
Vegetation Resources Inventory

Fort St. James District - Project Implementation Plan for Photo Interpretation

Prepared by
Ministry of Forests, Lands and Natural Resource Operations
Forest Analysis and Inventory Branch

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Section 1 - Introduction

Background Information

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) has identified a need to complete a new photo interpreted inventory (Vegetation Resources Inventory [VRI], Phase 1) in the southern portion of the Fort St. James Forest District. The plan is to complete this inventory by March 2018. This document details the planning necessary for the project to commence.

The mountain pine beetle (MPB) has significantly affected the forest cover in the Fort St. James District. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, updated species compositions to reflect MPB mortality, and an estimate of the amount of dead volume in the District.

Significant concerns have been raised regarding the mid-term timber supply given the enormous impact of the MPB in this District. Recent uplifts of the allowable annual cut (AAC) have occurred in order to expeditiously harvest as much of the beetle-killed wood as possible before it exceeds its shelf-life. The Special Committee on Timber Supply summarized key messages from a series of local public hearings including the need to base decisions on an updated inventory.

Stakeholders and First Nations attended one of two VRI Phase 1 planning meetings on January 28, 2015 in the Fort St. James District Office for an introduction to the project and to provide input regarding their needs and objectives. Stakeholder and interest groups at the meetings included:

- Fort St. James District staff
- BC Timber Sales staff
- Research forest representative
- Woodlot chapter representative
- Local First Nations

A complete list of invitees and attendees is available in Appendix A.

Document Objectives

This Vegetation Resources Inventory Project Implementation Plan (VPIP) is a working document that states the critical reasons and objectives for carrying out a Phase 1 VRI in the Fort St. James District. It includes details on the area to be inventoried, issues with the current inventory, objectives, and key steps required to be carried out for a successful completion of a photo interpretation project.

Overview of the VRI Process

The VRI provides a strategic inventory (as opposed to an operational inventory) at the management unit level (e.g., District, TSA or TFL) designed to answer two basic questions: where is the resource, and how much is there? The VRI consists of two phases: air photo interpretation (Phase 1) and ground sampling (Phase 2). These phases may be undertaken in combination or, in certain situations, individually.

Phase 1 involves acquisition of new photos, delineation of new polygons, and estimation of polygon attributes, with the final product being the corporate inventory. Phase 2 involves ground sampling a random subset of the new polygons to verify the level of confidence in the Phase 1 inventory, and to provide detailed information on stand characteristics (such as tree size distribution and condition) that is not available from the Phase 1 inventory.

The individual stages of a VRI Phase 1 project include the following:

- Image acquisition: Images used for VRI photo interpretation projects must be less than five years old. The photos for this project were acquired in the summer of 2014.
- Historical data source transfer: The existing data sources in the project area are evaluated and captured digitally if they are deemed to be useful for the current project.
- Delineation: New linework is delineated on the images. Polygon delineation is based on the B.C. Land Cover Classification Scheme (BCLCS). This land classification scheme includes both vegetated and non-vegetated cover classes. Polygons identified by the land classification scheme are further divided into similar vegetated or non-vegetated polygons based on mensurational attributes (species, age, height and crown closure) and/or ecological attributes where appropriate.
- Fieldwork: A series of calibration points are established for use by the interpreters. These calibration points are a combination of air calls via helicopter, and ground calls. The calibration program allows the interpreters to gain some familiarity with the project area, and the data acts as reference points while attributing neighbouring polygons.
- Attribute estimation: All delineated polygons are assigned attributes which describe the vegetative or non-vegetative characteristics of the polygon. A complete description of the attributes described is available in the *VRI Photo Interpretation Procedures*.

More details regarding the VRI process and the VRI procedures and standards are available at the Forest Analysis and Inventory Branch (FAIB) website: <http://www.for.gov.bc.ca/hts/vri/index.html>.

Fort St. James District “Target Area” Landbase

In recent years, VRI Phase 1 projects have typically been conducted for entire TSAs or Districts. The primary benefit of this is generating a consistent inventory product (both in qualities and vintage) to be used in timber supply analyses. In this case, however, the Phase 1 project (“target”) area is the southern ~40% of the Fort St. James District (Figure 1). There are several reasons for this departure from typical practice. First, priority areas for current re-inventory projects are still centred on MPB-impacted areas of the province. This project area captures the vast majority of pine-leading stands within the District (Figure 2), and it also corresponds to the majority of the timber harvesting land base (THLB); therefore, this project area contains the area most impacted by MPB- and harvest-induced changes to the inventory within the District. Second, the Fort St. James District is sufficiently large enough to make the completion of an inventory under a single project impractical given the current capacity for photo interpretation work in the contracting community. The inventory for the remainder of the District is less than ~25 years old, and given its sufficient lack of pine and harvesting activity, and the limitations on annual photo interpretation capacity, it will suffice for the near future.

Note that all tables in this section represent data based specifically on the project area, which does not include all of the Fort St. James District (for reasons discussed above), and does include portions of the Prince George District (86,954 ha, or 6.1%) and the Mackenzie TSA (64,921 ha, or 4.6% of the project area) (due to completion of Phase 1 projects using square edge mapsheets).

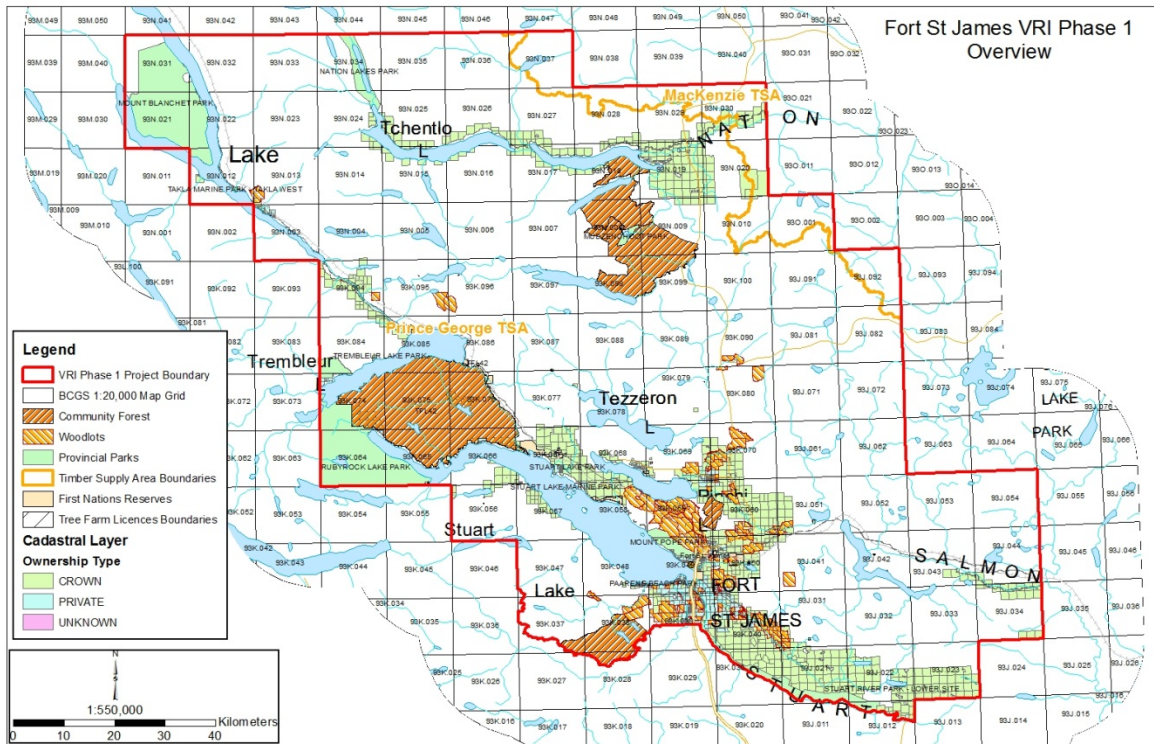


Figure 1. Overview of Fort St. James VRI Phase 1 project area. (See Appendix C for full-page maps)

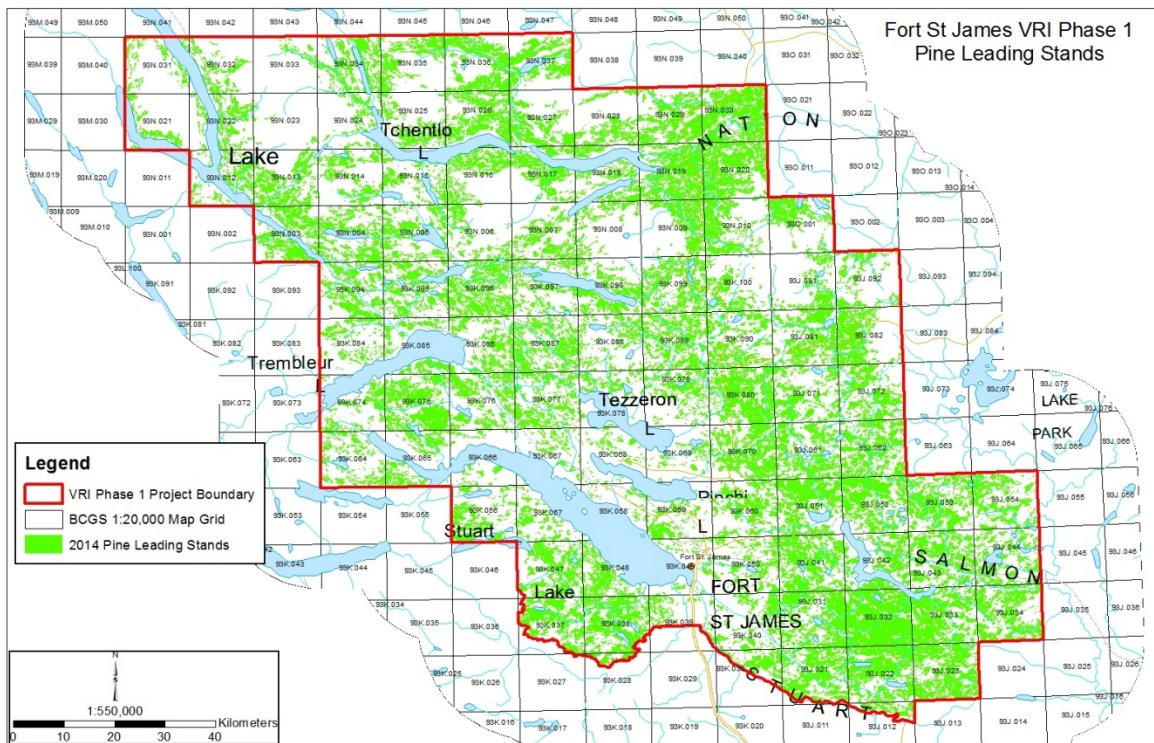


Figure 2. Pine leading stands in the Fort St. James VRI Phase 1 project area. Pine leading is defined as any polygon with Species 1 being any pine species $\geq 50\%$ by basal area.

