL	20.8	21	2719	2500	317
224	SX >=80%	>=17 SI and <20 SI	<2000 sph	<52 years old	S88BL6PL6	0	NATURAL	19.5	5	272	700	3,316
225	SX >=80%	>=17 SI and <20 SI	>= 2000 sph and < 10000 sph	<52 years old	S98BL1PL1	2	NATURAL	18.2	36	2702	3000	123
227	SX >=80%	<17 SI	<2000 sph	<52 years old	S92PL5BL3	0	NATURAL	14.8	21	845	700	594
228	SX >=80%	<17 SI	>= 2000 sph and < 10000 sph	<52 years old	BL86PL11FD3	1	NATURAL	13.3	38	3620	3500	60
229	SX >=80%	<17 SI	>=10000 sph	<52 years old	S95PL5	0	NATURAL	15	28	16000	10000	2
230	SX <80%	>=20 SI	<2000 sph	<52 years old	S52PL36FD12	7	NATURAL	22.3	22	964	700	7,803
231	SX <80%	>=20 SI	>= 2000 sph and < 10000 sph	<52 years old	S70PL15BL15	15	NATURAL	21.1	28	2892	3000	2,106
232	SX <80%	>=20 SI	>=10000 sph	<52 years old	S70PL25BL5	16	NATURAL	20.3	25	11306	10000	2
233	SX <80%	>=17 SI and <20 SI	<2000 sph	<52 years old	S62PL24BL12FD2	8	NATURAL	19	23	1242	1000	1,424
234	SX <80%	>=17 SI and <20 SI	>= 2000 sph and < 10000 sph	<52 years old	S70PL15BL14FD1	8	NATURAL	18.8	18	3135	3500	1,374
235	SX <80%	>=17 SI and <20 SI	>=10000 sph	<52 years old	S72BL14PL14	5	NATURAL	18.6	21	10438	10000	35
236	SX <80%	<17 SI	<2000 sph	<52 years old	S65PL28BL4FD3	5	NATURAL	14.6	29	1048	1100	646
237	SX <80%	<17 SI	>= 2000 sph and < 10000 sph	<52 years old	S60PL31BL6FD3	7	NATURAL	15.8	16	4022	3500	462
238	SX <80%	<17 SI	>=10000 sph	<52 years old	S61BL39	0	NATURAL	16.3	22	10200	10000	0
239	FD >=80%	>=20 SI	<2000 sph	<52 years old	FD87PL7S6	0	NATURAL	20.7	5	126	1200	3,863
240	FD >=80%	>=20 SI	>= 2000 sph and < 10000 sph	<52 years old	FD92PL4S4	6	NATURAL	20.4	44	2793	2500	168
242	FD >=80%	>=16 SI and <20 SI	<2000 sph	<52 years old	FD92PL5S3	0	NATURAL	18.1	7	208	700	2,433
243	FD >=80%	>=16 SI and <20 SI	>= 2000 sph and < 10000 sph	<52 years old	FD94S3PL3	7	NATURAL	18.9	40	2493	3000	106
245	FD >=80%	<16 SI	<2000 sph	<52 years old	FD92PL6S2	0	NATURAL	15.2	3	169	700	126
246	FD >=80%	<16 SI	>= 2000 sph and < 10000 sph	<52 years old	FD100	0	NATURAL	15.6	45	2358	3500	0
248	FD <80%	>=20 SI	<2000 sph	<52 years old	FD65PL23S12	17	NATURAL	21.1	33	1128	1100	1,697
249	FD <80%	>=20 SI	>= 2000 sph and < 10000 sph	<52 years old	FD64S16PL15BL5	9	NATURAL	21.5	36	2879	3000	532
250	FD <80%	>=20 SI	>=10000 sph	<52 years old	FD60PL30S10	6	NATURAL	20.6	8	17020	10000	3

