
Fort Nelson Forest District

Vegetation Resources Inventory
Strategic Inventory Plan (VSIP)
Revision for 2006-2010

Prepared by:
IRC Spatial Data Group Inc.
November, 2006

Executive Summary

On behalf of the Ministry of Forests and Range (MoFR), Canadian Forest Products Ltd. (Canfor) is planning to complete a Vegetation Resources Inventory (VRI) on approximately 3,189,547 hectares or approximately 34% of the almost 9.9 million hectares in the Fort Nelson TSA. The objective of the inventory is to update the existing inventory to VRI standards in order to provide suitable data required to address today's forest management planning issues and improve the current inventory. The last inventory completed in the project area was conducted more than 30 years ago in the early 1970's. This outdated inventory does not meet current forest planning needs and creates significant uncertainty in many forest management decisions particularly the determination of Fort Nelson Allowable Annual Cut. The VRI program for this area is planned for the eastern and northern portions of the TSA along the Alberta and Northwest Territory borders, respectively.

The objectives of this VRI strategic Plan (VSIP) are to:

- outline the different VRI activities and products required to address the forest management and inventory issues as identified in the *Rationale for AAC Determination (TSR2 2001)* and other documents relating to forest inventory issues for the project area;
- provide general strategic direction for implementing inventory activities;
- provide the plan required for obtaining Forest Investment Account (FIA) funding; and
- provide the foundation for the VRI Project Implementation Plan (VPIP).

The VSIP was prepared from communications with numerous organizations that may have an interest in this new inventory and in accordance with current MoFR standards and guidelines.

Funding for the 2006 fiscal year has been approved for \$750,000. No funding beyond this current year has been approved although MoFR have indicated the Provincial Government's intentions are to continue its present provincial funding levels for VRI at least for the next two years.

The current forest inventory for the Fort Nelson TSA ranges in vintage from 1970 to 2002 with about two thirds completed prior to 1990. There are 835 mapsheets covering the TSA of which only 273 have been completed to VRI standards. This program is aimed at completing an additional 253 mapsheets to VRI standards.

The TSA contains three biogeoclimatic zones including the Boreal White and Black Spruce (BWBS), Spruce Willow Birch (SWB) and Alpine Tundra (AT). The dominant biogeoclimatic zone is the BWBS zone which covers about two-thirds of the TSA. Currently, 84% of the forests in the Crown Forest Land Base (CFLB) are between 31 and 160 years of age

The Chief Forester states in his AAC determination (2001) that an improved inventory will be critical in reducing uncertainty in future determinations. District and Regional MoFR staff believes the most significant issues related to the existing older forest inventory are:

- broad typing
- incorrect species
- incorrect estimate of site productivity
- poor mapping of forest stand boundaries
- poor estimation of understorey spruce.

- poor distinction between black and white spruce stands

The VRI activities proposed in this plan include:

- a. Phase I - photo interpretation
- b. Phase II - ground sampling for timber and ecology
- c. Inventory Analysis and Adjustment of the Photo Interpreted Estimates

These activities will be completed over the next 5 years and the entire VRI program will require an estimated total funding between **\$6,221,943.00 to \$6,282,893.10**, or an average of approximately 1.25 million dollars per year.

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1.0 INTRODUCTION

1.1 Background

On behalf of the Ministry of Forests and Range (MoFR), Canadian Forest Products Ltd. (Canfor) is planning to complete a Vegetation Resources Inventory (VRI) on approximately 3,189,547 hectares or approximately 34% of the almost 9.9 million hectares¹ in the Fort Nelson TSA. The objective of the inventory is to update the existing inventory to VRI standards in order to provide suitable data required to address today's forest management planning issues and improve the current inventory. The last inventory completed in the project area was conducted more than 30 years ago in the early 1970's. This outdated inventory does not meet current forest planning needs and creates significant uncertainty in many forest management decisions particularly the determination of Fort Nelson Allowable Annual Cut. The VRI program for this area is planned for the eastern and northern portions of the TSA along the Alberta and Northwest Territory borders, respectively.

The objectives of this VRI strategic Plan (VSIP) are to:

- outline the different VRI activities and products required to address the forest management and inventory issues as identified in the *Rationale for AAC Determination (TSR2 2001)* and other documents relating to forest inventory issues for the project area;
- provide general strategic direction for implementing inventory activities;
- provide the plan required for obtaining Forest Investment Account (FIA) funding; and
- provide the foundation for the VRI Project Implementation Plan (VPIP).

The VSIP was prepared from communications with numerous organizations that may have an interest in this new inventory. Specifically, the following organizations were contacted and informed of the project and were given the opportunity to provide input towards this plan:

Licensees

- Canfor Fort Nelson

BC Government

- MoFR – Branch, Region and District
- BC Timber Sales
- Ministry of Environment – Parks, Ecosystems
- Ministry of Tourism, Sports, Arts
- BC Oil and Gas Commission

¹MoFR. Source Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

First Nations

- Fort Nelson
- Prophet River
- Fort Liard
- Kaska Dena
- Dene tha

Other Non-Government Resource Sectors

- Canadian Association of Petroleum Producers
- Encana Corporation
- Information Land Management Bureau

Many of the organizations have a need for the VRI products as they become available. A list of the people contacted during the preparation of this VSIP is provided in Appendix 1.

IRC Spatial Data Group Inc. (IRC) through a collaborative process worked with MoFR and Canfor staff to develop this strategic plan. The MoFR is responsible for approving this plan.

Given that the TSR 3 document was not available during the time of writing and the area to be inventoried is similar to the area inventoried in the central portion of the TSA between 1999 and 2004, the MoFR and Canfor agreed to use the December 1998 VSIP as a basis for this VSIP².

This document has four main sections. The first section provides an overview of the VRI process and over riding principles. The second section provides the business consideration for the inventory including a general description of the land base, inventory history and the forest management and inventory issues. The third part of the VSIP provides the inventory plan and the VSIP concludes with an implementation strategy.

1.2 The Vegetation Resources Inventory

VRI was developed and implemented following the recommendations of the 1991 report *The Future of Our Forests* produced by the Forest Resources Commission.³ Development and implementation of the VRI was conducted by a group of specialists, representing government, industry, and academia as well as the consulting community.

