
Vegetation Resources Inventory

Kalum Timber Supply Area
Vegetation Resources Inventory
Project Implementation Plan

Prepared by

Forest Analysis and
Inventory Branch

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1 Introduction

1.1 Background and Overview of the Inventory Process

The Ministry of Forests ("Ministry") has developed a planning process to ensure the successful implementation of Vegetation Resources Inventory ("VRI") photo interpretation projects. The VRI Project Implementation Plan ("VPIP") is a working document describing the key reasons and objectives for carrying out a new inventory project. The VPIP identifies the project areas the Ministry intends to re-inventory using the VRI photo interpretation process, issues with the current inventory for those areas, and key steps required to complete projects successfully. Ministry-certified photo interpreters produce VRI photo-interpreted inventories, which are reviewed and approved by the Ministry to ensure that projects meet current standards, are congruent with Forest Analysis and Inventory Branch ("FAIB") business plans, and meet the needs of all the consulted parties.

The Ministry has identified a need to complete a new VRI within the Coast Mountains Natural Resource District ("CMNRD"). A new VRI provides a strategic level planning inventory at the management unit level and answers two fundamental questions:

- Where is the vegetation resource (e.g., trees, shrubs, wetlands, etc.) located?
- How much of a given vegetation resource is within a given inventory unit?

The VRI is a formalized summary of knowledge about the overall condition of the forest land base. It is typically depicted as a continuous series of British Columbia Geographic System ("BCGS") 1:20,000 scale map sheets that indicate forest inventory information using several descriptors. A broad spectrum of forest management activities uses the VRI information, including assessment of forest biodiversity and old growth, wildlife habitat modelling, watershed modelling, timber supply reviews and many other applications to ensure that forest resources are managed and conserved sustainably.

1.2 Project Planning Area

The CMNRD is in the northwestern part of British Columbia in the Skeena Natural Resource Region. The CMNRD office in Terrace administers an area of roughly 80,000 square kilometres encompassing the communities of Terrace, Kitimat, Prince Rupert, the Nass Valley, and Stewart. There are five Timber Supply Area ("TSA") and three Tree Farm Licence ("TFL") units within the CMNRD, as well as First Nation Woodland License and Woodlot License tenures and the Terrace Community Forest. Furthermore, part of the Nisga'a Nation Treaty Lands under the Nisga'a Final Agreement (*Nisga'a Final Agreement Act* (SBC 1999, c 2)) also falls within the CMNRD.

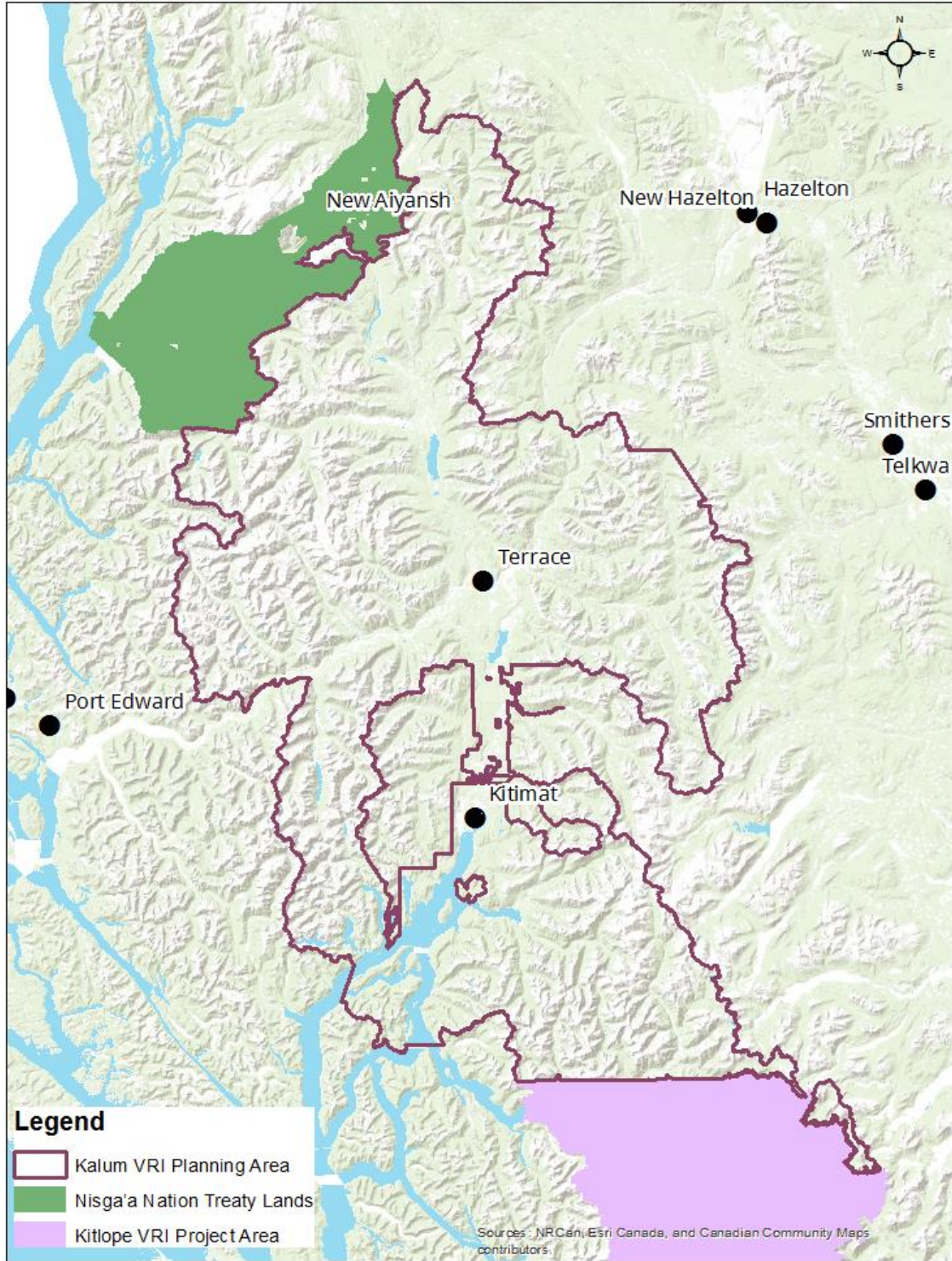
The new VRI will focus on the re-inventory of up to 1.53 million hectares of the CMNRD, herein the Kalum VRI Planning Area. The Ministry intends to complete a re-inventory of the planning area in one or more VRI project area units for project management purposes, subject to available funding and aerial photography, with planning and implementation occurring over the next two to three years. The boundary between