Photo Interpretation VPIP for Fort St. James District

The Fort St. James District comprises 3.18 million hectares, which represents ~40% of the Prince George TSA. Of this area, 2.01 million hectares are provincial Crown forest land. The project area is 1,415,852 ha. Considering only the landbase of the project area that is part of the Fort St. James District (1,263,978 ha), the project covers ~40% of the Fort St. James District and ~16% of the Prince George TSA. Approximately 13% of the entire project area is classed as parks, reserves, private land, and area-based tenures (Table 1, Figure 1).

Table 1. Land classification in Fort St. James VRI Phase 1 project area.

Land Classification	Area (ha)	% of Project Area
Project Area	1,415,852	100.0%
Provincial Parks	61,025	4.3%
Protected Areas & Reserves	281	0.0%
Indian Reserves	3,997	0.3%
Private	17,210	1.2%
Community Forest Agreements	70,348	5.0%
Woodlots	28,772	2.0%
<i>Parks, Reserves and Tenures Total</i>	<i>181,634</i>	<i>12.8%</i>

The town of Fort St. James is the primary community within the Fort St. James District, along with numerous smaller aboriginal communities including Nak'azdli (Nak'azdli First Nation), Binche, Tache, Middle River (Tl'azt'en First Nation), Yekooche (Yekooche First Nation), Takla Landing and Buckley House (Takla Lake First Nation). Other First Nations with interests overlapping the project area include Halfway River First Nation, Lake Babine Nation, Lheidli T'enneh Nation, McLeod Lake Indian Band, Nadleh Whut'en Band, and West Moberly First Nation.

The Fort St. James District presents a diversity of landscapes, from the rolling plateau in the southern portion of the District to the extremely mountainous and largely roadless landscapes of the north. Large lake systems include Takla, Trembleur, Stuart, Inzana, Pinchi, Tezzeron and Nation (Tsayta, Indata, Tchentlo, and Chuchi) Lakes.

The Fort St. James District covers parts of the headwaters of three major river basins: the Skeena, the Fraser, and the Peace. The first two drain to the Pacific Ocean while the Peace River flows, via the Mackenzie River, to the Arctic Ocean.

Forests are mostly lodgepole pine and spruce, with balsam at higher elevations and scattered patches of aspen. There are some areas of Douglas-fir, particularly along the shores of Stuart Lake (this breakdown also holds true for the smaller project area [Table 2]). A history of frequent wildfires has left a mosaic of forest ages, while the recent MPB outbreak has killed a majority of the mature pine stands in the southern portion of the District. Old- and mature-balsam stands predominate in the northern portion of the District.

Table 2. Leading species in Fort St. James VRI Phase 1 project area.

Leading Species	Area (ha)	% of Project Area
Pine (PL, PLI, PJ)	514,141	36.3%
Spruce (S, SB, SE, SS, SW, SX, SXW)	381,261	26.9%
Balsam (B, BL)	162,323	11.5%
Aspen (AC, ACT, AT)	96,732	6.8%
Douglas Fir (FD, FDI)	27,677	2.0%
Birch (EP)	4,729	0.3%
Tamarack (LT)	78	0.0%
Total	1,186,942	83.8%

The sub-boreal spruce (SBS) is the predominant BEC zone in the project area, with the Engelmann spruce – sub-alpine fir (ESSF) and boreal alтай fescue alpine (BAFA) zones occupying higher elevation areas in the north part of the project area (Table 3, Figure 3).

Table 3. Biogeoclimatic zones in Fort St. James VRI Phase 1 project area.

Biogeoclimatic Zones	Area (ha)	% of Project Area
Sub-Boreal Spruce (SBS)	1,205,973	85.2%
Engleman Spruce - Subalpine Fir (ESSF)	204,905	14.5%
Boreal Altai Fescue Alpine (BAFA)	4,973	0.4%
Total	1,415,852	100.0%

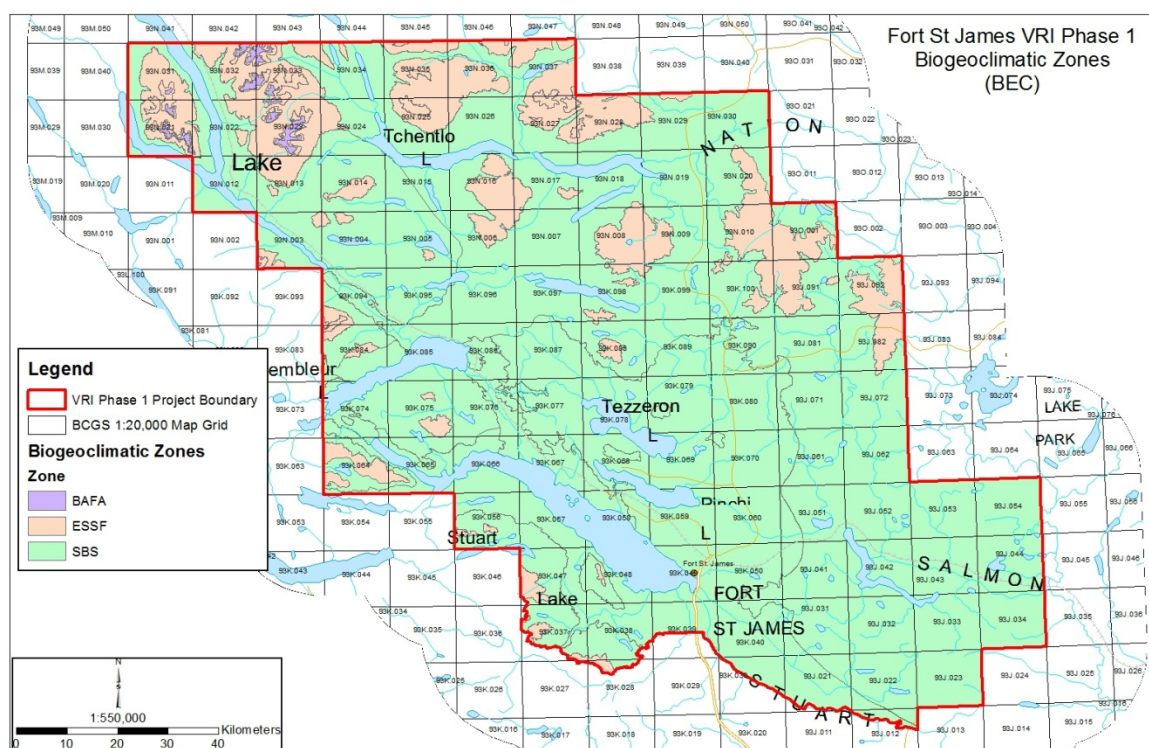


Figure 3. Biogeoclimatic zones in the Fort St. James VRI Phase 1 project area.

State of the Current Inventory

The forest cover attributes for the vast majority of the Fort St. James VRI Phase 1 project area conform to the VRI standard, with non-VRI standard (FIP or “T”) areas corresponding to RESULTS polygons (Figure 4). The majority of the project area was last re-inventoried in the early-2000s. (Figure 5), with the northern portion re-inventoried in the late 90s, and minor areas in the east corresponding to the Mackenzie TSA re-inventoried in the late-2000s.

Depletion and reforestation updates to the inventory from the RESULTS (REporting Silviculture Updates and Land status Tracking System) database are current to November 2013. Free growing updates have not yet been integrated into the inventory (note that depletion, reforestation and free growing updates are current to November 2014 in the VRIMS production layer). Recent fires are also not reflected in the inventory unless this data has been submitted via RESULTS. The inventory file has been projected to 2014 and polygon volumes have been adjusted to reflect MPB mortality observed in the most recent forest health overview flight.

This MPB “kill” in the database is a derived number based on several factors. The model looks at the amount of lodgepole pine (PI) in each polygon along with information from the most recent forest health overview flight and the BCMPB kill model. The model reduces the volume of live PI in the polygon but does not address changes in other attributes such as species composition, basal area or density.

VRI Phase 2 ground sampling and Net Volume Adjustment Factor (NVAF) programs were completed for the Fort St. James District between 2006 and 2009. Analysis using these programs’ data resulted in the development of an adjustment ratio for the Phase 1 height, age, basal area, stems per hectare, Lorey height and total live net merchantable volume.

