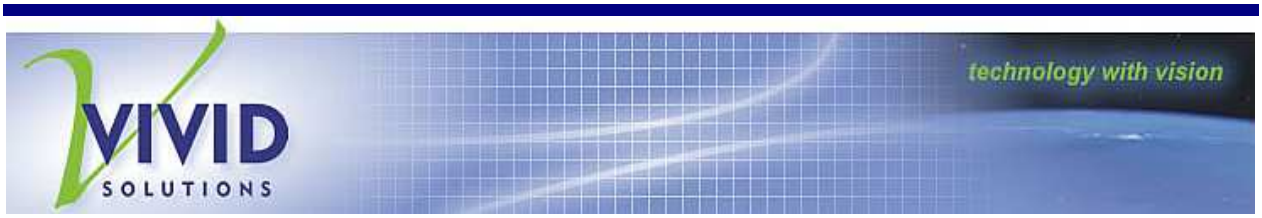

VEGETATION RESOURCE INVENTORY MANAGEMENT SYSTEM[VRIMS]

Detailed Design

Client:	Ministry of Forests and Range Terrestrial Information Branch
Date:	September 1, 2005
Revision:	1.3

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Document Change Control

REVISION NUMBER	DATE OF ISSUE	AUTHOR(S)	DESCRIPTION
1	December 20, 2004	Vivid Solutions Inc.	Release Version.
1.1	July 11, 2005	Vivid Solutions Inc.	Updated Section 3.4.2 'User Interface – Transaction Audit and Management Tool' and Appendix G
1.2	August 12, 2005	Vivid Solutions Inc.	A. Updated MSRM to MOFR, to reflect the change in Ministry. B. Updated section 4.3.2 to discuss the division of application and server support by MSRM and MOFR. C. Appendix 'F' to reflect the data conversion mappings that will take place in the LRDW Reader. D. Create Appendix 'I' to discuss how to manage disturbance events. The discussion is the result of a discussion paper developed for the ministry. E. Updated section 3.1.17 about Wildlife Tree Patches. F. Updated section 3.4.1 and 3.4.2 with new screen captures of application GUI's. G. Created section 3.4.3 that depicts the Management Tool. H. Updated section 3.3.2 – Adjusted Replicator to emphasis that all data will be 'completed' using VDYP 7.
1.2	August 25, 2005	Vivid Solutions Inc.	A. Added discussion notes and pictures on RESULTS submission Generalizations. B. Removed all references to GML. GML will not be utilized within VRIMS.

			C. Updated section 3.1.9, 3.2.4 to reflect the change that the Assessment Layer is now a spatial view, rather than a spatial table.
1.3	September 1, 2005	Vivid Solutions Inc.	A. Updated section 3.2.8 to better reflect the Replication Process. B. Updated section 3.2.7 to better reflect the Integration process. C. Updated section 5.9.2 to update how RESULTS disturbances will be determined and how subsequent identical disturbance events will be managed.

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1. PURPOSE

The Resource Inventory Branch of the Ministry of Sustainable Resource Management is responsible for terrestrial and aquatic systems in British Columbia, including classification and data collection methods, inventory and mapping procedures, interpretations, provincial standards, data management (information systems, data capture and data warehouses), and conservation status.

The Provincial standard for completing Forest Cover Inventories in British Columbia is the Vegetation Resources Inventory (VRI). This is an inventory methodology whose primary objective is to assess the quantity and quality of timber by Timber Supply Area (TSA) or District.
The primary use of this inventory is its use for the Timber Supply Review. The strength of the province's forest cover inventory is as a 'whole', the aggregation of polygons into Timber Supply Analysis units, rather than its 'individual parts' or polygons.

There are two phases of the work that can be part of a Vegetation Resources Inventory:

- Phase I - Air photo interpretation
- Phase II - Ground sampling, including a destructive phase - Net Volume Adjustment Factoring (NVAF)

The INCOSADA suite of tools is a toolset developed to convert, capture and update map information under the conditions outlined by the INCOSADA project. This toolset which includes VEGCAP(Vegetation Cover Attribute Program) supplants the existing FCAP (Forest Cover Attribute Program) and custom map update software.

The Variable Density Yield Prediction (VDYP) is an empirical yield prediction system for natural stands, based upon temporary inventory sample and permanent growth sample data. The model predicts stand heights, diameters, volumes and mean annual increments at different utilization levels and ages. VDYP uses the 'Air Method', which uses crown closure as the density measure.

It is the purpose of the Vegetation Resource Inventory Management System (VRIMS) to replace the INCOSADA suite of tools, provide a seamless, contiguous forest cover spatial database and provide a data repository for purposes of performing vegetation re—inventories, vegetation updates and scientific analysis and validation of the forest inventory.

The benefits of the Vegetation Resource Inventory Management System are expected to include:

- Open, accurate and comprehensive access to information;
- Single data repository for the storage of all data related to vegetation re-inventory and updates.
- Efficiency in the provision of access to information and its storage; and,

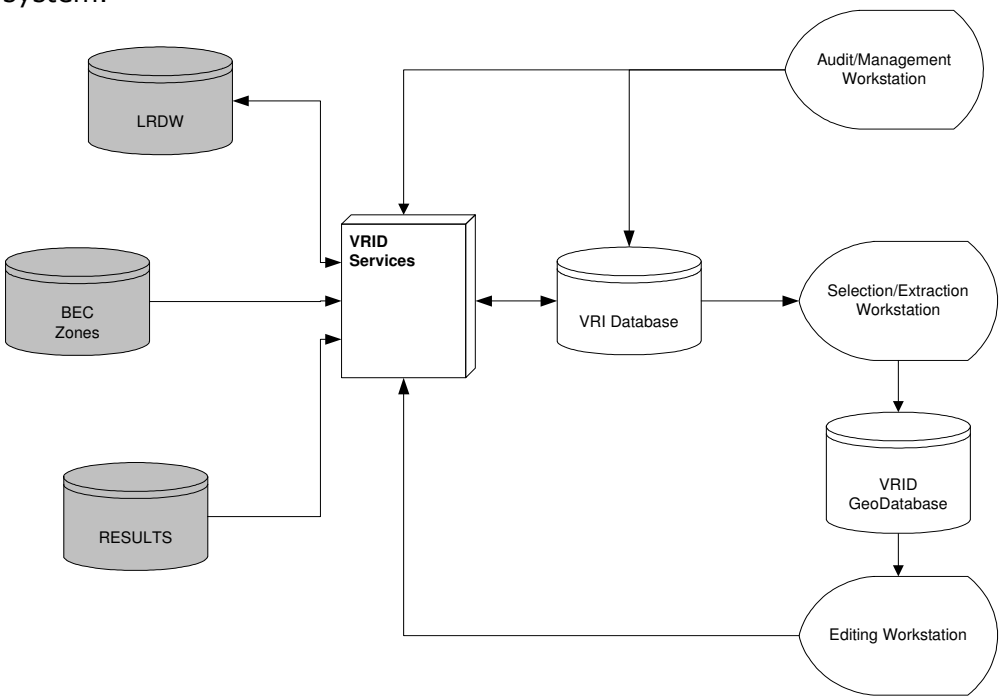
- Efficiency in the collection, integration, analysis to information and its storage.

The Vegetation Resource Inventory Management System Detailed Design document is a comprehensive is a set of technical specifications that will be used to define architecture, components, processes and graphical user interfaces that will be implemented to create and maintain a seamless, contiguous spatial database for the purpose of managing vegetation resource inventory. The Detailed Design Document is intended to answer the "HOW" questions associated with implementing a new system.

2. OVERVIEW

2.1 SYSTEM OVERVIEW

The following diagram shows a high-level view of the VRIMS system. It shows the major datastores, servers, user workstations, and external dependencies for the system.



In this document the acronym 'VRID' is also used to refer specifically to the database component of the VRIMS system.

2.2 SYSTEM OBJECTIVES

The system objectives of the Vegetation Resource Inventory Management System are to:

- Migrate and convert vegetation resource data, currently stored in the LRDW into VRIMS;
- Edit spatial data;
- Select and extract data from the VRID;
- Generate GML to provide a neutral form factor for data exchange;
- Update disturbance event data;

- Accept or reject data from external data sources, including the Reporting Silviculture Updates and Land Status Tracking System(RESULTS);
- Integrate external data into the VRID;
- Project data using VDYP 7; and,
- Replicate data to the LRDW.

2.3 CONFIRMATION OF SCOPE

The Vegetation Resource Inventory Management System will support the following processes.

- Migration and conversion of data from the LRDW;
- Editing of spatial data using commercial off the shelf software;
- Selection and extraction of data from the VRID;
- Generation of GML as a means of common data exchange;
- Preparation of data to include business rule validation;
- Updating the disturbance event information;
- Accepting or rejecting, as a means of screening external data sources;
- Integration of data from external data sources into the VRID;
- Projection of data using VDYP 7 as a means for growing vegetation information; and,
- Replication of data into the LRDW.

2.4 SYSTEM CONSTRAINTS

The Vegetation Resource Inventory Management System will be hosted on the Ministry's server infrastructure and must comply with the technical standards developed by the Ministry and the British Columbia government. These standards include:

- Source code standards;
- Interfaces with standard utilities;
- Content approval processes;
- Copyright notice requirements;
- Standard copyright, disclaimer and privacy clauses;

- Standard date formats;
- Links to databases standard;
- Development languages; and,
- Testing standard.

The Vegetation Resource Inventory Management System is to include the use of commercial off the shelf software, as well as custom user interface and will include the following elements:

- Common ESRI desktop editing tools;
- Common user authentication service; and,
- Common security gateway.