[A] AU	[B] Species Composition	[C] Managed Site Index Range	[D] Density Range	[E] Age Range	[F] TIPSY Input Species Composition	[G] Area Wtd. Avg. Deciduous (%)	[H] Input Regeneration Method	[I] Area Wtd. Avg. Managed Site Index	[J] Area weighted Average Age (years)	[K] Area Weighted Average Density (sph)	[L] Initial Density (sph) used in TIPSY	[M] THLB area (ha)
251	FD <80%	>=16 SI and <20 SI	<2000 sph	<52 years old	FD69PL24S6CW1	15	NATURAL	18.7	37	1071	1200	1,077
252	FD <80%	>=16 SI and <20 SI	>= 2000 sph and < 10000 sph	<52 years old	FD64S18PL15HW3	8	NATURAL	18	31	2662	3000	279
253	FD <80%	>=16 SI and <20 SI	>=10000 sph	<52 years old	FD62PL30S8	10	NATURAL	19.8	8	19840	10000	1
254	FD <80%	<16 SI	<2000 sph	<52 years old	FD65PL29S6	2	NATURAL	15.6	39	1310	1300	56
255	FD <80%	<16 SI	>= 2000 sph and < 10000 sph	<52 years old	FD45HW20S16CW12PL7	2	NATURAL	15.3	43	2510	3500	21
263	BL >=80%	<17 SI	<2000 sph	<52 years old	BL83S10PL7	0	NATURAL	10.3	14	203	700	393
265	BL >=80%	<17 SI	>=10000 sph	<52 years old	BL84S14FD1PL1	1	NATURAL	14.2	39	11735	10000	152
266	BL <80%	>=20 SI	<2000 sph	<52 years old	BL49S37PL14	10	NATURAL	21.2	36	1457	1500	22
267	BL <80%	>=20 SI	>= 2000 sph and < 10000 sph	<52 years old	BL55S33PL12	10	NATURAL	22	21	3741	4000	16
269	BL <80%	>=17 SI and <20 SI	<2000 sph	<52 years old	BL46S38FD15PL1	0	NATURAL	19	37	1622	1700	126
270	BL <80%	>=17 SI and <20 SI	>= 2000 sph and < 10000 sph	<52 years old	BL70S30	0	NATURAL	18	25	2700	3000	12
272	BL <80%	<17 SI	<2000 sph	<52 years old	BL61S33Pl6	6	NATURAL	14.9	33	771	800	508
273	BL <80%	<17 SI	>= 2000 sph and < 10000 sph	<52 years old	BL55S32PL13	2	NATURAL	14.5	28	5346	3500	460
274	BL <80%	<17 SI	>=10000 sph	<52 years old	BL62S28PL10	3	NATURAL	15	29	12902	10000	38

Notes:

- A regeneration delay of 2 years was assumed for all existing managed yields
- All existing managed stands used the natural regeneration method in TISPY due to the age range that the existing managed stands definition covers (1960-2011). Therefore, there is no recognition of genetic worth attributed to previously planted stands.
- Columns A through E are the stratification criteria used to stratify stands that fell within the existing managed definition into analysis unit.
- Column F provides the input species composition. The input species composition is based on the weighted average species compositions with all deciduous species removed (all coniferous species factored up by deciduous proportion). This was necessary as TIPSY does not grow handle mixed species stands (i.e. deciduous mixed with coniferous). Where deciduous species was present, separate pure deciduous yields were generated and these were subsequently pro-rated down to their respective compositions along with the pro-rated coniferous counterparts.
- Column G provides the weighted average deciduous species composition of the analysis units. This percentage was used to reduce coniferous input densities.
- Column H indicates the regeneration method used in TIPSY. Only the Natural regeneration method/distribution was used for existing managed Analysis Units.
- Column I provides the area weighted average managed site index.
- Column J provides the area weighted average age of each analysis unit. Column K and L show the weighted average densities and input densities used in TIPSY, respectively.
- Column M shows the THLB area associated with each analysis unit.
- Each existing managed stand AU has a respective future managed version of itself. All TIPSY assumptions were identical except that genetic worth values for future managed stands were applied.

