ANNEX "A" - STATEMENT OF WORK

1. Title:

Jasper National Park Vegetation Resources Inventory Mapping Quality Assurance

2. Background:

Jasper National Park (JNP) historically has no vegetation inventory. Fire and land management planning have been done from an Ecological Land Classification, satellite imagery and air photos. Following a widespread, severe Mountain Pine Beetle infestation between 2014 and 2019 the forest cover in JNP has significantly changed. Accordingly, previous land cover data are not sufficiently accurate to support management planning in the park. JNP has initiated a project to develop a Vegetation Resource Inventory (VRI) that follows the BC government's Vegetation Resources Inventory standards. Additionally, JNP is seeking a Quality Assurance (QA) contractor for the project.

3. Objective:

The QA contractor is required to provide quality assurance services concurrently with completion of each stage of the VRI photo interpretation project for the JNP VRI Project. The references to the guiding documents for this QA contract can be found in the References section of this document. Additional guiding documents for this contract include:

- The **Statement of Work** from the *Vegetation Resources Inventory Project Implementation Plan for Photo Interpretation* contract

The QA contractor is expected to be familiar with the objectives and standards of the VRI project as outlined in the document above. Where a discrepancy exists between the Contract and the guiding documents that are referenced in this Contract, this Contract takes precedence.

The QA contractor must be an independent 3rd party from the primary photo interpretation company(s) under contract with the Parks Canada Agency (PCA) for completion of the Jasper National Park VRI photo interpretation and digital map production contract.

3.1 Project Scope

The QA contractor will assume overall responsibility for carrying out all aspects of the VRI quality assurance process and ensure that all the required deliverables are submitted to the PCA in the formats and timeframes required by VRI procedures and this contract document. This includes progressive data submission for all stages of the project for quality assurance and final deliverables.
The QA contractor is responsible for carrying out quality assurance on the following stages of the project:
- Delineation
- Data source transfer
- Field calibration
- Attribute Estimation

All work under this contract must be completed by a BC VRI Certified Photo Interpreter.

Given the large amount of interpretation required, the VRI project has been divided into two non-overlapping project blocks (Fig. 1). The **North Block** (Requirement A) encompasses 21 Full Map Equivalents (FME) or **497,564 ha, 39%** of which is unvegetated (rock/ice). The **South Block** (Requirement B) encompasses 27 FME or **625,403 ha, 46%** of which is unvegetated (rock/ice). The QA

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contractor with be responsible for quality assurance for **both** project blocks which may or may not be held by two independent contractors.

In JNP, full mapsheets average **23,440 ha**.

The expected total number of ground and air calls will be between 480-816 and 960-1,545, respectively; 10% of which require QA.

3.2 File Preparation

Once VRI phase 1 photo interpretation work is underway, the delineation, attribution and field calibration data will be provided by the VRI contractor(s) to the QA contractor via e-mail or ftp for the QA, by batch as agreed to in the project pre-work meeting.

3.3 Specific services

The QA contractor(s) will provide quality assurance services on each stage throughout the project, as per the delivery schedule. The stages include polygon delineation, historical data source transfer, field calibration, and attribute estimation. In coordination with all parties, the QA contractor must:

- Organize and meet with the PCA representative prior to initiating the work, to review methods, standards and any VRI contractor(s) internal QC results.
- Establish a procedure with the VRI contractor(s) to acquire all necessary materials in order to conduct the VRI QA review.
- Organize and undertake QA of VRI air and ground fieldwork
- Conduct a VRI QA review of Polygon Delineation, Data Source Transfer, and Attribute Estimation for the project area.
- Analyse and report on results and findings in a QA report to the PCA representative and VRI contractor(s).
- Provide pass/fail recommendations to the PCA representative. Final determination of acceptance resides with the PCA. If the PCA determines that the VRI contractor(s) must perform re-work, then a second full QA must be performed and submitted to the PCA.
- Where there are concerns with aspects of the QA evaluation, the QA contractor will forward the appropriate classified photo, maps or databases to, and consult with, the PCA representative for direction.
- All QA will be performed using the VRI QA procedures and standards available at the time of contract signing, unless modified by this contract or agreed to by the PCA and QA Contractor.
- All QA work deemed unacceptable must be re-worked. All costs associated with any rework will be the responsibility of the QA Contractor.
- If the QA contractor determines that work performed by the VRI contractor(s) would be undesirable, but still meets QA standards, they must bring the work to the attention of the PCA contact. An example would be if it becomes apparent to the QA contractor that an area of the project was not under contract, but probably should have been.
- If the QA contractor receives all the required material by the VRI contractor(s) and quality assurance work does not commence within 10 calendar days of each stage of the project, the PCA may undertake the QA activity and the QA contractor will forfeit that portion of the QA work under the contract.
- Notwithstanding the above, field calibration QA must be coordinated with the VRI contractor(s) so that the QA personnel are on site at the same time as the VRI contractor(s) to ensure prompt feedback, and potential problems with fieldwork can be corrected prior to crews leaving the work area.