The Vegetation Resources Inventory is designed to answer two questions:

1. Where is the resource located?
2. How much of a given vegetation resource (for example, timber or coarse woody debris) is within an inventory unit?

VRI is conducted in two distinct phases. Phase I - Photo Interpretation and Phase II - Ground Sampling.

The photo interpretation phase identifies the location of the forest resources of the entire project area through delineation of polygons. For each polygon identified numerous attributes are

² October 18, 2006 Meeting of Technical team (MoFR, Canfor & BCTS) Meeting in Fort Nelson

³ MoFR. Fort Nelson Forest District Vegetation Resources Inventory Strategic Inventory Plan Dec. 29, 1998

estimated based upon aerial photographs or digital images, existing information and data collected through a combination of air and ground field calibration points. Attributes estimated include land cover type, numerous tree, ecological, non-treed (shrubs, herbs, and bryoids) and non-vegetated (roads, lakes, talus slopes, etc.) attributes.

The ground sampling phase provides the information necessary to determine how much of a given characteristic is within the inventory area. A random sample using a standard sample selection process of polygons identified in the first phase is determined based on achieving a sampling error of +/- 10% for all units with a 95% probability for the target population. Samples are established in the field and data is rigorously collected for trees, site, soils, plants, succession, coarse woody debris, and range values. The samples are "plot clusters" and consist of a main plot with up to 4 associated auxiliary plots.

As part of the ground sampling phase, destructive sampling is required to determine a Net Volume Adjustment Factor (NVAF). This sampling involves detailed stem analysis of sample trees that have been randomly selected from the Phase II plots. NVAF sampling collects data that is used to account for errors in the estimates of merchantable tree volume. The NVAF is calculated from the ratio of actual to estimates of sample tree volumes and is applied as a correction to VRI ground sample volumes. This data, used in conjunction with the original ground sampling data, provides an unbiased estimate of the net merchantable volume in the project area.

Using the results of the Phase II sampling data, the relationship between the polygon estimates and ground samples is used to adjust the photo interpreted polygon estimate. An adjustment of every polygon for the entire VRI project area is completed to provide a statistically valid new inventory.

Prior to commencing each VRI phase, a *Vegetation Resource Inventory Project Implementation Plan (VPIP)* must be completed and subsequently approved by the MoFR.⁴

1.3 VRI Overriding Principles⁵

VRI procedures are being implemented throughout British Columbia. The implementation is based on the following guidelines:

- To implement inventory projects to satisfy business needs as defined in the VSIP and VPIP documents. The VSIP (this document) identifies the general strategic forest management and inventory issues for a unit of land, and indicates the activities and products required to address those issues; the VPIP identifies the operational priorities and spatial locations for proposed VRI activities.
- To develop VRI products in a coordinated and structured way. For instance, photo interpretation activities are implemented in logical units (e.g., mapsheets or watersheds), all land areas within these units are included, all VRI attributes are interpreted, etc.
- To implement inventory projects following approved VRI implementation standards.

⁴ MoFR. VRI Lakes TSA Planning Meeting July 7, 2006 PowerPoint Presentation

⁵ MoFR Fort Nelson Forest District Vegetation Resources Inventory Strategic Inventory Plan Dec. 29, 1998

- To ensure that photo estimated attributes are subsequently adjusted using phase II ground sampling data with the objective of quantifying resource values with better statistical confidence.

These overriding principles address the issues and recommendations identified in the Forest Resources Commission's 1991 report *The Future of Our Forests*. The report identified that forest inventories lacked adequate information on non-timber values or measurements of accuracy and precision, and maintained a narrow focus on commercial timber volumes and the operable landbase.

1.4 Overview of VRI planning process⁶

This VSIP was developed following the MoFR VRI planning process, which is an important component of the overall VRI process and linkages. The overall VRI process and linkages include:

1. Forest management decision processes (land integration planning)
2. Identification of forest management issues
3. VRI strategic planning (VSIP)
4. VRI implementation planning (VPIP)
5. Implementation, development and maintenance of procedures and standards
6. Data analysis

The VRI planning process involves developing the Strategic Inventory Plan (VSIP) and Project Implementation Plan (VPIP) that identify resource specific management issues, desired inventory products, and priorities. The VSIP outlines the VRI products required to address forest management issues and provides strategic direction for implementing inventory activities.

The VPIP is a work plan that details the operational activities identified in the VSIP and identifies the specific project areas, priorities, roles and responsibilities, schedules and budgets for photo interpretation projects and ground sampling & NVAF activities.

This VSIP was developed under the MOFR VRI planning process. Specific documents that were referenced included guidelines for *Preparing a VRI Strategic Inventory Plan (VSIP) for Ground Sampling and Photo Interpretation* available at

http://www.for.gov.bc.ca/hts/vri/standards/plan/preparing_vri_strategic_inventory_plan.doc

Other referenced documents used in this report include:

- Fort Nelson Forest District December 29, 1998 VSIP
- Fort St John Forest District January 13, 1999 VSIP
- The Fort Nelson TSA Timber Supply Review (TSR3) (Analysis and Data Package) 2005
- The Fort Nelson TSA TSR2 *Rationale for AAC Determination* 2001

In addition, the <http://www.for.gov.bc.ca/hts/vri> website was also visited to obtain additional information.

⁶ MoFR Fort Nelson Forest District VRI Strategic Plan December 1998

1.5 Funding

The implementation of the inventory program described within this VSIP is currently subject to funding from the provincial Forest Investment Account (FIA). Funding for the 2006 fiscal year has been approved for \$750,000⁷. No funding beyond this current year has been approved although MoFR have indicated the Provincial Government's intentions are to continue its present provincial funding levels for VRI at least for the next two years.

Funding for inventory activities in future years is anticipated to come from the current Forest Investment Account (FIA) or similar funding mechanisms. Currently, the process for annual funding requirements involves Canfor requesting funds from Price Waterhouse Coopers through the FIA account and MoFR prioritizing the project within the provincial framework.