Future Managed of Existing Natural - TIPSY Inputs

[A] AU	[B] BGC variant	[C] Existing Leading Species	[D] Site Index Range	[E] Input Regeneration Method	[F] Regeneration Method (%)	[G] Input Species Composition	[H] Input Initial Density	[I] Regen. Delay	[J] Area Wtd. Avg. Managed Site Index	[K] THLB area (ha)
10001	ESSFmv 1	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	19.2	1.5
10002	ESSFmv 1	PL	>=20 SI	Natural	80	PL80S10BL10	2500	2	12	0.9
10002	ESSFmv 1	PL	>=20 SI	Planted	20	PL80S10BL10	1000	2	12	0.9
10003	ESSFmv 1	PL	>=17 SI and <20 SI	Natural	80	PL80S10BL10	2500	2	15.1	1.6
10003	ESSFmv 1	PL	>=17 SI and <20 SI	Planted	20	PL80S10BL10	1000	2	15.1	1.6
10004	ESSFmv 1	PL	<17 SI	Natural	80	PL80S10BL10	2500	2	14.4	444.7
10004	ESSFmv 1	PL	<17 SI	Planted	20	PL80S10BL10	1000	2	14.4	444.7
10005	ESSFmv 1	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	14.7	371.5
10045	MS xv	FD	<16 SI	Planted	100	FD60PL30S10	1100	2	12.9	0.3
10046	MS xv	PL	>=20 SI	Planted	100	PL80S15BL5	1100	2	16.4	0.8
10047	MS xv	PL	>=17 SI and <20 SI	Planted	100	PL80S15BL5	1100	2	15.4	33.7
10048	MS xv	PL	<17 SI	Planted	100	PL80S15BL5	1100	2	15.9	118,761.0
10049	MS xv	SX	>=20 SI	Planted	100	S60PL20BL20	1100	2	17	4.8
10050	MS xv	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1100	2	15.7	87.9
10051	MS xv	SX	<17 SI	Planted	100	S60PL20BL20	1100	2	15.8	24,028.8
10052	SBPSdc	BL	<17 SI	Planted	100	BL50S40PL10	1000	2	15.1	1.5
10056	SBPSdc	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	17.2	5.3
10056	SBPSdc	FD	>=20 SI	Planted	100	FD90S10	1000	2	17.2	5.3
10057	SBPSdc	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	19.1	41.9
10057	SBPSdc	FD	>=16 SI and <20 SI	Planted	100	FD90S10	1000	2	19.1	41.9
10058	SBPSdc	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	18.1	66.9
10058	SBPSdc	FD	<16 SI	Planted	100	FD90S10	1000	2	18.1	66.9
10059	SBPSdc	PL	>=20 SI	Natural	80	PL90S10	2500	3	18.7	452.3
10059	SBPSdc	PL	>=20 SI	Planted	20	PL90S10	1000	2	18.7	452.3
10060	SBPSdc	PL	>=17 SI and <20 SI	Natural	80	PL90S10	2500	3	18.2	1,937.9
10060	SBPSdc	PL	>=17 SI and <20 SI	Planted	20	PL90S10	1000	2	18.2	1,937.9
10061	SBPSdc	PL	<17 SI	Natural	80	PL90S10	2500	3	17.5	107,049.3
10061	SBPSdc	PL	<17 SI	Planted	20	PL90S10	1000	2	17.5	107,049.3
10062	SBPSdc	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	16.6	3.8
10063	SBPSdc	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	17	72.4
10064	SBPSdc	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	17.5	53,613.0
10067	SBPSmc	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	15.3	5.6
10068	SBPSmc	PL	>=17 SI and <20 SI	Natural	80	PL90S10	2500	3	16.4	50.2
10068	SBPSmc	PL	>=17 SI and <20 SI	Planted	20	PL90S10	1000	2	16.4	50.2
10069	SBPSmc	PL	<17 SI	Natural	80	PL90S10	2500	3	15.6	48,532.3
10069	SBPSmc	PL	<17 SI	Planted	20	PL90S10	1000	2	15.6	48,532.3

