

# **100 Mile House Timber Supply Area – TSA 23**

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## **Vegetation Resources Inventory Strategic Inventory Plan**

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January 16, 2009

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# Acknowledgements

This planning process was initiated by Al Hicks and Sara Johnson of 100 Mile House Lumber, A Division of West Fraser Mills Ltd. It has been supported by both industry and government Stakeholders including:

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Planning Forester, BC Timber Sales, Kamloops Timber Sales Office  
Marino Bordin, Interfor  
Dave Conly, Tolko Industries Ltd.

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Forest Analysis and Inventory Branch staff in Victoria  
Gary Johansen, Will Smith and Graham Hawkins

Regional Forest Health staff in the Southern Interior Forest Region, Williams Lake  
Leo Rankin

Timber Supply Branch, Kamloops and Victoria  
Jeff Stone and Barry Snowden

Local knowledge from the 100 Mile House District  
Christine Lohr, Stewardship Officer  
Roger Packham, Ecosystem Officer

Funding for this VRI Planning project was provided through the Forest Investment Account Land Base Investment Program, 'Inventory Focus Funding Account'.



# Executive Summary

The Ministry of Forests & Range (MFR) staff recognizes that the inventory in the 100 Mile House Forest District is among the older inventories in the province. This was one consideration when this Management Unit (MU) was given priority provincially.

During the Timber Supply Review 2 (TSR2), uncertainty regarding existing stand volumes caused the Chief Forester to conclude that there is a need to “complete a Vegetation Resource Inventory for the Timber Supply Area (TSA); in particular, to improve the forest cover attributes.”<sup>1</sup>

More recently, the Mountain Pine Beetle (MPB) epidemic has devastated the forests of the former Cariboo Forest Region, including 100 Mile House TSA. The Ministry of Forests & Range completed TSR3 locally in 2006 to create an action plan in response to the infestation. In the ‘Rationale for Allowable Annual Cut (AAC) Determination’, the results of the VRI Phase II project were discussed and applied in the analysis. The Chief Forester has recommended that “after the MPB epidemic has subsided” the TSA should be re-inventoried. “The inventory needs to identify what has survived the epidemic so that volume forecasts can be more accurately determined.”<sup>2</sup>

Through the Vegetation Resources Inventory (VRI) Strategic Inventory Planning (VSIP) process, the Stakeholder group in the 100 Mile House TSA has investigated the inventory options and the timing of their being undertaken. This document includes a record of the state of the inventory. It also reflects the decision-making process that has concluded that a Vegetation Resources Inventory project needs to be implemented in this TSA.

The initial step in the preparation of this Strategic Inventory Plan was to bring the TSA’s Stakeholders together at a meeting in Chasm (south of 100 Mile House) on November 12, 2008. The meeting’s agenda was designed to:

1. Provide background on the Vegetation Resources Inventory process
2. Assess the status of the Mountain Pine Beetle epidemic locally.
3. Discuss client data needs in the TSA
4. Investigate support that can be provided through the Vegetation Resources Inventory

There are many issues that the Stakeholders are seeking to address through a new inventory. Some have been identified in previous reviews. The Mountain Pine Beetle epidemic has exacerbated the situation and lengthened the list.

The Business Needs build a strong case and it has been concluded that a VRI investment is appropriate in this TSA. A ‘full’ VRI has been identified in this plan. Several key decisions that are important to this project include:

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<sup>1</sup> Page 34 of 2002 AAC Rationale

<sup>2</sup> P42 of 2006 Rationale

- Delaying the start up of the Phase 1 photo acquisition to ensure that the ‘greying’ of the forest<sup>3</sup> is complete. An option of a ‘phased’ approach to the Phase I project is discussed in the plan.
- Completing the Phase II Ground Sampling and Net Volume Adjustment Factoring (NVAF) project and the Adjustment and Analysis in a two year period, following delivery of the Phase I photo interpretation. Again, a ‘phased’ approach to the VRI Ground Sampling may be the most suitable option.
- Investigating the option of a Phase II ‘supplemental’ project that could include sampling the existing VRI samples. This project will provide volume and mortality information for TSR4.

This TSA has had ‘focus funding’ from the Forest Investment Account (FIA) made available during the 2008/09 fiscal year. It is the intention of the Lead Licensee to follow up this VRI planning process with a VRI Project Implementation Plan (VPIP) for Photo Interpretation. If the VRI Phase II ‘Supplemental’ project is to be undertaken, a plan for this work will also be prepared during this fiscal year. The VPIP provides operational details and final decisions for each activity that is part of a VRI project.

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<sup>3</sup> After the needles have dropped, the understory is more visible.

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# 1. Introduction

## 1.1 Background

The Vegetation Resources Inventory (VRI) in the province of British Columbia (BC) is a 'broad' inventory designed to support, among other things, the Timber Supply Review (TSR) process. The current Timber Supply Review in the 100 Mile House Timber Supply Area (TSA) reflects management practices that are evolving in response to the Mountain Pine Beetle (MPB) attack.

Undertaking a Vegetation Resources Inventory project requires starting with a formalized plan. Often supported by a contracted VRI specialist, the VRI Strategic Inventory Planning (VSIP) process requires local Stakeholders' involvement in making decisions on project direction. While the process does follow a kind of 'template', it should be unique and relevant to the management unit and its clients.

The VSIP builds the Business Case for a VRI project. It details the history of the existing inventory, identifies local forest management issues and evaluates the effectiveness of the 'phases' of the VRI to address these issues. The VSIP provides direction for the next step in the VRI planning process, the development of the more detailed Project Implementation Plan (VPIP).

Nona Phillips Forestry Consulting prepared this plan in consultation with the 100 Mile House TSA Stakeholders. Included in the Stakeholders' group are the following:

- 100 Mile House Lumber, A Division of West Fraser Mills Ltd., 100 Mile House
- Tolko Industries Ltd., Cariboo Woodlands, Williams Lake
- British Columbia Timber Sales (BCTS), Kamloops Timber Sales Office (TSO)
- Interfor, Kamloops
- Canim Lake Band
- Canoe Creek Band (Stswecem'c Xgat'tem Development Limited Partnership)
- Cariboo/100 Mile House Woodlot Association
- Ministry of Forests and Range (MFR)
  - – Forest Analysis & Inventory Branch (FAIB)
  - – Southern Interior Forest Region (SIFR)
  - – 100 Mile House Forest District
- Ministry of Environment (MoE), 100 Mile House

An initial 'Issues Paper' was distributed prior to the Stakeholders' meeting in Chasm held on November 12, 2008, to stimulate discussion. This VSIP was developed based on this paper and subsequent input received from the

Stakeholders at the meeting and during the review of the various editions of this plan.

## 1.2 Vegetation Resources Inventory Overview

In 1991, the Forest Resources Commission recommended “that the Government of British Columbia undertake a commitment to complete inventories for all renewable forest resource values using standardized compatible systems”.

The Vegetation Resources Inventory is one of a number of inventories that were developed in the 1990’s in the province. The VRI has been the ‘standard’ for forest cover (FC) inventory in British Columbia since 1996. The Resources Information Standards Committee (RISC) has evolved as the group who oversees the protocols required to complete an inventory program.

As stated on the Ministry of Forest and Range’s website for the Vegetation Resources Inventory<sup>4</sup>, the VRI was designed to answer two questions:

1. Where is the resource located?
2. How much of a given vegetation resource is within a management unit?

Among the strengths of the VRI are its multi-option approach to address inventory related questions in a specific management unit, its statistically accurate procedures and its re-introduction of a ground sampling phase to adjust the photo interpreted attributes.

Participating Stakeholders require some understanding of this inventory process. Part of this document and the Stakeholders’ meeting is dedicated to Inventory specialists providing this overview.

The Vegetation Resources Inventory has several components that may be undertaken in combination or in some cases individually, including:

1. Phase 1 or Photo Interpretation

The Photo Interpretation phase involves estimating vegetation polygon characteristics from aerial photographs.

The key steps involve:

- Delineating the vegetated and non-vegetated land base into polygons based on similar vegetation characteristics
- Field calibration for the photo interpreters

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<sup>4</sup> <http://www.for.gov.bc.ca/hts/vri/index.html>

- Attribute estimation, incorporating historical data, field calibration data and the skills of the photo interpreters
- Digital capture of attribute and graphic information to produce VRI maps

## 2. Phase II or Ground Sampling activities

The ground sampling phase provides the information necessary to determine how much of a given attribute is within the inventory area.

There are two parts to this phase.

- i) Establishment of 'cluster' samples randomly across the project area. The data collected at the cluster samples may include the measurement of timber and/or ecology attributes. Net close utilization volume is obtained by call grading and net factoring trees, and breakage loss factors.
- ii) Destructive sampling following the protocols established in the Net Volume Adjustment Factor (NVAF) process is used to correct for errors in the estimation of net tree volume. The NVAF work, a mandatory component of the Phase II program, provides an adjustment factor that is used during sample compilation to produce unbiased estimates of net close utilization tree volume and adjusts the net factor volumes from the plot establishment activity.

## 3. Analysis and Adjustment

- Data analysis is the process of screening, preparing, and comparing compiled ground sample data to the Phase 1 inventory data, to determine the relationships between these data.
- Attribute adjustment is the process of applying the relationship between photo estimation data and ground sampling data to the initial estimates in the photo interpreted database.

## 4. Monitoring plots

Monitoring programs are recognized by the Province to be part of the VRI process and may be funded by the Forest Investment Account (FIA). The following are features of this work:

- RISC Procedures exist that determine the methodology for data collection. Based on the National Forest Inventory (NFI) – British Columbia Standard.
- Monitoring creates a permanent, remeasurable design that is a statistically based system of monitoring and reporting.
- It allows for repeated measurement of forest attributes over time, at defined locations.
- It monitors change over a long term at intervals of 5 to 10 years.

- Projects often include collecting full VRI ground sampling data, including timber and ecology.
- It addresses mid to long term issues i.e. projects often target managed stands in younger age classes.

