

# PROJECT COMPLETION REPORT

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**PHASE 1 - VEGETATION RESOURCES INVENTORY (VRI)**

**PHOTO INTERPRETATION and DIGIAL MAP PRODUCTION**

of the

**OKANAGAN TSA**

**2000 - 2010**

for

Okanagan Innovative Forestry Society

and

Ministry of Forests and Range

PREPARED BY : J. A. Grace RPF

Glen Dick RPF

**March 2010**



# 1. Introduction

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**1.1 Purpose:** The purpose of this report is to document and provide a historical reference of the area of interest, personnel and activities associated with the completion of the Okanagan TSA Phase 1 Vegetation Resources Inventory (VRI). For the Okanagan TSA, this includes the entire TSA, excluding major Parks and TFL lands. Some private lands were included, other not.

It should also be noted at this point, that the "Project Completion Report" did not become a VRI Standard until 2008. Project Completion Reports were completed by TFMG (Timberline Forest Management Group) for the areas they did and will be referenced as attachments to this report.

**1.2 Timeframe:** Work on the Okanagan TSA VRI started in 2000 and ran to 2010.

**1.3: Project Administrator:** The Okanagan Innovative Forestry Society (OIFS) led by Glen Dick, RPF, initially of Riverside Forest Products and later as a contractor (Terrafor Resources Ltd.) was the lead for this VRI project.

**1.4 Planning Documents (History):** The Okanagan TSA consists of 2.246 million hectares, portions of 192 BCGS maps (136.6 map sheet equivalents (mse's)) and portions of 11 Public Sustained Yield Units (Appendix 2) that initially had what was called unit B survey inventories completed from 1962 to about 1979. These old inventories lacked much of the data now collected from a VRI and this was the initial drive for a new Inventory for the Okanagan TSA. Also of note: While planning for a new inventory for the Okanagan TSA has been ongoing since 1996 the actual project(s) did not start till 2000 and have run till 2010. Also, the VSIP / VPIP planning processes (significantly) and VRI Standards have changed over this time period. The most current standards for any year were used as the project(s) proceeded through the TSA.

In 1996 a PIA (Pre-Inventory Analysis) was completed by the Ministry of Forests Kamloops Forest Region, Re-inventory forester - Jim Grace RPF. This review used about 550 ground calls to assess the quality of the existing inventory and some minimal identification of issues from Licensees. This document indicated issues with the state of the inventory of that day and was signed off by the then Regional Manager Fred Baxter, Director of Inventory Branch, Dave Gilbert and the 3 Forest District Managers. Lack of funding prevented any start to this inventory at this time.

In March of 1999 a VSIP (Vegetation Resources Inventory Strategic Inventory Plan) was completed by MoF Inventory Branch staff and TSA licensees for the Okanagan TSA, and TFL's 15, 33 and 49. TFL 15 and 49 already had VRI Phase 1 and 2 completed, but not TFL 33 or the Okanagan TSA. This plan suggesting a retro-fit process for the TSA. This plan lacked funding (Forest Renewal BC) and was not started.

In 2000 Gorman Bros Lumber ( Kerry Rouck) undertook a VRI of 2 maps ( 82E084 and 085) approx. 32,000 ha's, in the Joe Rich Creek Area of the TSA. This was completed by ARC Alpine - Frank Scheithauer, Manager Bio-terrain lines were not used here.

In April 2002 a VSIP update for the 1999 VSIP(Project OK1-002) written by J.S. Thrower & Associates Ltd., was completed for the Okanagan Innovative Forestry Society (OIFS) . Glen Dick RPF was the Licensee contact (Riverside Forest Products) .

December 11, 2002 the first VPIP: KATSA 2043019 Okanagan TSA VRI Phase 1 Project Plan was completed. This plan was for a VRI and Bioterrain Integration Inventory. The object was to collect standard VRI Photo Estimation data , utilizing pre-delineated bioterrain polygons as a basis for the VRI. JMJ Holdings of Nelson BC did the Bioterrain work. This plan was for delineation of approximately 1,000,000 hectares or 108 maps in the southern portion of the TSA. Timberline Forest Inventory Consultants was to do the VRI work and Craig Robinson RPF of Forsite Consultants Ltd in Salmon Arm was doing the administrative work for the OIFS. This project plan resulted in the actual delineation of about 14 full map sheet equivalents (mse's).

August, 2003: SOTSA 22 4206019: VRI Test Sheets Okanagan TSA Project Plan . This project was completed by Timberline Resource Inventory Consultants on 4 maps. 082E034, 092H080, 082L018 and 082L048. The objective of doing 4 maps was to acquire the various licensees support for VRI. These 4 maps encompassed portions of the operating areas of all of the major licensees within the TSA. The Bioterrain / VRI hybrid inventory applied. 52,247 hectares or 3.2 map sheet equivalents (mse's) were completed. 68 ground calls and 140 air calls completed by Timberline and QA' ed by Craig Robinson of Forsite and delineation and attribute estimation QA completed by Jim Grace, MoF .

In 2004 - 2005 an additional 6 maps (82L001, 002, 011, 012, 021, 022) were completed by Timberline, bringing the total to this point of 12 maps ( 2 maps were Joe Rick Ck.). Warren Nimchuck and Rob Oran were the principal Timberline people involved.

October 2005: Okanagan Timber Supply Area - VRI - Strategic Inventory Plan - Revised for 2005 - 2007. Written for the Okanagan Innovative Forestry Society by Glen Dick. This was an update to the 2003 plan, to focus on the northern wet belt and maps throughout the TSA not dominated by pine (Mountain Pine Beetle areas (MPB). The Mountain Pine Beetle (MPB) epidemic was becoming a major issue for VRI. The MoF did not want any VRI in MPB active areas.

November 2005: Okanagan Timber Supply Area - VRI - Project Implementation Plan Photo Interpretation - Revised for 2005 -2007. Written for the OIFS by Glen Dick. This plan addressed 101 maps in the wet belt / minor pine areas for VRI. It also addressed changes to VRI standards concerns by the MoF such as collection of silviculture data (Results data) , addressing needs for use of old data sources and collection of new field data.

By the start of 2007 - 56 maps have been completed to VRI standards.

March 2007: Okanagan Timber Supply Area - VRI - Photo Interpretation - Revised for 2007 - 2009. Written for the OIFS by Glen Dick. This revision addressed the need for new photography. The 2001 - 02 1:30K colour photo was now out of date. It also addressed a need to complete VRI in non pine areas first and continuing issues around **RESULTS** data , Woodlots, minor parks and protected areas.

**1.5 Funding:** The Joe Rich Creek VRI completed by Timberline Forest Inventory Consultants, for Gorman Bros. Lumber Co. and the initial photo acquisition in 2001/02, were funded through FRBC.

All other VRI funding, accept for the 2007, federally funded (Mountain Pine Beetle Fund) for digital photo acquisition and softcopy data, was funded through the Forest Investment Account (FIA) **and delivered through the Okanagan Innovative Forestry Society and Riverside Forest Products**

## 2 Project Area Description

The Okanagan TSA covers the Okanagan Shuswap Forest District; formerly Salmon Arm, Vernon, and Penticton Forest Districts. It is one of the largest and most ecologically complex TSAs in the province. The total area consists of approximately 2,246,713 hectares, covering portions of 192 maps or 136.6 MSE's ( map sheet equivalents) (Appendix 1).