2.5 MEASURES OF SUCCESS

The key measures of success for the Vegetation Resource Inventory Management System are as follows:

- **Effectiveness**—the quantity of accepted and successfully integrated transactions;
- **Efficiency**—the costs associated with the operation of the Vegetation Resource Inventory Management System;
- **Integrity**—the extent to which transactions, once integrated, accurately reflect the contents of the original data;
- **Availability**—the percentage of time that the Vegetation Resource Inventory Management System is available to Ministry staff;
- **Compliance**—the extent to which the Vegetation Resource Inventory Management System provides access to affected business users of the system, including Ministry staff and external clients where appropriate; and,
- **Support**—the ease with which the Vegetation Resource Inventory Management System can be maintained and enhanced.

2.6 QUALITY ASSURANCE

In accordance to the SDLC Standards for Quality Assurance (QA), the Vegetation Resource Inventory Management System Project Steering Committee (members listed below) was formed to perform the QA of the Detailed Design Document and other deliverable resulting from the Vegetation Resource Inventory Management System project. The Detailed Design document is quality assured for:

- Fit with Ministry infrastructure;

- Meets business needs as described in the Business Requirements Document;
- Data Model soundness;
- Appropriate data mapping (where data conversion is required);
- Content;
- Appropriate testing strategy;
- Technical feasibility; and,
- Technical language.

Coordination and feedback with respect to the QA of deliverables between the Steering Committee and the vendor has occurred via the Vegetation Resource Inventory Management System Project Manager. Quality assurance processes have also included monitoring of the Vegetation Resource Inventory Management System project through status reports, incident tracking system reports (vendor) and meetings by the Project Manager with the vendor producing the deliverables.

Presentations to key stakeholders were held in key locations in British Columbia to present the concept of the Vegetation Resource Inventory Management System and to provide the opportunity of participants to ask questions, raise concerns and provide feedback.

2.7 TARGET AUDIENCE

The Vegetation Resource Inventory Management System Project Steering Committee is responsible for reviewing and approving this Detailed Design Document. The members on the Steering Committee are:

- Doug Say, Manager, Application Development Services;
- Ann Morrison, Senior Vegetation Update Forester;
- Tim Salkeld, VRI Technical Applications Coordinator;

Once approved by the Steering Committee, the Detailed Design Document will form part of the project documentation that will be submitted for final decision.

2.8 DOCUMENTATION

The following list of documents have also been produced to assist in the development of the Vegetation Resource Inventory Management System:

- Business Requirements Document;
  The VRIMS Business Requirements document details the business needs for the creation of a single data repository, with a suite of tools, required to manage the re-inventory and update of vegetation resource information.

- VRIMS – Supplemental – VDYP7 - VRID Mappings Microsoft Excel spreadsheet;

  This document provides the mapping relationships between VDYP7 and the Vegetation Resource Inventory Database. Included in the spreadsheet are two worksheets. The first worksheet "Output Mappings" details the progression of output data from the VDYP tables, to storage in the LRDW, and finally how the data will be stored in the VRID. The second worksheet "VDYP7 Mappings To VRID" depicts the data mappings from the VDYP tables to the corresponding fields in the VRID.

- VRIMS – Supplemental – Vegetation Resource Inventory Database Description;
  This document represents the entity report generated from Oracle Designer.

- VRIMS – Supplemental – Label Mapping. Microsoft Excel Spreadsheet;
  This document depicts the mapping of fields from the INCOSADA table structure to the VRID, required for labelling purposes.

- VRIMS – Supplemental – Labelling Historical Document; Microsoft Word document.
  This document provides background information for the labelling requirements.

- Oracle PL/Sql stored procedures, VEG_LABEL_UTILITY;
  This PL/Sql package contains code required to generate the labels for vegetation resource inventory polygons in the LRDW.

- VRIMS – Supplemental – VegCap II Business Validation Rules. Microsoft Excel spreadsheet;
  This document details the business rules used for the validation of vegetation resource inventory polygons.

- VRIMS – Supplemental – VegCap II Business Validation Rules. Microsoft Word document.
  This document specifies the validation rules for Vegetation Cover Polygons defined in the VRID data model. It uses a relatively formal specification language which is intended to be human-readable and also easy and unambiguous to implement.

  The rules given are primarily intended to validate newly entered data. Some rules are marked as [Conversion], to indicate that they apply at Conversion time only.

- VRIMS – Supplemental – BC Land Classification Cover VRID Business Rules. Microsoft Word document.
  This document details the business rules used for the validation of the BC Land Classification Cover's.

- VRIMS – Supplemental – BC Land Classification Cover Historical Document. Microsoft Word document.

This document provides detailed information about the coding requirements for determining the BC Land Classification Cover.

- VRIMS – Supplemental – RESULTS – VRID Mappings" Microsoft Excel spreadsheet.
  This document provides the mapping relationships between the LRDW and the VRID. Included in the spreadsheet are four worksheets. Each worksheet depicts a table in the LRDW and demonstrates the mappings the are required for the VRID.

These documents should be read in conjunction with this Detailed Design Document in order to have a full understanding of the current business context and system requirements.

2.9 METHODOLOGY

In designing the Vegetation Resource Inventory Management System, the following tasks were performed:

- Formed a Vegetation Resource Inventory Management System Project Steering Committee;
- Consulted with MSRM staff;
- Consulted with internal stakeholders of the INCOSADA system;
- Consulted with internal stakeholders of the VDYP system;
- Documented related systems that would require conversion, or provided interface into, or out of, the Vegetation Resource Inventory Management System.
- Documented the INCOSADA system and its business processes;
- Defined the Business and Functional Requirements for the Vegetation Resource Inventory Management System;
- Produced prototype applications that demonstrated the ability to solve the problem.
- Produced a Business Requirements Document; and,
- Produced the Detailed Design Document.

3. APPLICATION DESIGN

The system being designed is termed the Vegetation Resource Inventory Database (VRID). It provides the datastores and applications which allow the Vegetation Update Process to take place.

3.1 APPLICATION DATA STRUCTURES

The Vegetation Resource Inventory Database is built on Oracle technology, with the addition of ESRI's ArcSDE technology. ArcSDE is a server software product used to access multi-user geographic databases stored in relational database management systems.

As data is passed along through each business area, and therefore passed through the data repositories, each repository interacts with, or accepts data from additional data sources.

Listed below are the various data sources that are specific to Vegetation Update Process and the data requirements for the Vegetation Resource Inventory Database.

3.1.1 COORDINATE SYSTEM

Although not a data structure, the Coordinate System is integral to the manipulation and display of the data. The Ministry has a standard projection and datum for all spatial data. The projection is Albers Equal Area Conic, The datum is NAD83, based on the GRS80 ellipsoid. Please refer to the following Ministry web site for complete details, and further discussion regarding the required coordinate system; http://srmwww.gov.bc.ca/gis/bceprojection.html

3.1.2 CONVERSION AREA

The Conversion Area will be considered the pre-production area of the Estimated Business Area, that can be utilized to accept data from the LRDW. All data conversion, user acceptance testing and quality assurance activities will be performed on the data in the Conversion Area. After all conversion work is completed, the Conversion Area will take on the role as the Estimated Business Area. No data transfer will be required.

A separate testing area will be maintained to store smaller collections of data and will be utilized to remedy outstanding data issues and to test and demonstrate the effectiveness of proposed business processes.

USED BY

- **Conversion Process.**

3.1.3 STAGING AREA

The Staging Area is a collection of tables, identical to the Estimated Business Area of the Vegetation Resource Inventory Database, that are used to hold any datasets that will be integrated into the VRID.

USED BY

- **Data Preparation Process.**
- **Integration Process**.
- **Auditing Process**.

3.1.4 VRI POLYGON AREA

The VRI Polygon Area is a set of tables that represent VRI Polygon features in the VRID. It contains the spatial component of features, along with all attributes which do not change during the feature's lifecycle. Additional attributes containing most of the business-level information for VRI polygons are stored in the three Business Area tables: Estimated, Adjusted and Projected. These Business Areas are described, in detail, in the following sections.

When polygons are integrated into the VRID as part of an update, features will be created for them in the VRI Polygon Area and dependent attributes will be created in the Estimated and Adjusted Business Areas. When a VRI polygon is replaced by new polygons during subsequent updates, the features will be marked as retired.

The VRI Polygon Area contains the only copy of the geometry for each feature that exists in the VRID.

USED BY

- **Conversion Process.**
- **Selection / Extraction Process.**
- **Data Preparation Process.**
- **Integration Process**.
- **Auditing Process**.
- **Replication Process.**

3.1.5 ESTIMATED BUSINESS AREA

The Estimated Business Area is a collection of tables containing a complete set of business attributes for each VRI polygon. This area contains the original VRI attributes supplied with the polygon when it is first integrated into the VRID and these will be considered the primary operational attributes for all VRI polygons.

During the integration of new features into the VRID, all attributes will be written to the Estimated Business as well as the Adjusted Business Area.

The Estimated Business Area is the default source for exporting data when required for a Re-Inventory, VRI Editing or an Adjustment exercise.

USED BY

- **Conversion Process.**
- **Selection / Extraction Process.**
- **Integration Process.**

3.1.6 ADJUSTED BUSINESS AREA

The collection of tables that make up the Adjusted Business Area is the second of the business data areas for VRI polygons.

During the adjustment exercise, performed by Ministry Staff or External contractors, data will be exported from the Estimated Business Area, adjusted by means of statistical analysis and imported back to the Adjusted Business Area.

Final calculations, data verifications and adjustments will be managed in the Adjusted Business area, prior to moving the attributes to the Projected Business Area during the Projection Process.

USED BY

- **Conversion Process.**
- **Selection / Extraction Process.**
- **Integration Process**
- **Projection Process.**

3.1.7 PROJECTED BUSINESS AREA

The Projected Business Area is the third of the business data areas for VRID polygons. During the Projection Process, attribute data from the Adjusted Business Area will be replicated to this area and updated by the Variable Data Yield Prediction model. No manual modifications to data in this area will be permitted.