### **1.3 Vegetation Resources Inventory Overriding Principles**

To ensure consistent and effective implementation of the inventory the following principles guide projects across the province:

- Strategic and Project Implementation Plans are produced for each management unit.
- The Strategic Inventory Plan provides background on the VRI process, tailoring the inventory to the business needs identified by an interactive process with the Stakeholders.
- Project Implementation Plans are working documents that outline the operational activities associated with implementing and documenting the inventory decisions identified in the VSIP. A VPIP includes details on the geographic area, scheduling, roles and responsibilities, costs and deliverables. General references to timelines are provided, since the projects are 'focus funding' dependent.
- Together the VSIP and VPIP form a critical part of the record for Vegetation Resources Inventory projects and they have high value in both the short and long term. If diligently written, they archive the initiation of the process. The VPIP should provide a guideline to execute the applicable Phase of the VRI.
- Implementation will follow the standards and procedures established by the Resources Information Standards Committee that are available at the website:  
<http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm>

### **1.4 Vegetation Resources Inventory Planning**

The VRI planning process is a requirement of both the Ministry of Forests & Range and the Forest Investment Account and approval is required by the MFR prior to undertaking a VRI project. This is to ensure that the need for an inventory project has been assessed and that the activities proposed address issues identified in the TSA.

The steps in the planning process are:

- Identify Stakeholders and consult with them throughout the project. Initially, a meeting is held with the Stakeholders to describe the process and their input is obtained to identify issues specific to the

management unit. This client group is updated throughout the planning process and provided with opportunities to comment on critical decisions.

- Develop a VRI VSIP that records the current state of the inventory and investigates additional data requirements. Based on the 'Business need', this plan may include a recommendation to undertake VRI activities. As required, VRI tools will be identified that support local forest management issues.
- Prepare a VRI VPIP for each prescribed activity as directed by the approved VSIP. Separate plans are required for Phase I photo interpretation and Phase II ground sampling. The ground sampling VPIP includes Net Volume Adjustment Factor sampling, analysis and adjustment and monitoring activities as well as details on the ground samples.

Approved VRI Strategic and Project Implementation Plans are time-sensitive documents that if the planned activities are delayed, may require some review before undertaking a project under their direction. They are available to the public and posted on the Vegetation Resources Inventory web-site:

[http://www.for.gov.bc.ca/hts/vri/reports&pub/vri\\_vripub.html#top](http://www.for.gov.bc.ca/hts/vri/reports&pub/vri_vripub.html#top)

## 1.5 Funding

100 Mile House Lumber is acting as the Lead from the local Stakeholder group. This Licensee has been provided with 'focus funding' through 'targeted inventory funds' from the Forest Investment Account allocation, administered by PriceWaterhouseCoopers (PWC). VRI projects that develop as a result of this planning may be eligible for funding through the FIA process, subject to approval from the Ministry of Forests & Range and priorities set by the Vegetation Inventory Advisory Committee (VIAC).<sup>5</sup>

An approximate budget for the type of projects under consideration has been included as part of this planning process. These costs are based on similar projects on similar landscapes throughout the interior of the province.

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<sup>5</sup> VIAC is a collaborative government-industry group that provides strategic guidance to the VRI program of the MFR. For further details, please reference the website:

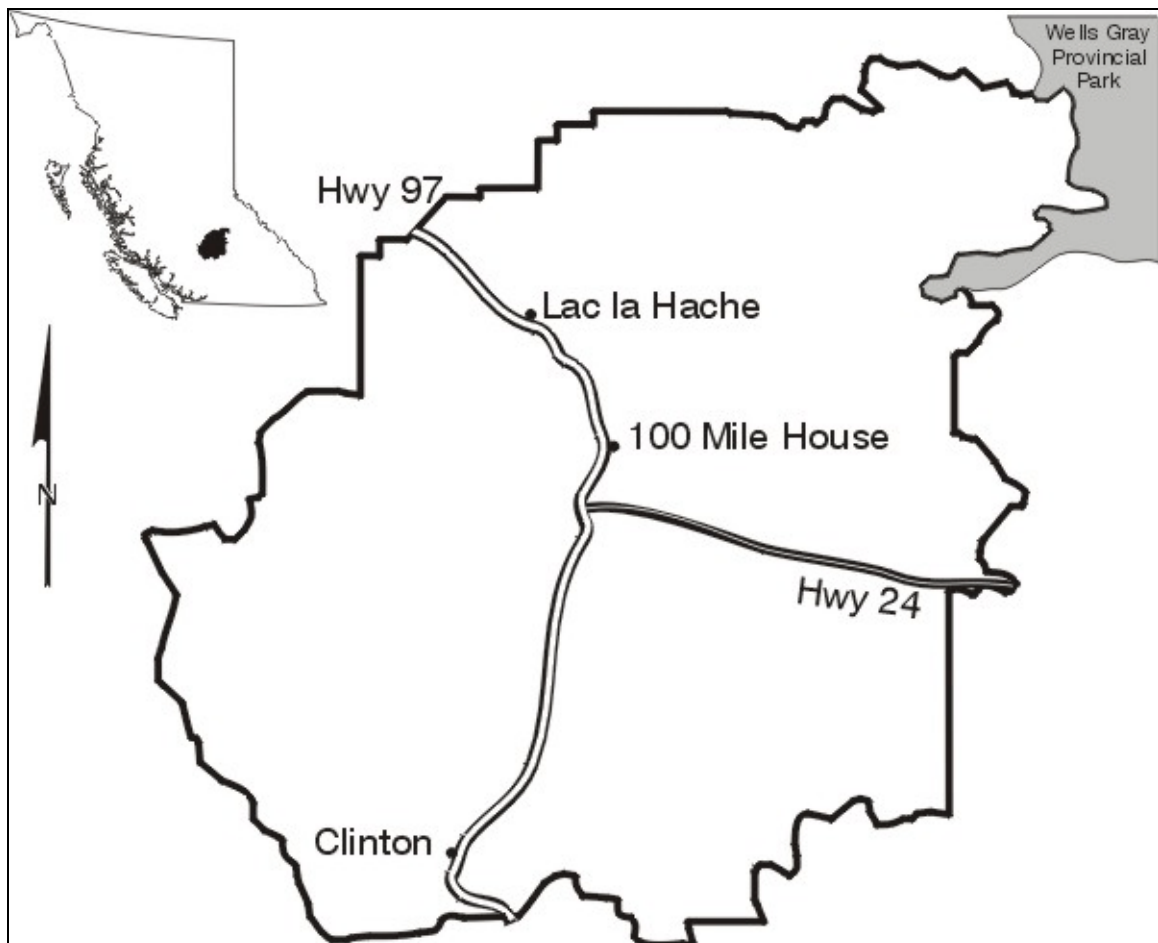
<http://www.for.gov.bc.ca/hts/VIAC/index.htm>

## 2. Business Considerations

### 2.1 Current Landbase (adapted from the 100 Mile House TSA Rationale for Allowable Annual Cut (AAC) Determination – September 6, 2006)

The 100 Mile House TSA is one of fifteen TSAs in the Ministry of Forests and Range, Southern Interior Forest Region. It covers approximately 1.23 million hectares in south central British Columbia. It is bounded by the Williams Lake TSA to the north and northwest, the Fraser River to the west, Kamloops TSA to the south, and the Cariboo Mountains and Wells Gray Park to the east. The Timber Supply Area boundary coincides with the District boundary and it is administered from the MFR office in 100 Mile House. Figure 1 is an overview map of the TSA.

**Figure 1. Overview map of the 100 Mile House TSA**



100 Mile House is the largest Municipality in the TSA (1885 residents<sup>6</sup>). According to the 2001 census, the population for the neighbouring area is approximately 14,756. Other communities encompassed within the TSA are: Clinton, Lac la Hache, Forest Grove, 70 Mile, Lone Bute and Bridge Lake.

Table 1 summarizes the area managed by the BC Ministry of Forests and Range and reductions made to derive the timber harvesting land base. The portion of the total TSA area that will be included in VRI Phase I and Phase II activities will be determined during the Project Implementation Planning phase.

**Table 1: Area Summary for the 100 Mile House Timber Supply Area<sup>7</sup>**

<b>Land Classification</b>	<b>Area (ha)</b>	<b>Percent of productive crown forest land</b>
Total TSA Area	1,230,000	
Crown forest	940,000	
Land not managed by BC Ministry of Forest and Range- woodlots, parks, protected areas, Crown land reserves	50,000	
Productive forest managed by BC Ministry of Forest and Range	890,000	100.0
Reductions to the Crown forest available for timber supply – ‘netdowns’	150,000	
Land Base for TSR2 assumptions	740,000	
Reduction for OGMAs	112,600	
<b>TSR3 landbase (THLB)</b>	<b>627,400</b>	

The 100 Mile House TSA has varied topography. It consists primarily of undulating plateau with the Fraser River valley forming much of the western boundary and includes the lowest elevations in the TSA. The southwestern part of the study area includes areas of higher relief, the largely calcareous Marble and Pavilion ranges. Along the north eastern edge of the TSA the area rises steeply to form the Quesnel Highlands and the most westerly portions of the Cariboo Mountains.<sup>8</sup>

The southwestern part of the TSA along the Fraser River has a hot, dry climate, while the Cariboo Mountains to the northeast produce a wet climate

<sup>6</sup>2001 census from the South Cariboo Community profile, [http://www.100milehouse.com/userfiles/sc\\_community\\_profile.pdf](http://www.100milehouse.com/userfiles/sc_community_profile.pdf)

<sup>7</sup> From 100 Mile House Timber Supply Area AAC Determination p. 10 & 11 –September, 2006

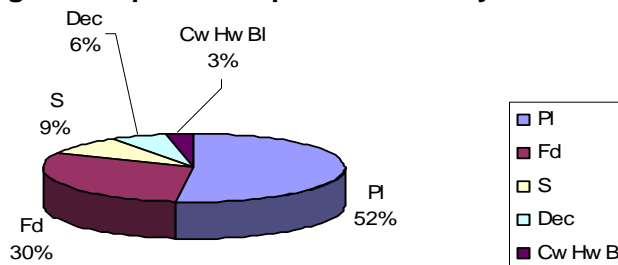
<sup>8</sup> From Large Scale Biogeoclimatic Mapping of the 100 Mile House TSA – 2008, Ray Coupe.