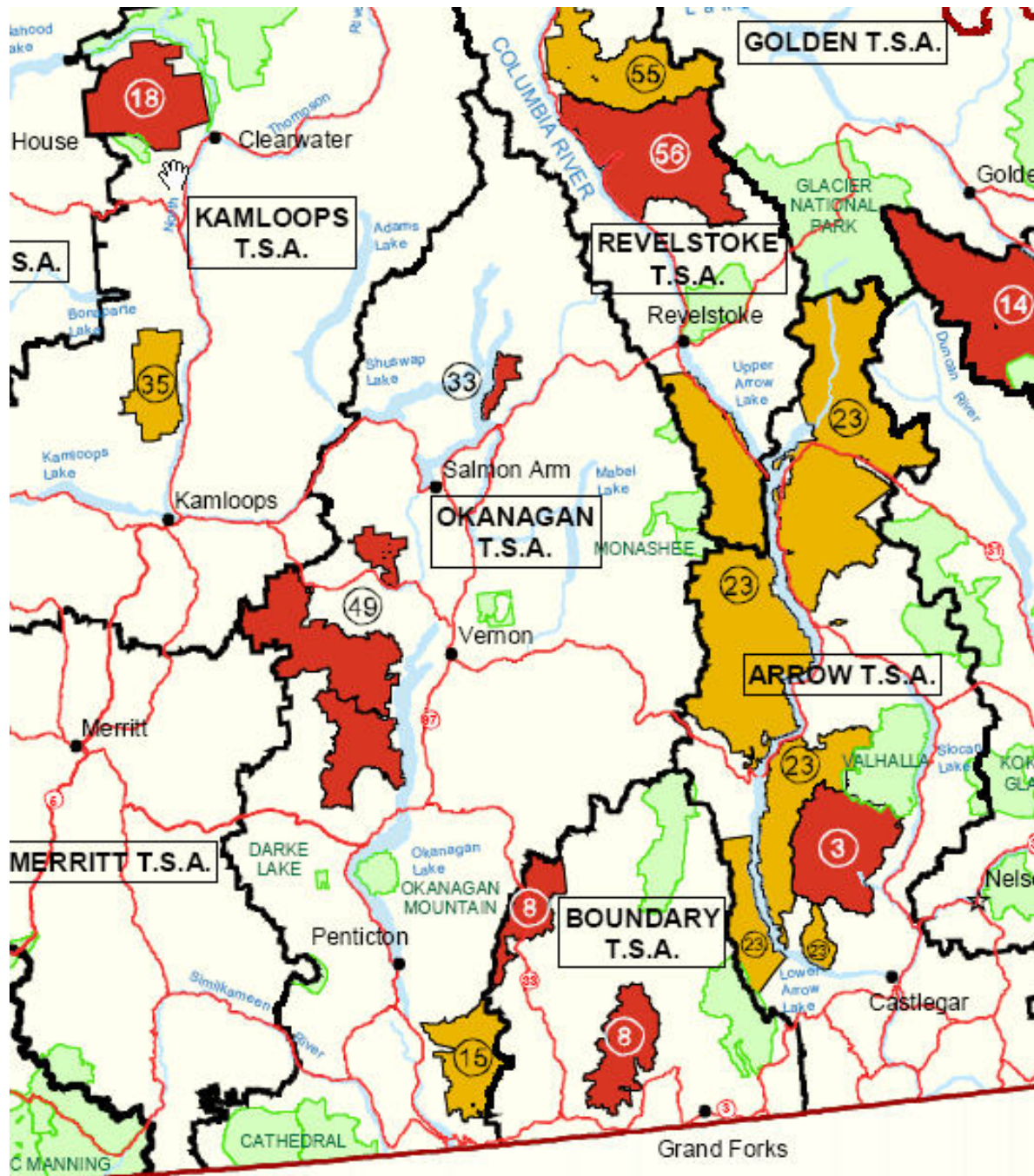
The Okanagan TSA is predominantly located in the Shuswap and Okanagan Highlands Region of the Southern Interior Plateau Area. The Shuswap Highlands extends from the northern TSA borders to the Coldwater Valley east of Vernon. It consists of gentle to moderate sloping plateau areas, with valley areas commonly steep because of glacial erosion. The Okanagan Highland extends southward from the Coldwater Valley to the 49th parallel. The Okanagan Highland includes more rounded mountains and ridges and gentle open slopes. Approximately 320 km. long and 140 km. wide, the Okanagan TSA stretches from the Seymour River watershed, that flows into Shuswap Lake; south to the Canada-USA border. From west to east it extends from the Okanagan Range to the Monashee Mountains. Major lakes such as Okanagan, Mara, Kalamalka, Mabel, Sugar, Skaha, and Osoyoos Lakes occupy some of the major valleys of the area. The area contains seven of the fourteen Biogeoclimatic Zones of B.C., indicating a large degree of ecosystem diversity and providing a multitude of resource values. Diverse mixed forests in the wet areas of the north give way to drier mixed pine-fir forests, until almost desert conditions are reached around Osoyoos in the South.

One of the fastest developing areas in the province, the Okanagan TSA supports some of B.C.'s largest population centers, including, Salmon Arm, Vernon, Kelowna, and Penticton. The main industries are forestry, agriculture, tourism, and manufacturing. The Okanagan TSA also supports the greatest diversity of wildlife in the Province.

**Table 1: Okanagan TSA Area**

Land base	Area (ha)	
<b>* Total Area</b>	<b>2,246,713</b>	
Non-crown land	405,579	
Non-forest	399,203	
Non-commercial brush	0	
Existing roads, trails, landings	21,358	
Productive Forest	1,420,573	

excerpt from Okanagan IFPA Uplift Analysis - Timberline Forest Inventory Consultants.



Map provided by TNRG.



# 3 Personnel

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The Okanagan TSA - VRI ran from 2000 to 2010. Numerous contracts over the years involving numerous personnel from the major VRI contractors of the day. Details on who was involved with which maps are noted in Appendix 1.

## **ARC Alpine**

Frank Scheithauer RPF and BC Certified Photo Interpreter  
Ron Metcalfe BC Certified Photo Interpreter

## **Timberline Natural Resource Group (TNRG) ; formerly Timberline Resources Inventory Consultants (TRIC)**

Frank Scheithauer RPF Project Manager and BC Certified Photo Interpreter  
Warren Nimchuk, RPF Project Manager and BC Certified Photo Interpreter  
Rob Oran RPF BC Certified Photo Interpreter.  
Kelly Sherman RPF and BC Certified Photo Interpreter  
Jerry Sproule RPF and BC Certified Photo Interpreter  
Mathius Hulten RFT and BC Certified Photo Interpreter  
Rob Paterson RFT and BC Certified Photo Interpreter  
Ron Metcalfe BC Certified Photo Interpreter  
Andy Ferguson and BC Certified Photo Interpreter.  
Tyson Wolowski Trained FT and Photo Interpreter  
Grant. Photo Interpreter  
Ferguson. Photo Interpreter

### **Digital Map Production**

David Myers BSc Senior GIS Digital Mapping Supervisor.

## **Forest Dimensions Inc. (FDI);**

Jerry Stenberg RPF: General Manager and BC Certified VRI Photo interpreter.  
Andy Little RFT and BC Certified Photo Interpreter  
Kela Auger BC Certified Photo Interpreter  
Yari Neilsen BC Certified Photo Interpreter  
Murray Foubister BC Certified Photo Interpreter  
Mark Hemstock Photo Interpreter.  
Don Skinner R.P. Bio. and BC Certified Photo Interpreter  
Chris Snauwert and Greg Escott Field Work Recorders.

### **Digital Map Production.**

Darrell Roberts  
John Smith



### **Integrated Resources Consultants (IRC)**

Jon Aleman RPF, Project Manager and BC Certified Photo Interpreter  
Bruce Townsend RPF and BC Certified Photo Interpreter  
Chris Lauder RPF and BC Certified Photo Interpreter  
Horia Serban Photo Interpreter

### **3rd party QA Personnel ;**

Jim Grace RPF and BC Certified Photo Interpreter MoF  
Craig Robinson RPF and BC Certified Photo Interpreter. Forsite  
Lloyd Wilson RPF and BC Certified Photo Interpreter Independent  
Verne Sundstrom RPF and BC Certified Photo Interpreter Independent  
Laurie Wilson RPF and BC Certified Photo Interpreter Independent  
Don Skinner R.P. Bio. and BC Certified Photo Interpreter - Concrete Jungle  
Murray Foubister BC Certified Photo Interpreter FDI  
Mathias Hulten RFT and BC Certified Photo Interpreter. Timberline

### **VRI Project Administration:**

Glen Dick RPF , Riverside Forest Products, Okanagan Innovative Forestry Society; Terrafor Resources Ltd.  
Craig Robinson RPF and BC Certified Photo Interpreter, Forsite Consultants Ltd. Salmon Arm BC.  
Nona Philips RPF BC Certified Phase 2 VRI consultant; Nona Philips Contracting, Williams Lake BC.