Additional information on the current funding mechanism can be found at the following website:

http://www.for.gov.bc.ca/hts/fia/vri_business_flow2006.pdf

⁷ Darrell Regimbald. 2006. Canfor Fort Nelson. Forester. Personal Communication

2.0 BUSINESS CONSIDERATIONS

2.1 Land and Resource Base

The Fort Nelson TSA is located in the north-eastern corner of British Columbia and is the second largest timber supply area in the province, covering almost 9.9 million hectares.⁸ The TSA is bordered to the east by Alberta, to the north by the Northwest and Yukon Territories, to the west by the Cassiar TSA and on the south by the Fort St. John and Mackenzie TSAs. The entire region is within the Arctic watershed and is largely drained by the Liard River and its major tributaries include the Fort Nelson, Prophet, Muskwa, Toad, Kechika and Petitot rivers⁹. A smaller area in the eastern portion of the TSA is drained by the Hay River system.

The topography forms a gradient of increasing relief as the landscape changes from boreal forests in the east to the mountainous terrain of the Rocky Mountains in the west.

In 2005 the population of Fort Nelson, the main community in the TSA where approximately 75% of the population lives, was estimated to be 6607¹⁰. Smaller communities in the TSA include Prophet River, Toad River and Muncho Lake. Eight First Nations communities are located or have a traditional territory within the Fort Nelson TSA¹¹ including:

- Fort Nelson First Nation
- Dene Tsaa TSE K’Nai First Nation
- Halfway River First Nation
- Tahltan First Nation
- Dena tha’ First Nation
- Fort Liard First Nation
- Lower Post First Nation
- Dease River First Nation

As of 2001, the TSA consisted of 39 parks, protected areas and ecological reserves totaling 1,052,516 ha or 10.7% of the TSA¹². The TSA contains three biogeoclimatic zones including the Boreal White and Black Spruce (BWBS), Spruce Willow Birch (SWB) and Alpine Tundra (AT). The dominant biogeoclimatic zone is the BWBS zone which covers about two-thirds of the TSA. Table 2.1 provides a summary of key information about each of the BEC zones within the TSA

Table 2.1: Biogeoclimatic Zones of the Fort Nelson Timbers Supply Area¹³

Zone	General Description	Tree Species	Area (ha)	Percent (%)
Boreal White and Black Spruce	- Covers most of the eastern portion of the TSA - elevation up to 1300 meters. - characterized by long, very cold winters and short growing season	Dominant : white spruce, black spruce, lodgepole pine, trembling aspen. Minor : balsam poplar, tamarack, subalpine fir, common paper birch and Alaska paper birch	6,808,966	69
Spruce Willow Birch	- found on middle elevations of northern Rocky Mountains, Cassiar Mountains and much	Lower Elevation Dominant : White spruce and	1,677,572	17

⁸ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

⁹ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹⁰ Source: Statistics Canada

¹¹ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹² MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹³ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

	of the Liard Plateau - elevation 1300 m to 1500m - Winters long and cold, summers short and cool. - Harshest climate of all forested zones in BC.	subalpine fir Minor: black spruce, lodgepole pine and trembling aspen Upper Elevations – dominated by tall deciduous shrubs including birch, and willow		
Alpine Tundra	- Above 1500 meters in Southwest side of TSA - Harshest climate of all BC zones	Trees generally absent Plants are small, close to ground and often widely separated by bare soil or rock	1,381,529	14
Total			9,868,067	100

The Fort Nelson TSA contains a large portion (42%) of non-productive, non-forest and/or non-crown land. The remaining 58% of the land base is considered productive forest. The majority of the stands in the TSA are dominated by Aspen which covers about 40% of the Timber Harvesting Land Base (THLB). Spruce dominates about 33% of the THLB while Pine, Cottonwood, and Balsam dominate in 23.5%, 3% and 0.5% of the THLB, respectively¹⁴.

Currently, 84% of the forests in the Crown Forest Land Base (CFLB) are between 31 and 160 years of age¹⁵.

A summary of the Timber harvesting land base determination for the Fort Nelson TSA is found in table 2.2.

Table 2.2 Fort Nelson TSA – Area Summary¹⁶

Classification	Net Area Removed (ha)	Percentage of TSA	Percentage of Productive Forest Area (CFLB)
Total TSA Area	9,868,067		
Private land, federal land, woodlots	29,927		
Area Managed by the MoFR	9,838,140	100	
Non-forest, non-productive, no typing	3,705,856	37.67	
Alpine	3,006	0.03	
Non-commercial cover	350,671	3.56	
Existing roads, trails and landings	46,686	0.38	
Total Productive Crown Forest land Base (CFLB)	5,741,212	58.3	100
Parks, UREPS and Ecological Reserves	371,322	3.77	6.87
NSR from wildfire, non-productive or misclassified	76,632	0.78	1.33
Non-merchantable	250,253	2.54	4.36
Low timber productivity	2,729,564	27.74	47.54
Riparian reserve	190,667	1.94	3.32

¹⁴ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹⁵ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹⁶ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

Environmentally sensitive areas	122,878	1.25	2.14
Unstable terrain	9,197	0.09	0.16
Wildlife range burns	27,109	0.28	0.47
Stand-level biodiversity	367	0.00	0.01
Seismic areas	26,026	0.26	0.45
Inoperable areas	361,670	3.68	6.30
Black spruce leading stands	143,258	1.46	2.50
Total Reductions to CFLB	4,308,943	43.80	75.05
Current Timber Harvesting Land Base	1,432,269	14.56	24.95
Future roads, trails and landings	29,285	0.30	0.52
Future stand-level biodiversity (WTP)	6,272	0.06	0.11
Future Timber Harvesting Land Base	1,396,172	14.15	24.32

2.2 Inventory History and Issues

The current forest inventory for the Fort Nelson TSA ranges in vintage from 1970 to 2002 with about two thirds completed prior to 1990. There are 835 mapsheets covering the TSA of which 32.7% or 273 have been completed with a VRI phase I inventory from 1999 to 2002. Ground and NVAF sampling was conducted on 249 of the 273 mapsheets followed by attribute adjustments being completed between 2003 and 2004¹⁷.

The remaining two thirds of the TSA was completed to “traditional” inventory standards and “rolled over” into VRI format. Although the data is in a VRI format, many of the VRI data attributes fields are blank as no information was available from the traditional inventory databases nor new data been gathered. Table 2.3 provides a list of the major inventory dates, the type of inventory, general location and approximate coverage of the TSA and is shown on a map in figure 2.1.