The forest landscape of the 100 Mile House TSA is diverse and supports a wide range of resource uses including timber, forage, non-timber forest products, fish and wildlife habitat, water and recreation and tourism opportunities.

There are eighteen biogeoclimatic subzones/variants in the TSA with the single largest unit being IDFdk3. The dominant tree species in the TSA (area of stands with the species leading) are lodgepole pine (about 52% of the volume in the THLB) and Douglas fir (30%). Other tree species present include spruce (9%), subalpine fir (balsam), western red cedar, western hemlock (together comprising 3%) and various deciduous species (6%) (see Figure 2). The majority of the pine volume is considered

mature (over 80 years old) and therefore particularly susceptible to the pine epidemic. Overall, about 60% of the timber harvesting land base consists of mature forests that are at least 80 years of age, while the remaining 40 percent of the forests are considered immature.

**Figure 2: Species Representation by Area**



Three First Nations have communities in the TSA. They are all Secwepemc (Shuswap) people:

- Tsq’escen (Canim Lake)
- High Bar
- Xatl’tem/Stwecem’c (Canoe Creek)

Other First Nations with traditional territories in the TSA are:

- Esketemc First Nation (Alkali Lake)
- T’exelc (Williams Lake)
- Whispering Pines (Clinton)
- Ts’kw’aylaxw (Pavilion)
- Bonaparte
- Skeetchestn
- Simpcw (North Thompson)

## 2.2 Forest Cover Inventory History

Sections 2.2 to 2.4 summarize the original inventory volume and attribute issues identified in the Inventory Audit and corroborated in the ‘extended analysis’ and the Phase II and NVAF projects. There are enough issues identified to conclude that the 100 Mile House TSA is due for a complete VRI project. But since this inventory was completed and analysed, the Mountain Pine Beetle epidemic has



dramatically impacted the local forest cover and the resultant mortality has become the bigger issue.

Projects that resulted in the current Forest Cover Inventory in the 100 Mile House TSA were undertaken in four Public Sustained Yield Units (PSYUs) that comprise the TSA. Table 2 provides a record of this history.

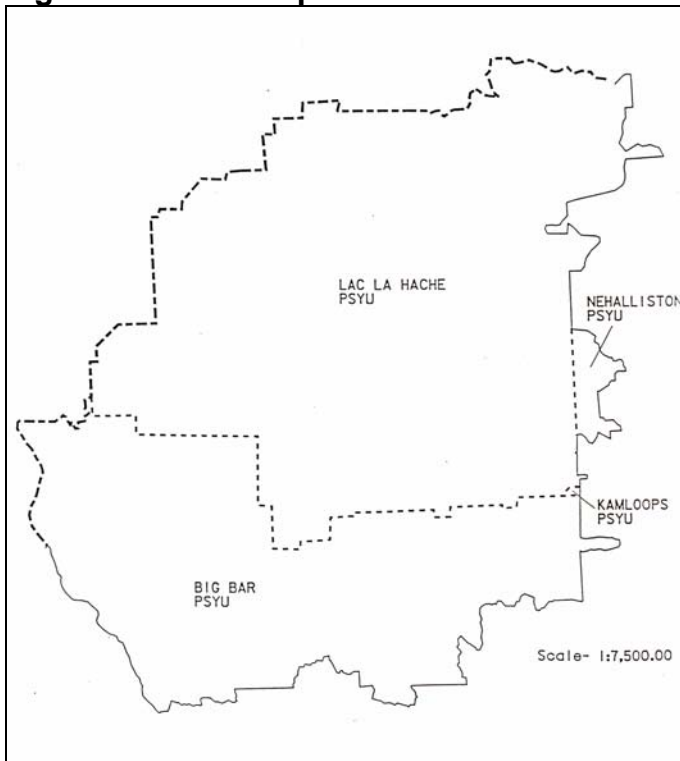
**Table 2: Inventories completed in the 100 Mile House TSA<sup>9</sup>**

Unit Name	Type of Inventory <sup>10</sup>	% TSA	Inventory Date	E.S.A.
Lac la Hache PSYU	Unit Survey	61.5	1972	1977
Big Bar PSYU	Unit Survey	36.2	1962, 1976	1976
Nehalliston PSYU	Unit Survey	1.4	1965, 1973	1973
Kamloops PSYU	Unit Survey	0.3	1968, 1977	1977
Parks & Woodlots	Unit Survey	0.6	N/A	N/A
Lignum IFPA	VRI – Phase II & NVAF, Phase I	17	1997-1999 1999-2002	
100 Mile House TSA-exclusive of Lignum IFPA	VRI – Phase II NVAF	83	2001-2003	

<sup>9</sup> Details for Units Survey timelines are from: Inventory Accuracy Assessment - 100 Mile House TSA – Draft. Prepared by Gregor Lee, Reinventor Forester, MoF Cariboo Region, February 16, 1998 Page 9.

<sup>10</sup> The old PSYU Inventory was called a Unit Survey, not a Reinventor. All of the attributes collected were mid-pointed range values i.e. age class, height class. Anything from approximately 1987 to 1996 was a Reinventor with more refined attributes. Personal Communication, Jim Grace, February 20, 2008.

**Figure 3. PSYU Map**



In the mid 1990s, part of both 100 Mile House and Williams Lake TSAs was managed by Lignum Ltd. as an Innovative Forest Practices Agreement (IFPA)<sup>11</sup>. Representing approximately 17% of the landbase<sup>12</sup>, VRI Phase I and Phase II ground sampling<sup>13</sup> have been completed on this part of the 100 Mile House TSA.

In the remaining TSA (approximately 83 per cent of the landbase), the inventory was completed to previous FC1 standards. For this part of the TSA, the Forest Inventory Planning (FIP) files were rolled over to the VRI format. In this rollover process, the inventory does not contain VRI attributes that were not part of the FIP files i.e. ecological attributes and additional timber and wildlife attributes.

In the period 2001-2003 a VRI Phase II project (including Net Volume Adjustment Factor sampling) was completed on the non-IFPA part of the TSA. While the inventory files were not adjusted, there is an analysis for the non-IFPA portion of the TSA which is discussed in Section 2.4 of this plan. This analysis was included in Chief Forester's discussions around volume in the TSA in TSR3.

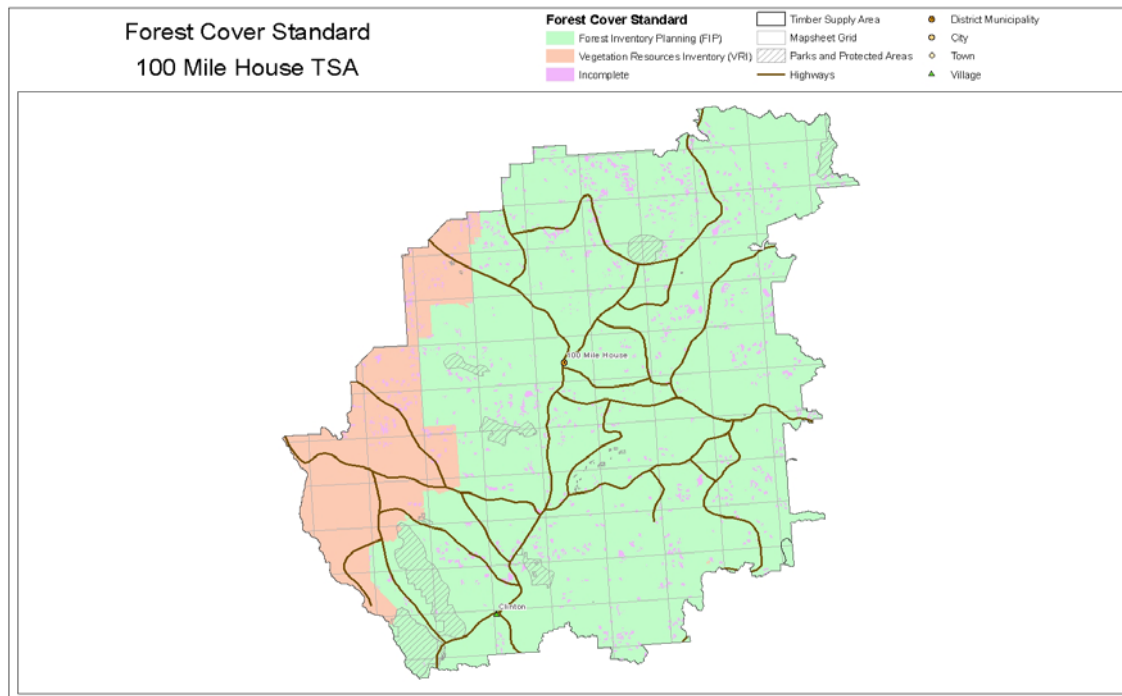
Effective February 2009, the data for the 100 Mile House TSA forest inventory will be 2007 for updates and 2008 for projection.

<sup>11</sup> The IFPA is now held by Tolko Industries Ltd.

<sup>12</sup> 100 Mile House TSA Rationale for TSA, page 12

<sup>13</sup> During the course of the Lignum VRI Phase II project in the IFPA, 345 ground samples were completed with 107 of these being in the 100 Mile House section of the IFPA.

**Figure 4. 100 Mile House TSA - IFPA area = VRI Forest Cover Standard**



### 2.3 Inventory Audit and further Analysis of the 100 Mile House Inventory

A significant inventory initiative that occurred in most managed tenures in British Columbia between 1992 and 1999 was the Inventory Audit program. The Inventory Audit methodology was developed to provide a statistical description of the accuracy of the forest inventory's volume estimates<sup>14</sup> by management unit.