# 4 Air Photo Coverage / Format

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## 4.1 Year and Scale

In 2001 1:30,000 scale colour photography was the preferred photo acquisition scale by the Ministry of Forests, Kamloops Forest Region, for VRI. The MoF was promoting softcopy technology (Diap Viewer) using digital imagery for VRI. The Ministry felt that the ability to zoom into digital imagery using a computer would allow for use of smaller scale photo than was acceptable for use with conventional hardcopy photos for VRI. 1:30,000 colour photography was flown for the entire TSA; contract administered by BC Government -Base Mapping Geomatic Services (BMGS), Al Spring. Some of the areas were not captured to VRI Standards, so the 82 M blk and 82L032 and 82L067 were re flown at the same scale(1:30K) in 2002. Complete, acceptable coverage of the TSA was obtained over the 2 years at this scale.

In 2007 this 1:30,000 scale photography had reached the MoF's age limit ( 5 yrs) for photo use for VRI activities. The now Ministry of Forests and Range - Forest Analysis and Inventory Branch through its Mountain Pine Beetle (MPB) fund; funded the acquisition of new photography for a southern portion (76 maps, primarily 82E, 92H and some 82L maps)of the TSA. 1:30,000 colour photo was also, no longer the preferred scale( 1:20,000 colour now preferred) for VRI in the Southern Interior and in this case the Ministry wanted to peruse its first digital photo acquisition project. This project was administered by BMGS - Al Spring. This digital Imagery was captured at a Ground Sampling Distance (GSD) of 33 cm or an approximate scale of 1:27,500. While this approximated scale is smaller than preferred, it did appear sharper than conventional photo at a scale of 1:20,000 scale. The other issue with digital photo is the large increase in number of frames required to cover an area, however, this imagery being used in a softcopy environment made this a non- issue.

The OIFS in 2007, through FIA funding and a contract run by Ken Blagborne of FDI, also captured the rest of the TSA to the north at a scale of 1:20,000 colour conventional photography, using a 6 inch lens. This lens allowed for a lower flying height for photo acquisition and potentially sharper imagery.

## 4.2 Pre-set Model Format

For the 2001, 2002 imagery, International Systemap Corporation's SIS and SJS format imagery was created by IMT ( International Mapping Technology) of Vancouver BC. The SIS format imagery was a full size format; approximately 900+ meg file size for this project, that Base Mapping Geomatic Services (BMGS) required as a standard deliverable. The SJS format is a compressed imagery format of the SIS files, and in this case, less than 100 megs per file. Rate of scanning effects file size. The full format files were potentially too large for some contractors of the day to utilize easily. The compressed files were preferred by the MoF and OIFS for use for VRI and proved to show no measurable loss of quality with this compressed imagery. This imagery was scanned at approximately 20 microns.

In 2007, both the digital imagery in the south and the conventional imagery in the north used the SJS format for pre-set model creation. . There was no scanning of the digital imagery required. The conventional photo was scanned at approximately 15 microns and International Systemap Corporation's SJS format files created.

# 5 VRI Assessment

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The existing or original inventory for the Okanagan TSA, prior to 2000, consisted of the old Unit B Survey Inventories of the 1960's and 70's, covering either whole or portions of 11 different PSYU's ( Appendix 2) . These Inventories were class bases for age and height, with no species percents (i.e. FS 831 M) and lacked much of the attributes now required for the VRI Standard. During the 1980's these maps were cut and spliced from the old NTS format to the then new BCGS format. They were shifted and rubber sheeted from NAD 27 to NAD 83 projection. ESA's ( Environmental Sensitivity Area's) were added in the 1970's. In the 1980's these class based inventories were being captured digitally and this required a percent be added to the species composition to total 100% and the age and height classes of the leading species were mid-pointed for enter into the digital data base; crown closure was also added . By the time the VRI was implemented in 1996, portions of this inventory were from 17 to 34 years old.

The 1996 MoF inventory Audit showed a high level of confidence in the overall average mature (>60 yrs) volume for the Okanagan TSA. 299 m3 / ha for the audit volume and 293 m3 /ha for the inventory volume ( ratio of 1.02 %); but the distribution of the existing volume between biogeoclimatic zones and the individual polygon estimates remained uncertain.

The 1996 Pre-Inventory Assessment (PIA) and 1999 VSIP both recognized and recommended a need for a new Inventory.

In 2002, the now formed, Okanagan Innovative Forestry Society (OIFS) and Ministry of Forests, as the major stakeholders, again undertook a revision to the 1999 VSIP. Significant forest management issues were highlighted in TSR 2 - Aug. 1, 2001. Other emerging data needs considered to be relevant to the Okanagan TSA that could be completed with a VRI included.

- Age of the Inventory; needs to be brought to VRI Standards.
- Accuracy of forest-cover labels and spatial accuracy of stands. Species composition descriptions are inaccurate, especially in stands managed through the selection system. Need update to species composition labels for deciduous and deciduous-coniferous mixed stands.
- Polygon resolution is inadequate - individual polygon areas are large.
- Mountain Pine Beetle Salvage and other related logging history, outdated and inaccurate, leaving many groups of small patches that are not captured in inventory update.
- Highly variable IDF stands require finer delineation and addition of VRI attributes to more accurately project the stand growth and help select or define appropriate silviculture treatments for these stands.
- Over estimation of stand ages (i.e. FDi)
- Small Wood Pine (stocking class 4) volume estimates .
- Pest infestations (particularly with MPB) - contribute to stand variability and makes inventory update for depletion difficult and leads to poor inventory projections.
- Silviculture history and Free growing information requires significant improvement.
- Meeting third party certification criteria.

# 6 VRI Phase 1 Photo Interpretation Process

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## 6.1: General Comments

This project spans a time frame from 2000 to 2010. Numerous VRI contractors and staff were involved in the various contracts over the length of this Project. The MoF Inventory Section and its role in VRI went from total control to almost no involvement ( during - MSRM - Ministry of Sustainable Resource Management days from 2002 to 2005) back to significant involvement in the later years. Significant changes to VSIP and VIPIP requirements evolved as well as tightening of the VRI Photo Interpretation and Field data collection Standards, to ensure that the VRI Standards of the day were maintained, still, with some uncertainty at times.

The major variance to VRI Standards for this project, was the inclusion of a Bio-terrain Inventory as the bases for delineation of the VRI. It was originally the intent of the OIFS to reduce costs associated with delineation by combining these 2 inventories. It was the MoF's position that this was a VRI and that the bio-terrain inventory must meet VRI Standards. Shifting of some bio-terrain lines became necessary to achieve this standard. The initially 12 maps did not have the bio-terrain as a base, nor was the bio-terrain inventory base used in the final 2 years (82E/ 92H blk - dry-belt areas) of this VRI.

Historically, private lands were always included in re-inventories, but part way through this project, FIA changed its position and stopped funding the inclusion of private lands for VRI. The 2006 to 2009 work by Timberline did not include VRI of private lands, but both IRC and FDI included private forested lands in the areas they completed.

All delineation, fieldwork, attribute estimation and digital map production was completed as per the current VRI Standard of any particular year of this project.

All work was completed using one of the following softcopy systems.