The labelling process generates and stores polygon labels based on the attribute information in this area.

This area is the source of the attributes replicated to the LRDW.

USED BY

- **Projection Process.**
- **Replication Process.**

3.1.8 SYSTEM CONTROL AREA

The System Control Area manages the state of all transactions and automated processes as data is processed into the Vegetation Resource Inventory Database.

USED BY

- **Conversion Process.**
- **Integration Process.**

- **Auditing Process.**
- **Data Preparation Process.**
- **Projection Process.**
- **Replication Process.**

3.1.9 ASSESSMENT AREA SPATIAL VIEW

The Assessment Area Spatial View will depict all polygons that have been copied out of VRIMS for as part of a Re-Inventory, VRI Editing or an Adjustment exercise. Acting as a visual indicator, the Assessment Area will show Ministry staff all areas that are actively being updated.

USED BY

- **Selection / Extraction Process.**
- **Integration Process.**

3.1.10 VRID GEODATABASE

Creating an VRID Geodatabase, using ArcMap, will be the method employed to extract, store and edit data from the Vegetation Resource Inventory Database for Ministry staff.

Ministry staff will create and manage the VRID Geodatabase using common tools found in ArcCatalog. As the Ministry does not adhere to the practice of employing Version Management strategies, this will not be considered a disconnected editing session. Manual intervention, utilizing common extraction, translation and loading applications, will be used to return the VRID Geodatabase back to the Staging Area of the Vegetation Resource Inventory Database.

A template VRID Geodatabase will be created that comprises the data model schema of the Estimate Business Area of the Vegetation Resource Inventory Database to be used for a Re-Inventory and VRI Editing exercises. A template VRID Geodatabase will be created that comprises the data model schema of the Adjusted Business Area of the Vegetation Resource Inventory Database to be used for an Adjustment exercise. These tables will be populated, using custom tools and queries, after the creation of the Personal Geodatabase. This step is required, since a VRID Geodatabase does not maintain a relational database structure.

It is proposed that the standard data exchange format of VRID Geodatabase and GML be utilized when sharing data between the Ministry and external clients.

It is understood that for purposes of supplying data to external sources the Ministry may require the data in formats other than PGDB. To accommodate the delivery of data in various formats it is proposed that the Ministry utilize Safe Software's FME application to extract and translate the Vegetation Resource Inventory data from the VRID database to the format required.

For template structure for Adjustments please refer to the "VRIMS – Supplemental – VDYP7 - VRID Mappings" Microsoft Excel spreadsheet.

For template structure for Re-Inventory and VRI Editing please refer to the "VRIMS – Supplemental – Vegetation Resource Inventory Database Description" document, under Estimated Business Area Tables.

USED BY

- **Selection / Extraction Process.**
- **Editing Process.**
- **Data Preparation Process.**

3.1.11 LRDW

The Ministry of Sustainable Resource Managements' Land and Resource Data Warehouse is an integrated collection of spatial and attribute data published from diverse sources, structured for efficient access in support of decision-making and distribution to a wide range of clients.

The LRDW contains a complete copy of the current VRI dataset. This dataset will be used as the source for the initial population of the VRID by the Conversion Process. Once VRIMS is in operation, the Projected Business Area will become the source for the LRDW VRI dataset.

The LRDW also contains reference data used during VRIMS processes. The BioGeoClimatic Zone layer is used during the Projection Process. The RESULTS ACTIVITY_TREATMENT_UNIT is accessed during the Labelling Process.

USED BY

- **Conversion Process.**
- **Projection Process.**
- **Replication Process.**

3.1.12 RESULTS SUBMISSIONS

The Reporting Silviculture Updates and Land Status Tracking System [RESULTS] application tracks Silviculture information by managing the submission of Openings, Disturbances, Silviculture activities and Obligation declarations as required by the Forest and Range regulation and legislation.

USED BY

- **Data Preparation Process.**

3.1.13 RE-INVENTORY DATA

Re-Inventory data are large datasets that have been extracted from the Vegetation Resource Inventory Database, packaged and delivered as either a GML document or as a VRID Geodatabase, to an external contractor that perform spatial and attribute updates on.

External Re-Inventory datasets, in GML format, will be submitted to EFS for document validation. If the document successfully passes EFS validation, the Re-

Inventory EFS Agent will accept the document and process the submission through Acceptance Testing and store the dataset in the Staging Area.

USED BY

- **Selection / Extraction Process.**
- **Editing Process.**
- **Data Preparation Process.**

3.1.14 VRI EDITING DATA

A VRI Editing exercise involves small data collections, usually single 1:20,000 scale Mapsheets and all encompassing polygons and associated attribution. Once an area of interest has been defined that will be the subject of the VRI Editing exercise, the data is exported to an VRID Geodatabase for Ministry staff to perform the VRI Editing.

USED BY

- **Selection / Extraction Process.**
- **Editing Process.**
- **Data Preparation Process.**

3.1.15 ADJUSTMENT DATA

An Adjustment exercise involves large or small data collections involving one or many 1:20,000 scale Mapsheets and only non-spatial attributions. Once an area of interest has been defined that will be the subject of the Adjustment exercise, the data is exported as either a GML document or a VRID Geodatabase.

The data model and data requirements for an Adjustment exercise requires only the non-spatial attributes from the GML and the VRID Geodatabase.

USED BY

- **Selection / Extraction Process.**
- **Editing Process.**
- **Data Preparation Process.**

3.1.16 DISTURBANCE EVENTS

SOURCES OF DISTURBANCE EVENTS

Disturbance Events are categorized as 'Managed' or 'Unmanaged'.

A **Managed Disturbance Event** originates from RESULTS. It occurs in an Opening and is reported by the Licensee. It can be either a natural or man-made disturbance. A disturbance event is maintained within RESULTS in the DISTURBANCE_RESULTS table.

An **Unmanaged Disturbance Event** originates from the update process. It can be either a natural or man-made disturbance. It is identified on a as-needed

basis by Ministry staff by providing details about the disturbance during the update process.

In VRIMS both Managed and Unmanaged disturbance events are modelled and processed identically.

USED BY

- **Integration Process.**

3.1.17 WILDLIFE TREE PATCHES

A Wildlife Tree Patch (WTP) is a permanent reserve associated with a logging site that protects trees with valuable wildlife tree attributes. The size of a WTP depends on the biodiversity emphasis designated for each individual landscape, which is established in higher-level plans for each landscape unit.

If the WTP is the largest Forest Cover Polygon, then do not use the WTP to generalize the entire Opening when the Opening is not 'Free To Grow'. Rather use the next largest, non WTP, Forest Cover Polygon to generalize the Opening.

If the WTP has full attributes (species, age, height, etc) in RESULTS and is greater than, or equal to 1 ha, then integrate into the VRID using the RESULTS attribution.

If the WTP has no attributes provided in RESULTS, then do not integrate into the VRID.

If the WTP is completely contained within the RESULTS geometry and the WTP is greater than 1 ha, bring forward the attribution from the VRID and populate the WTP record.

USED BY

- **Integration Process.**

3.1.18 BEC ZONES

BioGeoClimatic Zones is a classification system that identified climate as the primary factor influencing ecosystem development. Government researchers mapped out 14 broad BioGeoClimatic zones with distinct patterns of soil and vegetation, usually characterized by the general tree species that dominates over time.

The BioGeoClimatic Zone system is a common language to understand the characteristics of each ecosystem and to prescribe appropriate management practices. Each of B.C.'s BioGeoClimatic zones is divided into smaller sub zones and variants based on climate conditions. Within each of these, lands are further classified at the site-specific level.

The data source is available from MSRM as a SDE layer.