An Inventory Audit was undertaken in the 100 Mile House TSA in 1994. In the audit process, 50 forested polygons were randomly selected from the total forested area in the management unit for sampling. Some key results of the analysis of the audit data showed:

- A statistically acceptable but borderline sampling error associated with the mature component of the sample (stands over 60 years).
- Further analysis that post-stratified the population by operability yielded results showing that the volume in the operable forested area of the TSA is being overestimated by the inventory. In the Audit Report, this bias was attributed to the classification attributes.
- The assessment of the non-forest strata indicated that this inventory did not meet provincial standards.<sup>15</sup>

<sup>14</sup> Resource Inventory Branch, Inventory Audit Sampling Standards & Procedures 1998.

[http://www.for.gov.bc.ca/hts/vri/audits/audit\\_manuals/auditsp.pdf](http://www.for.gov.bc.ca/hts/vri/audits/audit_manuals/auditsp.pdf)

<sup>15</sup> 100 Mile House TSA Inventory Audit 1996

<http://www.for.gov.bc.ca/hts/vri/audits/reports&pub/overview/100milehouse-overview.pdf>

## “Extended Analysis in the 100 Mile House TSA”

As a result of the audit findings, the Cariboo Region conducted a Pre-inventory Assessment (PIA) locally. This included further field work and analysis of the nature of the inventory issues in the 100 Mile House TSA. The goal was to determine the direction for a new forest cover inventory. The following reports were prepared<sup>16</sup> and the results of this study were considered in the Chief Forester’s analysis of the existing inventory in TSR2:

1. Inventory Accuracy Assessment -100 Mile House TSA. 1998
2. Inventory Audit –Extended Analysis –Determining the Nature of Per Hectare Volume Bias. 2000

The extended analysis focused on the identified volume over-estimate. It reported that the TSA wide overestimate of 11% was largely confined to the Big Bar PSYU and the Interior Douglas Fir Biogeoclimatic zone. This means the overestimate in these areas is much higher as shown in Table 3.

**Table 3. Extent and Magnitude of Bias within 100MH TSA<sup>17</sup>**

Unit	Bias%
TSA	11
Big Bar PSYU	18
IDF (BEC)	30
IDF in Big Bar PSYU	26

The report recommendations were as follows:

- “Sufficient samples should be established in the affected PSYU and BEC Zone to confirm the findings of this study.
- In the interim, the available sample data should be used as a basis for adjustment of per hectare volumes in the current timber supply process.”

### 2.4 2001-2003 Vegetation Resource Inventory Phase II Project

The Ministry of Forests conducted a VRI planning exercise in the late 1990s with an emphasis on ground sampling. A series of plans resulted in the Region championing a VRI Phase II and NVAF project for 100 Mile House in the non-IFPA segment of the TSA in the period 2001 to 2003<sup>18</sup>. The VRI project collected data for 75 samples and 110 NVAF destructively sampled trees, based on the strategies developed in the VRI Project planning processes.

<sup>16</sup> These reports exist only on the MFR files and were not published.

<sup>17</sup> Extracted from Extended Analysis –Gregor Lee -2000.

<sup>18</sup> This project was managed by Nona Phillips, the VRI Phase II Forester in the Cariboo Region and was financially supported by Al Hicks and Gordon Todd of Weldwood in 100 Mile House utilizing FRBC and FIA funding.

## Documentation of Analysis for VRI – Analysis of the VRI ground sampling data - Statistical Adjustment, 2003

At the completion of the ground sampling project (including NVAF), a statistical analysis of VRI height, age, and volume attributes was completed for the non-Lignum IFPA area of the TSA. The following table shows the adjustment factors.

**Table 4. 100 Mile House TSA VRI Adjustment Factors<sup>19</sup>**

<b>Stratum</b>	<b>Ht adjustment ratio of means</b>	<b>Age adjustment ratio of means</b>	<b>“Attribute adjusted” volume adjusted ratio of means</b>
Pine leading <=80yrs	1.164	1.037	0.869
Pine leading >80yrs	1.027	0.880	0.854
Fir leading <=120 yrs	1.210	1.003	1.123
Fir leading >120 yrs	0.875	0.608	1.312
Other coniferous leading	0.911	0.893	0.918
Deciduous leading	0.926	0.908	1.011

This means that VRI volume estimates are overestimated by 13% and 15% for immature and mature pine respectively. Immature and mature Fir on the other hand is underestimated by 12% and 31% respectively. Other conifers are overestimated by about 8% while deciduous estimates compared favorably to ground sampling.

### 2.5 Site productivity

Provincial site productivity work such as the Old Growth Site Index project (OGSI) conducted by Provincial Inventory staff has verified the belief that actual site indices (SI) may be higher than those indicated using existing data based on mature stands.

With the changes occurring in the forest of this TSA, the ability to assess the potential of forest sites for future growth will be important in setting priorities for forest management activities. The Chief Forester has directed local Stakeholders to assess growth and yield on residual stands not harvested and to verify site productivity for managed stands. Other inventory products like the Predictive Ecosystem Mapping (PEM) data base finalized in 100 Mile House in

<sup>19</sup> 100 Mile House TSA Documentation of analysis for Vegetation Resource Inventory Statistical Adjustment. ADDENDUM. Jahraus & Assoc. Consulting Inc. September 2003.

2008 will likely be assessed to link site index to site productivity for TSR<sup>20</sup>. But overall, the trend will continue to reference site index using the forest cover inventory on an operational basis. A new Phase I followed by Phase II has the potential to improve the site index values available from the VRI.

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<sup>20</sup>This project has achieved an overall accuracy of 65%, and has been approved to have met the standard required for its use in the base case for timber supply analysis. The link to site index will be SIBEC, the MFR Research Branch's correlation of BEC site factor information with site index.

## 2.6 Forest Management and Inventory Issues

The following is a list of issues identified at the November 12, 2008 Stakeholders' Meeting. Except for the Mountain Pine Beetle related issues, the list is similar to the one developed at the 1997 Stakeholders' Meeting.

Issue	VRI Effectiveness			Remarks on VRI Effectiveness
	Photo-Interpreted Estimates	Ground sampling & NVAF	Monitoring	
1. Structure of stands following MPB attack. The current inventory shows PI representing 57% of the THLB. Need to know what live volume remains.	High	High	Moderate to High	Critical to wait until needles have dropped as Phase I can only delineate according to the photos provided. Phase II can give good information about attributes and volumes at time of sampling. Monitoring can be used to reflect successional information i.e. what comes in after the MPB and change in the forest.
2. Shelf life. Monitoring the duration of merchantability of the dead timber in MPB attacked areas.	N/A	Moderate to High	Moderate to High	MFR discussed results of provincial & federal studies. NVAF has additional merchantability collection added in 2008. Monitoring projects can show duration of merchantability.
3. Mortality in young stands. Affect of MPB on immature stands (less than 60 years)	High	Moderate	Moderate	New Photo Interpretation can improve estimates on openings older than those populated by RESULTS. Phase II will provide attribute information for openings age 31+, based on current species labels. Ground Sampling can target a strata with age classes 31 to 60. A Monitoring project could target this population. To date, FFT has targeted stands up to age 30.
4. Reliability of volume estimates in unmanaged stands. - identified in previous ground sampling projects in the TSA	Moderate	High		For pine, important to use photos showing post-MPB epidemic forest. New Phase I can provide more accurate attributes for VDYP to use in deriving volumes. Ground sampling effective in providing good data on actual volumes. This data can then be used to adjust the database.
5. Volume of managed stands. -'snapshot' estimates of current volumes for managed stands	Moderate	High	High	New Phase I can provide more accurate attributes for VDYP to use in deriving volumes. Ground Sampling will provide very good data on actual volumes. The data can then be used to adjust the

Issue	VRI Effectiveness			Remarks on VRI Effectiveness
	Photo-Interpreted Estimates	Ground sampling & NVAF	Monitoring	
				database. Limitations as the current managed stands may not exceed 35 years – ground sampling starts with age 31+
6. Errors in inventory attributes. The issue of volume reliability has been linked to classification.	Moderate	Moderate		Phase I and Ground sampling may improve individual polygon values and reduce errors in attributes. Photo Interpreted database can be adjusted (for numeric attributes only) using Ground Sampling.
7. Volume of dead wood. -Better estimates of dead wood volume desired based on Chief Forester's consideration in TSR.	Low	High	Moderate	To date, Phase I has not captured dead tree attributes in the inventory. MFR has been piloting the idea of a dead layer in Phase I to get a better handle on this. Ground Sampling and NVAF would be effective to provide good information on dead potential volumes.
8. Mid term timber supply. Stakeholders are looking for information regarding where this will come from: - Additional information on existing structure of these stands desirable. -Additional data on future volume coming from the understory i.e. poles, sapling.	Low	Moderate to High	Moderate	New photo interpreted Estimates (Phase I) would be useful if photos show forest after the infestation is finished. Ground Sampling can give good information about current attributes and volumes of MPB stands. To study this in ground sampling project might identify strata that define this part of the population i.e. non-pine stands, pine less than 50%. May wish to modify small tree plot data collection to increased size or additional classes <sup>21</sup> .
9. Underestimate of site productivity. Current forest cover may underestimate site index. Chief Forester has directed obtaining better estimates in immature stands and better information in remaining stands. Also critical for priority setting i.e. for forest management activities.	Moderate	High	High	Phase I can provide better estimates of height for use in determining Site Index. Ground Sampling can provide data for Site Index based on current stands. Monitoring can provide data, over time. Monitoring is suited to targetting young managed stands to capture data on potential of the TSA .
10. Uneven-aged management (Douglas Fir) issues. Include top height and age	Moderate	Moderate		Phase I – VRI procedures have potential to provide data on multi-layered stands. Phase II – Data can be used to help check

<sup>21</sup> An investigation of the Dave Coates' paper (Research Branch) may result in several changes to the 'small tree plot' including increasing the size to a 3.99 m radius and adding several size classes so that all trees in the plot are tallied. This has been done on several other TSA's VRI projects where MPB has had an influence.