- International Systemap Corporation's DiAP Softcopy system;
- ESRI/International Systemap Corporation's PurVIEW for ArcGIS Softcopy system.
- Intergraph SSK.

## 6.2 Inventory Base Maps

The British Columbia Geographic System ( BCGS) - TRIM base was used for all maps.

## 6.3 Data Source Analysis

Historic Data points available for this project included air calls, ground calls and pre- 1979 samples maintained in the Kamloops Forest Region and its Districts in hardcopy format (XO books) from the old PSYU inventories. The 1996 Okanagan Pre-Inventory Assessment, completed by Jim Grace RPF, documented all historic data points still available. ( approximately 16,000 + data points from these old

inventories) Salmon Arm and Vernon FD still had most points available, but Penticton was missing much of its data. There were also some additional ground calls completed by Kamloops Forest Region Inventory staff during the 1980's gathered to assist in the conversion of the old NTS maps to the digital data base. The 1996 PIA process also collected about 550 new ground calls during its assessment. It was at the classifiers discretion whether any of these oldest data points were still relevant for use in this VRI. The first 12 maps completed during this project did not include the use of any of these historic data sources ( 2002 to 2005 time frame). All of these old data sources were provided to the contractors for all work, from 2005 to 2010 and used at their discretion. .

In addition the OIFS collected over 10,000 + cruise data points, which were provided to the VRI contractors. The spatial locations of these points along with some basic attributes (Species, age, height) provided additional information for photo interpreters.

## 6.4 Polygon Delineation

All lands within the Okanagan TSA, were re-inventoried to VRI Standards, with these exceptions:

- major parks ( Cathedral and Okanagan Mountain),
- TFL's ( 15, 33 and 49) were delineated to VRI Standards.
- The 2006 -2009 TNRG Projects excluded private lands. This is noted in the March 25, 2009 Project Completion Report, Phase 1 - Vegetation Resources Inventory and Digital Map Production of The Okanagan TSA ( 082L and 092 I Letter Blocks), prepared by Frank Scheithauer.

Minor parks, protected areas and all woodlots not previously inventoried to VRI standards were included in the delineation process. Any woodlot that had already had a VRI completed by the various Woodlot Associations, was inserted into the data base later. TFL 15 and 49 had VRI's completed in the 1990's. TFL 33 has not had any VRI completed. Cathedral Park had a VRI completed in 1996. The Westbank Community Forest also had a VRI completed in 2009.

Initially, Bioterrain polygons delineated by geoscience experts under a separate contract were to provide the foundation for all of the VRI polygons. Two types of digital terrain lines were delineated. "Hard lines" distinguishing well-defined bioterrain boundaries that could be precisely delineated and "Soft Lines" distinguishing bioterrain boundaries of features that were gradational or non-specific. The MoF insisted that these bioterrain lines must meet VRI Standards or be maintained as a separate level. An agreement was reached that the "soft lines must meet VRI Standards and would be adjusted to reduce redundant or excessive numbers of polygons.

Eventually, the Bio-terrain Inventory was used primarily in the wet - belt areas ( Appendix 1 indicates which map are wet belt), as a projected polygon count of 1500 - 1800 polygons was assumed ( average polygon size of about 10 - 12 hectares). The Dry - belt areas, primarily south ( 82E / 92H) did not use the Bio-terrain Inventory as a start as polygon counts of 2100 to 2200 were predicted and the 7 map project, IRC did in 2006 using the Bioterrain Inventory as a base, had resulted in excessive numbers of polygons, (2500 +) being created; which had to be re-visited to be cleaned up, and reduce polygon

numbers for these maps. Originally it was anticipated that using bioterrain delineation as a base for all VRI polygons would create significant cost and time efficiencies for VRI interpreters, but the need to move or adjust softline work reduced any efficiency anticipated. .

The project delineation was completed to TSA / TFL / major Park boundaries and all maps within the Okanagan TSA were delineated . There were no holes within the photo coverage. All silviculture openings outer boundaries were photo confirmed to the date of the imagery The exterior boundaries of opening not showing on the photos were either provided to the VRI contractors by the Licensees or through RESULTS.

Delineation criteria (based on the British Columbia Land Classification System) was used.

- Vegetated vs. non-vegetated land;
- Treed vs. non-treed land;
- Stand structure (i.e. vertical complexity and layers);
- Pattern;
- Crown closure;
- Species composition;
- Average stand age;
- Average stand height;
- Basal area;
- Density;
- The presence or absence of lesser vegetation (i.e. shrubs, herbs and bryoids);
- Disturbance.

## 6.5 Field Calibration Data Collection

### 6.5.1 Field Calibration Plan.

Field calibration plans were submitted to the OIFS (Glen Dick) and the MoF (Jim Grace) for each project undertaking . These plans are a VRI Standards requirement. Field Calibration Plan were submitted in either of 2 ways ; either as a digital file )(i.e. Digital field data collection sample plan maps (in Microstation DGN format or Arc Shape file format)) that could be overlaid on the existing digital map base, new delineation or digital orthos, or as points marked both for ground calls and air calls on hardcopy orthos. The MoF did not have a preferred method. The Field Plan is basically at the discretion of the photo interpreters doing the work , bases on forest type visitation criteria established in the VPIP or contract and to ensure that locations of visitation points are spread throughout the project area. Generally the OIFS project Manager requested the MoF approve all Field Calibration Plans.

## 6.5.2 Candidate Stand Criteria

- A range of representative treed and non-treed types.
- Types not previously field surveyed.
- A range of representative Problem Forest types as identified in the *Okanagan TSA Inventory Audit* (1997) and the *Okanagan Timber Supply Area Rationale for Annual Allowable Cut (AAC) Determination* (2001); including:
  - Deciduous types;
  - Deciduous/Coniferous Types;
  - Douglas-fir and Douglas-fir leading types (age class 6+).
- Types under-sampled in past forest surveys including:
  - Balsam leading types (age classes 2,3,4,8 and 9);
  - Douglas – fir types (age classes 4 and 9);
  - Spruce leading types (age class 9);
  - Douglas-fir leading types (age class 5);
  - Lodgepole pine types (age class 5 and 6).
- Mixed Deciduous Conifer Types
- Types identified by classifiers during the delineation stage

## 6.5.3 Field Data Collection

Generally, proposed air and ground calibration point locations were stereoscopically pre-selected using the particular softcopy systems each contractor owned. Photo interpreters pick the points to visit and preliminary geodetic coordinates for each point were calculated by their GIS sections. These proposed locations were then plotted on orthophotos for use in the field. Final geodetic coordinates for each ground calibration point were recorded in the field at the center point of each ground calibration point established and any points moved, added or deleted were corrected back in the office, for both the ground calls and air calls. Ground call data was digitally recorded using a data logger. All air call information was recorded on hardcopy VRI air call forms. VRI contractors either scanned these forms or entered the data into a digital form of their making. Eventually, a digital excel spread sheet summary (in approved MoF format) was produced and submitted as a project deliverable.

There was no fieldwork in private lands, woodlots or parks. Only air calls in the Snowy Recreation Area near Cathedral Park.



## Information Collected

### **Air Calibration Points**

- Estimate of species composition;
- Estimates of the average age and height of the two leading species;
- Estimates of lesser vegetation attributes, if applicable (e.g. shrub height and percentage cover, percentage herb cover, percentage bryoid cover, type and percentage of non-vegetated cover);
- Estimate of snag frequency (snags per hectare);
- Other attributes, if applicable (e.g. presence of insects or disease).

### **Ground Calibration Points**

- Species composition;
- Age and height of the two leading species;
- Basal area;
- Stand density (stems per hectare);
- Snag frequency (snags per hectare);
- Estimates of lesser vegetation attributes, if applicable;
- Estimates of other attributes, if applicable.