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]
AU	BGC variant	Existing Leading Species	Site Index Range	Input Regeneration Method	Regeneration Method (%)	Input Species Composition	Input Initial Density	Regen. Delay	Area Wtd. Avg. Managed Site Index	THLB area (ha)
10070	SBPSmc	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	9.2	2.2
10071	SBPSmc	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	14.4	268.7
10072	SBPSmc	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	14.3	15,670.4
10073	SBPSmk	BL	>=17 SI and <20 SI	Planted	100	BL50S40PL10	1000	2	20	21.9
10074	SBPSmk	BL	<17 SI	Planted	100	BL50S40PL10	1000	2	19.7	90.3
10078	SBPSmk	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	20.3	0.0
10078	SBPSmk	FD	>=20 SI	Planted	100	FD90S5FD5	1000	2	20.3	0.0
10079	SBPSmk	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	19.8	62.2
10079	SBPSmk	FD	>=16 SI and <20 SI	Planted	100	FD90S5FD5	1000	2	19.8	62.2
10080	SBPSmk	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	19.9	77.1
10080	SBPSmk	FD	<16 SI	Planted	100	FD90S5FD5	1000	2	19.9	77.1
10081	SBPSmk	PL	>=20 SI	Natural	80	PL90S5FD5	2500	3	20	366.1
10081	SBPSmk	PL	>=20 SI	Planted	20	PL90S5FD5	1000	2	20	366.1
10082	SBPSmk	PL	>=17 SI and <20 SI	Natural	80	PL90S5FD5	2500	3	19.9	2,707.7
10082	SBPSmk	PL	>=17 SI and <20 SI	Planted	20	PL90S5FD5	1000	2	19.9	2,707.7
10083	SBPSmk	PL	<17 SI	Natural	80	PL90S5FD5	2500	3	19.8	68,480.6
10083	SBPSmk	PL	<17 SI	Planted	20	PL90S5FD5	1000	2	19.8	68,480.6
10084	SBPSmk	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	20	33.5
10085	SBPSmk	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	19.9	835.5
10086	SBPSmk	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	19.6	34,732.7
10088	SBPSxc	PL	>=17 SI and <20 SI	Natural	80	PL80S20	2500	3	13.5	0.5
10088	SBPSxc	PL	>=17 SI and <20 SI	Planted	20	PL80S20	1000	3	13.5	0.5
10089	SBPSxc	PL	<17 SI	Natural	80	PL80S20	2500	3	13.6	6,141.6
10089	SBPSxc	PL	<17 SI	Planted	20	PL80S20	1000	3	13.6	6,141.6
10090	SBPSxc	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	13.5	1,517.6
10098	SBS dk	PL	>=20 SI	Natural	80	PL60S20FD20	2500	3	21.7	66.6
10098	SBS dk	PL	>=20 SI	Planted	20	PL60S20FD20	1000	3	21.7	66.6
10099	SBS dk	PL	>=17 SI and <20 SI	Natural	80	PL60S20FD20	2500	3	21.4	384.8
10099	SBS dk	PL	>=17 SI and <20 SI	Planted	20	PL60S20FD20	1000	3	21.4	384.8
10100	SBS dk	PL	<17 SI	Natural	80	PL60S20FD20	2500	3	21.3	554.6
10100	SBS dk	PL	<17 SI	Planted	20	PL60S20FD20	1000	3	21.3	554.6
10101	SBS dk	SX	>=20 SI	Planted	100	S60PL20BL20	1000	3	21.5	379.4
10102	SBS dk	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	3	21.5	1,191.1
10103	SBS dk	SX	<17 SI	Planted	100	S60PL20BL20	1000	3	21.5	3,829.7
10104	SBS dw 2	BL	>=17 SI and <20 SI	Planted	100	BL50S40PL10	1000	2	20.2	0.5
10105	SBS dw 2	BL	<17 SI	Planted	100	BL50S40PL10	1000	2	20.7	5.3
10109	SBS dw 2	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	19.5	1,460.8