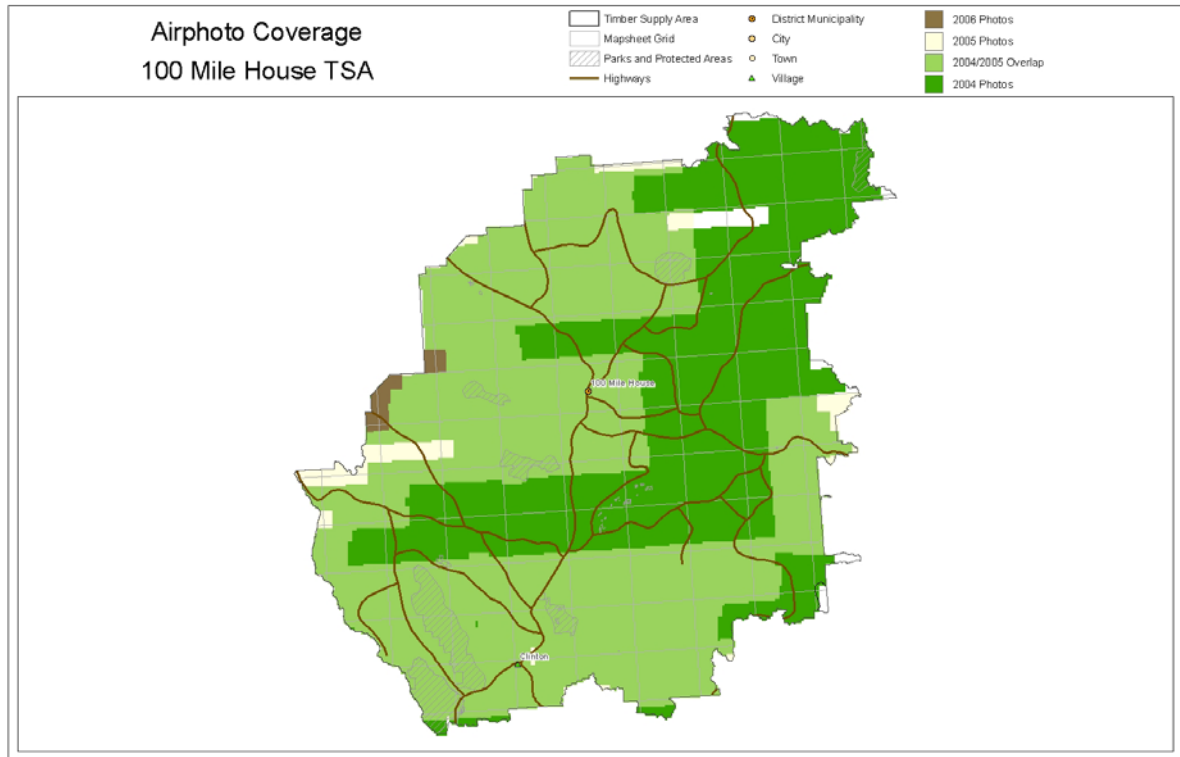
Issue	VRI Effectiveness			Remarks on VRI Effectiveness
	Photo-Interpreted Estimates	Ground sampling & NVAF	Monitoring	
measurements, potential incorrect volumes and inaccurate estimates of wildlife-related attributes i.e. crown closure.				the volumes assigned i.e. in the IDF.
11. Problem Forest Types. The attempt to better define PFT is based on the need but limited by the ability to identify merchantability criteria.	Moderate	High		New Phase I can verify/improve the estimates in these stands. Targeted Ground Sampling in these types will provide good data. Can also target this stratum in analysis. Since the attempt to better define PFT is based on the need but limited to the ability to identify merchantability criteria, NVAF destructive sampling in target species may help to improve the objectivity in the approach to PFTs.
12. Decay, waste and breakage. Desire better information on these.	Low	High		NVAF data will provide information on decay and waste. This data could be used to provide information to verify the current loss factors and adjust the photo-estimated inventory. Breakage is not part of the VRI system.
13. Landscape level biodiversity. -retention of structure in FTG blocks - identified age overestimation of the current inventory affecting assumptions regarding seral stage distribution.	Moderate	Moderate	Moderate	New Phase I followed by Phase II may improve age issue. Photo interpretation can provide more detailed information on non-forest attributes. Ground Sampling can provide data on Coarse Woody Debris, Forest Succession and ecology.
14. Ungulate winter range, Wildlife management areas. -managing for species at risk i.e. caribou	Moderate	Low		VRI attributes can be important to support wildlife issues i.e. species and age. New Phase I can provide finer delineation and specific attributes for non-forest areas. Ground sampling will show general incidence of lichens for caribou (TSA level overview), but not spatial extent.

## 2.7 VRI Activities and Products

### 2.7.1 VRI Photo Interpretation (Phase 1)

At the Stakeholder meeting, the Ministry of Forests Inventory staff provided an update on the age of the existing photos. The timeframe is illustrated on the map in Figure 5. It would appear that the majority of the TSA was flown in either 2004 or 2005.

**Figure 5: Photo coverage**



The following concerns suggest that the TSA would need new photos to undertake a Phase I project:

1. The government standard is that the photos cannot be older than 5 years at the outset of the project. This deadline is approaching since a VRI Phase I project would not be starting until 2009 at the earliest.
2. The available photo coverage does not reflect the changes to the forest based on various insect infestations. All technical advisors have recommended flying the TSA when the insect infestation is complete and ideally the needles have dropped to maximize the opportunity of typing the remaining live understory.

Once a photo set is acquired Phase I, including the delineation of new polygons and the estimation of new attributes, takes 2 to 3 years to complete.

There are several major differences between the standards of the previous inventory in the non-IFPA segment of the TSA and the VRI standards that are now in place including the following:

- A discrete value for height and age is required rather than a class (e.g. Height Class 2 = 10.5m -19.4m). Differences in height of 2-3 metres now require a new polygon.
- Equal emphasis is placed on stands of all ages and species. The older inventories tended to be biased toward mature timber and the commercial species of the time.
- In the areas with Unit Surveys, delineation should improve with a new inventory. The old inventory's linework is based on the Kail plotting to NTS map bases. The linework has since been spliced into the BCGS sheets, hand digitized and then rubber sheeted onto the TRIM base.
- The delineation and attribute collection on non-treed types is part of the VRI photo interpretation. There is greater attention paid to these types and the delineation is much finer. There are no more large polygons with an Alpine label. A polygon like this could be broken up into: bedrock, snow cover, shrub tall, shrub low, herbs, avalanche chutes, talus, etc.
- The Vegetation Resources Inventory collects attributes that were not collected in the previous inventory, including:
  - Timber: 2<sup>nd</sup> species, age and height, density, basal area, vertical complexity, tree cover pattern.
  - Ecology: site position meso, modifying process, surface expression, SMR, SNR.
  - Non treed types: Percentage covers for herbs, shrubs and non-vegetated types.
- VRI does not collect 'cultural' attributes – NPBR, NCBR, Alpine Forest, NP, Rock, Open Range, Swamp, NSR, etc. The photo interpreters now estimate what they see rather than making a 'cultural judgement' about the value. For example, Open Range might have a graminoid label with low tree Crown Closure (cc).

### **2.7.2 VRI Ground Sampling (Phase II)**

The VRI Ground Sampling phase requires a completed photo interpreted inventory – either new or existing. It involves the establishment of 'cluster' ground samples and the completion of Net Volume Adjustment Factoring destructive sampling. It must be followed up by a statistical analysis and adjustment of the photo interpreted database.

Recognizing that a Phase II project has already occurred on the existing inventory, a full scale Phase II project would only be undertaken in 100 Mile House following the completion of a new Phase I. In preparing a plan for Ground Sampling there are four areas where decisions must be made by the Stakeholders.

1. Developing the overall project design including the sampling population, the sample strata and working out the methodology to derive the number of samples that will be completed in the project.
2. Selecting activities to be completed in the project from the “ground sampling toolkit”:<sup>22</sup> Optional plot types in Phase 2 VRI sampling include:
  - O - Full VRI – includes timber and ecology data<sup>23</sup> collection. Coarse Woody Debris (CWD) and Succession are included as part of the ecological data.
  - Q - Timber Emphasis – tree information only is collected.
  - D - Timber Emphasis plus Coarse woody debris data.
  - T – Timber Emphasis plus Succession information.
  - Z – Timber Emphasis with Site Series
3. Seeking direction on the Net Volume Adjustment Factor Sampling from the Provincial Volume and Decay Forester, based on his overall experience and the initial NVAF project in 100 Mile House.

NVAF sampling involves a detailed stem analysis of sample trees, calculation of actual net volume, and the calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations). The NVAF data provides an adjustment factor that is used during sample compilation to produce unbiased estimates of net merchantable tree volume.

Net Volume Adjustment Factor sampling requires these actions:

- Step 1 – Based on the sample list developed for ground sampling, prior to fieldwork, a sub-set of the ground samples is selected to ‘enhance’ to provide the population from which a tree list is developed for the NVAF destructive sampling.<sup>24</sup>
- Step 2 - Sample trees are selected from this sub-set of the ground samples using the following considerations: age-class, strata, diameter and geographic distribution.

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<sup>22</sup> A complete listing can be found on page 30 of the VRI Ground Sampling Procedures.

<sup>23</sup> At this time, with the investment by the local licensees in the ecologically-based PEM inventory recently completed, the local Stakeholders feel that it is unlikely that any ecology data collection will be part of the Phase II ground sampling program.

<sup>24</sup> The selection of the NVAF samples and the trees to be destructively sampled is made in an unbiased manner according to the NVAF Standards.

- Step 3 – The sample trees selected in Step 2 are felled and sectioned to measure actual net volume according to the NVAF protocol.