MoF ground call Standards require 1 point calls for types with 2 or less species and 3 point ground calls for stands with 3 or more species. In this project, both FDI and IRC followed these standards, but Timberline preferred the single point call, as this point is just a reference point for certain VRI attributes. While, only using one point calls is not the MoF's standard, exclusively using only single point ground calls was not stopped.

### TFMG - Rationale for Establishing One-Plot vs. Three-Plot Ground Calibration Points

- The purpose of establishing calibration points is to familiarize the photo interpreter with local characteristics, conditions and variations;
- The accuracy and consistency of photo-interpreted descriptions improves as the proportion of field visited polygons increases;
- One-plot calibration points cost less to establish than three-plot calibration points. Therefore, for a given budget, more forest stands can be field- visited using one-plot points than three-plot points;
- There is no statistically significant difference in the accuracy of attribute descriptions derived from one-plot calibration points compared to three-plot calibration points.

The Ministry of Forest prefers that all photo interpreters are involved in all phases of fieldwork to obtain local knowledge , particularly for those map areas they are responsible for. Generally all photo interpreters for all of the VRI Contractors on this project were involved in the ground work to some extent. This wasn't true for some of the air call work, as in some cases only one or two of the most experienced classifiers did the air call work, not providing local experience to other photo interpreters, but did provide a reduced cost to the VRI contractor for this portion of the work.

**Table 2: List of numbers of Field Data Points Collected.**

Company	Area	Year	Ground Calls	Air Calls	Comments
Arc Alpine	2 maps	2000	25	40	*Est. on 2.0 mse's
Timberline	4 maps	2003	68	140	
Timberline	6 maps	2004	40	80	
TFMG	76 maps	2006-2009	1103	1860	All XGV one point calls
TFMG		2009	70	112	Westbank CF & Private Lands
IRC	82E Blk.	2006	100	162	
FDI	82M Blk.	2006	472	756	Includes 1 and 3 pt. Road and Heli Access.
FDI	82E Blk.	2008	211	398	Includes 1 and 3 pt. Road and Heli Access.
FDI	82L Blk.	2008	58	85	Includes 1 and 3 pt. Road and Heli Access.
FDI	82E & 92H Blk.	2009	376	694	Includes 1 and 3 pt. Road and Heli Access.
Totals			<b>2,523</b>	<b>4,368</b>	

\* Had no info. on exact numbers of calibration points established.

### 6.5.3.2 Air Observation and Ground Observation

Air observations and ground observations are casual calls with no cost associated. These are generally established between the formal air or ground calls as the classifier moved from one point to the next. Information recorded generally is a quick look for one or more attributes, such as, species, age or height and is recorded on the ortho or photos being used for navigation from one point to the next. All of the contractors involved in this project, specified casual observations would be collected as a part of the field work program. These generally were not captured to the digital data base.

The 2006-2009 work of Timberline documents an additional 465 air observations and 465 ground collected.

### 6.5.3.3 Data Description Format

All field data is in digital form and was submitted to the MFR as part of the project deliverables. This included a summary (with geodetic coordinates) in the MFR specified MS Excel format.

## 6.6 Attribute Estimation and Cover Descriptions

### 6.6.1 Final Attribution

VRI descriptions were derived based on the following sources.

- Current inventory field sampling data;
- Field data from previous inventory surveys (existing data sources);
- Compiled cruise plot data supplied by OIFS;
- Digital tree height measurements;
- The photo interpreter's local knowledge, skills and experience.

The process used to assign attributes to the vegetation cover polygons was per VRI Photo Interpretation Standards of the day. Generally, for polygon numbering, the numbering was generated by computer programming, starting at the north west corner of a map and proceeding by approximate photo strip width to end at the south east corner of a map. From review of the polygon descriptions in the MoF VRI data base (LRDW) all attributes were assigned the full VRI (V record) attributes, excluding silviculture openings, not free growing. Major Parks and TFL's were excluded, and some of the private lands ( Timberline projects) were not included in VRI attribution. Part way through the 10 years of this project, FIA took the position to not fund private lands; however some of the VRI contractors included private lands ( forested areas) as a matter of course without additional cost to FIA, as traditionally these lands were always included.

Softcopy technology provides the opportunity to measure tree heights directly off digital imagery. For most contracts within this project, particularly after 2005, Photogrammetric height were measured off the digital imagery in approximately 50% of the treed polygons and generally kept on a separate level of the data base by the photo interpreters.

All polygon descriptions were edge tied to adjacent map sheets within the project areas.

The following attributes were assigned to all polygons, as applicable:

- Mapsheet number;
- Polygon number;
- Ecological Information (including Surface Expression, Modifying Processes, Site Position, Soil Moisture Regime and Alpine Designation);
- BC Land Classification;
- Soil Nutrient Regime;
- Tree layer;
- Tree crown closure
- Tree cover pattern;
- Vertical Complexity;
- Species composition;
- Age of the first species;
- Age data source code;
- Height of the first species;
- Age of the second species;

- Height of the second species;
- Basal area;
- Stand density;
- Silviculture opening number;
- Stand disturbance and treatment history;
- Site index;
- Site index species;
- Snag frequency;
- Descriptions of lesser vegetation (Shrubs, Herbs, Bryoids);
- Description of non-vegetated components.

Software:

Generally, each VRI contractor has its own custom software for input of VRI polygon descriptions. The format and content of the resultant MoF MS Access MDB format data was validated using MoF Vegcap 3.0 software. Vegcap error reports were submitted as a project deliverable.

## 6.6.2 Silviculture Information

Silviculture information was initially provided, directly by the TSA licensees. Later the Ministry of Forests selected RESULTS as a standard for inclusion of silviculture data into the MoF corporate database and required licensees to submit all their activities to the MoF through Results. Results data, submitted to the MoF by the licensees, initially, proved to be a poor source of information for VRI, in some cases, as it could be very inconsistent for opening external boundaries, redundant linework and incomplete attributes. It became an issue of contention between the VRI contractors and MoF VRI foresters as its inclusion, at times, was causing sub-standard data to be entered into the corporate data base and resulted in increasing workloads for the VRI contractor to complete projects. The Southern Interior VRI Foresters and the MoF FAIB, VRI Update Section, along with VRI contractors eventually addressed this issue with a set of VRI Standards for incorporation of Results data.

Criteria used to address silviculture openings included:

- External opening boundaries were photo interpreted, verified and delineated directly from the project imagery;
- Internal opening polygon boundaries for non-free growing stands were derived from information supplied by the MFR; In the later years, non free growing (FTG) openings would have all internal linework removed and only use the attributes of the largest polygon within the opening.
- Internal opening polygon descriptions for non-free growing stands were derived and maintained from inventory information supplied by the MFR. Any missing VRI information was photo interpreted directly from the project imagery;
- Internal opening polygon boundaries for free growing stands were photo interpreted and delineated directly from the project imagery;
- Internal opening polygon descriptions for free growing stands were photo interpreted and assigned full VRI descriptions (using previous forest survey information supplied by the MFR as a guide).
- All stands designated as free-growing by the MFR were assigned a description of “FTG” in the Project Name field of the MDB database (as per MFR instructions).

## 6.7 Digital Map Production.

Initially, softcopy VRI projects were delivered to the MoF in Microstation design file 3d and 2d formats. Later, Timberline, started using a personal geodb.mdb format for their Purview softcopy systems and eventually the MOF FIAB Update section adopted a personal geodatabase format that their Vegetation Resource Inventory Management System (VRIMS) could use and was the VRI Standard for digital mapping products in the last 2 years of this project. .

Noded VRI base maps were electronically compared to the digital VRI attribute file to ensure that there is an exact one to one correspondence. These base maps are then vector and polygon cleaned using Sierra's Maps 3D software. This is to eliminate any line work errors.

Concurrently, the following items were checked to ensure compliance with the Phase I VRI standards and specifications:

- Single neat line format;
- Transfer and coding of all new roads, trails and landings;
- Location and coding of field data sources;
- Accuracy of planimetry and cadastre and annotation of toponyms and descriptions;
- All edge-ties for line work and polygon descriptions.