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multiple project areas may coincide with the extent of the 2021 and 2022 aerial photography gathered for the re-inventory.

Figure 1 illustrates the Kalum VRI Planning Area location.

Figure 1. Kalum VRI Planning Area



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Table 1 summarizes the TSAs within the Kalum VRI Planning Area. The Cascadia and Pacific TSAs comprise Timber Supply Blocks ("TSB") within the planning area and other portions of the province.

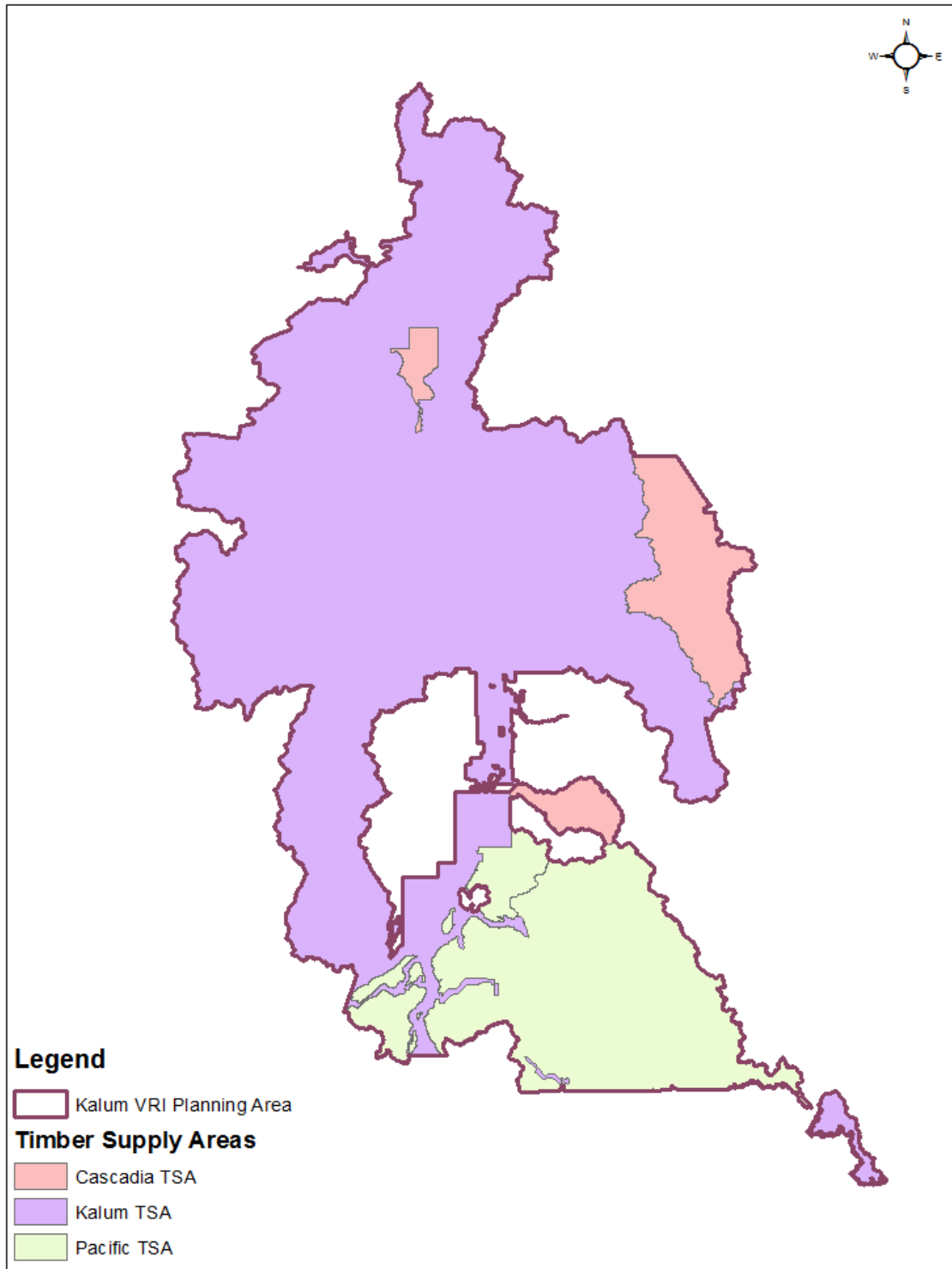
Table 1. Area summary of the Kalum VRI Planning Area by Timber Supply Area and Block