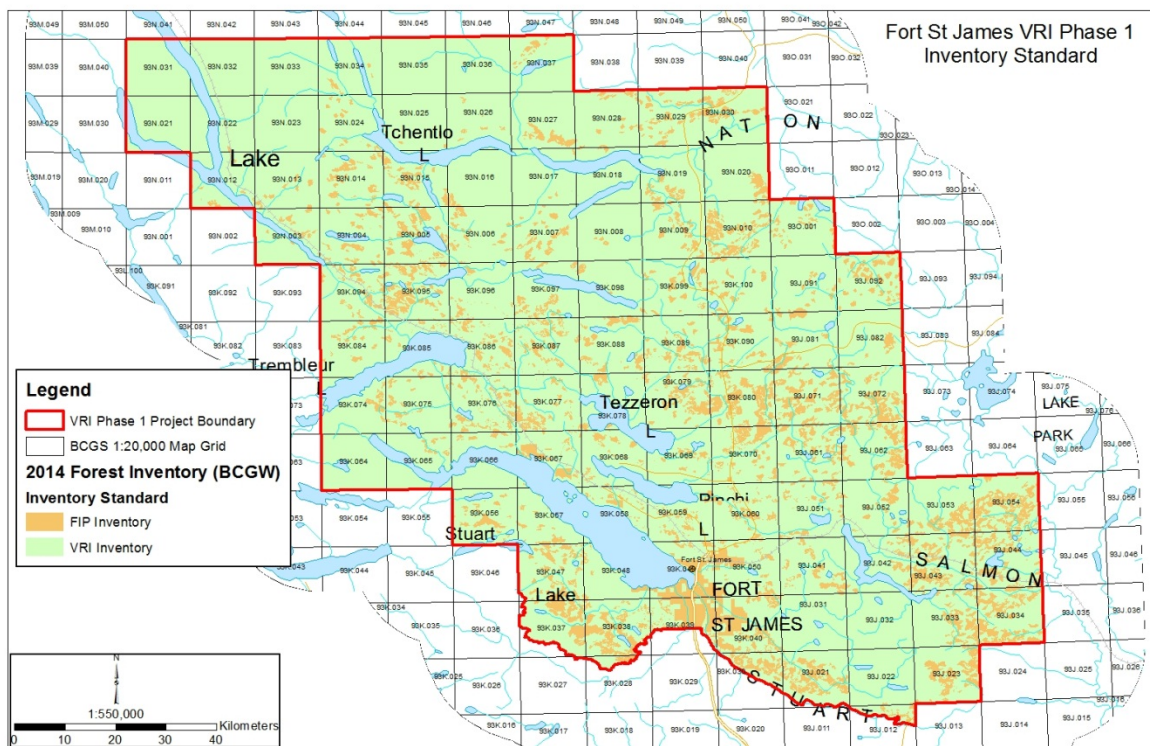


Figure 4. Inventory standard for the Fort St. James VRI Phase 1 project area. FIP Inventory includes “T” records, which are modified FIP or incomplete VRI records, the main source of which is RESULTS polygons.

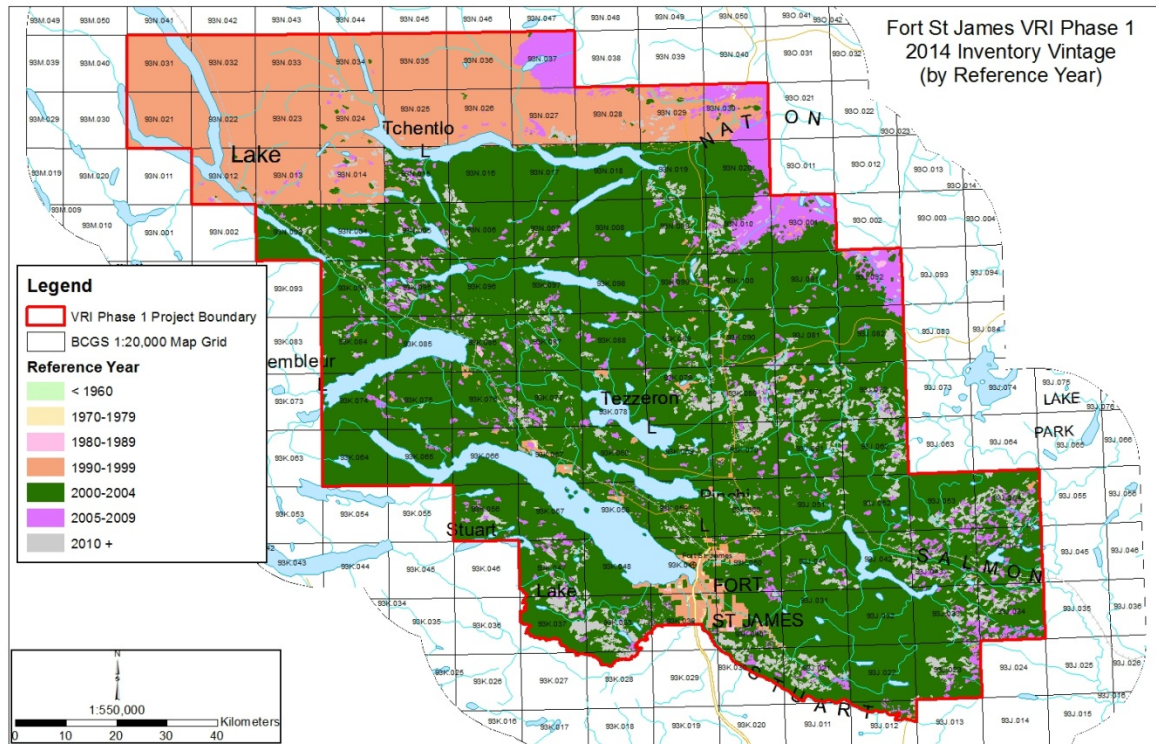


Figure 5. Inventory vintage (reference year) for Fort St. James VRI Phase 1 project area.

Section 2 - Photo Interpretation Plan

Project Objectives

The overriding objective of this photo interpretation project is to produce a new photo interpreted inventory to account for the massive change due to MPB mortality, and subsequent harvesting, since the last inventory for this project area. The new inventory will provide much needed current information on the spatial distribution of live and dead stands, update species compositions to reflect MPB mortality and harvesting, and provide an estimate of the amount of dead volume in the project area. One of the key outcomes of the project is to acquire improved information on the location of the MPB-killed stands and how much residual volume is left in these stands in order to better inform mid-term timber supply analyses.

Project Area

The entire Fort St. James VRI Phase 1 project area (Figure 1) will be photo interpreted, including all parks, protected areas, First Nations reserves, community forests, woodlots and private land.

The total project area is 1,415,852 ha covering 104 individual BCGS 1:20,000 full and partial mapsheets. For Contractor planning purposes, this equates to 99 full map equivalents (FMEs) based on 14,300 ha/FME (Appendix B).

Re-inventory of the adjacent Vanderhoof District, Lakes TSA and Morice TSA are currently being carried out (Figure 6), and all work for this project will tie with those new inventories where the project boundaries meet. There will be no gaps of older inventory left between these project areas.

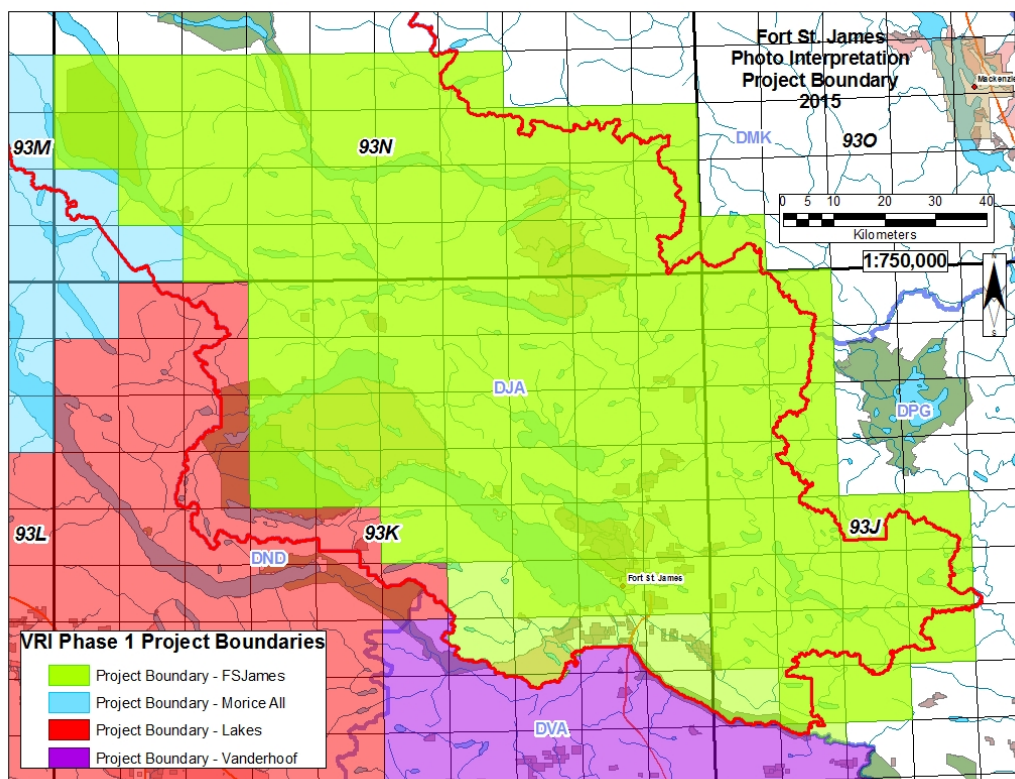


Figure 6. Adjacent VRI Phase 1 inventory project areas.

Stakeholder-Identified Issues

Several issues were identified at the stakeholder meetings that should be taken into account, where practicable, when planning and implementing the project:

1. Pine/non-pine volumes:
 - Data comparisons (by the District and local licencees) have been done for all harvested blocks in the TSA over the past three years between the inventory net volume and gross cruise volume reduced by the VRI net reduction factor. This comparison was done using live and dead stems.
 - Whether the differences are averaged across licencee, district or TSA, the results show the current inventory is underestimating pine volume and overestimating non-pine (primarily spruce) volume.
 - This issue could be confounded by a sample bias (the VRI inventory is intended to be accurate over the entire landbase, as opposed to the harvested landbase).
 - Another possible source of the difference could be within-polygon variation, since VRI polygons and harvest block boundaries rarely coincide.
2. Balsam volume/mortality:
 - Balsam volume is significantly underestimated by the current inventory, although much of that missing volume is now dead.
 - This issue becomes more prevalent as you move north in the District into Supply Block B (northern third of the project area and beyond), although the percentage of balsam mortality appears to vary widely from valley to valley.
3. District re-inventory outside of the project area:
 - The older inventory within the District but north of the project area (where balsam mortality is a major issue) should be a priority for re-inventory.
 - This area represents at least some of the short-term (and the majority of the mid-term) timber supply for the District; major harvest activities are already shifting into this area and will remain there for many years to come.
 - On a side note, it has also been noted that a similar pressure for re-inventory of the northern portions of the Mackenzie TSA exists for the same mid-term timber supply reasons as noted here for this District.
4. Deciduous volume:
 - Analysis of a small “deciduous” Phase 2 program in 2009/10 indicates that the current inventory overestimates deciduous volume (primarily aspen).
5. Species occurrence:
 - Whitebark pine and Douglas-fir occur across several mapsheets within the project area (e.g., in the Takla and Mitchell ranges). However, a data fix to the current inventory may have inadvertently removed those species from the inventory (either entirely or in large swathes), while in other cases the species could have been misclassified. In either case, they are not present in the current inventory where they are known to be present.