### Standards

- Ministry of Forests Vector Cleaning Specifications (1997);
- Forest Resource GIS Specifications and Standards for 1:20 000 Digital Mapping (1998);
- Ministry of Forests, Forest Inventory Manual (1992) Volume 5-Preparation and Creation of FRGIS Data Files (March, 1996 revisions);

# 7 Deliverables

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VRI deliverables for each project and each map sheet included:

- Original hardcopy field forms for all field calibration data.
- any hardcopies of digital orthophotos used for fieldwork.
- A digital copy of all field calibration data in an excel spread sheet format provided by the MoFR - FAIB. Initially, for simple digital storage of this data, but later to build the MoF-FIAB "Calibration Tile".
- each map in either a microstation dgn file format with appropriate graphics file or the VRIMs validated personal geodatabase file in ARC geodb format; depending on the VRI contractor and year of the particular project. The MoFR VRIMs file format was not a standard till the spring of 2009.
- All validation reports for digital mapping, required by the MoF
- Digital Imagery, originally provided by the MoFR, in .sjs format with associated .mod, .std files required for softcopy work.
- All 3rd party quality control documentation for each phase of a project.

# 8 Quality Assurance

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All projects required the use of independent third-party VRI certified Photo Interpretation - Quality Assurance personnel. In addition, each VRI contractor was also required to perform quality control on each phase of the VRI and all the VRI personnel involved with any phase of the work.

All quality Assurance (QA) was conducted in accordance with the MoF Photo Interpretation Quality Assurance Procedures of the day. All QA personnel involved in any period of this 10 year project are noted in Section 3 Personnel.

Once a phase of work was reviewed by 3rd party QA, it was returned to the VRI contractor to review, if necessary and make any necessary adjustments.

All Phase 1 VRI work completed by the various VRI contractors was accepted, once revisions were made, if required, and the VRI Contractor notified the MoF Regional Inventory Forester and OIFS lead that corrections had been reviewed / corrected.

No significant issues were identified by 3rd party QA personnel, that would have made it necessary to redo completed work, with minor exceptions noted below.

All quality assurance work was supposed (required) to be submitted as a deliverable, generally as each phase of a VRI project was in progress, so that any issues could be addressed immediately. Quality Assurance documentation for the first few years was limited. Initially e-mails with score sheets attached were the method QA was delivered, as 3rd party QA had not yet become the course for QA reporting, but eventually more formal reports were developed by the QA contractors with consistent delivery. Delineation QA required a minimum of 3 softcopy models be reviewed; All field work was quality assured at a 5% rate, based on the number of calibration points established. Final Attribution was QA'ed at a rate of 2% of total number of polygons up till 2009; the rate was then increased to 3%.

The number of quality assurance reports associated with this project, and the lack of availability of some, prevents their inclusion in this report. A brief overview of who did the Quality assurance is outlined below:

- Joe Rich Creek (82E084,085 in 2000) was a project completed prior to the OIFS involvement, by Gorman Bros Lumber Co. No comment on QA documentation is included here.
- From 2002 to 2005, QA was primarily performed by Jim Grace- RPF - MoF (delineation and Attribution) and Craig Robinson - Forsite Contractors - Salmon Arm, BC. (fieldwork) A total of 10 maps were completed in this time period. QA documentation was generally a simple e-mail with QA forms attached and not every map may have got the required QA for all components. MoF VRI staff role in QA being one issue.
- In 2006, Vern Sundstrom, assisted by Lloyd Wilson completed all of the field work QA, completed by the three contractors (Timberline, FDI, IRC). There was only one submission, the June 10th 2006 QA Report by Vern Sundstrom for map sheets 82L092 to 096, that indicated leading and second species ages and leading species height, were substandard and the QA contractors, verified this on the ground. This was corrected and re-submitted. All other QA for all 3 VRI contractors met VRI Standards.  
- Of note: The March 31, 2006 QA report stated "The air calls are listed as all being completed by one interpreter, Frank Scheithauer, on one day". There were approximately 283 air calls completed with a QA rating of 93%. An excellent QA rating, but if this is correct, little local knowledge gained for individual photo interpreters.



- Laurie Wilson did all the QA for delineation and final attribution for FDI and IRC work. There were no significant issues identified .
- Don Skinner (Jan. 24, 2007 Report) did the QA for 30 maps Timberline completed ; for delineation, data source transfer and final attribution. No significant issues identified.
- 2007. Don Skinner; TNRG Delineation and Attributes. 6 groups of QA reviewed and any attributes not meeting VRI Standards were returned to the classifier for review and correction.
- 2008: The Westbank Community Forest (WCF) and portions of private forest lands included on selected maps was completed by TFMG . Murray Foubister (FDI) complete the air calibration calls quality assurance and Don Skinner did the polygon delineation and final attribution QA. No issues indentified.
  - October 31, 2008, Chase Ck , 6 maps,( 82L051,052,062,063,072,073), Silent Water Forestry, Lloyd Wilson, with Vern Sundstrom, completed Field work QA ( 58 ground calls - 9 checked, 85 air calls - 9 checked) exceeding the 5% requirement; no issues identified. The, delineation, data source transfer and attribution, was quality assured by Lawrence Wilson. No issues identified.
  - In 2008 /09 FDI completed 20 parts of maps covering the east and west sides of the Okanagan Lake corridor, directly adjacent to the lake, stretching from northwest of Kelowna International Airport and south to Osoyoos. All work was reviewed by Mathias Hulten of TFMG. Some delineation issues noted and corrected; fieldwork ( 398 XV ( 41 checked) and 210 XGV (24 checked) exceeding 5% requirement ) was good. Attribution had no issues identified.
- 2009/10: FDI completed the west side of the TSA, 82E and 92H maps. All FDI work was reviewed by Mathus Hulten of TFMG. No significant issues were identified.

It should be noted that VRI Standards are a minimal acceptable requirement ( i.e. 85% minimum for most attributes ) and that in most cases these standards were well exceeded for this VRI.

## 9 Costs

**Table 3: VRI Phase 1 Costs**

Year	Project #	Proponent	Ha's	Cost	FIA Funding
2000	Joe Rich Ck	Gorman Bros.	32,000.0	\$35,442.00	FRBC Funded \$1.11 ha.
2003/04 VRI	4206019	OIFS	52,247.0	\$74,145.48	Discretionary
2005/06 VRI	4480002	OIFS	741,913.0	\$238,226.01	Discretionary
2005/06 VRI Tolko	4482017	OIFS	186,673.0	\$147,303.26	Discretionary
2006/07 VRI	4633007	OIFS	391,925.0	\$440,565.65	Discretionary
2007/08 VRI	4820001	OIFS	285,302.0	\$197,268.48	Focus
2008/09 VRI	5001001	OIFS	374,059.0	\$634,386.47	Focus
2008/09 VRI	4948008	OIFS	119,931.7	\$59,506.27	Discretionary
2009/10 VRI	9137003	OIFS	281,000.0	\$532,000.00	Focus
			*2,246,713	\$2,358,843.62	

**Total VRI Costs were approximately \$1.05 per ha.**

**Table 4: Air Photo Costs Summary**

Year	Scale	Proponent	Ha's	Cost	
2001/02	1:30k Colour	OIFS - FRBC		\$800,000.00	
2007	1:20k colour	OIFS - FIA		\$517,392.00	
2007	33cm GSD	MoF MPB Fund		\$362,230.00	
			2,246,713	\$1,679,622.00	

**Total Photo costs for two flights, and softcopy data for the TSA were approximately 0.75 cents per ha.**  
The 2001/02 photo acquisition was intended for both PEM (Bio-terrain) and VRI mapping.