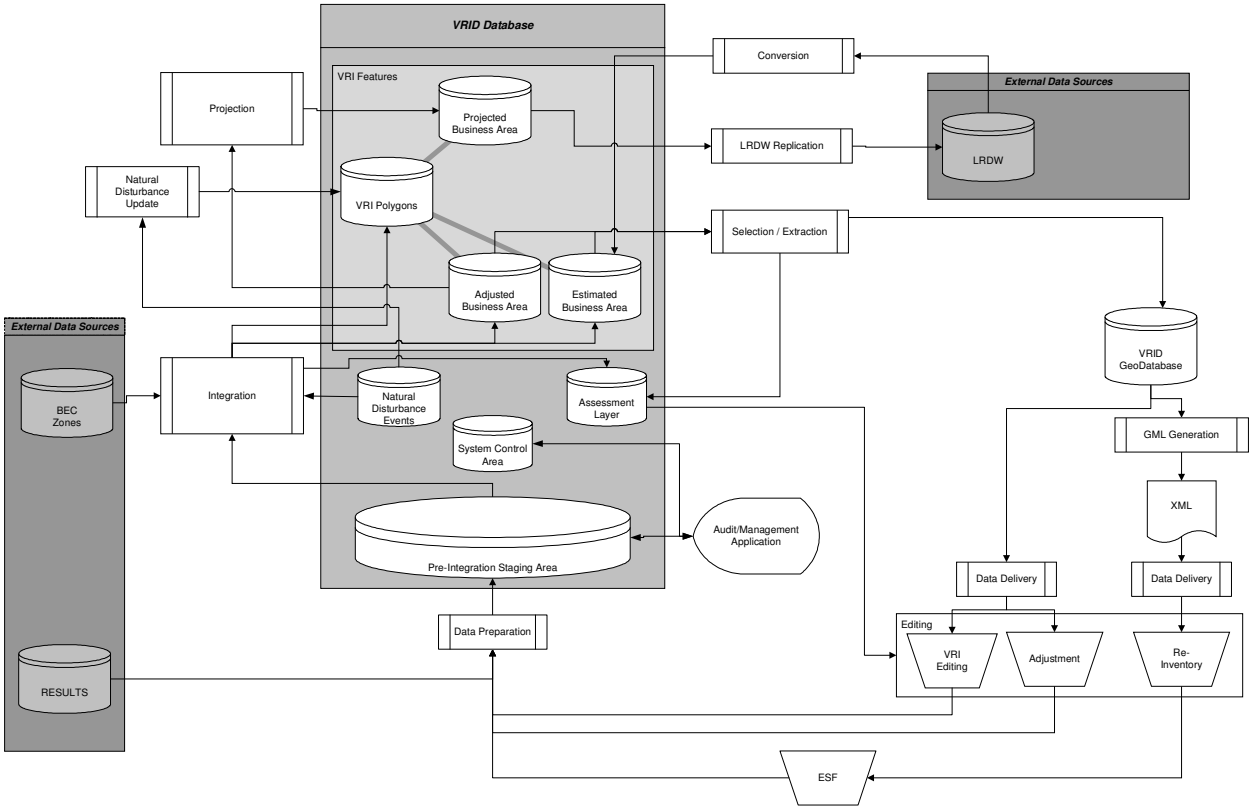
USED BY

- **Integration Process.**

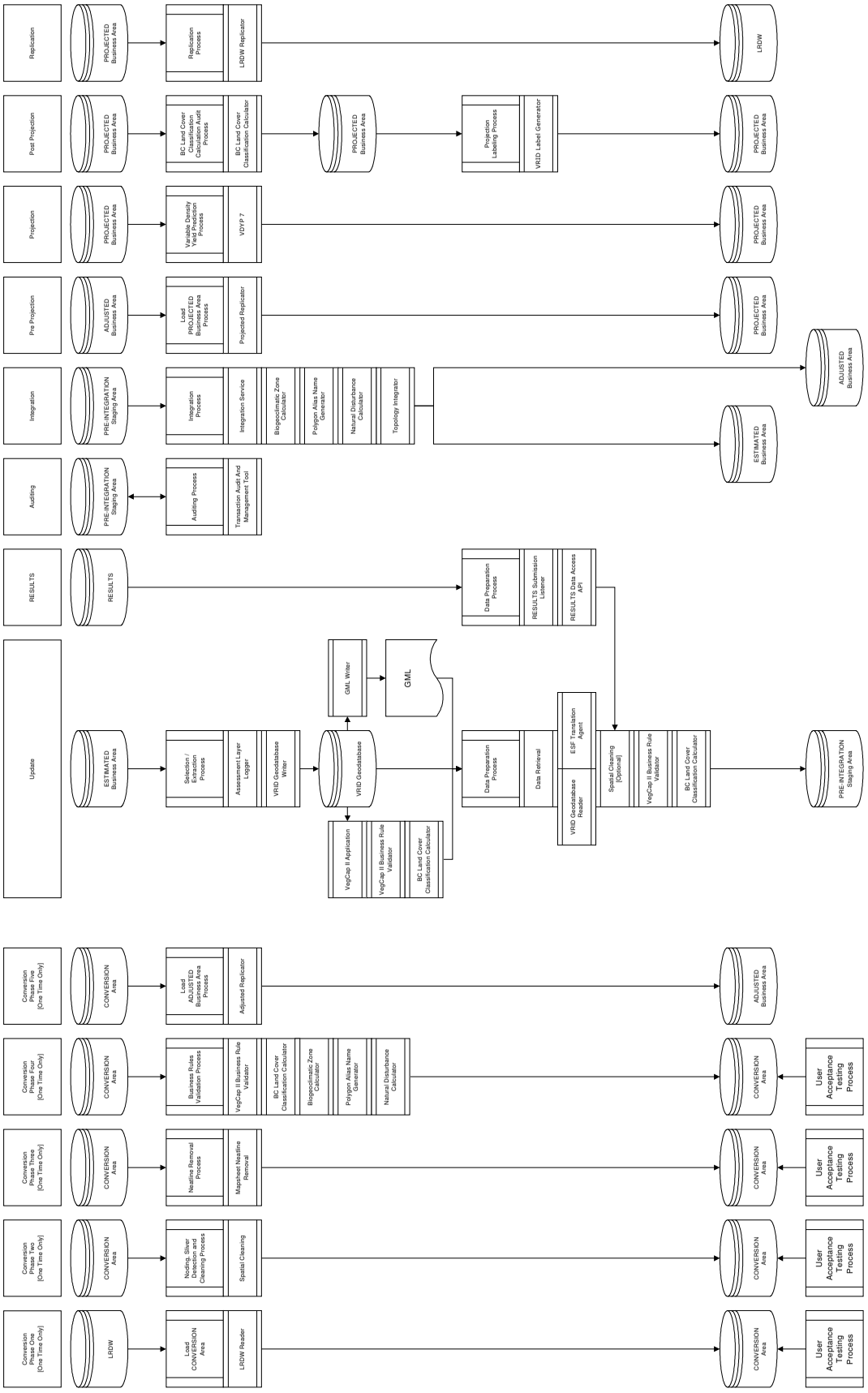
3.2 APPLICATION PROCESS SPECIFICATIONS

3.2.1 PROCESS DIAGRAM

The following diagram depicts the interaction of processes with the various internal and external data sources of the Vegetation Resource Inventory Database, from a ***system overview*** perspective.



The following diagram depicts the interaction of processes with the various internal and external data sources of the Vegetation Resource Inventory Database, from a ***business process*** perspective.


Conversion Phase One (One Time Only)
Conversion Phase Two (One Time Only)
Conversion Phase Three (One Time Only)
Conversion Phase Four (One Time Only)
Conversion Phase Five (One Time Only)
Update
Auditing
Integration
Pre Projection
Projection
Post Projection
Replication
RESULTS
LRDW
CONVERSION Area
ESTIMATED Business Area
PRE-INTEGRATION Staging Area
ADJUSTED Business Area
PROJECTED Business Area
RESULTS
LRDW Reader
Nodding Sliver Detection and Cleaning Process
Spatial Cleaning
Nateline Removal Process
Mapsheet Nateline Removal
Business Rules Validator Process
VegCap II Business Rule Validator
BC Land Cover Classification Calculator
Biogeoclimatic Zone Calculator
Polygon Alias Name Generator
Natural Disturbance Calculator
Load ADJUSTED Business Area Process
Adjusted Replicator
User Acceptance Testing Process
Selection / Extraction Process
Assessment Layer Logger
VRID Geodatabase Writer
VRID Geodatabase
VegCap II Application
VegCap II Business Rule Validator
BC Land Cover Classification Calculator
GML Writer
GML
Data Preparation Process
Data Retrieval
VRID Geodatabase Reader
ESF Translation Agent
Spatial Cleaning (Optional)
VegCap II Business Rule Validator
BC Land Cover Classification Calculator
RESULTS Submission Listener
RESULTS Data Access API
Auditing Process
Transaction Audit And Management Tool
Integration Process
Integration Service
Biogeoclimatic Zone Calculator
Polygon Alias Name Generator
Natural Disturbance Calculator
Topology Integrator
Load PROJECTED Business Area Process
Projected Replicator
Variable Density Yield Prediction Process
VDYP 7
BC Land Cover Classification Calculator Audit Process
BC Land Cover Classification Calculator
Projection Loading Process
VRID Label Generator
Replication Process
LRDW Replicator

3.2.2 CONVERSION PROCESS

The Data Conversion Process includes any action that manipulates external data sources for use in the population of the Vegetation Resource Inventory Database, Estimated Business Area.

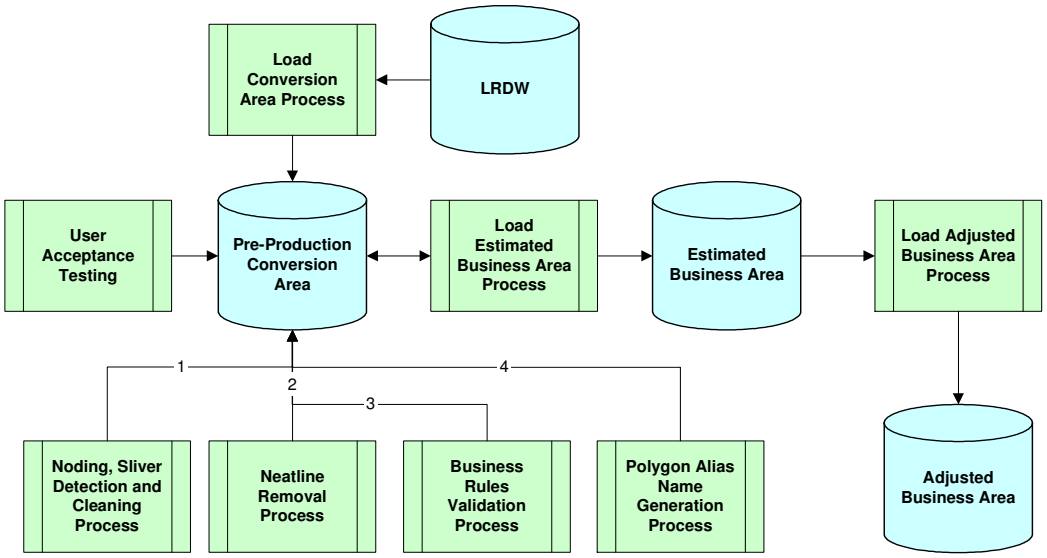
The primary source of conversion data will come from the Vegetation Inventory as defined by the LRDW. The LRDW will be the data repository that will be used to initially populate the Vegetation Resource Inventory Database, Estimated Business Area.

The Data Conversion Module is a single process that uses various techniques to assess and validate data before migration to the Estimated Business Area and the Adjusted Business Area.

The Data Conversion Module also includes one process that replicates data from the Projected Business Area to the Land Resource Data Warehouse. This will be a once per year process.