Timber Supply Area	Timber Supply Block	Area (ha)	Area (ha)
Kalum TSA			1,108,188
Pacific TSA	Block 28A	264,589	
	Block 28C	15,358	
	Block 28D	4,157	
	Block 28E	1,135	
	Block 28F	889	
	Block 28G	530	
	Block 28H	93	
	Block 29	21,454	
	<i>Subtotal</i>		308,205
Cascadia TSA	Block 9	19,752	
	Block 10	83,268	
	Block 11	10,854	
	<i>Subtotal</i>		113,874
Total			1,530,267

Source: WHSE ADMIN BOUNDARIES.FADM.TSA

Figure 2 illustrates the location of the Kalum, Pacific and Cascadia TSAs within the Kalum VRI Planning Area.

Figure 2. Timber Supply Areas within the Kalum VRI Planning Area



Source: WHSE ADMIN BOUNDARIES.FADM TSA

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Table 2 summarizes the Kalum VRI Planning Areas by land use.

Table 2: Area summary of the Kalum VRI Planning Areas by land use.

Description	Area (ha)
Crown - Forest Management Unit	742,926
Crown Tenure - Tree Farm License	422,788
Crown - Conservancy Area, Ecological Reserve, Protected Area, Prov. Park	152,373
Crown - Misc. Reserves	87,308
Private	26,439
Crown Tenure - Community Forest Agreement	25,143
Crown Tenure - First Nations Woodland License	20,884
Crown - Community Watershed	3,831
Crown - Forest Recreation Reserves	3,128
Federal - Indian Reserve	2,609
Crown Tenure - Woodlot License	1,862
Crown - UREP (Use, Recreation and Enjoyment of the Public Reserves)	1,824
Crown - Municipal Parcels	1,642
Crown - Local/Regional Park	811
Unknown Ownership/Exceptions	202
Federal - Dominion government Block/Federal Parcels	118
Crown Lease - Misc. lease	118
Crown - Heritage Site	3
<i>Subtotal</i>	1,494,009
Ocean or Unreported	36,257
Total	1,530,267

Source: WHSE FOREST VEGETATION.F OWN; WHSE BASEMAPPING.FWA BAYS AND CHANNELS POLY

2 Section 2 Project Objectives and Current Inventory Status

2.1 Project Objectives

FAIB has developed a ten-year provincial inventory action plan to update older inventories to the current VRI standards, provide complete coverage of inventory across the province to eliminate any data gaps and update the currency of the inventory.

The overarching objective for the Kalum VRI Planning Area is to produce an updated photo-interpreted inventory described to the current standards, which will account for the accumulated change since its last re-inventory. The changes are attributable to annual harvesting and planting, insect and disease mortality, salvage harvesting, wildfires, and realized differences between modelled growth since the last re-inventory and actual growth on the land base.

Furthermore, the inventory process will replace the forest inventory for TFL 1. The Ministry acquired the TFL 1 inventory more than a decade ago. It meets an earlier Provincial standard that generalized the mapping and description of high-elevation areas, which now limits its utility for wildlife habitat management and other processes.

Conversely, the Kalum VRI Planning Area excludes TFL 41. The Ministry purchased the TFL 41 forest inventory from the licensee in 2021, and it meets the Ministry's current needs.

The new VRI will provide much-needed current information on the spatial distribution of live and dead stands, update species compositions to reflect insect, disease and weather-related mortality and harvesting, and improve the estimation of dead standing volume.

2.1.1 Standards of the Existing Inventory

Only a minor portion of the existing inventory meets the full VRI standard (Figure 3).