[A] AU	[B] BGC variant	[C] Existing Leading Species	[D] Site Index Range	[E] Input Regeneration Method	[F] Regeneration Method (%)	[G] Input Species Composition	[H] Input Initial Density	[I] Regen. Delay	[J] Area Wtd. Avg. Managed Site Index	[K] THLB area (ha)
10110	SBS dw 2	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	19.4	11,682.1
10111	SBS dw 2	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	19.2	8,046.3
10112	SBS dw 2	PL	>=20 SI	Natural	80	PL75S15BL5FD5	2500	3	19.6	371.1
10112	SBS dw 2	PL	>=20 SI	Planted	20	PL75S15BL5FD5	1000	2	19.6	371.1
10113	SBS dw 2	PL	>=17 SI and <20 SI	Natural	80	PL75S15BL5FD5	2500	3	19.3	2,442.3
10113	SBS dw 2	PL	>=17 SI and <20 SI	Planted	20	PL75S15BL5FD5	1000	2	19.3	2,442.3
10114	SBS dw 2	PL	<17 SI	Natural	80	PL75S15BL5FD5	2500	3	19.4	14,819.2
10114	SBS dw 2	PL	<17 SI	Planted	20	PL75S15BL5FD5	1000	2	19.4	14,819.2
10115	SBS dw 2	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	19	343.2
10116	SBS dw 2	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	19.4	1,372.6
10117	SBS dw 2	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	19.1	12,582.8
10118	SBS mc 1	BL	<17 SI	Planted	100	BL50S40PL10	1000	2	17.6	14.7
10122	SBS mc 1	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	18.1	151.5
10123	SBS mc 1	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	18.2	547.9
10124	SBS mc 1	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	17.5	13.9
10125	SBS mc 1	PL	>=17 SI and <20 SI	Natural	80	PL90BL10	2500	2	18.3	155.7
10125	SBS mc 1	PL	>=17 SI and <20 SI	Planted	20	PL90BL10	1000	2	18.3	155.7
10126	SBS mc 1	PL	<17 SI	Natural	80	PL90BL10	2500	2	18.2	553.0
10126	SBS mc 1	PL	<17 SI	Planted	20	PL90BL10	1000	2	18.2	553.0
10127	SBS mc 1	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	19.4	26.3
10128	SBS mc 1	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	19.1	100.1
10129	SBS mc 1	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	18.6	1,092.3
10130	SBS mc 2	BL	>=17 SI and <20 SI	Planted	100	BL50S40PL10	1000	2	19.2	0.1
10131	SBS mc 2	BL	<17 SI	Planted	100	BL50S40PL10	1000	2	18.1	760.0
10135	SBS mc 2	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	18.1	4.5
10135	SBS mc 2	FD	>=20 SI	Planted	100	FD60S30BL10	1000	2	18.1	4.5
10136	SBS mc 2	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	18.3	45.2
10136	SBS mc 2	FD	>=16 SI and <20 SI	Planted	100	FD60S30BL10	1000	2	18.3	45.2
10137	SBS mc 2	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	17.9	43.7
10137	SBS mc 2	FD	<16 SI	Planted	100	FD60S30BL10	1000	2	17.9	43.7
10138	SBS mc 2	PL	>=20 SI	Natural	80	PL75S10BL10FD5	2500	3	18.1	75.1
10138	SBS mc 2	PL	>=20 SI	Planted	20	PL75S10BL10FD5	1000	2	18.1	75.1
10139	SBS mc 2	PL	>=17 SI and <20 SI	Natural	80	PL75S10BL10FD5	2500	3	17.9	567.3
10139	SBS mc 2	PL	>=17 SI and <20 SI	Planted	20	PL75S10BL10FD5	1000	2	17.9	567.3
10140	SBS mc 2	PL	<17 SI	Natural	80	PL75S10BL10FD5	2500	3	17.9	27,456.7
10140	SBS mc 2	PL	<17 SI	Planted	20	PL75S10BL10FD5	1000	2	17.9	27,456.7
10141	SBS mc 2	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	18.7	71.0