- District staff will provide FAIB with spatial information showing where these species occur to help inform the air and ground field calibration programs.
 - Larch has been called in the inventory but is not present outside of some openings where Siberian larch has been trialed.
 - Some misclassification of balsam as spruce has been noted.
6. Site index in high-graded stands:
- Ground sampling in the John Prince Research Forest indicates that site index tends to be underestimated in the current inventory, on average by 3 m.
 - This could be due to the presence of high-graded stands where the much older age of the now dominant crown class balsam is applied to the entire stand, which is predominantly a younger and smaller diameter cohort of a very similar height.
 - As a result, the current inventory often shows these mixed cohort stands with higher values for age, basal area, and volume, and a lower site index than is actually present.
7. Avalanche chutes:
- In many cases, avalanche chutes are not delineated separately from the surrounding forest, and these are important features for mapping grizzly habitat.
 - This could be due to some of the chutes being too narrow to allow delineation.
 - It could also be that in some cases the repeating pattern of forest and chute are captured in one polygon with the chutes being described using attributes such as land cover components, shrub/herb cover, non-vegetated cover or modifying process.
 - Polygons with avalanche chutes within them could be identified through the use of a query based on the attributes listed above. The old ESA label of “Ea” is no longer available in the VRI, but the modifying process field does have an “A” code for avalanching. A spot check of the current inventory does show that there are numerous polygons with this code.
8. Dead pine overstory with healthy understory:
- In many cases, there is a viable understory layer beneath the MPB-killed overstory, but it is not described in the inventory.
 - For the most part this won't be able to be described due the inability to see it on the aerial photography.
 - An understory layer can be picked up on ground calibration plots, but without the ability to see that layer on the air photo, it cannot be extrapolated to neighbouring polygons. Infra-red photography may assist with the attribution of understory layers, but trees less than 2 m in height are difficult to resolve in mid-scale photography.

Aerial Photography

Digital frame camera imagery of the project area was acquired to GeoBC photo standards and specifications in the summer of 2014. Flight lines were oriented in an east/west direction and captured at 30 cm GSD (ground scale distance), approximately a 1:15,000 scale. Softcopy image sets will be available as RGBnIr 4 band 8 bit JPEG compressed TIF with a ZI project file. This will allow for natural colour display of imagery as well as colour infrared display using the same image file and softcopy setup.

It is hoped that the use of the infrared display may make it easier for photo interpreters to identify live vs. dead trees in large areas of MPB mortality. It may also be able to help identify the presence of understory vegetation.

Approximately six FMEs in the Fort St. James project area will utilize 2012 photography acquired for the Vanderhoof District Phase 1 project (shown as the lighter green mapsheets in Figure 6). The specs for these photos are also as described above.

One hardcopy set of the digital photos will be supplied to the Fort St. James District office. The hardcopy photos are not the same size or resolution as the traditional air photos.

Historical Data Sources

Data sources are used as calibration points for improving the quality of air photo interpretation. Existing data sources include air calls, ground calls, permanent and temporary samples and observations distributed across the project area during previous inventories.

An estimated 6,351 air and ground calls have been established in the project area since the first forest inventory project there (Table 4). However, ~80% of the FIP air calls have no sample date and are therefore unusable; this leaves a net of 2,524 historical air and ground calls. In addition, an unknown number of the established data sources will have been destroyed over the years through harvesting and other disturbances. The actual number of data sources still available will be determined at the data source transfer stage.

Table 4. Historical calibration points in the Fort St. James District VRI Phase 1 project area.

Year	FIP Air Calls (X)*	FIP Ground Calls (XG)	VRI Air Calls (18)	VRI Ground Calls (17)
1952 - 1996	4,784	130		
1992 - 2013			667	770

* Of the total 4,784 historical FIP air calls for this project area, ~80% have no sample date.

All data sources that were available in the last re-inventory project are documented on the earlier document photos. A digital spatial location of these points will be made available to the Contractor in a shape file. All data sources will be reviewed by the Contractor to determine if they are still relevant before they are used. Those that are still relevant to a new inventory on the 2014 imagery will be transferred to a digital format provided by the Ministry.

Situations that would justify removal of existing data sources include a major disturbance (such as a large fire, harvesting or insect/disease damage), large stand structure changes, or as defined in the contract document. Data sources in MPB-impacted stands will have to be examined closely to determine how relevant they are.

Any data can be used as a calibration data source so long as it has X and Y coordinates. Permanent sample plots, cruise plots, timber recce information, terrestrial ecosystem mapping (TEM), predictive ecosystem mapping (PEM), and SIBEC plots are examples of other data that can be used. However, this data would first need to be determined and then assembled into a format that the Contractor could easily use.

Polygon Delineation

Polygon delineation is to be completed to VRI standards. Any deviation from these standards must be agreed to by the Ministry Project Manager.

It is critical in the MPB impacted stands to capture the residual live tree component. Therefore, throughout the delineation process the live trees must guide the line placement and the resulting polygon boundaries. Photo interpreters will not extrapolate visible understory to adjacent polygons; only when understory is visible will it be summarized as a separate layer in each polygon.

The *VRI Photo Interpretation Procedures* now contain detailed procedures for dealing with dead stands and stands with significant amounts of dead trees resulting in a “dead” (“D”) tree layer.

Integrating RESULTS Information

The integration of the RESULTS spatial files and tree attribute data will be completed at the delineation and attribution stages of the project. The Contractor is required to incorporate RESULTS information for all non-free growing openings as it exists in the database. For free growing openings, photo interpreters may re-delineate and/or re-attribute the polygons if they do not agree with the RESULTS information. However, if the free growing survey information is recent, the data is typically accepted as is.

A PGDB file for the RESULTS openings found within the project area (Table 5, Figure 7) and the associated tree attributes will be provided to the bidders attending a mandatory project viewing session.

Table 5. Summary of RESULTS database openings for Fort St. James District VRI Phase 1 project area.

RESULTS Data	Area (ha)	% of Project Area	# of Openings
RESULTS Depletion/Regen	168,423	11.9%	10,179
RESULTS Free Growing	107,573	7.6%	7,191
Total	275,996	19.5%	17,370

Some openings found on the air photos won't be found in the RESULTS data cut. Attribution of harvested areas that are not identified in the RESULTS spatial files will be completed in accordance with the *Photo Interpretation Guidelines for Integrating RESULTS Information*.

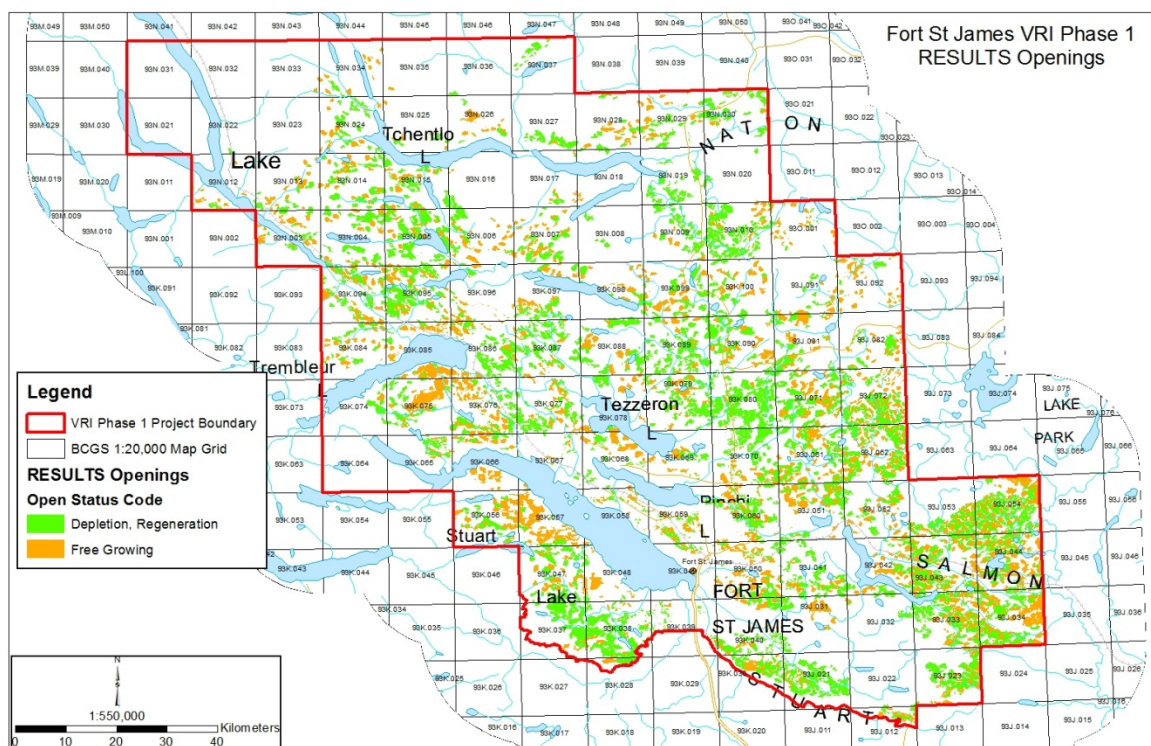


Figure 7. RESULTS polygons in Fort St. James District VRI Phase 1 project area.

New Data Sources

The fieldwork program calls for the establishment of air and ground calls to provide photo interpreters with actual ground data to use as calibration points. The current standard for distribution of calibration points is a minimum of 10 ground calls and 20 air calls per FME. Actual minimums for this project are still to be determined.

The ground call types will be a combination 1-point and 3-point calls. The type of ground call established in each polygon is based on the species complexity as described in the *VRI Photo Interpretation Field Calibration Procedures*. The typical ratio of 1-point to 3-point ground calls in the Fort St. James District would be approximately 7:3. However, the MPB mortality in the project area will definitely affect this, and there may be more 3-point calls necessary to adequately capture the variability in residual pine stands, or a modified ground call procedure may be used.

The ratio of air calls to ground calls may also need to be adjusted due to the MPB mortality. It may prove that air calls are more useful to capturing the variability and presence of understory than ground calls, as air calls can cover an entire polygon, while ground calls only cover a small proportion of it.

The exact ratios of air calls to ground calls, and 1-point to 3-point ground call types will be determined before the project starts. This determination will be based on recommendations from other recent VRI Phase 1 projects in MPB-impacted areas and by reviewing the new aerial images.