Please see Appendix F, for conversion translation rules.

PROCESS DIAGRAM



LOAD CONVERSION AREA PROCESS

To eliminate performance, security and processing issues of the LRDW during conversion, a Conversion Staging Area will be created to facilitate all data conversion, user acceptance testing and quality assurance activities required prior to populating the Vegetation Resource Inventory Database.

To accomplish the transfer of data from the LRDW to the pre-production Conversion Area, it is proposed to read directly from the LRDW and write to the pre-production Conversion Area.

Prior to the transfer of data from the LRDW to the Conversion Staging Area it will be necessary to reconcile all outstanding INCOSADA Mapsheet files that are in the process of being updated. All 'checked out' Mapsheet files will be transferred into the LRDW by means of the INCOSADA Gateway [IGW], just prior to the production run, that will load the Conversion Staging Area of the VRID.

Once the loading of the Conversion Area has successfully completed, the use of INCOSADA files for editing and updating purposes will be stopped and will remain stopped if conversion succeeds. All IGW services will be shutdown.

The Estimated Business Area will act as the pre-production conversion area and will be used for all conversion, user acceptance, quality assurance and implementation testing.

COMPONENTS USED

- **LRDW Reader**.

NODING, SLIVER DETECTION AND CLEANING PROCESS

All submissions will be subject to a Noding, Sliver Detection and Cleaning process to ensure that the submission polygons do not contain slivers or gaps. Automated tools will perform noding of the submission that will identify any slivers or gaps that are present. If slivers or gaps are detected an automated cleaning process will result in the removal of these unwanted polygons.

COMPONENTS USED

- **Spatial Cleaner**.

MAPSHEET NEATLINE REMOVAL PROCESS

As a precursor for data conversion, the Neatline Removal Process will facilitate in the dissolving of all Mapsheet neatline topology within the Vegetation Inventory Cover dataset. As Neatlines are dissolved, polygons that span the Neatlines will be identified, matched to its spanning neighbour and joined together to make one continuous polygon, thus eliminating the Neatline.

As no prototyping has been attempted for this effort, the Ministry realizes that the removal of Neatlines will have to take on an iterative approach to assure that data is processed in a meaningful manner. Current data quality, as a result of on going adjustments along the neatlines, cannot be guaranteed to be either spatially correct; slivers, lack of noding, or non-spatially correct due to attributes not being correctly populated for neatline spanning polygons.

Spatial and non-spatial considerations will include complete noding of the entire Vegetation Inventory dataset, edge matching and vertical snapping of polygons spanning neatlines, identification of identical neatline spanning polygons through attribution, sliver and spike detection and removal.

In order to limit the size and complexity of geometry in the VRID, polygons will only be merged up to given area and geometry size limits.

By removing the Neatlines from the Vegetation Resource Inventory Database several key issues can be resolved.

- If the total area of a particular polygon that spanned a neatline was required, multiple calculations would be required.
- During RESULTS Submission integration, fewer business rules will have to be applied to submissions that span Mapsheets.
- If Mapsheet Gridlines are a requirement to perform a business function, they can easily be overlaid onto the Vegetation Inventory Cover. With this, spatial queries can be performed, such as, return all RESULT submissions that are contained within a specified grid.
- Time spent on quality assurance and data verification activities will be considerably reduced along former Mapsheet boundaries.
- If Mapsheet Gridlines becomes more accurate, there will be no effort required to try to conflate neatlines in the Vegetation Inventory Cover to the more accurate Mapsheet Gridlines.

COMPONENTS USED

- **Mapsheet Neatline Removal.**

BUSINESS RULES VALIDATION PROCESS

Data validation will include, BC Land Cover Classification calculations, VegCap II Business Rule Validation and the calculation of Biogeoclimatic Zones.

COMPONENTS USED

- **VegCap II Business Rule Validator**.
- **BC Land Cover Classification Calculator**.
- **Biogeoclimatic Zone Calculator**.

POLYGON ALIAS NAME GENERATION PROCESS

As a business requirement for the Vegetation Resource Inventory Database, all polygons within any 1:20,000 mapsheet must be uniquely identified.

The concept of a spatially seamless and contiguous Vegetation cover removes the ability to generate unique identifiers of mapsheet boundaries as positional identifiers including the mapsheet name as a component. However, polygon identifiers are integral to the business operation of the Ministry to identify work areas and to communicate with internal and external clients. As such, individual Vegetation polygons will be identified with a unique POLYGON_NUMBER, based on its relationship within a mapsheet boundary. A process is required to generate these unique id's for all Vegetation Resource Inventory polygons anywhere within the Province.

COMPONENTS USED

- **Polygon Alias Name Generator**.

USER ACCEPTANCE TESTING PROCESS

User Acceptance Testing will encompass all activities related to the validation and data quality assurance required by the Ministry. Using an iterative methodology, data that does not pass user acceptance testing will be manually inspected and corrected.

LOAD DISTURBANCE EVENTS PROCESS

At conversion any VRI polygon for which a disturbance is recorded is copied into the Disturbance Event table. Only the most recent disturbance is retained. The disturbance geometry and capture metadata is copied from the polygon. The disturbance attributes are obtained from the History table record where rank = 1.

At conversion, the Disturbance Events that have been identified with the ROSC project should be reviewed for possible inclusion.

COMPONENTS USED

- **Disturbance Event Update**

LOAD ADJUSTED BUSINESS AREA PROCESS

To accomplish the transfer of data into the Adjusted Business Area, it will only be necessary to transfer the non-spatial attribution. It will be necessary, however, to insure that the relationship between the VRI Spatial Object polygon geometry and the associated, non-spatial attributes remain intact, as all three business areas only maintain the single VRI Spatial Object polygon.

Additionally, at the time that the attribute information is moved to the Adjusted Business Area, it will be necessary to 'complete' each record to bring them up to a pre-projection standard.

COMPONENTS USED

- **Adjusted Replicator**
- **Completion Process**

3.2.3 EDITING PROCESS

The Editing Process involves any action that requires manipulation of either spatial or non-spatial attributes of the Vegetation Resource Inventory.

Data manipulation exercises can involve either ministry staff, or external contractors.

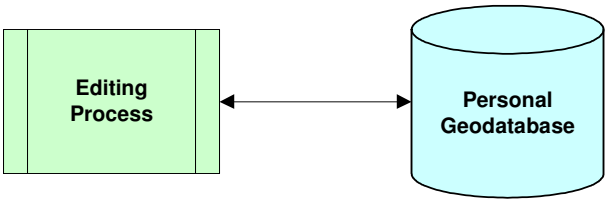
A VRI Editing exercise specifically refers to the manipulation of spatial and non-spatial data by ministry staff using ArcMap and the VegCap II Application. The

VRI Editing exercise can involve single or multiple Mapsheets of Vegetation Resource Inventory data.

Adjustments refers to the manipulation of non-attribute data for the purposes of statistical analysis.

A Re-Inventory exercise specifically refers to the manipulation of spatial and non-spatial data by external contractors using ArcMap and the VegCap II Application. The Re-Inventory exercise can involve geometries and non-spatial attributes of tens or hundreds of Mapsheets of data at a single time.

PROCESS DIAGRAM



VRI EDITING PROCESS

When editing of the Vegetation Resource Inventory data is required, data preparation, and data translation will be identical.

After the creation of the VRID Geodatabase has been completed, Ministry staff will perform all geometry editing using the editing functionality available in the ArcMap environment.

The VegCap II Application will provide the user interface for editing functionality of non-spatial attribution.

The VegCap II Application will be tied into the table structure within the VRID Geodatabase.

COMPONENTS USED

- **COTS Components**.

3.2.4 SELECTION / EXTRACTION PROCESS

The Selection/Extraction Process allows data to be identified and extracted from VRIMS for Update, Re-Inventory, VRI Editing or Adjustment exercises. The process results in the creation of an VRID Geodatabase that can be edited and updated using ArcMap.

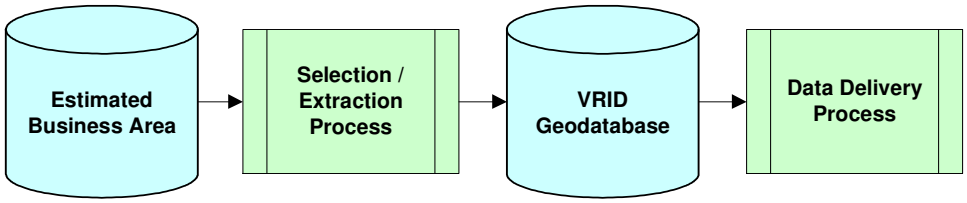
A Re-Inventory or Adjustment exercise will require Ministry staff to select the area that will be the subject of the Re-Inventory or Adjustment, using ArcMap. A custom ArcMap tool is then used to extract the selected data and create a VRID Geodatabase. If a external contractor requires the data in a format other than a

VRID Geodatabase, Ministry Staff can use custom tools to create an GML document as an additional method of data delivery.

When extracting data the data is copied from the Estimated Business Area. It is stored in a VRID geodatabase template based on the Adjusted Business Area data model.

To assist the contractor with completing the Re-Inventory or Adjustment exercise, additional data sources including digital photography or satellite imagery may be packaged and delivered along with the extracted dataset.

PROCESS DIAGRAM



ALTERNATIVES

Version Management of the SDE would allow for the process of disconnected editing. Disconnected editing has been developed to facilitate the ability to edit data while disconnected from the central database. The concept of disconnected editing simply involves checking data out from an enterprise ArcSDE Geodatabase into a personal Geodatabase, editing the data, and then uploading the data back into the ArcSDE Geodatabase.

If version management was in place, then the need to develop a personal Geodatabase translation tool would not be required.