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]
AU	BGC variant	Existing Leading Species	Site Index Range	Input Regeneration Method	Regeneration Method (%)	Input Species Composition	Input Initial Density	Regen. Delay	Area Wtd. Avg. Managed Site Index	THLB area (ha)
10142	SBS mc 2	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	18.3	652.0
10143	SBS mc 2	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	17.9	21,068.0
10145	SBS mc 3	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	19.7	2.1
10146	SBS mc 3	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	15	0.0
10147	SBS mc 3	PL	>=20 SI	Natural	80	PL70S20BL10	2500	2	19.4	0.2
10147	SBS mc 3	PL	>=20 SI	Planted	20	PL70S20BL10	1000	2	19.4	0.2
10148	SBS mc 3	PL	>=17 SI and <20 SI	Natural	80	PL70S20BL10	2500	2	19.4	18.0
10148	SBS mc 3	PL	>=17 SI and <20 SI	Planted	20	PL70S20BL10	1000	2	19.4	18.0
10149	SBS mc 3	PL	<17 SI	Natural	80	PL70S20BL10	2500	2	18.9	7,620.8
10149	SBS mc 3	PL	<17 SI	Planted	20	PL70S20BL10	1000	2	18.9	7,620.8
10150	SBS mc 3	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	18.9	6,559.8
10154	SBS mh	FD	>=20 SI	Planted	100	FD60PL30S10	1000	2	21	1,029.0
10155	SBS mh	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	2	21	3,605.2
10156	SBS mh	FD	<16 SI	Planted	100	FD60PL30S10	1000	2	21	492.8
10157	SBS mh	PL	>=20 SI	Natural	80	PL40S30PL30	2500	2	21.2	5.2
10157	SBS mh	PL	>=20 SI	Planted	20	PL40S30PL30	1000	2	21.2	5.2
10158	SBS mh	PL	>=17 SI and <20 SI	Natural	80	PL40S30PL30	2500	2	21.1	15.2
10158	SBS mh	PL	>=17 SI and <20 SI	Planted	20	PL40S30PL30	1000	2	21.1	15.2
10159	SBS mh	PL	<17 SI	Natural	80	PL40S30PL30	2500	2	20.9	3.7
10159	SBS mh	PL	<17 SI	Planted	20	PL40S30PL30	1000	2	20.9	3.7
10160	SBS mh	SX	>=20 SI	Planted	100	S60PL20BL20	1000	2	21.1	97.9
10161	SBS mh	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	2	21	302.1
10162	SBS mh	SX	<17 SI	Planted	100	S60PL20BL20	1000	2	20.7	478.6
10163	SBS mw	BL	>=20 SI	Planted	100	BL50S40PL10	1000	3	22.6	11.5
10164	SBS mw	BL	>=17 SI and <20 SI	Planted	100	BL50S40PL10	1000	3	23.2	118.7
10165	SBS mw	BL	<17 SI	Planted	100	BL50S40PL10	1000	3	18.8	45.5
10169	SBS mw	FD	>=20 SI	Planted	100	FD60PL30S10	1000	3	22.8	1,244.3
10170	SBS mw	FD	>=16 SI and <20 SI	Planted	100	FD60PL30S10	1000	3	22.6	1,525.4
10171	SBS mw	FD	<16 SI	Planted	100	FD60PL30S10	1000	3	21.2	300.4
10172	SBS mw	PL	>=20 SI	Natural	80	PL60S20FD10BL10	2500	2	21.5	148.3
10172	SBS mw	PL	>=20 SI	Planted	20	PL60S20FD10BL10	1000	3	21.5	148.3
10173	SBS mw	PL	>=17 SI and <20 SI	Natural	80	PL60S20FD10BL10	2500	2	22.5	873.5
10173	SBS mw	PL	>=17 SI and <20 SI	Planted	20	PL60S20FD10BL10	1000	3	22.5	873.5
10174	SBS mw	PL	<17 SI	Natural	80	PL60S20FD10BL10	2500	2	21	324.5
10174	SBS mw	PL	<17 SI	Planted	20	PL60S20FD10BL10	1000	3	21	324.5
10175	SBS mw	SX	>=20 SI	Planted	100	S60PL20BL20	1000	3	22.8	868.9
10176	SBS mw	SX	>=17 SI and <20 SI	Planted	100	S60PL20BL20	1000	3	22.7	2,035.6

[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]
AU	**BGC variant**	**Existing Leading Species**	**Site Index Range**	**Input Regeneration Method**	**Regeneration Method (%)**	**Input Species Composition**	**Input Initial Density**	**Regen. Delay**	**Area Wtd. Avg. Managed Site Index**	**THLB area (ha)**
10177	SBS mw	SX	<17 SI	Planted	100	S60PL20BL20	1000	3	21.9	5,095.8

Notes:

- Genetic worth assumptions are not shown, however the following GW values were applied: Fd 16.5%, Pl 9.4%, Sx 21.4%