In addition, although pine leading stands (36% of the project area landbase) traditionally do not require extensive field calibration to achieve reliable photo estimates, a higher than average air and ground calibration program may be required in the MPB stands to ensure a reliable determination of live vs. dead tree volume, which is a key objective of this inventory.

Prior to the initiation of a field calibration program, a Field Calibration Plan is to be submitted to the Ministry Project Manager for approval. Documentation within this sampling plan must include a map of the project area indicating the general location and distribution of the calibration points.

As part of the deliverables, the Ministry requires a complete set of any new data sources be provided in a digital format determined by the Ministry, including the geographical locations (UTM coordinates) of these data sources as well as the complete set of field attribute data collected.

Attribute Estimation

This project will be undertaken in softcopy (digital photogrammetric) format.

Photogrammetric tree heights will be taken where suitable at the discretion of the photo interpreter. There will be no quality assurance carried out of the photogrammetric heights as QA will involve digital height comparisons.

The MPB infestation has caused significant change to the forested landscape in the Fort St. James District. The focus for the attribute estimation will be on getting accurate descriptions of the live component of the forest. This includes the residual component remaining in the overstory and, where visible, the understory. Note that understory can typically only be interpreted when crown closure of the overstory is very low and the understory trees are large enough to be resolved on the photos.

All polygon descriptions will be carried out to the standards of the most current version of the *VRI Photo Interpretation Procedures*. This now includes the capture of attributes on the “dead” (“D”) layer for any polygons with more than 30% mortality, based on density.

Mapping

The Ministry has developed a format and database standards for the submission and storage of spatial and attribute data for VRI photo interpretation. All new projects must be completed to this standard and submitted to the Ministry Project Manager as per the delivery schedule.

The Contractor will adhere to the most current version of the *VRIMS Personal Geodatabase Structure and Use* and the *VRIMS Vegetation Cover Polygon Validation Rules* published by the Forest Analysis and Inventory Branch.

TRIM Base

A TRIM (NAD 83) format base file will be supplied to the Contractor.

The Contractor will be responsible for updating TRIM roads as part of the project. There will be no changes made to TRIM features unless significant changes have occurred to polygonal features such as lakes and double-line rivers. The contractor must maintain a record of any TRIM changes and submit all changes to the Project Manager in an approved format. The changes will be passed on to GeoBC to include in future TRIM updates.

Section 3 - Project Implementation

Project Pre-Work Meeting

A project pre-work meeting is mandatory. The purpose of this meeting is to bring together the Ministry Project Manager, VRI Phase 1 Contractor, MFLNRO representatives and Quality Assurance personnel prior to project start-up. This meeting will ensure that an efficient communication network is established, identify individuals responsible for all aspects of the project, allow discussion of any issues before project work commences, and establish timelines for deliverables and data flow. Minor changes to the contract to complete the Phase 1 activities may be identified at this meeting.

A project pre-work checklist, signed off by all parties attending, will be used to organize and guide the meeting.

Scheduling

The project will progress over three fiscal years, commencing in 2015/16, with approximately 15-30% of the photo estimation work completed during this first fiscal. Therefore, three field seasons will be required for collection of photo interpretation field calibration data. Field calibration is to coincide with subsequent attribution of associated blocks.

Similar VRI inventory projects will be taking place in the surrounding Vanderhoof District, Lakes TSA and Morice TSA during an overlapping time period. All work in the Fort St. James project will tie with the newly updated inventory from these projects. The Ministry will arrange for the exchange of delineation and attribution files with the contractors for these other projects.

A delivery schedule outlining progressive delivery of products will be submitted by the Contractor for each fiscal. The format of the delivery schedule will be agreed to at the project pre-work meeting. Note that during the first fiscal year of this project, calibration fieldwork and associated delineation and attribution should be conducted for the easternmost mapsheets adjoining the Prince George District, and cannot be conducted for mapsheets adjoining the Vanderhoof District. This is to accommodate integration with inventory files from current and future inventory projects.

Project Manager

The Ministry Project Manager for the Fort St. James District Phase 1 VRI project will be determined at the start of the project. Responsibilities include the following: coordinating the project; monitoring and communicating project progress with the local stakeholders; ensuring all contractors are qualified and certified; overseeing photo-interpretation activities; ensuring quality assurance is complete and delivered at each stage; and assisting in coordinating technical expertise where required.

Personnel

All VRI photo interpretation work must be completed by or directly supervised by a VRI Certified Photo Interpreter. At least 50% of the photo interpreters working on the project must be certified for VRI photo interpretation. All uncertified photo interpreters are to be directly supervised by a Certified Photo Interpreter working on that project. There may be a limit of 4-5 photo interpreters approved to work on the project; this would help maintain consistency across the project.

Quality Assurance

An independent third-party quality assurance (QA) will be completed on all stages of the project (historical data source transfer, delineation, calibration fieldwork, and attribution) in accordance with the *VRI Photo Interpretation Quality Assurance Procedures and Standards*.

QA for digital map production will be conducted by the Ministry. Contractors will utilize “VEGCAP for Contractors” validation software to perform QA on data files.

All QA findings and re-work instructions are communicated to the VRI Contractor by the Ministry Project Manager.

Deliverables

The VRI photo interpretation project deliverables for each stage of the photo interpretation project are outlined in the *VRI Photo Interpretation Procedures* and the *VRI Field Calibration Procedures for Photo Interpretation*.

The deliverables schedule will be supplied by the VRI Contractor, and approved by the Ministry, at the start of the project. Deliverables are required to be spread out evenly across the entire term of the contract. Deliverables required in a particular fiscal year must be submitted by the end of February to provide sufficient time for completion of independent third-party QA and Ministry in-house GIS QA.

Submission of all final deliverables will be signed-off by a qualified ABCFP registered Forest Professional.

Roles & Responsibilities

MFLNRO

The Ministry Project Manager is the point of contact for the Ministry and provides overall communication of project activities with contractors and Fort St. James District staff and stakeholders.

VRI Contractor

The VRI Contractor works with the Ministry Project Manager to ensure the planning, coordination and execution of project activities are consistent with the VPIP and contract requirements.

VRI QA Contractor

The VRI QA Contractor works with the VRI Contractor and Ministry Project Manager to ensure that Quality Assurance reporting meets the VRI prescribed standards.

References for Inventory Standards and Procedures

All work will be carried out in accordance with the following British Columbia Government specifications, current at the time of contract signing.

- *Vegetation Resources Inventory Photo Interpretation Procedures*
- *Vegetation Resources Inventory Photo Interpretation Quality Assurance Procedures and Standards*
- *Vegetation Resources Inventory Field Calibration Procedures for Photo Interpretation*
- *Photo Interpretation Guidelines for Integrating RESULTS Information* (contained within the *VRI Photo Interpretation Procedures*, Appendix A)
- *Vegetation Resources Inventory – The B.C. Land Cover Classification Scheme and addendum*

- *VRIMS Personal Geodatabase Structure and Use*
- *VRIMS Vegetation Cover Polygon Validation Rules*
- *Vegetation Resources Inventory – Preparing a Project Implementation Plan for Photo Interpretation, Appendix D*

Costs

The anticipated cost for completing the project, excluding photo acquisition, but including quality assurance, data capture and field costs, based on the level of field calibration to be completed, is \$1,700,000 based on an estimated \$1.20/ha. The QA costs are estimated at 7-10% of the overall photo interpretation project cost for this unit. Note that these estimates are used for project budgeting purposes only, based on current average costs for similar projects, and should not be used for the purpose of submitting bids on any work that may be tendered.

Project Sign-Off Sheet

Fort St. James District Vegetation Resources Inventory Photo Interpretation Project Implementation Plan

I have reviewed and approved the Fort St. James District Vegetation Resources Inventory Photo Interpretation Project Implementation Plan.

Pat Martin
Manager, Forest Inventory Section
Forest Analysis and Inventory Branch
Ministry of Forests, Lands and Natural Resource Operations

Date

Appendix A: Stakeholders' Meeting Attendance

Industry Stakeholders' Meeting

Table 6. Attendees at the stakeholder's meeting for industry representatives, held at the Fort St. James District Office on January 28, 2015.

Affiliation	Name	Invitation	Attendance
Apollo Forest Products / Sinclair Group	Darwyn Koch	✓	
BC Trappers Association (Stuart/Nechako)	Bob Fredericks	✓	
Canfor – Houston Operations	Greg Yeomans	✓	
Canfor – Plateau Operations	Terry Lazaruk	✓	
Canfor – Prince George Operations	Vince Day	✓	
Carrier Lumber	Jason Gordon	✓	
Conifex Inc.	Phil Smith	✓	
District of Fort St. James	Rob MacDougall	✓	
Dunkley Lumber	Doug Perdue	✓	
John Prince Research Forest	Sue Grainger	✓	✓
Nak'al Koh / Nak'azdli Development Corporation	Leonard Thomas	✓	
NIFP / K&D Logging (CFA)	John-Paul Wenger	✓	
North Central Guide Outfitters	Michael Schneider	✓	
Ruby Rock Resources	Shane Perry	✓	
Takla Development Corporation	John Allen French	✓	
Tanizul Timber (CFA)	John Marchal	✓	
Woodlot Chapter	Stephen Harrison	✓	✓
BC Timber Sales	Sheri Baker		✓
BC Timber Sales	Sharon Sims		✓
FLNRO, Fort St. James	Louise Bett		✓
FLNRO, Fort St. James	Susan Forshner		✓
FLNRO, Fort St. James	Neal Gooding		✓
FLNRO, Fort St. James	Cindy Holland		✓
FLNRO, Fort St. James	Carl Pollard	✓	✓
FLNRO, Fort St. James	Andrew Tait		✓
FLNRO, Fort St. James	Julia Vanderham	✓	✓
FLNRO, Fort St. James	Joanne Vinnedge		✓
FLNRO, Fort St. James	Mike Wagmann		✓

First Nations' Meeting

Table 7. Attendees at the meeting for First Nation representatives, held at the Fort St. James District Office on January 28, 2015.