#### 4. Considering any supplementary data collection.

Projects in other management units have included collection of 'supplementary data' that has since become part of the current VRI procedures. This includes collecting dead tree volume at the auxiliary plots and the merchantable wood assessment for NVAF. Following the lead of other MPB infested TSAs, the collection of additional data designed to provide Secondary Structure Attributes<sup>25</sup> is recommended in this TSA. To do this, the diameter of the 'small tree plot' would be increased from its "default" size of 2.50 metres in diameter to 3.99 metres. Adding two diameter classes would capture all live trees in the tally. This data collection is non-standard at this time. It would not be FIA fundable if it affected the bidding cost for ground sampling. But since the additional time requirement is minimal, this may not result in an increase in cost. It is important to note that if this data is collected, direction from the provincial specialists will be required to ensure its utility.

For this TSA, it is recommended that the preparation of the VPIP for Ground Sampling and NVAF be delayed until the photo interpretation activity is nearly complete. At that time, an additional Stakeholders' meeting would be advisable to review the Phase II activities and to provide focus to the operational plan for ground sampling.

## 2.8 Follow up Activities

### 2.8.1 Ground Sampling Analysis and Inventory Attribute Adjustment

At the completion of all VRI Phase I and Phase II activities, the data will be analysed and the inventory will be adjusted to the current MFR standards for the following attributes:

- Height
- Age
- Stems/hectare
- Basal Area (BA)
- Volume at 5 different utilization levels

The findings of the NVAF work (past and current) will be incorporated into this adjustment.

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<sup>25</sup> This data is being collected to support Dave Coates' work on Secondary Structure by providing further data at random sampling locations. There is a continued interest by the Chief Forester in post MPB TSAs. Personal communication with Dave Coates, January 16, 2009.

If it is a project objective to conduct analysis and discussions by species or species groupings, it is important to include this consideration when making decisions on the sample size at the planning stage.

In addition to the standard procedures' analysis, analysis should be completed related to any additional data collected. For the 'secondary structure data', cost recovery could be at the licensee's expense for both the data collection and compilation since this is beyond the VRI 'standard' procedures.

### **2.8.2 Monitoring**

Many TFLs and some TSAs have undertaken long term monitoring projects based on various identified business needs. Monitoring can provide data over time on such things as growth rates, changes to Criteria and Indicators, and successional information i.e. what follows Mountain Pine Beetle affected stands.

The focus of monitoring projects is to create an opportunity to answer questions about uncertainty in temporal forest management issues. These projects create the opportunity to track changes and trends in vegetation resources over time.

To conduct an effective monitoring program for a management unit, decisions for the project must be clearly defined including:

- What is to be monitored?
- Why is it being monitored?
- What is going to be done with the data?

During the VRI planning process, the Stakeholders may choose to delay their decision to develop a monitoring program. A plan can be incorporated later at the Project Implementation stage or through an amendment to the VPIP.

## **3. Inventory Plan Implementation**

### **3.1 Overview**

The Strategic Planning process is designed to investigate the current inventory's status and establish whether there is a Business Need for a new forest cover inventory. The 1994 audit and the 'Extended Analysis' suggested that the inventory was not reflecting accurate volumes in the operable landbase. The 1997 VRI planning exercise identified a list of Forest Management Issues, many of which are still outstanding today. In the TSR2 Rationale the Chief Forester recommended that a new VRI be completed for the TSA; in particular to improve the forest cover attributes. The VRI Phase II project corroborated the issues of the inventory. The Mountain Pine Beetle epidemic has further eroded the relevancy of the current inventory. In the AAC Rationale for TSR3 the Chief Forester recommended that a new inventory be undertaken in this TSA after the MPB epidemic has subsided.

This section of the Strategic Plan will take the theoretical discussions on the Vegetation Resources Inventory outlined in Sections 1.2, 2.6 and 2.7 and give direction to the VRI project specifically for this TSA. The Stakeholders will focus their planning efforts on a full VRI.

### **3.2 Phase I - Photo Interpretation**

Among its numerous benefits, a new Phase I would capture the remaining live tree volume in the TSA.

As the first step in undertaking a photo interpretation project, a decision must be made regarding the air photos that will be used on the project. Since the goal is to provide an inventory on the forest after the MPB epidemic, the timeframe of the project photos is critical. A presentation from the Regional Forest Health pathologist, Leo Rankin, at the Stakeholders' meeting identified the timelines on the attack in 100 Mile House. In 2004 and 2005, the MPB attack was at its beginning stages in this TSA. Therefore, the existing photos would not capture the post-beetle forest cover.

A real constraint to undertaking this project is photo acquisition at the optimum time to provide the best 'snapshot' of the forest. At the Stakeholders meeting, there was a desire to get this project underway. This enthusiasm needs to be tempered with the status of the beetle attack. The Forest Analysis & Inventory Branch staff point out that this is when the pine is grey and has dropped its needles.

Another consideration in planning a Phase I project is that the resource requirements are sizeable. Both funds (through a portion of the provincial

allocation from the Forest Investment Account inventory fund) and qualified interpreters are limited.

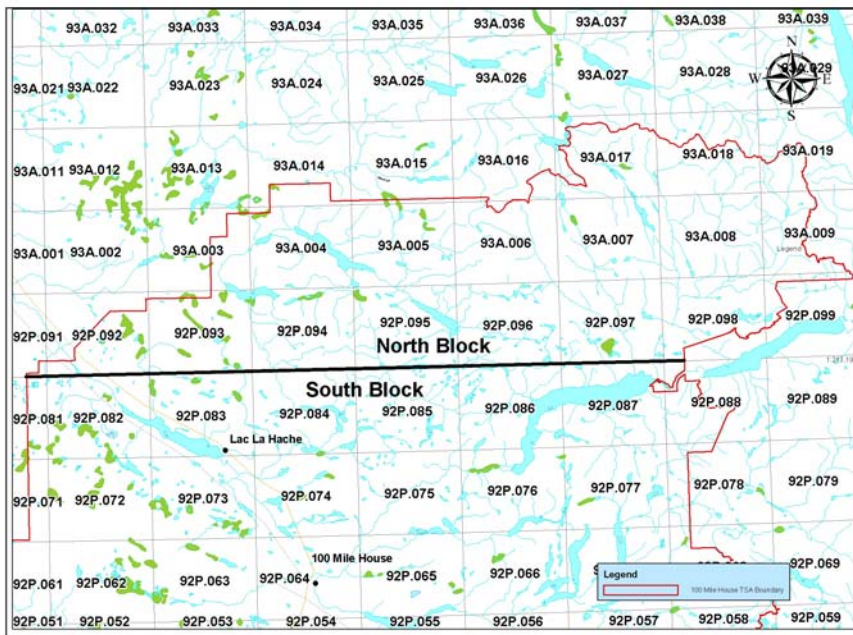
Fortunately, this is a relatively small TSA. One approach that has been suggested to get the project underway is to break down the project into two blocks. In the northeast section of the TSA, the bark beetle damage is complete. Starting here could allow a ‘phased’ approach to be undertaken. Figure 6 shows a possible boundary between the two blocks. Table 5 shows the area and mapsheet distribution between the two blocks.

The largest advantage of investigating this two phase option is that this could allow the project to proceed sooner as the North block could be flown sooner. Other advantages include the requirement of resources (both funding and contractors) being somewhat reduced on an annual basis and spread over a longer timeframe, the opportunity to ‘build’ on the first year in a subsequent year and gradually increase the project requirements. Disadvantages include the fact that unit costs may be increased by breaking the project down (i.e. the flight blocks would be smaller) and the Phase I project would be undertaken under a longer period.

**Table 5: Approximate VRI Project Block breakdown**

Project	North Block	South Block	Total
Total Area	205,000	795,000	1,000,000
Maps	22	85	
Full map equivalents	13.67	53	66.67

**Figure 6 – Delineation of North and South Blocks**





Note: All work will be undertaken by full mapsheet to the TSA boundary. If the 2 block approach is undertaken, the Ministry Forest Health pathologist suggested that we may want to proceed cautiously and keep the North Block project north of Canim Lake. The North block starts at mapsheet 92P091 and proceeds east and north to the TSA boundary.

The overall project landbase will include typing in the following:

- Private land
- Woodlots
- Parks

The VPIP for Phase II Ground sampling will identify whether these tenures will be included in the ground sampling population.

The trend in photo interpretation is softcopy technology. Softcopy refers to the project being done using digital air photos, on a computer screen. After the TSA is flown, the scanning of the photos, aerial triangulation and digital model building will occur before the project begins.

Once the appropriate timeframe has been decided, in relation to the completion of the MPB, ideally the Phase I project will proceed continuously (subject to funding). From start to finish, a Phase I project could be completed in 3 years overall.

With good project management, the delineation could be bid out and started in the same fiscal year in which the new photos are flown and produced. A decision on average polygon size or the desired number of polygons per mapsheet would be part of the Request for Proposal (RFP) to qualified contractors.

Fieldwork would follow in the next field season. The fieldwork is a mixture of ground and air calibration points completed throughout the project area. The goal is to improve the ability of the contractor to interpret the photos in the office by providing reference points with field measurements. The amount of fieldwork completed would be specified in the RFP and is determined by the forest management and inventory issues identified and approved funding levels. Other items to consider in the RFP are data source analysis and the field calibration plan which will assist with effective use of funding.

Attribute estimation follows the fieldwork.

At the Stakeholders' meeting, the addition of large format digital or conventional (LSP) photography to the project was discussed with regard to its ability to assist with field data collection. Large format photography has a variety of uses, from accessing remote or inaccessible areas to providing measurements or details of understory or brush conditions, heights, density, number of snags, etc. It creates

the opportunity to collect a large amount of data in a short time frame and have it available to revisit at any time without having to go back to the field. Its overall costs may be cheaper than any similar ground field visitation program. The VPIP for Photo Interpretation should include an assessment and decisions regarding adding a Digital Camera System to the 100 Mile House TSA Phase I project to augment the ground calibration.