Table 2.3 – Fort Nelson TSA – Current inventory Status¹⁸

Year of Inventory	Type of inventory	General location	Approximate Percent of TSA completed
1971 & 1972	Traditional	Eastern portion of TSA along the Alberta and Northwest Territory border	16
1973 & 1974	Traditional	Western portion of TSA	16
1980	Traditional	Central southeastern portion of TSA	13
1989	Traditional	North Central portion of TSA	2
1999 – 2004	VRI with 30% completed with Phase II combined with NVAF and adjustment	Central portion of TSA	33
Unknown	Traditional	Western portion of TSA	20
Total			100

¹⁷ MoFR Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

¹⁸ Ocular estimate based on figure 2.1

In 1996, the inventory standards in BC changed significantly to meet current forest planning requirements. The older inventory information for the Fort Nelson TSA collected prior to 1996 used methods that are below the current acceptable standard. In addition, in many cases, the photos used as the basis for this inventory information are even older than the inventory year and taken to a standard not acceptable by current practice.

District and Regional MoFR staff believes the most significant issues related to the existing older forest inventory are¹⁹:

- Broad Typing²⁰ - The standards for delineation for past inventory are much broader than current VRI standards. The recent VRI project area completed in the TSA resulted in significant increases in the Timber Harvesting landbase due to the finer level of delineation. Issues related to broad typing will be resolved with the new inventory
- Incorrect Species²¹ - Incorrect species is a result of the variability within the polygon due to the broad typing of stands and also species conversion caused by successional pioneer species (e.g. Aspen) being replaced by climax species (e.g. white spruce). VRI will reduce variability in a stand and identify climax species that are now detectable on the photography that have grown into the main stand canopy.
- Incorrect Estimate of Site Productivity²² - Incorrect site productivity estimates are a result of the variability within the polygon due to the broad typing of stands and procedures for estimating tree height and age. Tree height and age were estimated by classes rather than specific stand height and age estimates. VRI will improve the site productivity estimates by reducing variability in stands and provide actual tree heights and ages to refine site productivity estimates.
- Poor Mapping of Forest Stand Boundaries²³ - Poor mapping of forest stand boundaries is a result of using instruments with lower accuracy for mapping in the past resulting in less accuracy of the data than with today's techniques. The low accuracy data was shifted ("rubber-sheeted") from a North American Datum (NAD) 27 to a NAD 83 which created further inaccuracies. With new techniques, improved technology and higher standards, the VRI will improve the inventory.
- Poor Estimate of Understorey Spruce²⁴ - Understorey spruce is difficult to estimate as it can not be readily identified or detected on the photos/images as it is obscured by the main canopy. However, the phase II ground samples will assist in quantifying the amount of understorey spruce for the project area although the exact location of the stands will not be identified.
- Poor Distinction Between Black Spruce and White Spruce Stands²⁵ - Past Inventory standards did not require the distinction between black and white spruce. VRI inventory standards require the distinction of Black and white spruce, and will therefore improve this weakness of the old inventory.

In their submissions to the MoFR for the TSR 2, the B.C. Ministry of Environment Lands and Parks (MELP), Fort Nelson Regional Economic Task Force, Slocan Forest Products, Northern Rockies Regional District and Town of Fort Nelson all emphasized the importance of updating

¹⁹ MoFR The Fort Nelson TSA TSR2 *Rationale for AAC Determination* 2001

²⁰ Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

²¹ Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

²² Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

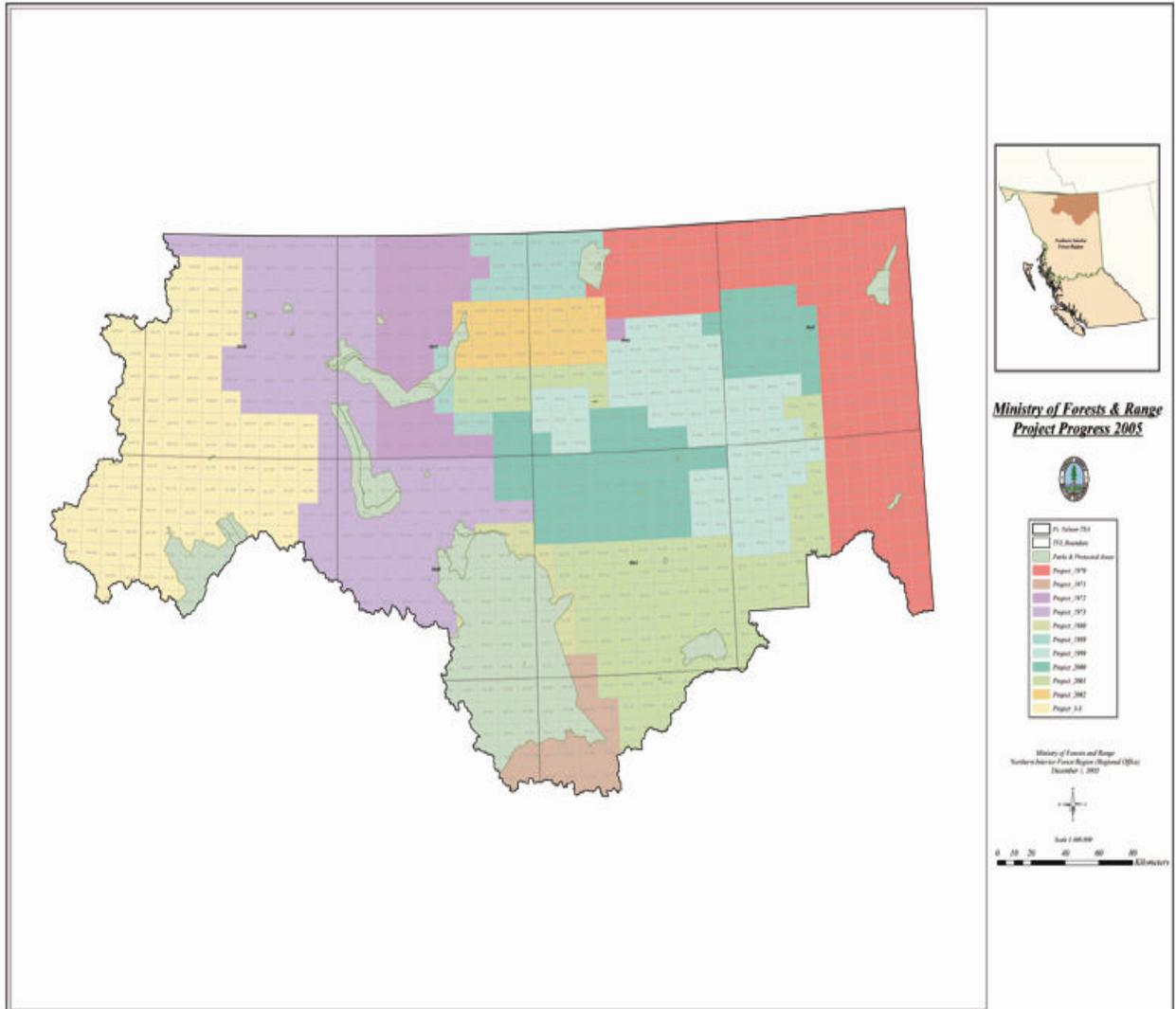
²³ Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