The current forest inventory in the Kalum VRI Planning Area is primarily Forest Inventory Planning ("FIP") data generated from photo interpretation from the 1970s to 1990s.

Newer VRI data exist towards the centre from the 1997 Kitimat Valley VRI project and along the eastern boundary from adjacent Morice TSA VRI projects in the early 2000s.

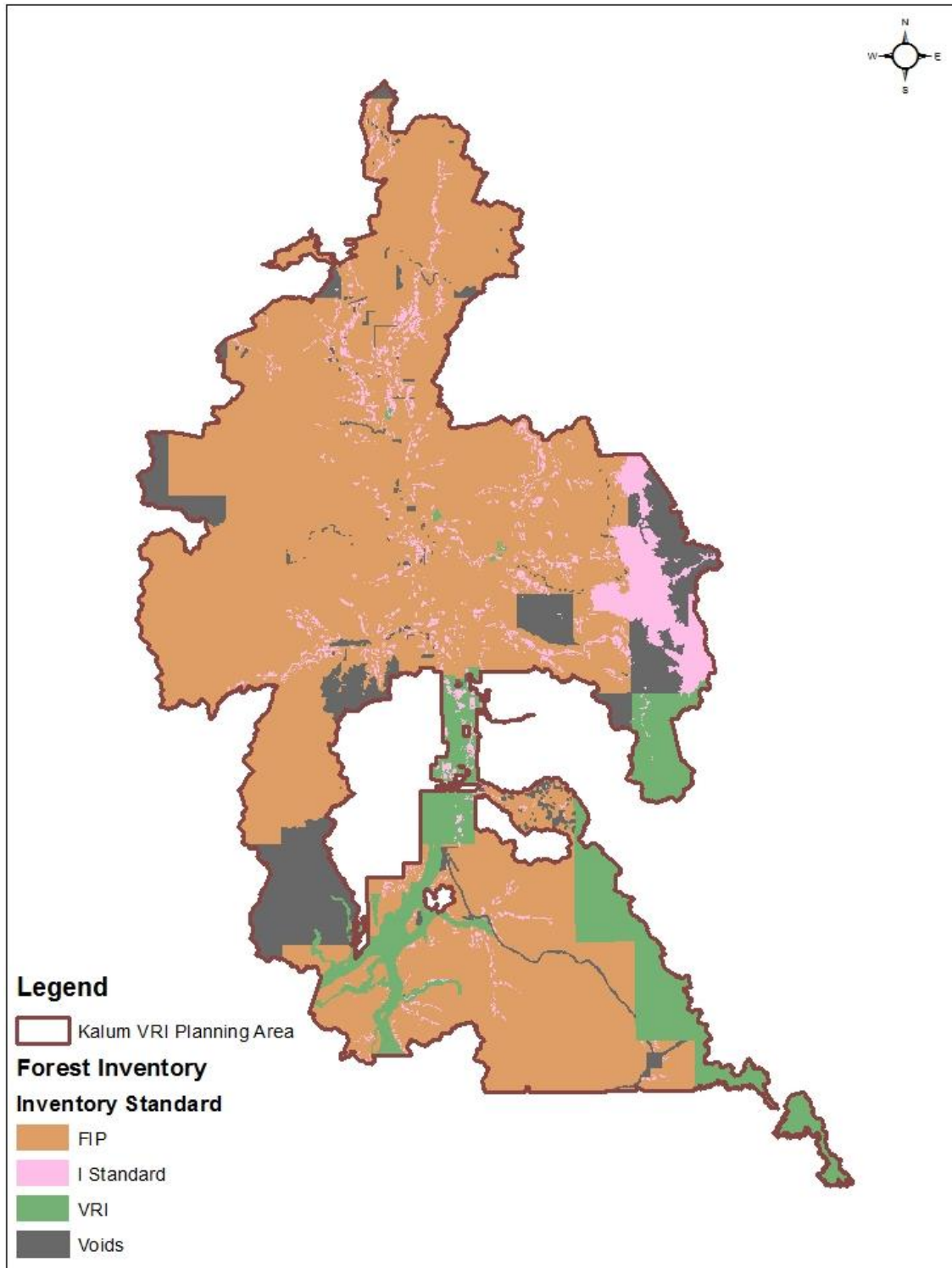
The Ministry generates "I" Standard records via annual updates for depletions, regeneration, and free-growing declarations sourced from the corporate Reporting Silviculture Updates and Land status Tracking System ("RESULTS") database.

The Ministry also applies the "I" Standard when inventory records from purchased inventories fall between the FIP and complete VRI standards. The large "I" Standard area near the eastern boundary is a portion of TFL 1 transferred into the Cascadia TSA in 2011.

Voids exist in the provincial forest inventory data where inventory data has not been created or made available to the Ministry. Due to the void management process, they appear as VRI polygons in the current forest inventory and have no attributes.