# 10 Conclusion and Recommendations

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The Vegetation Resources Inventory is the Provincial Forest Inventory and as such the property of the Province of BC. Initially, this Inventory was the responsibility of the Ministry of Forest, Inventory staff, but political decisions removed this responsibility to the private sector.

The length of time required to complete the Okanagan TSA VRI was not a desired time frame for completing a TSA Vegetation Resources Inventory. Generally a 1 or 2-3 year time frame is more appropriate, doing the work in logical blocks, to ensure consistency by VRI contractors in meeting and maintaining VRI Standards and delivery of final products. Additionally, maintaining cost efficiencies is facilitated by shorter VRI time frames.

Issues that influenced the delivery of the Okanagan TSA VRI included:

- A need for buy-in, by the various licensees involved in the OIFS.
- Restrictions on the role of MoF Inventory Staff.
- A learning curve required by the licensee project representatives to understand the needs of a Phase 1 Photo Interpretation VRI.
- Inconsistent funding throughout the first number of years of this project.
- The emerging Mountain Pine Beetle (MPB) issue. The OIFS was well into the VRI process and FAIB did not want any VRI completed until the MPB was finish. The OIFS addressed this by moving to the wet belt ( non-pine) areas of the TSA, to be complete first.
- The VRI VSIP / VPIP Standards changed significantly over the time frame of this project putting greater pressure of proponents to deliver a detail plan for VRI.
- A need to acquire photo coverage twice.

The previous inventory (PSYU)for the Okanagan was outdated and in need of revision. The Okanagan TSA VRI was initially a struggle to convince portions of the Okanagan Innovative Forestry Society of its need. Ultimately this was achieved and with perseverance by Glen Dick and MoF staff, completion of this VRI was achieved.

## 11) Potential Attachments

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- Westbank Community Forest - Project Completion Report. December 2008
- Okanagan TSA (082L and 092Letter Blk Project Completion Report. March 25, 2009
- Quality Assurance Documents. Can be found at MoF Forest Analysis Inventory Branch or with the Okanagan Innovative Forestry Society.

# APPENDIX: 1

The Okanagan TSA is comprised of 192 maps or 136.6 MSE's (map sheet equivalents)

**Maps in bold text indicate wet belt / fir leading priority areas**

\*\* Maps completed prior to 2005.

Map		VRI Date	Contractor	Photo Interpreter	MSE's
82E001		2010	FDI	Kela Auger	1.0
82E002		2009	FDI	Kela Auger	1.0
82E003		2009	FDI	Kela Auger	0.99
82E004		2009	FDI	Kela Auger	0.52
82E011		2010	FDI	Kela Auger	1.0
82E012		2009	FDI	Kela Auger	1.00
82E013		2009	FDI	Kela Auger	0.80
82E014		2009	FDI	Kela Auger	0.01
82E021		2010	FDI	Kela Auger	1.0
82E022		2009	FDI	Kela Auger	1.0
82E023		2009	FDI	Kela Auger	0.62
82E024		2009	FDI	Kela Auger	
82E031		2010	FDI	Yari Nielsen	0.87
82E032		2009	FDI	Kela Auger	1.0
82E033		2009	FDI	Kela Auger	0.83
**82E034		2003	Timberline	F.Scheithauer	0.36
82E041		2010	FDI	Yari Nielsen	0.61
82E042		2009	FDI	Kela Auger	1.0
82E043		2009	FDI	Kela Auger / Andy Little	1.0
82E044		2010	FDI	Yari Nielsen	0.91
82E051		2010	FDI	Yari Nielsen	0.90
82E052		2009	FDI	Andy Little	1.0
82E053		2009	FDI	Yari Nielsen	1.0
82E054		2010	FDI	Andy Little	1.0
82E055		2010	FDI	Andy Little	0.16
82E061		2010	FDI	Mark Hemstock	1.0
82E062		2009	FDI	Andy Little	0.90
82E063		2009	FDI	Andy Little	0.96
82E064		2010	FDI	Andy Little	1.0
82E065		2010	FDI	Andy Little	0.55
82E071	Westbank CF	2010/2009	FDI/TFMG	M. Hemstock/ J. Sproule	0.84
82E072	Westbank CF	2009	FDI/TFMG	A. Little/ J. Sproule	0.64
82E073		2009	FDI	Andy Little	0.85
82E074		2010	FDI	Andy Little	1.0

82E075		2010	FDI	Andy Little	0.93
82E076		2006	IRC	Chris Lauder	0.39
82E077		2006	IRC	Chris Lauder	0.02
82E081	Westbank CF	2010/2009	FDI/TFMG	M. Hemstock / J. Sproule	1.0
82E082	Westbank CF	2009	Timberline	Jerry Sproule	1.0
82E083		2009	FDI	Andy Little	1.0
**82E084	Joe Rich Ck.	2001	Arc Alpine	F. Scheithauer	1.0
**82E085	Joe Rick Ck.	2001	Arc Alpine	F. Scheithauer	1.0
82E086		2006	IRC	Chris Lauder	1.0
82E087		2006	IRC	Bruce Townsend/C.Lauder	0.56
82E088		2006	IRC	Horia Serban	0.06
82E091	Westbank CF	2010/2009	FDI/TFMG	M. Hemstock /J. Sproule	0.89
82E092	Westbank CF	2009	TFMG	Jerry Sproule	0.51
82E093	Westbank CF	2009	TFMG	Jerry Sproule	0.80
82E094		2009	FDI	Murray Foubister	1.0
82E095		2009	FDI	Murray Foubister	1.0
82E096		2006	IRC	Chris Lauder	1.0
83E097		2006	IRC	B. Townsend / H. Serban	1.0
82E098		2006	IRC	H. Serban / B. Townsend	0.89
82E099		2006	IRC	Horia Serban	0.04
**82L001		2004	Timberline	Rob Oran	0.90
**82L002	Westbank CF	2004	Timberline	Rob Oran	0.14
82L003		2008/09	TFMG	F.Scheithauer/ R.Metcalf	0.59
82L004		2008/09	TFMG	R. Metcalfe /F. Scheithauer	1.0
82L005		2008/09	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L006		2006/07	TFMG	R.Paterson/ F. Scheithauer	1.0
82L007		2006/07	TFMG	R. Paterson/ F. Scheithauer	1.0
82L008		2006/07	TFMG	R. Paterson/ F. Scheithauer	1.0
82L009		2006/07	TFMG	Grant/F. Scheithauer	0.18
**82L011		2004?	Timberline	Rob Oran	0.71
**82L012		2004?	Timberline	Rob Oran	0.10
82L013		2008/09	TFMG	Ron Metcalfe / F. Scheithauer	0.64
82L014		2008/09	TFMG	Ron Metcalfe / F. Scheithauer	0.94
82L015		2008/09	TFMG	Ron Metcalfe/ F. Scheithauer	1.0
82L016		2006/07	TFMG	M. Hulten/F. Scheithauer	1.0
82L017		2006/07	TFMG	M. Hulten/ F. Scheithauer	1.0
**82L018		2003	Timberline	MWM (2003)	1.0
82L019		2006/07	TFMG	Frank Scheithauer	0.63
**82L021		2004/05	Timberline	Rob Oran	0.36
**82L022		2004/05	Timberline	Rob Oran	0.10
82L023		2006/07	TFMG	Frank Scheithauer	0.44
82L024		2006/07	TFMG	Frank Scheithauer	0.96
82L025		2006/07	TFMG	F. Scheithauer/M. Hulten	1.0
82L026		2006/07	TFMG	R. Metcalfe/F. Scheithauer	1.0