²⁴ Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

²⁵ Dick Nakatsu 2006. Ministry of Forests. Forester. Personal Communication

and upgrading current inventories for the TSA. The chief forester states in his AAC determination that an improved inventory will be critical in reducing uncertainty in future determinations. Figure 2.1 provides a map showing the current inventory status for the Fort Nelson TSA²⁶.

Figure 2.1 Fort Nelson TSA – Current inventory Status²⁷



2.3 Forest Management Issues

On October 18, 2006, in a meeting involving MoFR, Canfor, and BCTS, it was agreed that the inventory related forest management issues identified in the 1998 VSIP and the Chief Forester's 2001 *Fort Nelson TSA Rationale for Annual Allowable Cut (AAC) Determination* are still applicable to the project area covered by this VSIP.

²⁶ MoFR The Fort Nelson TSA TSR2 *Rationale for AAC Determination* 2001

²⁷ Source MoFR

Key forest management issues identified in this document that would benefit from an improved spatial and attribute inventory to VRI standards include:

1. Mixed Wood Strategy

“Mixedwood stands form a substantial component of the timber harvesting land base. Currently 33.5 percent of the timber harvesting land base is comprised of these mixedwood stands. There is some uncertainty surrounding the accuracy of these numbers due to the vintage of the inventory and the standard to which it was collected. Mixedwood stands in this TSA have significant wildlife and biodiversity values. District management strategies for mixedwood stands are currently under development”

2. Spruce Budworm Infestation

“Recent spruce budworm overview mapping has indicated a significant increase in the amount of spruce budworm defoliation. With the decrease of the spruce budworm infestation in the TSA, understory spruce has been affected to a currently unquantified extent.”

3. Black Spruce-Leading Stands

“There is significant uncertainty regarding the descriptions of spruce-leading stands in the inventory for the Fort Nelson TSA. Of the 435 613 hectares of spruce-leading stands within the timber harvesting land base, 289 093 hectares (66 percent) are labelled ‘S’ (not indicating white spruce - Sw - or black spruce - Sb). Some of these stands are actually black spruce, but the proportion of ‘S’-labeled stands that are actually ‘Sb’ is unknown.”

4. Un-merchantable and Low Site Forest Types (NCBR)

“In the timber supply analysis, sites were excluded from the timber harvesting land base if they did not currently have a specified minimum volume per hectare, or would not be capable of producing a specified minimum timber volume within a specified time.”

During the October 18, 2006 meeting, MoFR, Canfor and BCTS identified that refined polygon delineation of the traditional NCBR types is required.

5. Lodgepole Pine-Leading Stands

The Chief Forester states “...given uncertainties related to the land base and inventory, I will not specify a particular harvest amount for lodgepole pine.”

6. Deciduous-Leading Stands

“Aspen-leading stands comprise 354,197 hectares (88 percent) of the current deciduous timber harvesting land base in the base case. A review of performance done by district staff indicates that it is reasonable to expect that harvesting will occur on this area. Furthermore, as discussed under *unmerchantable forest types*, this area might even be underestimated.”

7. Volume Estimates for Existing Natural Stands

“The Variable Density Yield Prediction model (VDYP) does not account for declining volumes within stands as they age past maturity. No complete and statistically valid inventory audit information is available for the Fort Nelson TSA to provide a frame for evaluation of any of the more informal comparisons referenced above”

8. Estimates for Site Productivity and Regenerated Stand Volumes

The Chief Forester states “...given the uncertainties in the inventory, I believe application of adjustments, which rely on accurate description of existing stand heights and ages, would be inappropriate in the Fort Nelson TSA. When more information becomes available regarding site productivity, it can be reviewed in future determinations.”

9. Mapping areas for strategic land use²⁸, Forest Stewardship Plans²⁹ and operational level planning would be improved with a new inventory³⁰ for:
 - a. Riparian
 - b. Old growth – Information Land Management Bureau will be identifying Old Growth Management Areas in the Fort Nelson TSA and require VRI data in a timely manner.³¹
 - c. Wildlife habitat
 - d. Cultural values
 - e. Landscape-level biodiversity
 - f. Ecosystem or Terrestrial Ecosystem Mapping
 - g. Protected habitat
 - h. Wetlands and Other Non Forested Types
 - i. Roads, trails, seismic lines and other oil and gas installations
 - j. Mountain Pine Beetle and other pests including Eastern Spruce Bud Worm, Spruce Bark Beetle, Western balsam Bark Beetle, Forest Tent Caterpillar and the Large Aspen Tortrix
 - k. Landscape-level biodiversity
 - l. Seral stage management

²⁸ Bill Lux. 2006. Kaska Dena. Personal Communication

²⁹ Darrell Regimbald, Canfor and Jason Smith, BCTS. 2006. Personal Communication.