SELECTION / EXTRACTION PROCESS

- Using available selection tools in ArcMap, Ministry Staff will identify the area that will be subject of the Update, Mini Re-Inventory, Re-Inventory or Adjustment exercise. The selection criteria for defining the area or interest may involve a spatial selection; i.e. all polygons within several Mapsheets, or all polygons within a specific forest district.

- Each polygon that has been extracted will have a state of "Checked Out". This will allow the Assessment Layer Spatial View to include those polygons that have been extracted in its selected set and therefore provide a visual indication of what areas are currently the subject of updating.

- Using available exporting tools in ArcMap, Ministry Staff will be able to export the selected area to an VRID Geodatabase.

- The VRID Geodatabase, that Ministry Staff will export data to, will be a pre-defined template that will have a pre-existing table structure tailored specifically to each editing exercise. Please refer to section 5.3.10 for a description of the VRID Geodatabase.

- Once the geometry of the Re-Inventory or VRI Editing area has been exported to the VRID Geodatabase, Ministry staff will run a routine that will populate the pre-existing tables with the non-spatial attribute information from the Estimated Business Area of the Vegetation Resource Inventory Database, based on the polygons included in the selection area.

- Once the geometry of the Adjustment area has been exported to the VRID Geodatabase, Ministry staff will run a routine that will populate the pre-existing tables with the non-spatial attribute information from either the Estimated Business Area or the Adjusted Business Area based on the data requirements of the client.

- Additional data sources, including digital photography, or satellite imagery may be used to assist Ministry Staff.

COMPONENTS USED

- **VRID Geodatabase Writer**.
- **Assessment Layer Spatial View**.
- **VRID GML Writer**.

DATA DELIVERY PROCESS

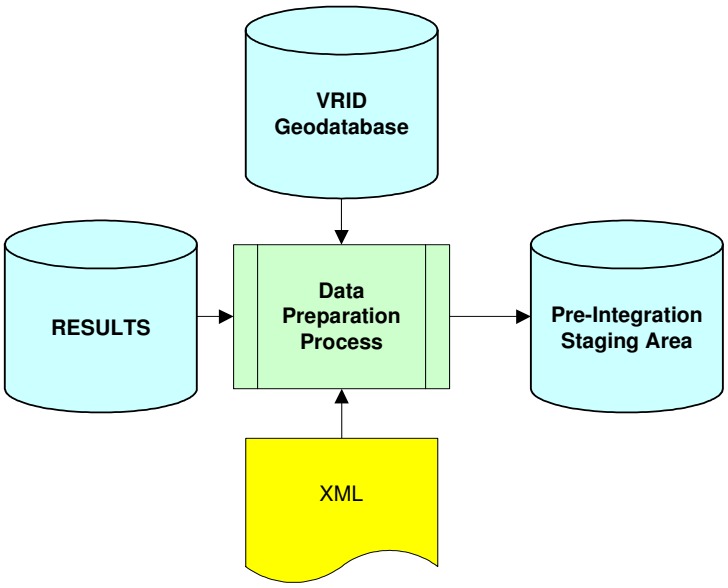
Ministry Staff will deliver the VRID Geodatabase and any additional datasets to external clients as required. Data delivery may include posting the data on a Ministry FTP site, or managing package delivery via the web. It is anticipated that the size of the VRID Geodatabase will preclude the use of e-mail as a delivery mechanism.

COMPONENTS USED

- **Data Delivery**.

3.2.5 DATA PREPARATION PROCESS

PROCESS DIAGRAM



DATA PREPARATION PROCESS

The Data Preparation Process is a component driven process that monitors the availability of new data from various sources, retrieves the new data, performs spatial and attribute validations, then writes the data to the Staging Area.

COMPONENTS USED

- **RESULTS Submission Listener.**
- **RESULTS Data Access API.**
- **VRID Geodatabase Reader.**
- **Data Retrieval.**
- **VRID GML Reader.**
- **VegCap II Business Rule Validator.**
- **BC Land Cover Classification Calculator.**
- **Spatial Cleaner.**

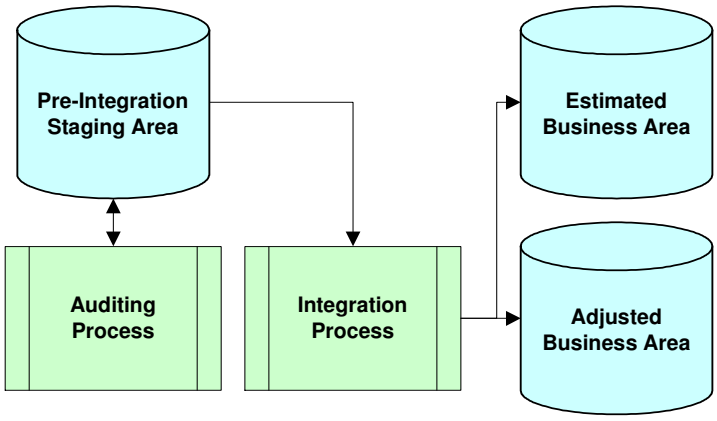
3.2.6 AUDITING PROCESS

The Audit Tool and the Management Tool will provide the visual means to interactively inspect, process and manage data integration of all data collections submissions, including Re-Inventory, Mini Re-Inventory and Adjustment into the Vegetation Resource Inventory Database.

The Audit Tool will be used to view all submissions that are stored in the Staging Area.

The following topics discuss the states of the submission transactions as the Audit Tool and the Management Tool process them.

PROCESS DIAGRAM



COMPONENTS USED

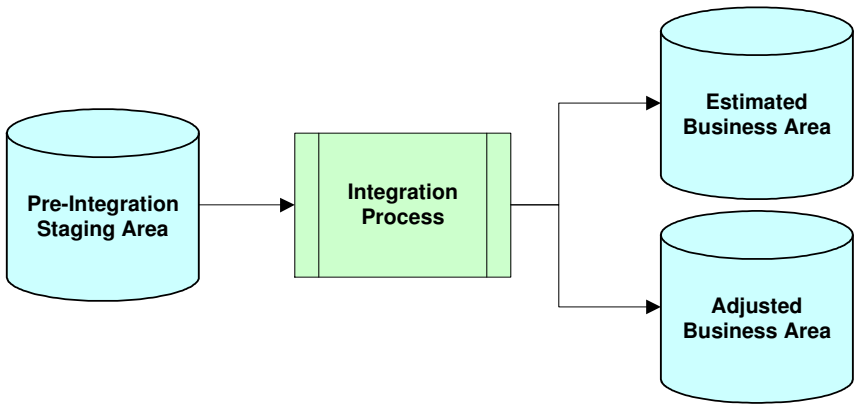
- **Audit Tool and Management Tool.**

3.2.7 INTEGRATION PROCESS

The Integration Process is tasked specifically with the integration of all external transactions that are destined for incorporation within the Vegetation Resource Inventory Database. External data can include submissions from RESULTS and all update data either from a contractor re-inventory, a ministry re-inventory or an adjustment.

The Integration Process works as the process engine moving data between the Staging Area and the operational database. Data that is being held in the Staging Area will be subjected to a Ministry audit. Data will only be integrated into the operational database if, during the audit process, the data has been placed in a state of acceptance by the auditor.

PROCESS DIAGRAM



INTEGRATION PROCESS

The Integration Process is responsible for the movement of data from the Staging Area into the Estimated and Adjusted Business Area's. Data will be written to the two Business Area's at the same time to preserve continuity between the two areas.

At time of integration, polygon data will be held in memory with a copy being written to the Estimated Business Area, while another copy will be subjected to a 'completion'. If the polygon that is being 'completed' fails to 'complete' correctly the current polygon data held in memory will be written to the Adjusted Business Area and an error will be generated that will be visible in the Audit Tool. A successfully 'completed' polygon will write that data into the Adjusted Business Area.

COMPONENTS USED

- **Integration Service.**
- **Spatial Cleaner.**
- **Topology Integrater.**
- **Completion Update.**
- **Disturbance Event Update.**
- **Polygon Alias Name Generator.**

3.2.8 PROJECTION PROCESS

The process of projecting vegetation data from the Adjusted Business Area to the Projected Business Area of the Vegetation Resource Inventory Database and the subsequent replication of data to the LRDW will require the use of extraction, translation and loading tools.

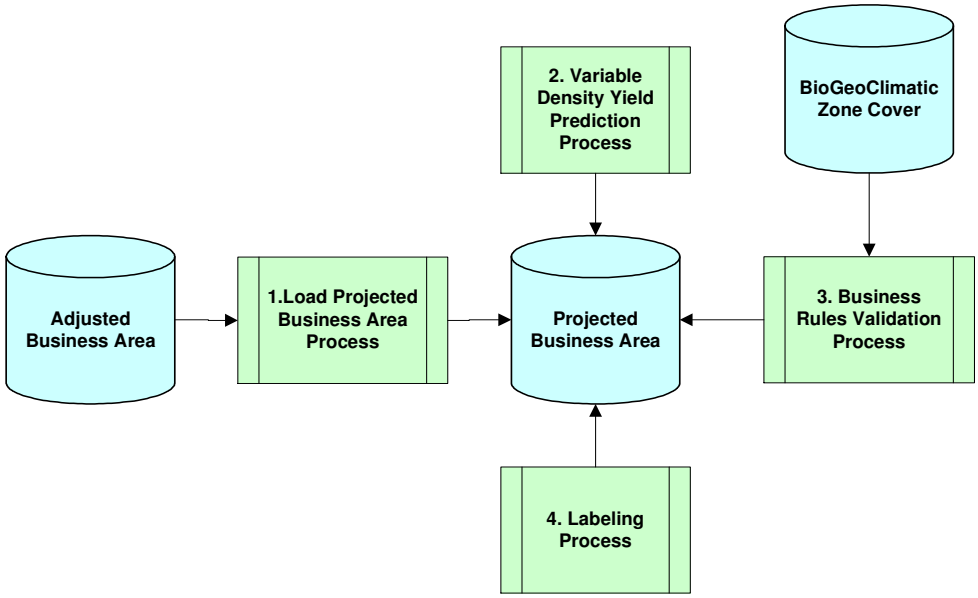
Data that requires 'adjusting' will be extracted from the Estimated Business Area into a Adjusted Business Area data model (Adjustment data will never be extracted from the Adjusted Business Area), for the purposes of data manipulation outside of the VRID.