Approximately 129,000 ha (8%) of the Kalum VRI Planning Area is void.

Figure 3. Inventory standards and voids within the Kalum VRI Planning Area.



Source: WHSE_FOREST_VEGETATION.VEG_COMP_LYR_1_POLY

2.1.2 Issues with the Existing Inventory

The timber supply review processes for the Kalum, Cascadia and Pacific TSAs identified concerns with the current forest inventory:

- The age and reliability of the existing forest inventory;
- Estimates of dead standing tree volumes;
- Descriptions of western redcedar and yellow cedar stands, which are critical cultural species to First Nations;
- Accuracy of vegetation cover descriptions for wildlife habitat modelling (i.e., avalanche chutes for grizzly bears and tree species for avian nesting); and
- Species composition changes resulting from wildfire and forest health impacts.

2.2 Kalum VRI Planning Area Description

Table 3 summarizes the Biogeoclimatic Ecosystem Classification ("BEC") zones in the Kalum VRI Planning Area. These zones lie at different elevations, with CWH at the lowest elevation and CMA and BAFA at the highest.

Table 3. Area summary of the Biogeoclimatic zones in the Kalum VRI Planning Area.

Biogeoclimatic Zone	Area (ha)
Coastal Western Hemlock (CWH)	645,469
Mountain Hemlock (MH)	634,482
Coastal Mountain-heather Alpine (CMA)	203,664
Interior Cedar Hemlock (ICH)	31,447
Boreal Altai Fescue Alpine (BAFA)	8,325
Engelmann Spruce-Subalpine Fir (ESSF)	6,829
Total	1,530,216

Source: WHSE FOREST VEGETATION.BEC BIOGEOCLIMATIC POLY

Based on the existing inventory, 44% of the Kalum VRI Planning Area is treed, 37% is non-vegetated land (e.g., rock, snow, ice), 7% is non-treed vegetation (e.g., shrubs, herbs), 4% is water, and the remaining 8% is devoid of attributes (Table 4).

Table 4. Land cover distribution in the Kalum VRI Planning Area.

Leading Species	Area (ha)	Area (%)
Treed Land	669,969	44
Non-Vegetated Land	568,593	37
Non-Treed Vegetated Land*	103,734	7
Water	58,625	4
Voids (No existing inventory)	129,290	8
Total Planning Area	1,530,211	100

Source: WHSE FOREST VEGETATION.VEG COMP LYR R1 POLY

* includes 1,423 ha of treed land where the leading species is blank and the non-productive descriptor is Non-Commercial Brush

Hemlock-leading stands dominate the treed portion of the Kalum VRI Planning Area, followed by stands leading with balsam (i.e., true fir). Western red cedar, yellow cedar, spruce, deciduous species, pine and Douglas-fir collectively comprise a small portion of the current known inventory (Table 5).

Table 5. Leading tree species distribution in the Kalum VRI Planning Area.

Leading Species	Area (ha)	Area (%)
Hemlock (H, HM, HW)	500,195	75
Balsam (B, BA, BL)	97,915	15
Deciduous (AC, ACT, AT, DR, EP)	25,530	4
Cedar (CW, YC)	19,856	3
Pine (PA, PL, PLC, PLI)	13,826	2
Spruce (S, SS, SW, SX, SXS)	12,610	2
Fir (FD)	37	<1
Total Treed Area	669,969	100

Source: WHSE FOREST VEGETATION.VEG COMP LYR R1 POLY

The Kalum VRI Planning Area includes areas with specific objectives or land uses incompatible with the field calibration work required for VRI projects (Table 6). The Ministry will exclude these areas (e.g., private land, Indian Reserves, other federal lands, recreation reserves) from any field calibration planning or work. The Ministry will limit field calibration work to aerial transects conducted by helicopter in areas managed by BC Parks, area-based tenures other than TFL 1 and community watersheds. The Ministry will

include non-specified areas where field calibration work may encounter wildlife and define operational and seasonal conditions for the work to mitigate wildlife disturbance.

Table 6. Areas excluded from field calibration work in the Kalum VRI Planning Area.

Description	Area (ha)	Excluded Field Calibration Work
Private	26,439	All
Forest Recreation Reserves	3,128	All
Indian Reserve	2,609	All
Use, Recreation, Enjoyment Public Reserve	1,824	All
Municipal Parcels	1,642	All
Local/Regional Park	811	All
Unknown Ownership/Exceptions	202	All
Dominion Govt. Block/Federal Parcels	118	All
Crown Lease - Misc. lease	118	All
Crown - Heritage Site	3	All
<i>Total All Calibration Excluded</i>	36,894	
Conservancy, Eco. Reserve, Protected, Park	152,373	Ground Work
Community Forest Agreement	25,143	Ground Work
First Nations Woodland License	20,884	Ground Work
Community Watershed	3,831	Ground Work
Woodlot License	1,862	Ground Work
<i>Total Ground Work Excluded</i>	277,881	
Crown - Forest Management Unit	742,926	None
Crown Tenure - Tree Farm License	422,788	None
Crown - Misc. Reserves	87,308	None
<i>Total Not Excluded</i>	1,808,784	
Total	1,494,010	

Source: WHSE_FOREST_VEGETATION.F.OWN

2.3 Kalum VRI Project Area Units

The Ministry intends to re-inventory the Kalum VRI Planning Area with one project, subject to available funding. The Kalum VRI Project could include up to 106.0 BCGS Full Mapsheet Equivalents ("FME") based on an average of 14,440 ha per FME.