Affiliation	Name	Invitation	Attendance
Halfway River First Nation	Chief Darlene Hunter	✓	
Lake Babine Nation	Chief Wilf Adam	✓	
Lheidli T'enneh Nation	Chief Dominic Frederick	✓	
McLeod Lake Indian Band	Chief Derek Orr	✓	
Nadleh Whut'en Band	Chief Martin Louie	✓	
Nak'azdli Band	Chantelle Bird & Rose Marie Sam (for Chief Fred Sam)	✓	✓
Takla Lake First Nation	Chief Anita Williams	✓	
Tl'azt'en Nation	Renel Mitchell (for Chief Justa Monk)	✓	✓
West Moberly First Nation	Chief Roland Willson	✓	
Yekooche First Nation	Chief Allen Joseph	✓	

Appendix B: Project Mapsheet Area Summary

Table 8. Area summary for mapsheets included in Fort St. James District VRI Phase 1 project area.

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)**	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
093J011*	8.88	0.00			
093J012*	3,232.77	0.23	28.59	870.73	31.65
093J021*	13,423.86	0.94	0.54	2,890.90	
093J022	14,510.82	1.0		696.60	
093J023	14,510.82	1.0		3,346.43	
093J031	14,475.94	1.0		989.55	
093J032	14,475.94	1.0		844.94	
093J033	14,475.94	1.0		3,163.98	
093J034	14,475.94	1.0		4,593.09	
093J041	14,441.02	1.0		1,653.73	
093J042	14,441.02	1.0		1,255.44	
093J043	14,441.02	1.0		3,620.06	
093J044	14,441.02	1.0		3,744.93	
093J051	14,406.04	1.0		1,958.20	
093J052	14,406.04	1.0		1,181.19	
093J053	14,406.04	1.0		2,611.78	
093J054	14,406.04	1.0		5,752.17	
093J061	14,371.03	1.0		3,537.11	
093J062	14,371.03	1.0		4,041.62	
093J071	14,335.96	1.0		2,757.36	
093J072	14,335.96	1.0		3,942.25	
093J081	14,300.85	1.0		1,812.32	
093J082	14,300.85	1.0		1,163.73	
093J091	14,265.70	1.0		776.49	
093J092	14,265.70	1.0		1,695.34	
093K027*	86.93	0.01			
093K028*	1,604.52	0.11		364.65	
093K030*	5,533.71	0.39	1.54	2,008.95	5.91
093K037*	11,265.00	0.79		981.64	
093K038*	13,750.89	0.96		1,838.88	
093K039*	8,754.56	0.61	1,581.33	2,975.49	819.95
093K040*	14,463.76	1.0	1,304.18	5,183.67	975.70
093K047*	14,294.67	1.0		2,583.75	
093K048	14,441.02	1.0	140.43	375.43	41.32
093K049	14,441.02	1.0	2,002.97	1,922.31	384.25

Photo Interpretation VIPIP for Fort St. James District

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)**	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
093K050	14,441.02	1.0	771.64	3,676.76	454.46
093K056	14,406.04	1.0		2,635.90	3.49
093K057	14,406.04	1.0	1.25	2,666.03	
093K058	14,406.04	1.0	50.29	748.49	4.61
093K059	14,406.04	1.0	28.48	1,519.76	69.52
093K060	14,406.04	1.0		2,633.43	
093K064	14,371.03	1.0		113.03	
093K065	14,371.03	1.0		512.40	
093K066	14,371.03	1.0		2,029.93	
093K067	14,371.03	1.0	185.18	1,235.02	355.66
093K068	14,371.03	1.0		1,238.16	
093K069	14,371.03	1.0	2.04	1,700.74	
093K070	14,371.03	1.0	20.47	2,685.12	
093K074	14,335.96	1.0		1,274.94	
093K075	14,335.96	1.0		1,603.39	
093K076	14,335.96	1.0		2,029.10	
093K077	14,335.96	1.0		2,084.06	
093K078	14,335.96	1.0		885.58	
093K079	14,335.96	1.0		3,124.09	
093K080	14,335.96	1.0		2,026.81	
093K084	14,300.85	1.0		1,424.65	
093K085	14,300.85	1.0		973.40	
093K086	14,300.85	1.0		2,168.82	
093K087	14,300.85	1.0		2,759.73	
093K088	14,300.85	1.0		1,766.14	
093K089	14,300.85	1.0		2,071.31	
093K090	14,300.85	1.0		1,570.80	
093K094	14,265.70	1.0		2,216.33	
093K095	14,265.70	1.0		3,757.94	
093K096	14,265.70	1.0		1,263.51	
093K097	14,265.70	1.0		1,336.71	
093K098	14,265.70	1.0		1,000.44	
093K099	14,265.70	1.0		2,381.38	
093K100	14,265.70	1.0		1,153.31	
093N003	14,230.50	1.0		1,379.79	
093N004	14,230.50	1.0		2,274.76	
093N005	14,230.50	1.0		2,762.36	
093N006	14,230.50	1.0		1,004.14	

Photo Interpretation VPIP for Fort St. James District

Mapsheet	Total Area (ha)	Full Map Equivalent (FME)**	FIP NP Area (ha)	VRI Vegetated/ Non-Treed Area (ha)	VRI Non-Forest Descriptor Area (ha)
093N007	14,230.50	1.0		2,355.40	
093N008	14,230.50	1.0		572.64	
093N009	14,230.50	1.0		1,292.40	
093N010	14,230.50	1.0		2,652.60	
093N012	14,195.25	1.0		1,024.39	
093N013	14,195.25	1.0		1,184.81	
093N014	14,195.25	1.0		2,284.80	
093N015	14,195.25	1.0		1,402.59	
093N016	14,195.25	1.0		286.26	
093N017	14,195.25	1.0		582.14	
093N018	14,195.25	1.0		421.88	
093N019	14,195.25	1.0		856.76	
093N020	14,195.25	1.0		751.03	
093N021	14,159.96	1.0		1,800.64	
093N022	14,159.96	1.0		305.51	
093N023	14,159.96	1.0		4,374.91	
093N024	14,159.96	1.0		1,966.39	
093N025	14,159.96	1.0		1,584.98	
093N026	14,159.96	1.0		1,725.60	
093N027	14,159.96	1.0		1,232.80	
093N028	14,159.96	1.0		1,761.60	
093N029	14,159.96	1.0		2,404.07	
093N030	14,159.96	1.0		1,039.53	
093N031	14,124.62	1.0		1,045.91	
093N032	14,124.62	1.0		1,408.17	
093N033	14,124.62	1.0		3,409.15	
093N034	14,124.62	1.0		1,216.14	
093N035	14,124.62	1.0		1,627.33	
093N036	14,124.62	1.0		1,071.42	
093N037	14,124.62	1.0		656.66	
093O001	14,230.50	1.0		1,521.48	
Totals:	1,415,852.02	99.01	6,118.92	192,642.91	3,146.54
Percent of Total Area:			0.4%	13.6%	0.2%

* Mapsheets that will be photo interpreted using 2012 air photos from the Vanderhoof District Phase 1 project.

** FME calculation based on an average of 14,300 ha/mapsheet in the project area.

Appendix C: Full-Page Maps

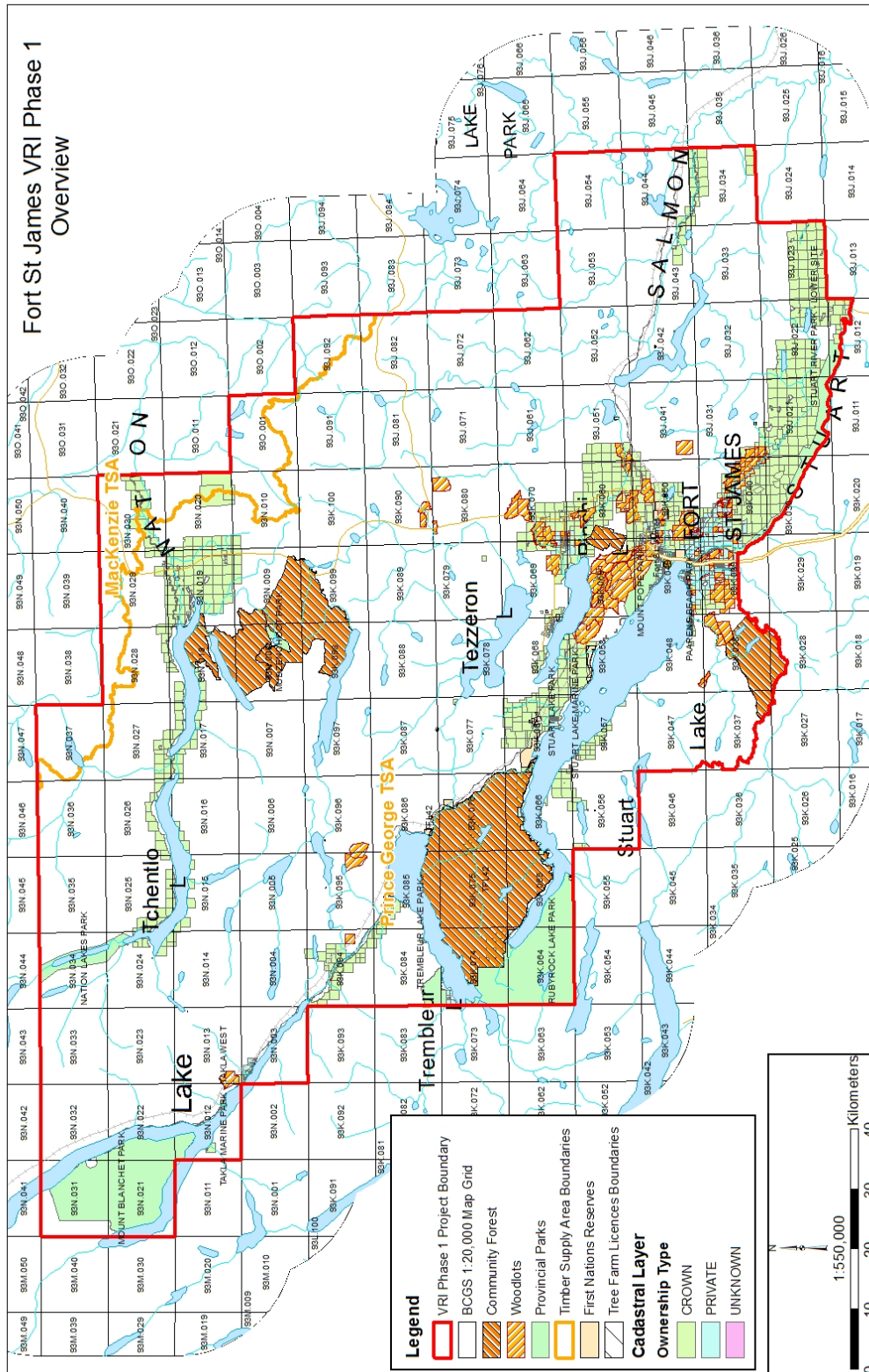


Figure 8. Overview of Fort St. James District VRI Phase 1 project area.