Once adjustments have been completed externally, the data will be returned to the VRID and will have attribute only data updated in the Adjusted Business Area.

At some moment in time, in the course of the year, the Projection Process will be initiated from the Management Tool. The Projection Process will load a single polygon into memory, 'project' the data and write the resulting data into the Projected Business Area.

Label generation will be final step in the Projection Process, prior to replication to the LRDW.

PROCESS DIAGRAM



BUSINESS RULES VALIDATION PROCESS

Data validation will include, BC Land Cover Classification calculations and the calculation of Biogeoclimatic Zones.

COMPONENTS USED

- **VegCap II Business Rule Validator.**
- **BC Land Cover Classification Calculator.**
- **Biogeoclimatic Zone Calculator**.

VARIABLE DENSITY YIELD PREDICTION PROCESS

The VDYP growth model is an empirical yield prediction system designed to predict average yields and project forest inventory updates over large areas (i.e., Timber Supply Areas). Currently a Java Application uses various calls to a Windows .dll to invoke the VDYP 7.0 component to perform the calculations.

The VDYP projection process, given a set of polygons, projects each polygon to the target end date and stores the results in the polygon's table structure in the database.

For each stand, the VDYP projection process uses a set of values gathered from the row entries in the table structure of the target vegetation cover polygon. These values are used by the VDYP DLL to calculate ages, heights, volumes, and diameters of all species in the stand. These calculated values are then inserted into the appropriate database records.

The VDYP Projection Process will be performed against the Projected Business Area of the VRID.

Please refer to the "VRIMS – Supplemental – VDYP7 - VRID Mappings" Microsoft Excel Spreadsheet for field mappings between VDYP7 and the Vegetation Resource Inventory Database, data model.

COMPONENTS USED

- **Variable Density Yield Predictor[VDYP]**

LABELLING PROCESS

The Labelling Process, also referred to as map notation, is the process of creating the Vegetation Cover labels that are used to present attribute information along with polygon information when a Vegetation Cover map is printed or displayed. The creation of a Vegetation Cover label involves building the label attributes and then determining a placement for the label.

The Labelling Process will be implemented as a separate process. It is run as the final process of the Vegetation Projection Processes. It can also be run independently at any time to refresh some or all of the polygon labels.

To calculate labels for VRI polygons whose source is a RESULTS opening, it is necessary to include information from the opening record in the RESULTS database (associated via the OPENING_ID). The required information is contained in the ACTIVITY_TREATMENT_UNIT table in the ACTIVITY_START, ACTIVITY_END, SILV_BASE and SILV_TECHNIQUE attributes. This information is obtained from the RESULTS dataset in LRDW.

Please refer to the "VRIMS – Supplemental – Label Mapping" Microsoft Excel Spreadsheet for related information.

Please refer to the "VRIMS – Supplemental – Labelling Historical Document" Microsoft Word document for related information.

Refer to the Oracle Pl/Sql stored procedure VEG_LABEL_UTILITY for detailed implementation.

COMPONENTS USED

- **VRID Label Generator.**

LOAD PROJECTED BUSINESS AREA PROCESS

The Load Projected Business Area Process is responsible for the transfer of data from the Adjusted Business Area to the Projected Business Area.

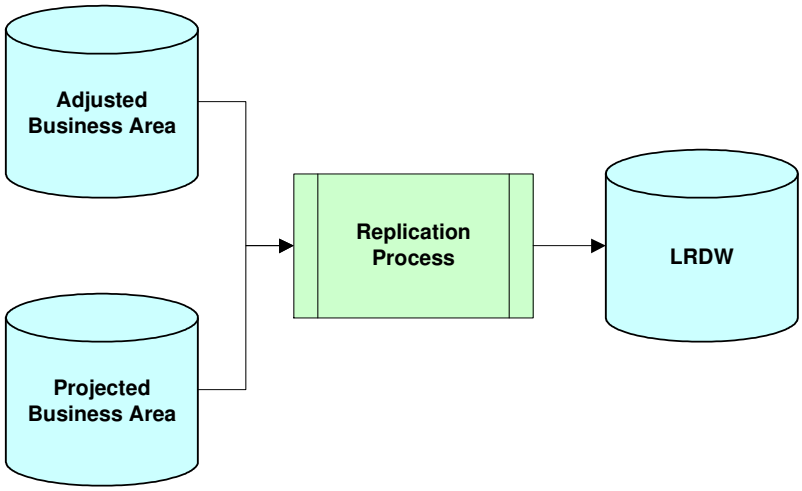
COMPONENTS USED

- **Projected Replicator.**

3.2.9 REPLICATION PROCESS

The process of moving data from the Projected Business Area of the Vegetation Resource Inventory Database into the LRDW will require the use of an extraction, translation and loading tool.

PROCESS DIAGRAM



LRDW REPLICATION PROCESS

The Replication Process is responsible for the transfer of data from the Projected Business Area and the Adjusted Business Area of the Vegetation Resource Inventory Database into the LRDW.

The transfer of data from the Adjusted Business Area is required to meet the reporting and analysis requirements of the Ministry for the purpose of creating Yield Calculation Tables.

It is anticipated that the VRID will be incorporated into the LRDW as a new ArcSDE layer after the completion of all Projection Processes have been completed. In subsequent years, the current layer in the LRDW will be purged and the latest version from the VRID will be inserted.

Prior to the LRDW Replication Process taking place, the current version of the vegetation data in the LRDW will be captured and preserved.

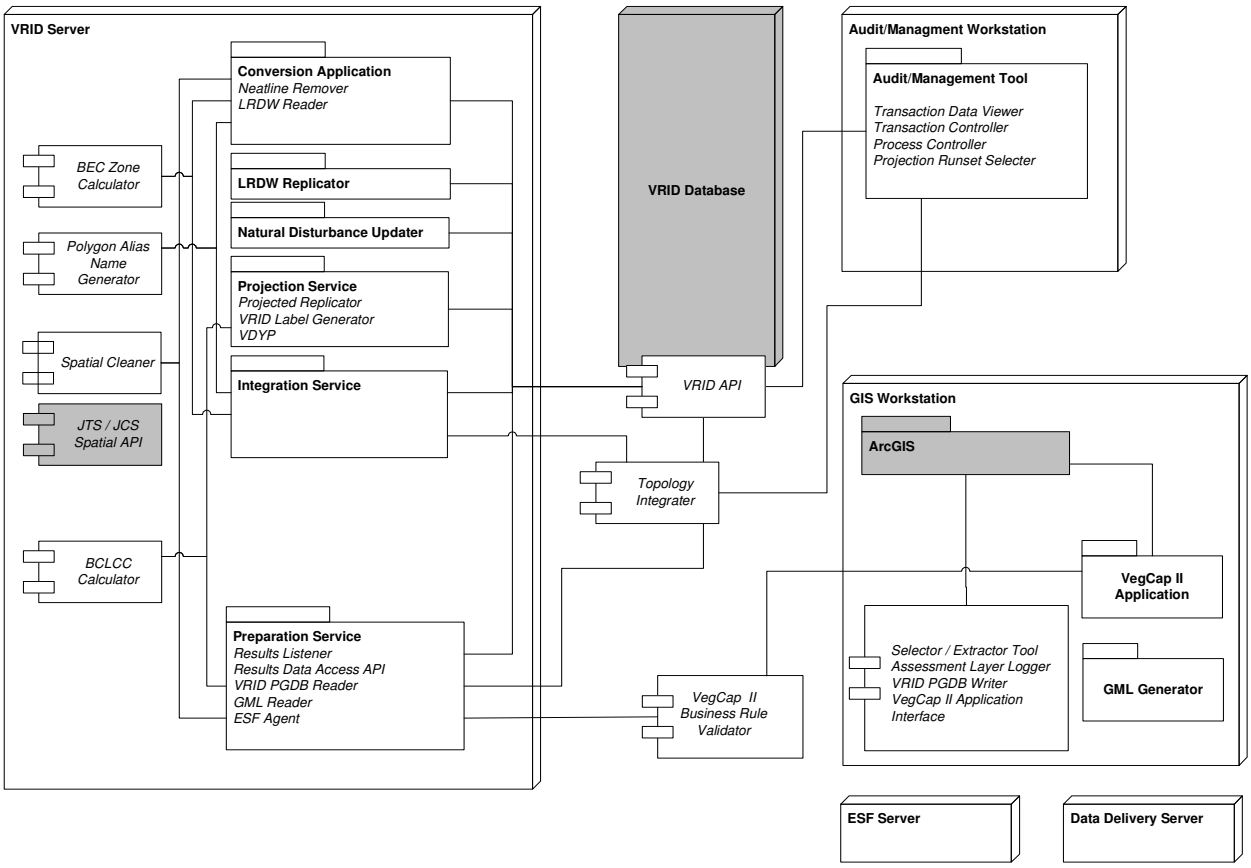
COMPONENTS USED

- **LRDW Replicator.**

3.3 APPLICATION COMPONENT SPECIFICATIONS

Please refer to the Ministry of Sustainable Resource Management, Standards and Architecture web page for discussions on standards for architecture and other standards; http://srmwww.gov.bc.ca/imb/3star/standards.html.