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3.4 Additional QA procedures

General

It is imperative for this project that the *Critical Attributes* are described as accurately as possible at the photo interpretation stage. Therefore, in cases where there is a discrepancy in photo estimation between the photo interpreter and QA contractor, the QA contractor will adjust the viewing to a larger scale in order to better assess the original estimate.

Ground calls for quality assurance may be selected randomly by the PCA project manager (to be decided at the pre-work meeting). Grouping calls to minimize QA travel time is not acceptable. The VRI contractor(s) will provide a list of ground calls on a given map, and the PCA project manager will provide the quality assurance list in return.

The QA contractor, as part of the field calibration QA process, will perform a 10% check on whether the transfer of coordinates and attributes for fieldwork from the VRI contractor's(s') field cards or forms to the PCA's ground calibration tile excel sheets has been done correctly. For Quality Assurance purposes, 1 point will be assigned for each photo data source, all attributes must be correctly summarized and transferred to the excel sheets. While there are no set Pass/Fail criteria for this attribute, the PCA will review this to determine if the data will need to be corrected by the VRI contactor.

Delineation
- Delineation QA will also include providing to the VRI contractor(s) and the PCA representative a PGDB or ESRI shape file indicating linework/polygons to either add, edit or remove.

Fieldwork
- Increment cores must be collected in straws, and labelled with the project name, the ground call number, the plot number in the call, and the tree number, written on a strip of waterproof paper stapled to the end of the straw. The increment cores will be delivered to PCA in the event of a discrepancy in age counts between the QA contractor and the VRI contractor that will result in a Fail rating or at the time of fieldwork completion if a discrepancy has not occurred. must Normal counting procedures will be used by the VRI contractor as specified in the VRI Field Calibration Procedures, but the cores will be available in the event there is a dispute between the Quality Assurance contractor and the VRI contractor.
- The QA contractor will coordinate calibration QA with the VRI Contractor(s). The QA contractor and VRI contractor(s) must be in the project area concurrently for a portion of the VRI contractor's(s') time to provide prompt feedback around potential problems with field calibration work before the VRI contractor departs the Project Area.
- The QA contractor is required to perform two (2) field trips for QA of field calibration work in each field season for each VRI contractor (if applicable). The first trip will occur at the start of the VRI contractor's (s') field session(s) to provide initial feedback. The second trip will occur at the end of the VRO contractor's(s') field session(s) to ensure all completed field calibration work for that season is subject to QA.

Attribution
- Each of the VRI contractor's(s') interpreters must select and attribute 30 polygons of their choice at the beginning of each year's attribution stage and submit them for review by the QA contractor and PCA representative. The purpose is to achieve consistency and clarification of interpretation expectations between the VRI contractor(s), QA contractors and the PCA.
- Prior to checking attributes, the QA contractor will run a VEGCAP validation to ensure that the data checks "clean". Any data that does not validate clean will be sent back to the VRI contractor (some known errors in VEGCAP validation are excluded, but exceptions must be discussed with the PCA Representative). Attribute estimation QA must be completed within 10 working days from the date the VRI contractor has submitted it to the QA contractor.

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- Detailed attributes are required for each polygon Quality Assured for attribution. This will include attributes for the VRI interpreter, and attributes for the QA interpreter shown underneath for each polygon Quality Assured.
- The QA contractor must run a set of PCA provided MS Access queries on each PDGB file prior to the random polygon selection. Where queries indicate an incomplete data submission, the batch may be returned to the VRI contractor for correction and the PCA's Contract manager's discretion.

ARC/GIS Checks
- As a final review, the QA contractor will be expected to conduct multiple theme checks on the entire map checking for omissions and/or errors. The expected theme checks are the following:
- Colour fill. The entire map should have colour-filled polygons (one colour) to help identify any possible holes in the inventory.
- Interpreter check. All interpreters' polygons should be colour coded to visually check to see if there are any odd polygon placements. For example, it is expected to have multiple interpreters on edge polygons, but unusual within the map. This may identify copy/paste issues or polygons with incorrect labels.
- BCLCS themes- Query the map by BCLCS level one of 'V' and level 2 of 'N'. Visually inspect the map with an ortho underneath to identify obviously mis-labelled polygons. Perform a separate query for BCLCS level one of 'N' and visually inspect the map again.