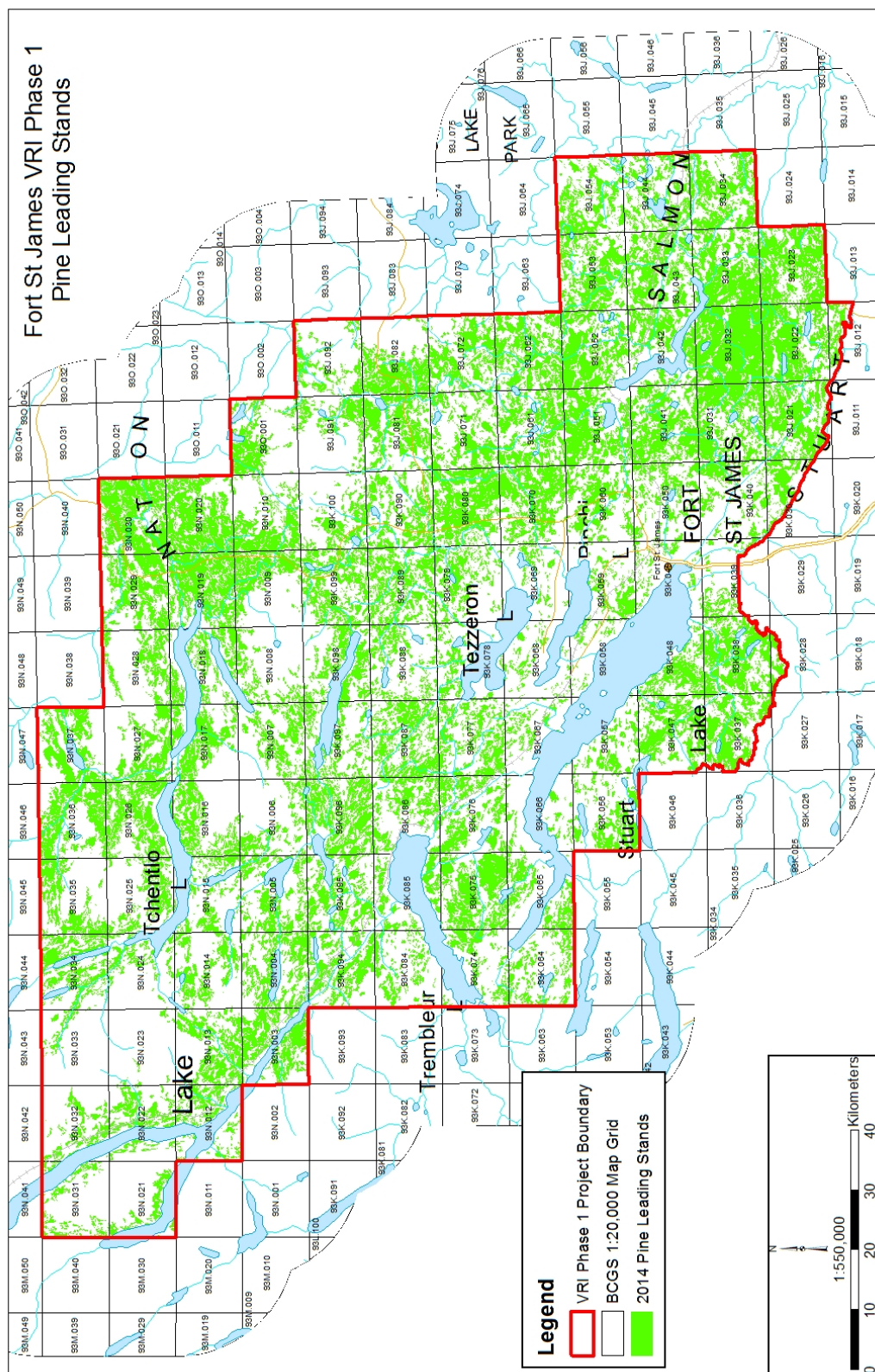


Figure 9. Distribution of pine leading stands in Fort St. James District VRI Phase 1 project area. Pine leading is defined as any polygon with species 1 being any pine species $\geq 50\%$ by basal area.

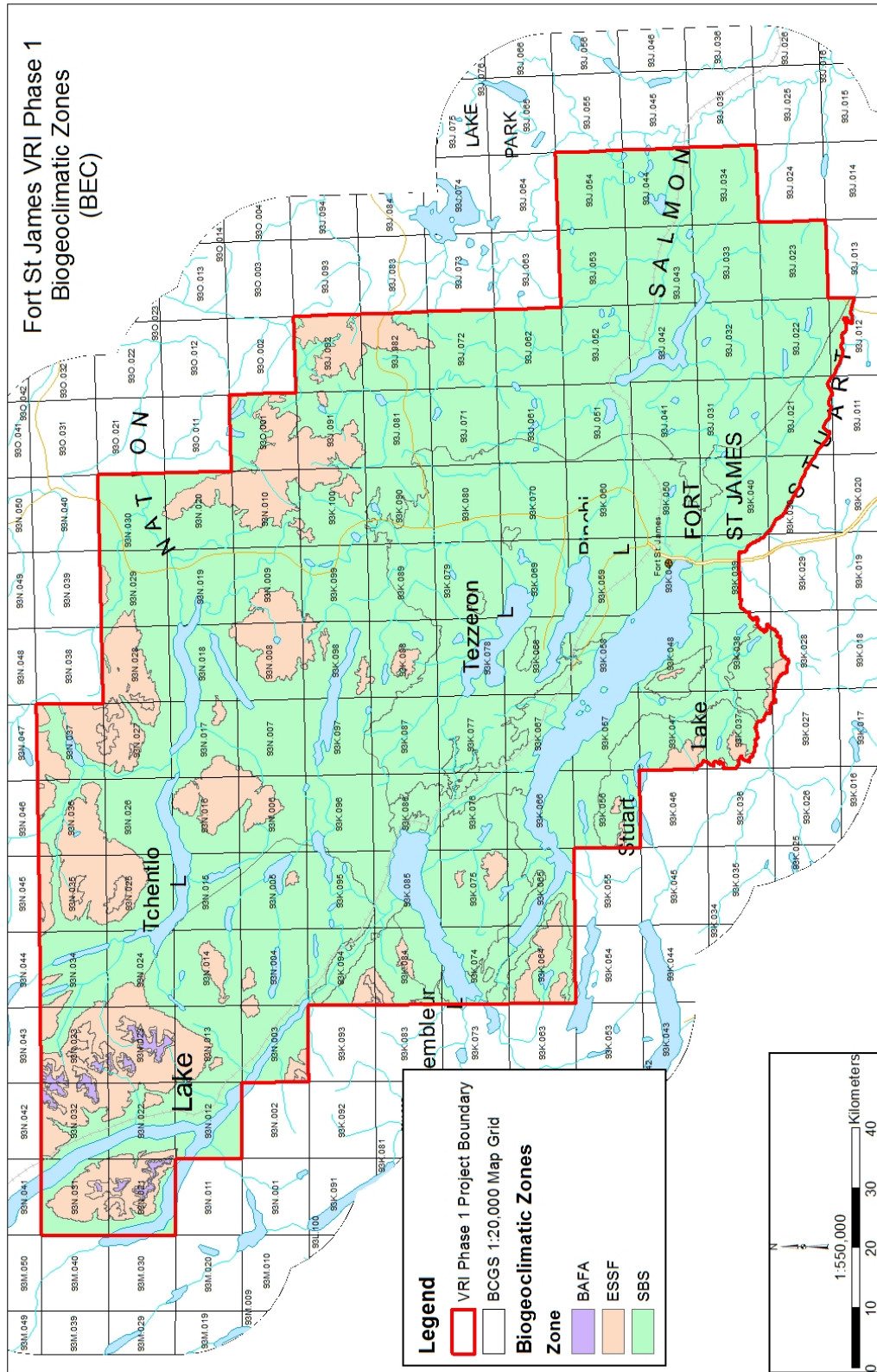


Figure 10. Biogeoclimatic zones in Fort St. James District VRI Phase 1 project area.