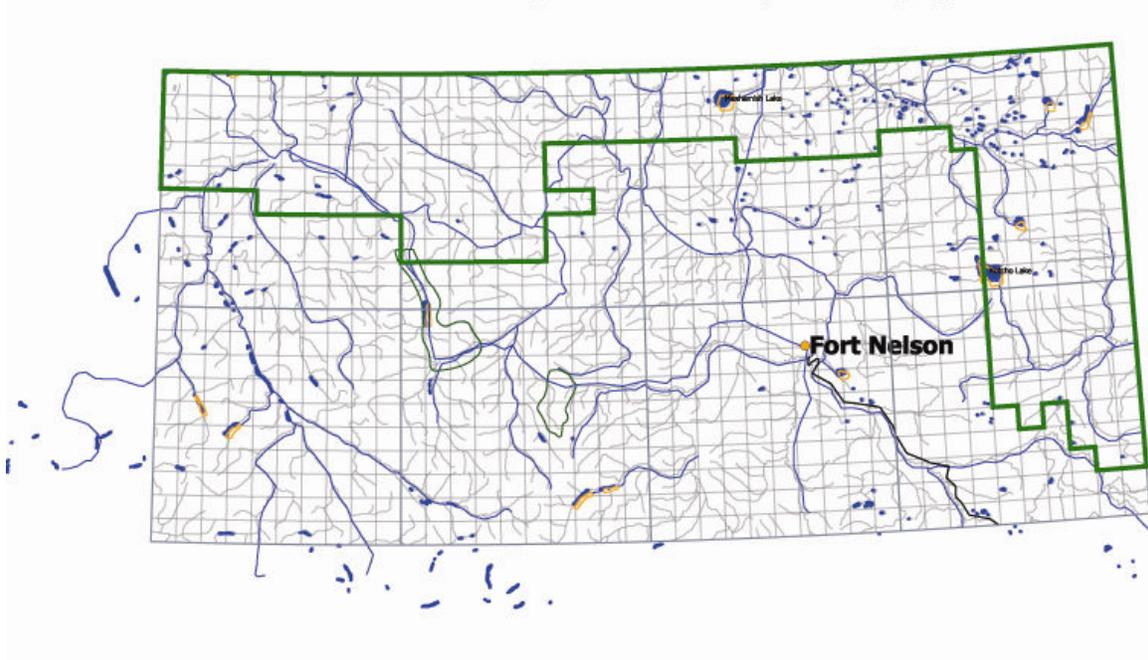
³⁰ MoFR The Fort Nelson TSA TSR2 *Rationale for AAC Determination* 2001 & MoFR Fort Nelson Forest District Vegetation Resources Inventory Strategic Inventory Plan Dec. 29, 1998

³¹ Anna Regnier. 2006. BC Ministry of Agriculture and Lands. Integrated Land Management Bureau. Personal Communication

3.0 INVENTORY PLAN

The objective of the VRI is to improve the existing inventory in the eastern and northern portion of the TSA to current standards as shown in Figure 3.1 to provide the information required to address the forest management and inventory issues detailed in section 2.2 and 2.3. A total of 253 mapsheets covering approximately 3,189,547.7 hectares are planned for this inventory.

Figure 3.1 Fort Nelson TSA VRI Project Area



The VRI activities proposed in this plan include:

- a. Phase I - photo interpretation
- b. Phase II - ground sampling for timber and ecology
- c. Inventory Analysis and Adjustment of the Photo Interpreted Estimates

3.1 Phase I – Photo Interpretation

Approximately 33% of the Fort Nelson TSA has been inventoried to current VRI Phase I standards and specifications. The photo interpretation phase is to improve the polygon delineation and estimation of attributes for each polygon.

The following project areas, by priority³² will be inventoried:

- Hay River
- Kwokullie
- Petitot
- Maxhamish

³² October 18, 2006 Meeting of Technical team (MoFR, Canfor & BCTS) Meeting in Fort Nelson

- Crow
- Hot Springs
- Coal River

The Interpretation will begin in the southeast portion of the TSA in the 094I BCGS letterblock, and progress to the north through the 094P letterblock, to the NWT border then west along the border through the 094O, 094N and 094M letterblocks.

Provincially certified photo interpreters will be required to complete the delineation and estimation of attributes using softcopy methodology in accordance to the most current VRI standards. All VRI Photo interpreted attributes will require collection to VRI standards and specifications. The project will include all Crown land, parks, ecological reserves, private lands and woodlots³³. No ground field work will be completed in any protected areas, parks or private lands.

Mid-scale 1:20000 scale aerial photograph will be acquired in 2006 and 2007³⁴. At the time of writing, approximately 66% of the project area has been photographed in the summer of 2006 with Base Mapping and Geomatic Services (BMGS) currently completing the Aerial Triangulation, scanning and Diap set-ups.

A VPIP is required prior to initiating the photo-interpretation project. The Photo interpretation phase will be completed over a 3 year period with approximately 84 mapsheets or 1.06 million ha completed in each of the following fiscal years 2007/08, 2008/09 & 2009/2010. Delineation will be completed on approximately one third of the project area in the early 2007. Due to the limited resources available to complete the project, multi-year contracts with contractors are strongly recommended.

3.2 Phase II – Ground Sampling

Upon successful completion of Phase I and approval of the deliverables to VRI standards, Phase II VRI Ground sample measurements will be established. A total of 144 VRI sample clusters³⁵ is required to achieve a sampling error of $\pm 10\%$ with a 95% probability for net timber volume in the Vegetated Treed portion of the project area and allow for calculations of sampling errors for VRI attributes. The coefficient of variation used to estimate the total number of plots was 60% and was based upon the CV used in December 19, 1998 VSIP.

Information will be collected on all attributes, but the variability of net volume will be used to set the sample size for the VRI ground sampling phase.

A random sampling of polygons and location of sample plots for the ground sampling will occur. Sample selection will adhere to VRI standards and the listing of the samples selected, methodology of selection process and details for implementing the Phase II, is to be included in the MoFR approved VPIP for Ground Sampling document. The VPIP should consider the inclusion of the existing VRI phase II ground samples that were completed in the first VRI inventory program in the TSA. No samples are to be located in protected areas or parks. As there are numerous parcels of protected areas through out the TSA, it is important to identify these protected areas prior to developing the sample plan.