### **3.3 Phase II Ground Sampling**

In the Vegetation Resources Inventory for 100 Mile House TSA, a Phase II ground sampling program, including NVAF will occur when the new photo interpretation is completed. The Phase I polygons are required to prepare the Phase II sample lists. The ground sampling will provide information on the quality of the photo interpreted inventory and ratios to be used to adjust the inventory.

#### **3.3.1 Inventory Objectives**

The objective of VRI ground sampling is to attain statistically valid timber volumes in the live and dead timber. A sample error objective of +/- 10% for overall inventory volumes, 95% probability will be targeted in a project.

#### **3.3.2 Target Population**

The target population selected for sampling in other TSA's is often the Vegetated Treed<sup>26</sup> landbase 30 year of age and greater.

#### **3.3.3 Sample Size**

The number of samples required to achieve the sampling error standard is a function of the variation of net volume with the inventory unit, estimated by the coefficient of variation (CV). For the previous 100 Mile House project (all of the TSA minus the IFPA area), 75 samples were required.

The current RISC standard 'Guidelines for the Preparation of a Project Implementation Plan for Ground Sampling and NVAF Sampling' recommends using the CV from the Inventory Audit, increased by 10% to account for differences in the sampling methodology to determine sample size. During the previous Phase II project, an analysis was undertaken partway through the project to reassess the sample size. Since the forest that has been inventoried post MPB will be changed from the one analysed in the Audit program, the Stakeholders may again choose to complete an interim project analysis to finalize the sample size.

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<sup>26</sup> B.C. Land Cover Classification Scheme

### **3.3.4 Sample Selection**

The sample selection will follow the Provincial VRI standard. The selection of sample polygons is based on stratified sampling using the Probability Proportional to Size with Replacement (PPSWR) sampling method.

In the previous Phase II project in the 100 Mile House TSA, the samples were post-stratified. Since that era, it is more common to determine strata when writing the Project Implementation Plan. The sample selection is also part of that planning process and the pre-stratified the population will be used as the basis to select and identify the samples.

It is recommended that stratification follows the trend at other VRI planning tables. Commonly, the strata are based on species or species groupings that are significant in terms of the landbase and the Stakeholder's identified interests. A decision on the number of strata should also consider that, from a statistical viewpoint, a stratum must be of sufficient size to derive adequate sample numbers to allow discussion and conclusions by individual stratum, in the analysis. This is generally understood to be a minimum of 15 samples in a stratum.<sup>27</sup> Otherwise, the analysis conclusions will be more general and may not provide stratum-specific answers.

In the VPIP, consideration is also given to weighting the strata. In an effort to simplify the analysis process, strata sizes are often based on their occurrence in the landbase.

### **3.3.5 Net Volume Adjustment Factor Sampling**

NVAF sample trees can be used to create statistical adjustments of loss factors and taper equations. The current NVAF sampling standard is the destructive sampling of 100 trees, 90 live and 10 dead. These samples are derived from approximately 30 ground samples. The objective is to achieve an overall sampling error of 7.5%.

At the Stakeholders meeting, the Provincial Volume and Decay Forester, Will Smith, presented the results of the NVAF sampling project completed in 2003 on the TSA. This data can be part of future NVAF analysis on this Unit. In the existing sample, 110 live and 5 dead trees were sampled. Destructive sampling of all major tree species, Fir, Pine and Spruce, achieved a sampling error of less than 5%. No additional sampling will be required in the live tree component of these species. The results of the 2003 project are available in the Addendum to the Analysis for the 100 Mile House TSA.

It is notable that the 2003 NVAF sample quantified the amount of sound wood fibre. Since that period, new NVAF sampling procedures have been adopted

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<sup>27</sup> Personal communication, MFR statistician, Sam Otukol.

to provide a measure of merchantable wood using modified scaling procedures.

The Southern Interior Forest Region and Forest Analysis & Inventory Branch Volume & Decay staff will provide guidance during the VRI planning process to ensure appropriate decisions are made regarding sampling strata, sample size and the live/dead ratio in this TSA. The Planning and Sampling Contractors representing the Licensees will work with the MFR to develop the NVAF ground sampling plan for the TSA. At the meeting, Will and the Stakeholders discussed future NVAF opportunities on this unit including:

Dead Pine – 20 to 30 trees for better estimates of merchantability  
Dead Spruce – 20 trees – based on the Spruce bark beetle issue on the Unit  
Live Cedar – 15 trees  
Live Balsam – 15 trees  
Live Aspen – 5 to 10 trees

### **3.3.6 Monitoring Plots**

Monitoring can provide data to fill information gaps over the long term. In developing a monitoring program, it is important to have identified long-term objectives. Sample locations can be selected using a grid across the landbase (i.e. using the VRI 100 m. grids) or through an area weighted selection process similar to Phase II ground sampling.

A small project was established in the TSA in 2006 to the Monitoring standard. It entailed collecting timber and ecological data on 20 pine leading locations selected from the 2001 and 2002 VRI Phase II samples. The goal of this initiative was to monitor the changes and trends over time of the timber and non-timber resources of MPB affected stands. This work was completed under the Federal Mountain Pine Beetle Initiative. Funding has not been secured for remeasurement.

No plans for the establishment of an additional Monitoring program were finalized at the Stakeholders' Meeting. Discussions with the Timber Supply staff following the meeting suggested that the "Phase II supplemental plots" discussed in Section 3.3.7 might be remeasured as Monitoring plots.

### **3.3.7 Phase II Supplemental Plots**

Recognizing that any 'planned' new VRI project will not be completed prior to TSR4, there was some discussion about how to provide the analysts with additional inventory information. Specifically, the focus was a method to provide some volume and mortality information that could be used in the analysis for the pine and the remaining live component of the forest. An innovative project that was discussed during the Stakeholders' Meeting was

revisiting the original VRI samples to collect relevant data to fill this information gap.

This project will be discussed further amongst the Stakeholders. If it is agreed to have potential, funding options will be pursued and a separate 'operational' planning process for this project will be undertaken.

### **3.3.8 Implementation**

Based on discussions at the Stakeholders' meeting, the following implementation schedule is suggested:

- 1) Acquisition of new photography, starting from the north. If the intent is to get the project started right away and funding follows, a block in the north could be flown as soon as 2009/10 fiscal year. Depending on timelines and available funds, a Phase I contractor could be engaged to complete the delineation of this block in the same fiscal year.
- 2) Acquisition of the photography for the remaining section of the TSA should not be undertaken any earlier than 2010/11. The decision may be to fly all of the TSA in one field season. Again, funding will be a driving factor.
- 3) Every effort should be made to compress the completion of all Phase I work in this TSA. It is not a large TSA, so resources should be applied to try to complete the inventory for each Block or the overall TSA in a 2 year timeframe.
- 4) VRI Phase II planning and ground sampling could be started at the beginning of the fiscal year following the completion of the Phase I. Tight timelines for the Phase I delivery may restrict the sample selection until the spring, but good project management would allow the completion of the sample selection, field package preparation and the VRI sampling in 1 fiscal year.
- 5) VRI Phase II sampling could be extended to two years. In Year I, the VPIP and sample selection would be finalized and an adequate number of samples would be completed to conduct an analysis to finalize the overall number of ground samples required. Of this initial data collection, all of the NVAF samples would be completed.
- 6) NVAF would follow in the second year of the Phase II project. The analysis and adjustment would follow post field season in Year 2.
- 7) The VRI Phase II 'supplemental' project can be completed in the first year that funds are made available so that this work will be completed prior to a future Timber Supply Review. The timeframe should be prior to 2011.

### **3.4 VRI Project Implementation Plans**

The next step in the planning process for the 100 Mile House TSA is to develop the Project Implementation Plans for Phase I and/or Phase II, based on the VRI work decided in this VSIP. As stated in Section 1.4, a unique Project Implementation Plan is required for each Phase of the VRI project prescribed. The VPIP will finalize and document details, following further recommendations and direction provided by the Stakeholders. Section 2.7.2 recommends that the VPIP for Phase II be written once the Phase I is near completion, so that it is relevant for an operational ground sampling project.

If a Phase II 'supplemental' project is to be undertaken, it should also have a Project Plan completed. This will ensure that all Stakeholders have been consulted and will serve as part of the permanent record of this process.

### **3.5 Roles and Responsibilities**

This section of the VSIP outlines organizational roles and responsibilities in a VRI project.

Licensees – usually under the guidance of a “Lead” Licensee:

- Initiate inventory projects through the FIA funding process to support planning of VRI inventories.
- Prepare requisite plans for inventory work. The VSIP establishes the overall VRI strategy. A VPIP is prepared prior to undertaking a specified VRI activity in a Management Unit.
- Inform other Stakeholders of the planning process and involve them in the project i.e. MFR and other key government agencies.
- Submit Strategic and Project Implementation plans to the appropriate MFR Regional office staff for their support, review and sign off.
- Sign off final approved edition of project plan(s).
- Apply to Price-Waterhouse Coopers for approval of project funding based on approved Plans.
- Complete the RISC inventory activities following the appropriate Standards and Procedures outlined in the Implementation Plan.
- Submit data from completed projects to the MFR/Provincial Data Warehouse (as appropriate).

MFR – Regional Office, Vegetation Resources Inventory Section

- Provide mentoring and advice regarding the Vegetation Resources Inventory methodology.
- Coordinate plan review within the MFR.
- Provide expertise to projects as they are ongoing.
- Facilitate the acceptance of the data as is appropriate.

- Review and provide feedback on the independent third party Quality Assurance Reports (QA).
- Assist and provide advice on the competitive bidding process.

MFR – Forest Analysis & Inventory Branch, Inventory Section

- Sign off final approved edition of project plan(s).