However, if there are funding constraints, the Ministry may re-inventory the Kalum VRI Planning Area in two projects starting in different fiscal years. Weather and wildfire smoke have hindered aerial photography acquisition in the Kalum VRI Planning Area for several years, resulting in aerial data collection from 2018 to 2022. The boundary between the two project areas may coincide with the aerial photography vintages (Figure 4).

Should the Ministry pursue two projects, the first would re-inventory the areas with the 2018 aerial photography and the north block of 2021 aerial photography. The second project would re-inventory the balance of the Kalum VRI Planning Area.

The first project area covers approximately 647,690 hectares within the larger Kalum VRI Planning Area and is 45.5 FME based on an average of 14,265 ha per FME. The second project area covers the remaining area, approximately 882,335 hectares, and is 60.4 FME based on an average of 14,615 ha per FME.

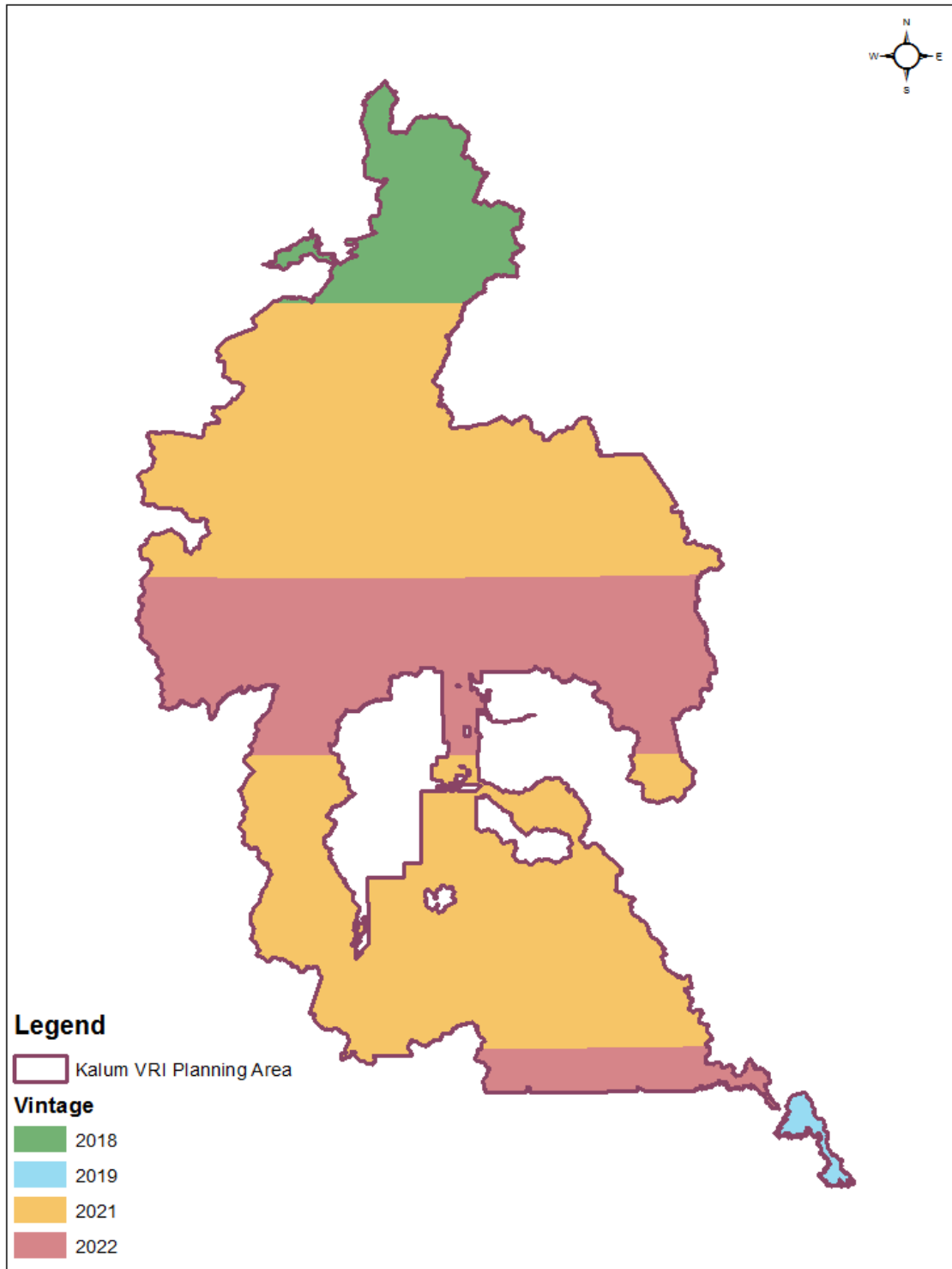
The final boundary of each project area at the time of contract signing may differ from the planning area to ensure that the finalized project boundary fits seamlessly with newer forest inventories in adjacent TSAs.