Twenty-four (24) mapsheets in the previous VRI inventory did not receive ground samples³⁶. These mapsheets should be included in VPIP for the ground sampling phase for this project. Ground samples were established within the central portion of the TSA in 2002 and NVAF

³³ October 18, 2006 Meeting of Technical team (MoFR, Canfor & BCTS) Meeting in Fort Nelson

³⁴ Darrell Regimbald. 2006. Canfor Fort Nelson. Forester. Personal Communication

³⁵ Gary Johansen 2006. MoFR Resources Inventory Branch. Forester. Personal Communication

³⁶ MoFR. Source Fort Nelson Timber Supply Area Timber Supply Review 3 Analysis Report Nov. 2005

samples in 2003. This sample information will be used in the development of future phase II implementation plans, particularly in the determination of sample strata and sample size requirements.

For budgeting purposes, the sample size for ground and NVAF samples for this current inventory is based on the inventory being statistically independent of other areas in the TSA. However, the phase II VPIP should identify how the sample data from the central portion of the TSA will be combined with the sample data collected in the new area. It is expected that the actual number of ground and NVAF samples to be established for this new inventory area will be fewer than that budgeted for, and is dependent on costs, field work completed in the central portion of the TSA, and the new population definitions and areas.

Two types of VRI plots are included for this inventory³⁷:

- Full VRI sample clusters where the full suite of information (timber, coarse woody debris, range and ecology) will be collected.
- Timber emphasis plots where only tree information is collected.

Four First Nation communities expressed an interest that First Nation's personnel be considered as part of the team to establish plots and collect data. The purpose of this approach is to combine a preliminary inventory of cultural values or traditional use and share knowledge between First Nation non-First Nation field crew members³⁸ regarding medicinal vegetation. Two of the First Nation communities expressed the need to collect ecological data in the ground sampling phase to assist in identifying various non-treed vegetation for medicinal and wildlife purposes.

Both Canfor and BC Timber sales expressed the need to collect ecological data in the ground sampling phase for building a stand alone document to demonstrate best management practices for supporting the Fort Nelson Sustainable Forest Management Plan. Ecological data would assist in improving the Predictive Ecosystem Mapping (PEM) assumptions and could lead to identifying potential rare ecosystems³⁹.

Table 3.2 provides a summary of the number of trees per species recommended by MoFR Branch staff⁴⁰ for NVAF sampling, based on a proportional sample, assuming the sampled area is equivalent to the unsampled remainder of the TSA⁴¹.

Table 3.2 provides a summary of the number of samples required for NVAF

Species	Number of trees
Deciduous	24
Black Spruce	10
Dead	21
White spruce	23
Lodgepole pine	21
Total	99

Note: Both Sample size and distribution is subject to change based on factors identified in Section 3.2⁴².

³⁷ October 18, 2006 Meeting of Technical team (MoFR, Canfor & BCTS) Meeting in Fort Nelson

³⁸ Lyle Mortenson Prophet River First Nation, Bill Lux Kaska Den First Nation, Lori Montour Fort Nelson First Nation & Joe Pastion Dena tha First Nation. 2006. Personal Communication

³⁹ Darrell Regimbald. 2006. Canfor Fort Nelson. Forester. Personal Communication

⁴⁰ E-mail correspondence between Warren Eng, Gary Johansen and Will Smith October 18, 2006.

⁴¹ E-mail correspondence between Warren Eng and Gary Johansen December 5, 2006.

All work completed will follow current Phase II VRI standards and specifications.

3.3 Inventory Statistical Analysis and Adjustment of Photo Interpreted Estimates

Adjustment to the Phase I data for the entire VRI project area will be completed for the project area to create a statistically valid inventory that combines all phases of the VRI. Consideration should be given as to whether or not the previous inventory and this inventory should be combined

3.4 Summary of costs

A summary of the cost for completing the various VRI activities for the 3,189,547.7 hectares is provided in table 3.3. For an estimated program cost breakdown by activity and year, see Appendix 2.

Table 3.3 Total VRI Project Costs – 2006 - 2010

VRI Phase /Task	Activity	\$/Ha	Total Cost (\$)	Comments
I	VSIP & Photo Interpretation VPIP	n/a	\$15,900.00	Actual 2006 cost ⁴³
I	Photo Acquisition, Aerial Triangulation, scanning	\$ 0.175	\$587,172.21	Actual costs from 2006 contract ⁴⁴
I	Polygon Delineation & Attribute Estimation	\$ 1.52	\$4,848,112.50	Based upon 2003/04 Nelson Forks rates (\$1.32/ha) ⁴⁵ plus 15% increase for inflation and current rates.
I	3 rd party Quality Assurance	\$ 0.05	\$159,477.39	Based on Dawson Creek 2006 VSIP
Total Phase I Photo Interpretation Costs			\$5,610,662.10	
II	Phase II VPIP		\$ 5 - 10,000.00	
II	Sample Plan and Sample package preparation (144)		\$72,000.00	-Includes sample design, selection and sample package preparation -based on \$500 per sample
II	Ground Sample(155)		\$387,500 - \$432,000.00	- collection of timber emphasis and ecology data - includes sample selection - \$2500 to \$3000 per plot
II	3 rd party Quality Assurance		\$38,750 to \$43,200.00	10% of ground sample costs
II	NVAF (99 trees)	\$790.00	\$78,210.00	2003/04 rates \$631.07/tree includes helicopter ⁴⁶ + 20% increase for helicopter & inflation (\$790/tree)
II	3 rd party Quality Assurance		\$11,821.00	10% of NVAF costs ⁴⁷ plus additional 4000 for helicopter access costs
Total Phase II Costs			\$647,231.00	
III	Statistical Analysis & Adjustment of Phase I Attributes		\$18-25,000	-2003/04 rate (\$14400) +25% ⁴⁸
Total Statistical Analysis and Adjustment Costs			\$18 - \$25,000	
TOTAL COST FOR 2006-2010 VRI INVENTORY PROGRAM			\$6,221,943.00 to \$6,282,893.10	

⁴² E-mail correspondence between Warren Eng and Gary Johansen December 5, 2006.

⁴³ Darrell Regimbald. 2006. CanFor Fort Nelson. Personal Communication

⁴⁴ Darrell Regimbald. 2006. CanFor Fort Nelson. Personal Communication

⁴⁵ Darrell Regimbald. 2006. CanFor Fort Nelson. Personal Communication.

⁴⁶ Darrell Regimbald. 2006. CanFor Fort Nelson. Personal Communication.