Involvement in the process by all identified Stakeholders is important to ensure that the plan is based on local knowledge and the project reflects local objectives and requirements. Documentation of opportunities for all Stakeholders to be involved in the planning process will be maintained on the project files. Files will be created by the Planning Contractor to be retained by the Lead Licensee and VRI Inventory staff in the Regional office. This includes the Stakeholder meeting agenda, record and presentations. All Stakeholders will be provided with the opportunity to review editions of the draft Strategic Implementation Plan prior to sign off.

### 3.6 Costs

**Table 6. Estimated sample sizes and costs for VRI Phase I and II activities in 100 Mile House TSA**

VRI Activity	Sample Size	Unit Cost	Total Cost
<u>PRELIMINARY PLANNING</u>			<b><u>\$50,000</u></b>
<u>PHOTO INTERPRETATION</u>	1,000,000 ha <sup>28</sup>	\$1.45 (includes Photo acquisition-\$0.30/ha, Photo interpretation-\$1.10/ha, Project Mgmt & QA-\$0.05/ha)	<b><u>\$1,450,000</u></b>
<u>GROUND SAMPLING</u>			
Contract administration-2 years			\$20,000
VPIP & package preparation			\$25,000
Timber Emphasis Plots – timber data collection	100	\$1,500/sample	\$150,000
NVAF destructive sampling	90	\$750/tree	\$67,500
Helicopter access-estimate			\$20,000
Mentoring & Quality Assurance-Timber plots			\$15,000
Mentoring and QA-NVAF			\$12,000
Final Compilation/analysis and inventory file adjustment			\$20,000
<b>Total Phase II</b>			<b><u>\$329,500</u></b>

**Table 7. Estimated funding breakdown for Phase II “Monitoring project”**

<u>Phase II Monitoring project</u>			
Project Management & QA Administration – includes			\$15,000
Sample Establishment Planning, Sample Selection&GIS	60	\$1,000/sample	\$60,000 \$incl. in planning (above)
Analysis			\$15,000
<b>Total Phase II Monitoring</b>			<b><u>\$90,000</u></b>

<sup>28</sup> Based on the approximate Crown Land section of the TSA. Area will be finalized in subsequent planning processes and contracts.



**Table 8. Sample size and estimated funding breakdown for establishment of a VRI Monitoring project**

<u>MONITORING</u>			
Contract Administration – includes GIS work			\$8,000
Sample Establishment	25	\$2,500/sample	\$62,500
Helicopter Access			\$5,000
Mentoring	1 crew	\$1,000	\$1,000
Quality Assurance		\$4000	\$4,000
<b>Total Monitoring</b>			<b>\$80,500</b>

**Table 9 - Estimated funding breakdown by year, based on timing of VRI activities**

Year	VRI Phase	Activity	Costs
Preliminary year -2008/09		All costs for plan preparation and 'Phase II Monitoring study' – strata development and GIS	\$50,000
<b>Preliminary Year Total</b>			<b>\$50,000</b>
Year 1	Phase II Re-measurement	Project Management & QA	\$15,000
		Ground sampling – 60 samples	\$60,000
		New strata work & GIS work	\$0
		Analysis	\$15,000
	<i>Sub total</i>	<i>Phase II Re-measurement</i>	<i>\$90,000</i>
	Phase I	Block 1 Digital Air Photo Acquisition & Block 1 Delineation	\$92,250
<i>Subtotal</i>	<i>Phase I</i>	<i>\$92,250</i>	
<b>Year 1 total</b>	<b>All phases</b>		<b>\$182,250</b>
Year 2	Phase I	Block 1 Field work & Completion Activities	\$205,000
		Block 2 Digital Air Photo Acquisition & Block 2 Delineation	\$357,750
<b>Year 2 total</b>			<b>\$562,750</b>
Year 3	Phase I	Block 2 Field work & Completion Activities	\$795,000
	Phase II	VPIP for Phase II & package preparation	\$25,000
<b>Year 3 total</b>			<b>\$820,000</b>

Year 4	Phase II	Field sampling – 100 samples, Project Management & QA	\$190,000
<b>Year 4 total</b>			<b>\$190,000</b>
Year 5	Phase II	NVAF and Analysis	\$114,500
<b>Year 5 total</b>			<b>\$114,500</b>
<b>Grand Total</b>			<b>\$1,919,500</b>

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# VRI Standards & Procedures

The most recent edition of the **Vegetation Resources Inventory Standards and Procedures** will be followed for the completing this project. They are located at the website:

<http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm>

The following is a list of the critical VRI Standards and Procedures:

## **Photo Interpretation**

Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Photo Interpretation, Version 2.2, May 2008

Vegetation Resources Inventory Photo Interpretation Procedures Version 2.4, March 2002

Vegetation Resources Inventory Photo Interpretation Standards and Quality Assurance Procedures, Version 3.1, May, 2008

Vegetation Resources Inventory Air Call Data Collection Procedures and Standards, Version 2.1, June 2007

Vegetation Resources Inventory Ground Call Data Collection Procedures and Standards Version 3.1, June 2007

## **Ground Sampling:**

Strategic Inventory Planning (VSIP), January 2005

Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling and Net Volume Adjustment Factor Sampling Version 3.0, May 2007

Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling Version 3.3, December 2002

Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling Version 3.3 Errata No. 1, April 2005

Vegetation Resources Inventory Ground Sampling Procedures Version 4.8, May, 2008

Ground Sampling Procedure Appendices Version 4.5, March 2004

Vegetation Resources Inventory Ground Sampling Quality Assurance Procedures and Standards for VRI Ground Sampling version 3.1, March 2008

Vegetation Resources Inventory Data Collection Standards for VRI Ground Sampling Version 2.1, March 2006

Vegetation Resources Inventory Ground Sampling Data Collection Procedures for Inaccessible Samples Version 1.0, March 2003

Net Volume Adjustment Factor Sampling Standards and Procedures Version 4.3, May 2008

Net Volume Adjustment Factor Sampling Standards and Procedures Version 4.2, Addendum, April 2007

### **VRI – Analysis and Adjustment**

Vegetation Resources Inventory Procedures and Standards for Data Analysis Attribute Adjustment and Implementation of Adjustment in a Corporate Database Version 2.0, March 2004

### **Monitoring**

National Forest Inventory BC Change Monitoring Procedures for Provincial and National Reporting Version 1.4, March 2005

Change Monitoring Inventory Ground Sampling Quality Assurance Procedures Version 1.1, March 2002

Change Monitoring Inventory Ground Sampling Quality Assurance Standards Version 2.1, May 2007





# Appendix A

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## Attendance at Stakeholders' Meeting



**Stakeholders' Meeting  
November 12, 2008, West Fraser Boardroom, Chasm, B.C.**

Meeting initiated and lead by Nona Phillips, Inventory Contractor

<b>Participant</b>	<b>Affiliation</b>
Sara Johnson	Silvicultural Forester, 100 Mile House Lumber
Ken Wolfe	Planning Forester, 100 Mile House Lumber.
Marino Bordin	Planning Forester, Interfor, Adams Lake
Catherine Cunningham	Practices Forester, BC Timber Sales, Kamloops Timber Sales Office, 100 Mile House Satellite Office
Dawn State	Practices Forester, BC Timber Sales, Kamloops Timber Sales Office, 100 Mile House Satellite Office
Zoran Boskovic	Planning Officer, BC Timber Sales, Kamloops Timber Sales Office, Kamloops
Candice Steinke	GIS Analyst, BC Timber Sales, Kamloops Timber Sales Office, Kamloops
Christine Lohr	MFR, Stewardship Officer, 100 Mile House District
Jim Grace	MFR, VRI Inventory Forester-Phase I, Southern Interior Forest Region, Kamloops
Matt Makar	MFR, VRI Inventory Forester-Phase II, Southern Interior Forest Region, Kamloops
Erin Hunter	MFR, VRI Inventory Forester, Southern Interior Forest Region, Kamloops
Gary Johansen	MFR, Planning, Forest Analysis & Inventory Branch, Victoria
Will Smith	MFR, Volume & Decay Sampling Officer, Forest Analysis & Inventory Branch, Victoria

Graham Hawkins	MFR, VRI Team Leader, Forest Analysis & Inventory Branch, Victoria
Nola Daintith	MFR, Silviculture Practices Forester – Forests for Tomorrow, Southern Interior Forest Region Williams Lake
Leo Rankin	MFR, Regional Entomologist, Southern Interior Forest Region, Williams Lake
John Stace-Smith	Contract Forester, Williams Lake

Other Stakeholders invited but who could not attend:

Dave Conly – Tolko Industries Ltd.

John Kalmokoff – Canim Lake Band – In discussions, John has offered support for the project but could not attend the meeting.

Mike McDonough – Canoe Creek

Mark McGirr – ILMB, GIS, Williams Lake

MoE – Roger Packham, 100 Mile House. John Youds in Williams Lake was also contacted.

Jeff Stone, Albert Nussbaum, Barry Snowden – MFR – Timber Supply Analysis group. Jeff is the 'local' contact but could not attend. Albert Nussbaum was contacted for an alternate and Barry Snowden who completed TSR3 for 100 Mile House TSA was also contacted.

Mike Simpson – Woodlot Forester for the Associations in 100 Mile House & Williams Lake.

# Appendix B

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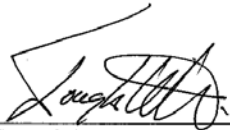
VSIP Approval Signature Page

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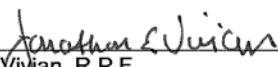
**100 Mile House Timber Supply Area Vegetation Resources  
Inventory Strategic Inventory Plan Approval**

The 100 Mile House TSA Vegetation Resources Inventory Strategic Inventory Plan was prepared in consultation with Ministry of Forests & Range staff. I have read and concur that this plan, dated January 16, 2009, meets current VRI standards, business needs and considerations. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan. .



Doug White, Woodlands Manager  
100 Mile House Lumber (*Lead proponent*)

January 20<sup>th</sup>, 2009  
Date



Jon Vivian, R.P.F.  
Manager  
Vegetation Resource Inventory  
Forest Analysis and Inventory Branch  
Ministry of Forests and Range

09.01.29  
Date