Table 7 summarizes the various project options. Note that BCGS map sheets decrease in size as latitude increases, resulting in different areas per FME sizes for each project.

Table 7. Project options for the re-inventory of the Kalum VRI Planning Area.

Project	Area (ha)	Area/FME (ha)	FME
Kalum VRI	1,530,026	14,440	106.0
Kalum North VRI	647,691	14,265	45.4
Kalum Central VRI	882,335	14,615	60.4

Figure 4. Aerial photography vintages within the Kalum VRI Planning Area.



Source: Geo BC flight index maps for 2018, 2019, 2021 and 2022.

2.4 Inventory Information Sources

New and other data sources that provide critical reference information, such as base mapping information or other data, are integrated into the new VRI:

- Reporting Silviculture Updates and Land Status Tracking System ("RESULTS") spatial and tabular data
- Base map information including Fresh Water Atlas ("FWA") water features and Digital Roads Atlas ("DRA") infrastructure features
- Biogeoclimatic Ecosystem Classification ("BEC") Zones spatial layers
- Forest health data such as Aerial Overview Survey ("AOS") data
- Historical field measurement data collected during previous inventory projects and corresponding aerial photography (if available)
- The existing forest inventory for the project area
- Digital orthorectified photography
- Digital frame aerial photography circa 2018, 2019, 2021 and 2022

FAIB's Photo Interpretation Standards page describes the standards, procedures and final deliverable formats that contractors will follow for the photo interpretation projects:

<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/forest-cover-inventories/photo-interpretation/standards>

3 Project Specifications and Photo Interpretation Plan

3.1 Aerial Imagery

The Province acquired digital frame camera imagery of the project area to GeoBC standards and specifications in the summers of 2018, 2019, 2021 and 2022.

The following is the list of digital products supplied:

- 4-band 8bit RGBI digital frame imagery with a 25 cm ground sample distance ("GSD") resolution and an east-west and west-east flight line orientation;
- ISSD ZVI stereo project file in UTM NAD 83 projection;
- 50 cm RBG natural colour ortho-imagery; and
- Photo index shapefile with image names and locations.

3.2 Stages of VRI Photo Interpretation

The Ministry typically divides a VRI project into three stages, which occur in succession: polygon delineation, field calibration and attribute estimation. Quality Assurance is a component of each project stage that happens concurrently.

A project pre-work meeting is mandatory. This meeting aims to bring together the Ministry Project Manager, VRI Photo Interpretation Contractor and Quality Assurance personnel before the project starts. This meeting will establish an efficient communication network, identify individuals responsible for all aspects of the project, allow discussion of any questions or issues before project work commences, and establish deliverables and data flow timelines. The meeting may result in minor changes to the contract to complete the photo interpretation activities. A project pre-work checklist, signed off by all parties attending, will be used to organize and guide the meeting.

3.2.1 Polygon Delineation

The BC Land Cover Classification Scheme ("BCLCCS") guides the polygon delineation process. The BCLCCS 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 vegetation attributes (i.e., treed versus non-treed), mensuration attributes (i.e., species, age, height, and crown closure), and ecological attributes where appropriate and as per standards in the *VRI Photo Interpretation Procedures* manual. Minimum interpreter-delineated polygon sizes will follow the delineation requirements in the *VRI Photo Interpretation Procedures* (Table 8).

Table 8. Minimum interpreter-delineated polygon sizes

Polygon Type	Size (ha)
Polygons with distinct attribute differences that create obvious boundaries on the imagery (e.g., trees versus shrubs; immature trees versus mature trees)	≥ 2 ha
Polygons with indistinct attribute/boundary differences on the imagery (e.g., similar stand species and ages with a 5-meter height difference)	≥ 5 ha
Polygons designated as Alpine (i.e., high elevation, above tree line with less than 1% tree cover)	≥ 5 ha for individual cover types; otherwise, combine adjacent cover types into polygons ≥ 5 ha and describe using land cover component descriptions

Source: Forest Analysis and Inventory Branch. 2022. VRI Photo Interpretation Procedures; version 3.8. Ministry of Forests.

The Ministry will supply RESULTS opening data and FWA polygon features for direct incorporation into the VRI.