82L027		2006/07	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L028		2006/07	TFMG	F.Scheithauer	1.0
82L029		2006/07	TFMG	F. Scheithauer	0.69
82L031		2008/09	TFMG	Ron Metcalfe	0.05
82L032		2008/09	TFMG	Ron Metcalfe	0.40
82L033		2006	TFMG	F. Scheithauer/R. Paterson	0.79
82L034		2006	TFMG	Rob Paterson	1.0
82L035		2006	TFMG	Mathius Hulten	0.55
82L036		2006	TFMG	Ferguson/ M. Hulten	1.0
82L037		2006/07	TFMG	R. Metcalfe/ F. Scheithauer	1.0
82L038		2006/07	TFMG	R. Metcalfe / F. Scheithauer	1.0
82L039		2006/07	TFMG	Ron Metcalfe/Scheithauer	0.61
82L041		2008/09	TFMG	Ron Metcalfe	0.08
82L042		2008/09	TFMG	Frank Scheithauer	0.99
82L043		2006	TFMG	R. Metcalfe/ F. Scheithauer	0.87
82L044		2006	TFMG	Ron Metcalfe /M. Hulten	1.0
82L045		2006	TFMG	Mathius. Hulten	0.89
82L046		2006	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L047		2006	TFMG	R. Metcalfe/ F.Scheithauer	1.0
**82L048		2003	Timberline	MWM (2003)	1.0
82L049		2006/07	TFMG	Ron Metcalfe	0.64
82L050		2008/09	TFMG	Frank Scheithauer	0.10
82L051		2009	FDI	Yari Nielsen	0.06
82L052		2009	FDI	Yari Nielsen	0.67
82L053		2006	TFMG	Rob Paterson	0.32
82L054		2006	TFMG	Rob Paterson	1.0
82L055		2006	TFMG	Rob Oran	1.0
82L056		2006	TFMG	R. Paterson/M. Hulten	1.0
82L057		2006/07	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L058		2006/07	TFMG	R. Metcalfe/F.Scheithauer	1.0
82L059		2006/07	TFMG	Ron Metcalfe	0.84
82L060		2008/09	TFMG	Frank Scheithauer	0.07
82L062		2009	FDI	Yari Nielsen	0.54
82L063		2009	FDI	Yari Nielsen	0.97
82L064		2008/09	TFMG	F. Scheithauer/R. Metcalfe	1.0
82L065		2008/09	TFMG	F. Scheithauer/ R. Metcalfe	1.0
82L066		2008/09	TFMG	F. Scheithauer/ R. Metcalfe	1.0
82L067		2007/08	TFMG	Ron Metcalfe	1.0
82L068		2007/08	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L069		2007/08	TFMG	Ron Metcalfe	0.99
82L070		2008/09	TFMG	Frank Scheithauer	0.06
82L072		2009	FDI	Yari Nielsen	0.71
82L073		2009	FDI	Yari Nielsen	1.0
82L074		2007/08	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L075		2007/08	TFMG	R. Metcalfe/ F. Scheithauer	1.0
82L076		2007/08	TFMG	R. Metcalfe/F.Scheithauer	0.99
82L077		2007/08	TFMG	R. Metcalfe / F. Scheithauer	0.96

82L078		2007/08	TFMG	R. Metcalfe/F. Scheithauer	1.0
82L079		2007/08	TFMG	R. Metcalfe/F. Scheithauer	0.85
82L082		2007/08	TFMG	Ron Metcalfe	0.20
82L083		2008/09	TFMG	F. Scheithauer/ R. Metcalfe	0.93
82L084		2008/09	TFMG	F. Scheithauer? R. Metcalfe	1.0
82L085		2008	TFMG	Ron Metcalfe	0.93
82L086		2008/09	TFMG	F. Scheithauer/R. Metcalfe	0.99
82L087		2008/09	TFMG	F. Scheithauer/ R. Metcalfe	0.96
82L088		2008	TFMG	F. Scheithauer/ R. Metcalfe	0.95
82L089		2008/09	TFMG	F. Scheithauer/ R. Metcalfe	0.61
82L092		2006/07	TFMG	Frank Scheithauer	0.01
82L093		2006/07	TFMG	Frank Scheithauer	0.83
82L094		2006/07	TFMG	F. Scheithauer / Grant	1.0
82L095		2006/07	TFMG	R. Paterson/F. Scheithauer	0.96
82L096		2006/07	TFMG	R. Paterson	0.67
82L097		2006/07	TFMG	R. Paterson	1.0
82L098		2006/07	TFMG	R. Paterson	0.96
82L099		2006/07	TFMG	Grant/ R. Paterson	0.28
82M003		2007	FDI	Andy Little	0.63
82M004		2007	FDI	Andy Little	1.0
82M005		2007	FDI	Andy Little	1.0
82M006		2006	FDI	Kela Auger	0.92
82M007		2006	FDI	Kela Auger	1.0
82M008		2006	FDI	Kela Auger	0.81
82M013		2007	FDI	Andy Little	0.46
82M014		2007	FDI	Andy Little	1.0
82M015		2007	FDI	Kela Auger	1.0
82M016		2006	FDI	Kela Auger	1.0
82M017		2006	FDI	Kela Auger	1.0
82M018		2006	FDI	Kela Auger	0.52
82M023		2007/08	FDI	Andy Little	0.07
82M024		2007/08	FDI	Andy Little	0.67
82M025		2007	FDI	Andy Little/ K. Auger	1.0
82M026		2007	FDI	Kela Auger	1.0
82M027		2008	FDI	Kela Auger	1.0
82M028		2008	FDI	Kela Auger	0.21
82M034		2007	FDI	Andy Little	0.01
82M035		2008	FDI	Andy Little	0.78
82M036		2008	FDI	Kela Auger	1.0
82M037		2008	FDI	Kela Auger	0.97
82M038		2008	FDI	Kela Auger	0.03
82M045		2008	FDI	Andy Little	0.04
82M046		2008	FDI	Kela Auger	0.87
82M047		2008	FDI	Kela Auger	0.75
82M056		2008	FDI	Kela Auger	0.73
82M057		2008	FDI	Kela Auger	0.12
82M065		2007	FDI	Kela Auger	0.01



<b>82M066</b>		2007	FDI	Kela Auger	0.53
92H008		2010	FDI	Kela Auger	0.17
92H009		2010	FDI	Kela Auger	0.43
92H010		2010	FDI	Kela Auger	0.12
92H018		2010	FDI	Kela Auger	0.12
92H019		2010	FDI	Kela Auger	0.75
92H020		2010	FDI	Kela Auger	0.60
92H028		2010	FDI	Kela Auger	0.02
92H029		2010	FDI	Kela Auger	0.25
92H030		2010	FDI	Kela Auger	0.14
92H040		2010	FDI	Yari Nielsen	0.04
92H050		2010	FDI	Yari Nielsen	0.17
92H060		2010	FDI	Yari Nielsen	0.12
92H070		2010	FDI	Mark Hemstock	0.52
92H079		2010	FDI	Mark Hemstock	0.02
**92H080		2003	Timberline	Warren Nimchuk	0.92
92H089		2010	FDI	Mark Hemstock	0.09
92H090	Westbank CF	2009	TFMG	M. Hemstock/ J. Sproule	0.90
92H100	Westbank CF	2009	TFMG	M. Hemstock/ J. Sproule	0.01
92I010		2008/09	TFMG	Ron Metcalfe	0.24

## Appendix 2: Inventory history of the Okanagan TSA by PSYU

Unit Name (PSYU)	Unit #	Inventory Dates	ESA's	Area (ha's)
Spallumcheen	112	1972	1977	450,079
Salmon Arm	115	1962 /75 /78	1978	135,379
Kettle	124	1963 / 77	1977	75,713
Edgewood	125	1967 / 77	1977	64,935
Adams	146	1968	1978	2,987
Eagle	150	1971		154,872
Shuswap	171	1963 / 75 / 79	1979	320,114
Ashnola	181	1969	1978	156,768
Barton Hill	182	1970	1977	63,376
Okanagan	187	1964 / 75	1975	701,737
Kamloops	261	1968 / 77	1977	32,635
				2,158,522

\*This table is taken directly from the pre-inventory assessment (Grace, 1996).