⁴⁷ Darrell Regimbald. 2006. CanFor Fort Nelson. Personal Communication.

⁴⁸ Will Smith. 2006. Ministry of Forests and Range. Personal Communication.

4.0 VEGETATION RESOURCES INVENTORY STRATEGIC INVENTORY PLAN APPROVAL

I have read and concur that the Fort Nelson TSA Vegetation Resources Inventory Strategic Inventory Plan, prepared by IRC Spatial Data Group and dated November 2006, meets current Vegetation Resources Inventory Standards, business needs and considerations.

Manager, VRI
Ministry of Forests and Range,
Forest Analysis and Inventory Branch

Date

I acknowledge that the Fort Nelson TSA Vegetation Resources Inventory Strategic Inventory Plan, prepared by IRC Spatial Data Group dated November 2006, has been approved by the Ministry of Forest and Range. I further acknowledge that Canfor Fort Nelson Division on behalf of Ministry of Forest and Range will implement the VRI program with funding provided by the Provincial government.

Woodlands Manager,
Canfor,
Fort Nelson Division

Date

Appendix 1 - List of individuals contacted in preparation of this document

Name	Position	Affiliation	Location
Al Hansen	Area Supervisor	MOE Parks	Fort Nelson, BC
Alex Ferguson	Deputy Commissioner	BC Oil & Gas Commission	Fort St. John, BC
Anna Regnier	Planning Officer	MoAL – Integrated Land Management Bureau	Fort St. John, BC
Bill Lux	Chief	Kaska Dena First Nation	Lower Post, BC
Bob Krahn	Stewardship Forester	MoFR - District	Fort Nelson, BC
Brad Harold		Canadian Association of Petroleum Products	Calgary, BC
Brian	Forest Technician	Prophet River First Nations	Prophet River, BC
Darrell Regimbald	Planning Forester	Canfor	Fort Nelson, BC
Dick Nakatsu	Inventory Team Leader	MoFR - Region	Prince George, BC
Gary Johansen	VRI Audit Coordinator	MoFR - VRI	Victoria, BC
Jason Smith	Practices Forester	BCTS	Fort Nelson, BC
Joe Pastion	Chief	Dene tha First Nation	Chateh, Alta
Joelle Scheck	Ecosystem Biologist	MOE	Fort St. John, BC
Kyna Rigal		Encana	Calgary, Alta
Laurence Bowdige	VRI Monitoring Program Coordinator	MoFR – VRI	Victoria, BC
Laurie Montour	Chief	Fort Nelson First Nation	Fort Nelson, BC
Lorraine Chipesia	Chief	Prophet River First Nation	Prophet River, BC
Lyle Mortenson	Forestry Advisor	Prophet River First Nations	Prophet River, BC
Margie	Acting Executive Director	Fort Liard First Nation	Fort Nelson, BC
Tim Bennett	District Recreation Officer	Ministry of Tourism, Sports, Arts	Dawson Creek, BC
Will Smith	Volume & Decay Sampling Officer	MoFR – VRI	Victoria, BC

Appendix 2 - Fort Nelson TSA Inventory Program Costs by Phase 2006 -2011

Inventory Activity	Unit	*Fiscal Year					Total
		'06/07	'07/08	'08/09	'09/10	'10/11	
VSIP & VPIP Photo Acquisition	VSIP/VPIP	\$15,900.00	\$0.00	\$0.00	\$0.00	\$0.00	⁴⁹ \$15,900.00
	Air photo acquisition and aerial triangulation	\$391,356.04	\$195,816.16	\$0.00	\$0.00	\$0.00	⁵⁰ \$587,172.21
Photo Interpretation	Budget Delineation	\$202,004.69		\$202,004.69	\$202,004.69	\$0.00	⁵¹ \$606,014.06
	Budget Fieldwork & Estimation	\$0.00	\$1,414,032.81	\$1,414,032.81	\$1,414,032.81	\$0.00	⁵² \$4,242,098.44
	3rd Party Quality Control	\$0.00	\$53,159.13	\$53,159.13	\$53,159.13	\$0.00	⁵³ \$159,477.39
Ground Sampling	VPIP	\$0.00	\$0.00	\$0.00	\$0.00	\$10,000.00	\$10,000.00
	Sample Plan & Packages	\$0.00	\$0.00	\$0.00	\$0.00	\$72,000.00	⁵⁴ \$72,000.00
	Ground Samples	\$0.00	\$0.00	\$0.00	\$0.00	\$432,000.00	⁵⁵ \$432,000.00
	3rd Party Quality Control	\$0.00	\$0.00	\$0.00	\$0.00	\$43,200.00	⁵⁶ \$43,200.00
	NVAF	\$0.00	\$0.00	\$0.00	\$0.00	\$78,210.00	⁵⁷ \$78,210.00
	3rd Party Quality Control	\$0.00	\$0.00	\$0.00	\$0.00	\$11,821.00	⁵⁸ \$11,821.00
Analyses and Adjustment	Statistical Analysis & Adjustment of Phase I attributes	\$0.00	\$0.00	\$0.00	\$0.00	\$25,000.00	⁵⁹ \$25,000.00
Total		\$609,260.73	\$1,663,008.11	\$1,669,196.63	\$1,669,196.63	\$672,231.00	\$6,282,893.10

*Note: Funding subject to availability.

⁴⁹ Actual Cost from 2006 contract.

⁵⁰ Actual Cost from 2006 contract.

⁵¹ Based upon 2003/04 Nelson Forks rates (\$132/ha) plus 15% for inflation and current rates.

⁵² Based upon 2003/04 Nelson Forks rates (\$132/ha) plus 15% for inflation and current rates.

⁵³ Based on Dawson Creek VSIP.

⁵⁴ Included sample design, selection and sample package preparation.

⁵⁵ Includes collection of timber and ecological information, also includes sample selection.

⁵⁶ Based on 10% of ground sampling costs.

⁵⁷ 2003/04 rates \$631.07/tree includes helicopter + 20% increase for helicopter & inflation (\$790/tree).

⁵⁸ Based on 10% of ground sampling costs.

⁵⁹ Will Smith. 2006. Ministry of Forests and Range. Personal Communication.