3.4 Parks Responsibilities

Parks Canada may provide the rotary wing aircraft for this contract with availability subject to change dependent on: current wildfire situation, current fire danger and emergency responses. Parks Canada will provide three (3) to five (5) days' notice regarding helicopter availability prior to anticipated field days.

Additionally, Parks Canada Agency will provide:

- GIS Image files and surface files as needed
- Digital ortho-images (where available)
- Ownership layer in digital file format
- Additional data source information (see Table 4 of the SOW from the *Vegetation Resources Inventory Project Implementation Plan for Photo Interpretation* contract for descriptions)
- Base Map layers where available (Boundaries, roads, trails, streams, and water bodies)
- Known fire boundaries and other applicable fire history layers
- Current Closed and Restricted Areas where fieldwork should not be conducted.

3.5   Deliverables

Final Deliverables by the VRI contractor(s) will be in PGDB format, and the QA contractor must perform attribute QA on the final PGDB files delivered by the VRI contractor(s). The VRI contractor(s) is obligated to deliver delineation in ESRI PGDB format as well, but it may be desirable to quality assure delineation using ESRI shape files if the VRI photo interpretation contractor delivers in that format.

Softcopy interpretation will be undertaken on 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 Z\I project file. All images must be copied from PCA provided hard drives at the beginning of the project and returned immediately.

All QA findings will be delivered on a progressive basis according to the standards and procedures unless noted.
These include, but are not limited to:

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- A summary of the QA air and ground fieldwork results (**QA reports according to standards must be provided at the completion of EACH fieldwork QA trip**),
- Any cards, maps and other data collected for this component
- After each relevant QA submission:
  1. An up-to-date VRI QA Report in an approved format (examples are provided in the QA standards) and signed by the QA personnel, including the tabulated scoring results for:
     1) Polygon Delineation,
     2) Field Calibration
     3) Attribute Estimation
  2. A list of attribute estimates made by QA personnel compared to the VRI contractor's estimates.
  3. Additional reports as appropriate (Overview QA delineation report, MSACCESS attribute query reports, etc.
- A summary of quality assurance results at the end of the project. This would include the completed tracking ledger, QA reports, and an overall project QA summary.

All reports will be sent to the PCA project authority. QA results must be discussed with the PCA project authority prior to delivering QA reports to the VRI contractor, and PCA will retain the final right of acceptance or requirements for re-work of the VRI contractors work. The parties recognize that feedback on fieldwork should be delivered to the VRI contractor(s) as soon as possible, while the crews are in the field.

Assessments for late submission of deliverables may be imposed. These assessments will be based on the following:
Attribution
- Progressive delivery of QA reports must begin within ten (10) working days of receipt of a batch of maps.

Delineation
- Progressive delivery of QA reports must begin within five (5) working days of receipt of a batch of maps.

Calibration
- Interim on-site QA report, in a format to be determined at the pre-work meeting, must be provided to the VRI contractor(s) prior to departure of the project work site during each field QA visit.
- Final report must be summited within fifteen (15) working days of the VRI contractor(s) completing the work.

4. Optional Services

Should Parks Canada be unable to provide rotary wing services the Contractor will be required to procure rotary wing services. The optional services may only be exercised by the Contracting Authority and will be evidenced, for administrative purposes only, through a contract amendment.

5. Acceptance of Service

All completed products will be checked for technical standards. All work must be in accordance with the standards and specifications outlined in this contract. Work not conducted in accordance with specifications and standards documents will be deemed unacceptable. In this case, and in addition to any other remedies set out in this Agreement, the PCA may require the QA contractor to make necessary changes to the QA deliverables at its sole cost and expense, in a manner that is satisfactory to the PCA.

The PCA may perform checks on the QA personnel's work on any stage of the project. The work will be checked in accordance with the QA standards and procedures, and the same additional checks outlined in this document.

The QA contractor has 15 business days to rework maps that are rejected. If there is a complaint, the complaint must be registered within 3 business days of the receipt of notice of the rejected maps.

6. References

All Contractor work shall be in accordance with the following British Columbia Government specifications, current at the time of contract signing, which forms part of this contract. All reference documents are available at: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/forest-cover-inventories/photo-interpretation/standards.

- 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
- Vegetation Resources Inventory – The B.C. Land Cover Classification Scheme and addendums
- VRIMS Personal Geodatabase Structure and Use
- VRIMS Vegetation Cover Polygon Validation Rules
- Vegetation Resources Inventory Preparing a Project Implementation Plan for Photo interpretation