3.2.2 Field Calibration

The VRI photo interpretation contractor selected by the Ministry for the project will collect field data. The field calibration stage lets the photo interpreters become familiar with the project area and collect tree data in different pre-identified polygons. This data helps calibrate the photo interpreters' knowledge of various forest stand types for the subsequent photo interpretation of stand attributes.

Field calibration data will include a combination of low-elevation helicopter passes over stands of interest (air calls) and ground plots (ground calls) accessed by road or, in remote locations, by helicopter. Interpreters collect tree information and measurements, including species, age, height, and basal area. Soil disturbance and destructive sampling are not components of field data collection for VRI photo interpretation.

The Kalum VRI project will require approximately 1,726 air and 738 ground calls. The standard number of air and ground calls per FME is 20 and 10, respectively. However, there is a proportional reduction in the number of air and ground calls per FME to reflect the area within each FME ineligible for field calibration work. The Ministry excludes non-treed alpine BAFA and CMA BEC zones (Table 3) and various ownerships (Table 6) from field calibration work. The VRI Contractor cannot establish field calibration plots in areas where the Ministry has not approved work or access. The *VRI Field Calibration Procedures for Photo Interpretation* describe the field calibration work.

Subject to a Letter of Authorization issued by BC Parks, the contractor may conduct modified field calibration work in some provincial parks and protected areas.

Before initiating a field calibration program, the VRI Contractor submits a field calibration plan to the Ministry for review and approval to ensure the plan accommodates all identified issues where possible. As part of the final project deliverables, the Ministry requires a complete set of all new field calibration data sources in a digital format determined by the Ministry, including their geographical locations (e.g., UTM coordinates) and the complete set of field attribute data collected.

3.2.3 Attribute Estimation:

VRI polygon attribution involves assigning descriptions that either estimate polygon characteristics (e.g., species, age, and height for treed polygons; shrub heights; ecological information) or contain other information relating to the polygon (e.g. disturbance history). The VRI Contractor uniquely identifies each polygon and makes subsequent qualitative and quantitative estimates for all vegetated and non-vegetated characteristics visible in the imagery for each polygon.

The VRI Contractor may describe land cover types within the polygon that are too small to meet the minimum polygon size requirements as a land cover component. The Ministry uses land cover components to identify the ecological function of the polygon or portions of the polygon.

3.3 Quality Assurance:

The Ministry or a third Quality Assurance contractor (independent of the VRI Contractor performing the VRI photo interpretation and field calibration work) will perform Quality Assurance on all project stages. The Quality Assurance auditor, whether they be Ministry staff or a third-party contractor, is a VRI Certified Photo Interpreter. The Quality Assurance auditor is present at the Ministry's pre-work meetings with the VRI Contractor. Quality Assurance must meet or exceed the *Vegetation Resource Inventory Photo Interpretation Quality Assurance Procedures and Standards* manual on each VRI project stage.

4 Project Scheduling and Implementation

The Kalum VRI project will proceed from north to south in each phase, with approximately 40 FMEs completed in the first fiscal year. The new inventory will be available through the BC Data Catalogue ([Data Catalogue \(gov.bc.ca\)](https://datacatalogue.gov.bc.ca)) the year after the project ends. The schedule may change to meet the Ministry's needs.

Table 9. The proposed project schedule for the Kalum VRI project.

Fiscal Year	Activity
2023/2024	VIP planning Contract Planning and Development
2024/2025	Contract Award Delineation
2025/2026	Delineation Field Calibration Attribution
2026/2027	Field Calibration Attribution
2027/2028	Field Calibration Attribution
2028/2029	Attribution Project Closure

A detailed delivery schedule outlining a progressive delivery of products will be set by the Ministry, in consultation with the VRI Contractor, for each fiscal year.

5 Roles and Responsibilities

Ministry Project Manager

The Ministry Project Manager is responsible for project coordination, monitoring project progress, ensuring all contractors are qualified and certified, overseeing photo-interpretation activities, ensuring quality assurance is complete and delivered at each stage, authorizing payment, and coordinating technical support where required.

VRI Contractor

The VRI Contractor works with the Ministry Project Manager to ensure that project activity planning, coordination and execution are consistent with the VPIP and contract. The VRI Contractor will provide a minimum of four interpreters to maintain data consistency and ensure a ratio of one VRI Certified Photo Interpreter to every Non-Certified Photo Interpreter on the project if the Ministry permits the latter interpreter type.

VRI Quality Assurance Contractor

A third-party VRI Quality Assurance Contractor or Ministry personnel will perform Quality Assurance.

When the Ministry utilizes a third-party VRI Quality Assurance Contractor, the VRI Quality Assurance Contractor will coordinate with the VRI Contractor and the Ministry to ensure that Quality Assurance reporting meets the contract terms and prescribed VRI standards.

The VRI QA Contractor or Ministry Quality Assurance personnel is a VRI Certified Photo Interpreter with a minimum of 10 years of VRI experience and independent of the VRI Contractor.

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