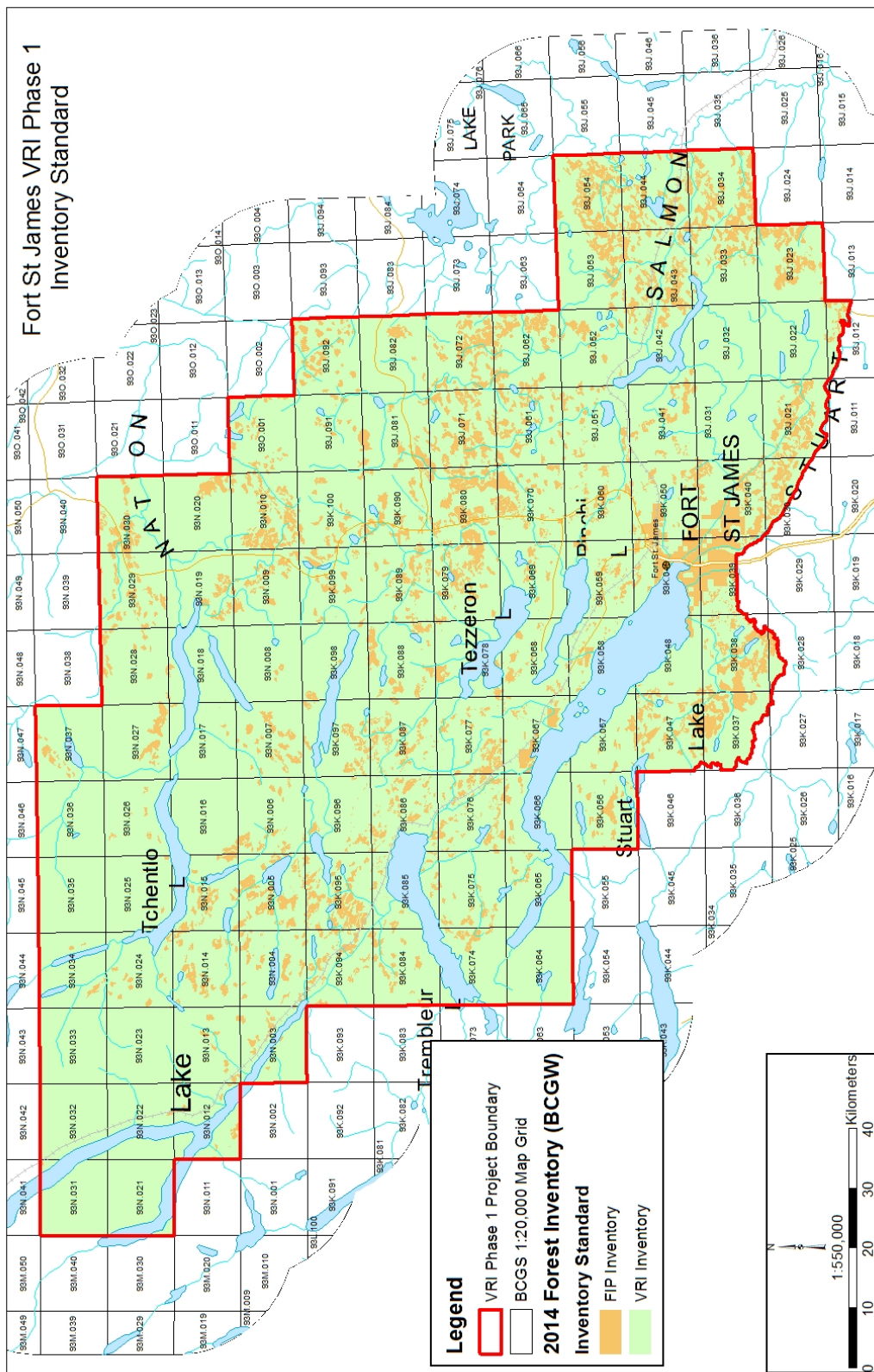


Figure 11. Inventory standard for Fort St. James District VRI Phase 1 project area. FIP Inventory includes “I” records, which are modified FIP or incomplete VRI records, the main source of which is RESULTS polygons.

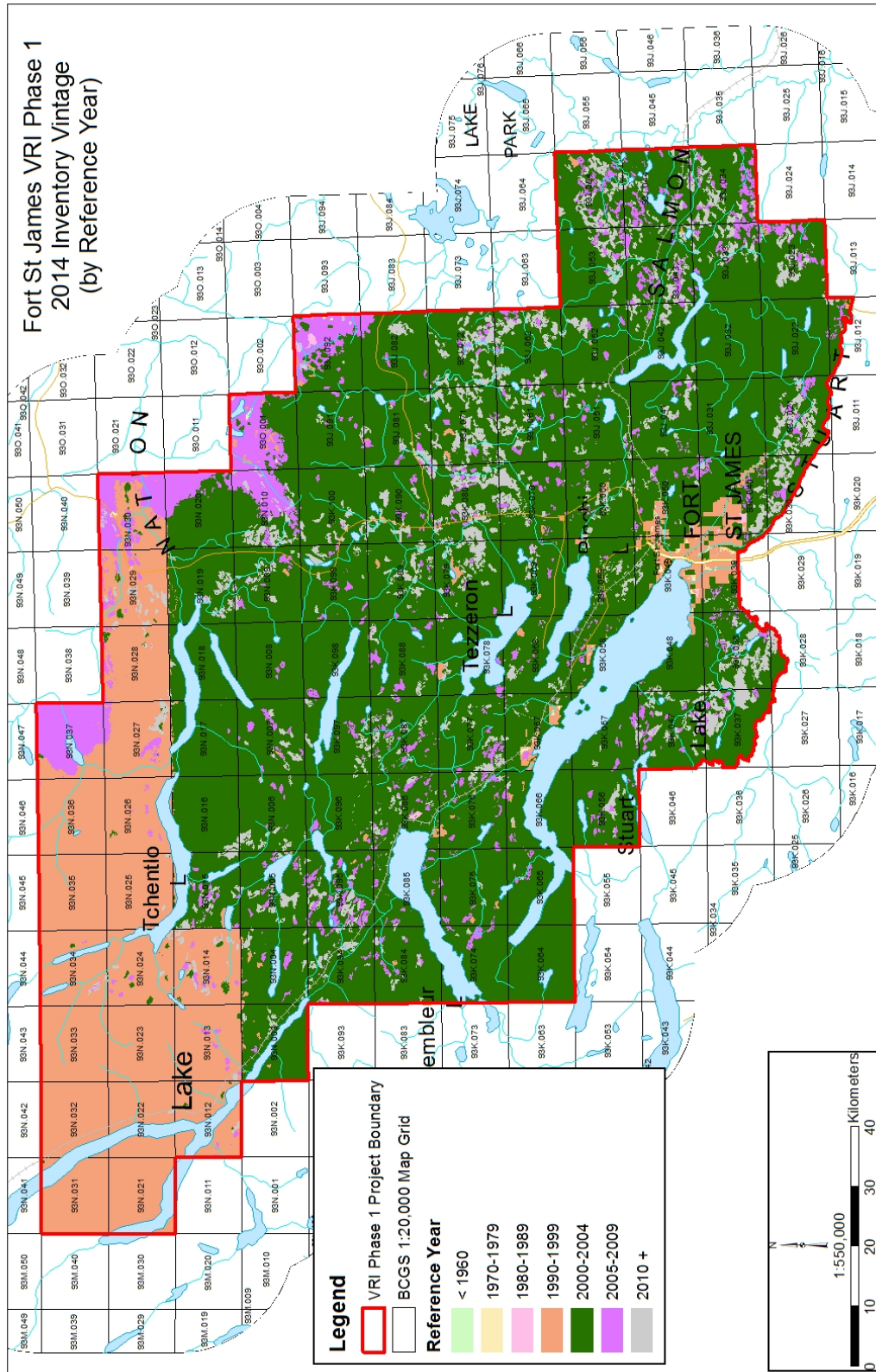


Figure 12. Inventory age for Fort St. James District VRI Phase 1 project area.

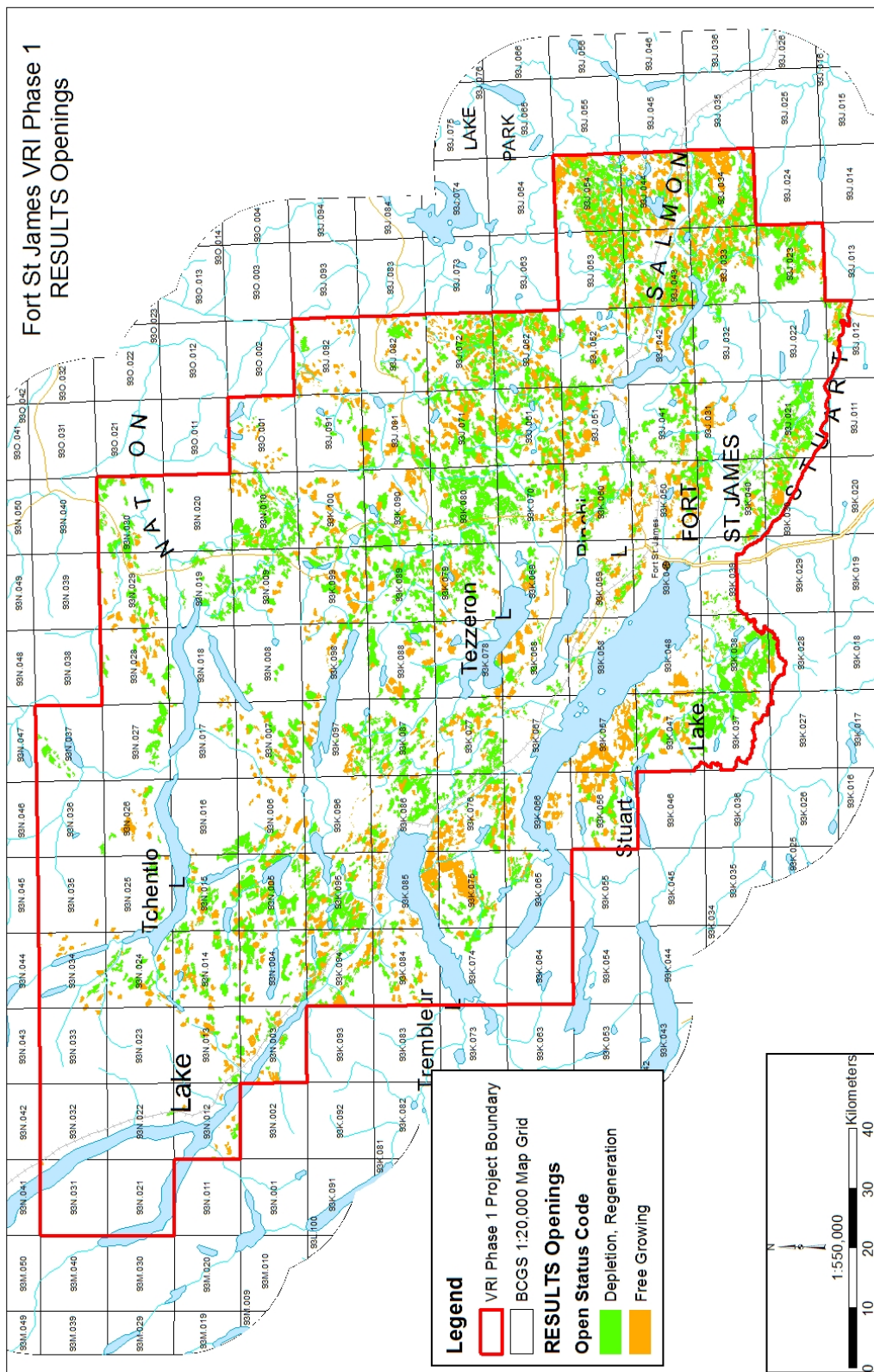


Figure 13. RESULTS polygons in Fort St. James District VRI Phase 1 project area.