3.3.1 COMPONENT DIAGRAM



3.3.2 CONVERSION COMPONENTS

There are five phases to converting all vegetation resource inventory data from the Land and Resource Data Warehouse[LRDW] into the Vegetation Resource Inventory Database[VRID]. These include, loading the conversion area, spatial cleaning, mapsheet neatline removal, business rule validation and once conversion is complete, loading the Adjusted Business Area.

Additionally, data conversion requirements will include the creation of tools that will be able to successfully node the entire Vegetation Resource Inventory from the LRDW, clean that data where slivers and gaps are detected in the fabric, removal of all mapsheet neatlines, apply VegCap II Business Rule validations, calculate the BC Land Cover Classification values and create a Polygon Alias Number for each polygon.

Phase One of the conversion process involves the migration of data from the LRDW into the Conversion Area of the VRID. Please refer to Section 2.1.2 of this document for specific details about the Conversion Area.

ADJUSTED REPLICATOR

The Adjusted Replicator will be responsible for processing all data within the Estimated Business Area into the Adjusted Business Area after all User

Acceptance Testing has been completed at the end of the conversion process. When data is transferred to the Adjusted Business Area, a call to VDYP 7 will be required in order to 'complete' the data. After a polygon record has been completed, the record will be written to the Adjusted Business Area.

CONVERSION APPLICATION

Specific conversion tools will be required to move Vegetation Resource Inventory data from the LRDW to the Conversion Area.

At the time of conversion, referential integrity will be enforced when data is being loaded from the LRDW into the conversion area.

The Ministry has a prototype application that moves Vegetation Resource Inventory data from the LRDW into the VRID. Leveraging this current technology, this application would be integrated into the suite of tools required for data conversion.

MAPSHEET NEATLINE REMOVAL

As a significant step to move from a mapsheet centric representation of vegetation resource inventory to a seamless, contiguous spatial database, the removal of Mapsheet Neatlines will facilitate the dissolving of all Mapsheet Neatline topology that currently appear in the LRDW's vegetation inventory cover dataset. As Mapsheet Neatlines are dissolved, polygons that span the Mapsheet Neatlines will be identified, matched to its spanning neighbour and joined together to make one contiguous polygon, thus eliminating the Mapsheet Neatline.

Reports will be created and maintained that track the success and failure to match polygons that span a neatline. These reports will be used by Ministry staff, in the case of successful matching to validate the process, and in the case of unsuccessful matching, to manually match the spanning by improving or correcting attribute information or remove the neatline by manual means.

It is not anticipated that the entire province can be processed in this manner. It is expected, by the ministry, that only 30% of the province will be cleaned at the time of conversion.

LRDW READER

The LRDW Reader is an Oracle stored procedure that provides functionality to copy and covert attribute data from the LRDW whse forest vegetation and populate the VRIMS conversion schema.

In addition to the LRDW Reader, a java utility will be used to copy SDE stored geometries in the LRDW to the SDO stored geometries in the VRIMS environment after the attributes have been moved.

A batch process will be executed that runs both applications and will accept a file as an input parameter that has a list of mapsheets that will be processed.

3.3.3 BUSINESS COMPONENTS

VEGCAP II BUSINESS RULE VALIDATOR

VegCap II Business Validation Rules will be applied against all data sources being applied to the Vegetation Resource Inventory Database.

AT CONVERSION

At conversion, all Vegetation Resource Inventory data from the LRDW will be subjected to VegCap II Business Validation rules.

All polygon data that has an inventory_standard of type "V" will pass through VegCap II Business Validation and be validated against all "V" validation rules. Error logging will be maintained. Data that has been successfully validated will be integrated into the VRID as inventory_standard of type "V".

All polygon data that has an inventory_standard of type "I" will pass through VegCap II Business Validation and be validated against all "I" validation rules. Error logging will be maintained. Data that has been successfully validated will be integrated into the VRID as inventory_standard of type "I".

All polygon data that has an inventory_standard of type "F" will bypass the VegCap II Business Validation and will be integrated into the VRID as inventory_standard of type "F".

The Project Name field contains extraneous data that is used to indicate that a VRI polygon has achieved a Free To Grow state. At time of conversion, the Project Name field will be scanned for "FTG" to check for this code. If present, the transaction records will record that the polygon has achieved Free To Grow status.

Any polygons that contain data that does not comply with the new VegCap Validation Rules will not be integrated into the VRID. Failed polygons will be assessed and data manually corrected, as required.

At time of production conversion, it is anticipated that no data will fail the new VegCap Validation Rules.

FROM RESULTS

RESULTS data, at depletion, will have an inventory_standard of "I" and will be subjected to "I" VegCap Business Validation Rules. RESULTS data, at Free To Grow will have an inventory_standard of "I" and will be subjected to "I" VegCap validation rules, until such time that the polygon is interpreted to VRI standards, when the inventory_standard of the polygon would be set to "V" during a Re-Inventory exercise.

DURING RE-INVENTORY

During a Re-Inventory exercise, only VRI Forest Cover Polygons, or RESULTS polygons that have been designated Free To Grow, will be updated and will therefore be subjected to "V" VegCap Business Validation Rules. RESULTS polygons that are still designated as a Depletion will not be updated.

For a detailed discussion of VegCap II Business Validation rules, please refer to the "VRIMS – Supplemental – VegCap II Business Validation Rules" Microsoft Excel spreadsheet, as well as "VRIMS – Supplemental – VegCap II Business Validation Rules" Miscorsoft Word document.

BC LAND COVER CLASSIFICATION CALCULATOR

The BC Land Cover Classification is a scheme to classify the current land cover characteristics of the Province of British Columbia, based on the delineation of cover on mid-scale aerial photographs (1:10,000 to 1:20,000).

BC Land Cover Classifications Schemes will be determined on a per polygon basis by applying business rules against available attribute information. Please refer to the supplemental document "VRIMS – Supplemental – BC Land Classification Cover Historical Document" for an overview of what the BC Land Cover Classification Scheme is all about. Additionally, please refer to the supplemental document "VRIMS – Supplemental – BC Land Classification Cover VRID Business Rules.doc" for specific details of business rules and application logic that will calculate the correct classifications.

The BC Land Cover Classification Calculator will be built, using Java, developed as a set of callable classes able to be used by the various processes that require the calculation of the BC Land Classification.

VRID LABEL GENERATOR

The VRID Label Generator is a component that creates label symbology for all polygons within the Vegetation Resource Inventory Database. A VRI polygon label represents both attribute and polygon information when a Vegetation Resource Inventory map is printed or displayed.

Label generation is currently implemented as a set of Oracle Stored Procedures in LRDW.VEG_LABEL_UTILITES. These procedures will be incorporated into the VRID schema and will be adapted to run against the Vegetation Resource Inventory Database tables.

When a label will is to be printed, the following steps are used to determine the placement of the label.

1. Calculate the height and width of the label. The following apply to the calculation:
    - The scale is assumed to be 1:15,000.
    - The width of a character is assumed to be 18 metres.
    - The height of a line is assumed to be 30 metres.

- The height is calculated as the number of non-blank lines in the label multiplied by 30 metres.
- The width is calculated as the number of characters in the longest label line multiplied by 18 metres.

2. Calculate the height and width of the largest vertically oriented rectangle that will fit in the polygon and the point at the centre of that rectangle.

3. If the label will fit entirely within the rectangle, the full label (all eight lines if they are all non-blank) will be centred vertically and horizontally at the centre point of the rectangle.

4. If the label will not fit entirely within the rectangle, a short label (Lines 1 and 2 of the full label) will be centred vertically and horizontally at the centre point of the rectangle. The full label will then be placed as a Node on the Side (NODSID), to the left of the neat lines, so that the complete label information is available.

5. If the total area of a polygon consists of 90% or more of water, a label for that polygon will not be printed. The following will apply.
   - If VEGETATION_COVER_POLYGON.inventory_standard_cd = "V" and NON_VEGETATED_CCOVER.non_veg_cover_pct > 90 and NON_VEGETATED_CCOVER.non_veg_cover_type = LA, RE,RI, OC Then Label = VEGETATION_COVER_POLYGON.polygon_id

6. This is not an issue where the Inventory standard is a I or F

This will not affect the swamps as we do not have a code in V for swamps.

Table and attribute mapping requirements between the LRDW and VRID can be found in the Excel spreadsheet "VRIMS – Supplemental – Label Mapping.xls"

BIOGEOCLIMATIC ZONE CALCULATOR

The growth model used in the Variable Density Yield Calculation process requires that each polygon be assigned a BioGeoClimatic Ecosystem Classification (Bec) Zone. This will be accomplished by overlaying a Bec Zone layer with the Vegetation Resource Inventory polygon layer. The polygons of the Vegetation Resource Inventory polygon layer will be assigned the Bec Zone that intersects an individual polygon. Where a Vegetation Resource Inventory polygon is intersected by many Bec Zones, the Vegetation Resource Inventory polygon will be assigned the Bec Zone with the largest intersecting polygon.

The BioGeoClimatic Zone Calculator will only make calculations based on the 14 BioGeoClimatic zones that British Columbia is divided into.

Data acquisition will require both geometry and attribute information. Attribute information is available as a MSAccess 2000 database from the Ministry of Forests. Geometry data is currently available as an SDE layer from the LRDW.

Additional information for BioGeoClimatic Ecosystem Classifications can be found here http://www.for.gov.bc.ca/hre/becweb/index.htm.

VARIABLE DENSITY YIELD PREDICTOR [VDYP]

The VDYP component is a growth projection model that predicts vegetation growth rates and applies them against the Projected Business Area.

VDYP 7 is a fully deployed Java application.

POLYGON ALIAS NAME GENERATOR

As a business requirement for the Vegetation Resource Inventory Database, all polygons within any 1:20,000 mapsheet must be uniquely identified.

The concept of a spatially seamless and contiguous Vegetation Inventory Database removes the integrated dependency of mapsheet boundaries as positional identifiers. However, mapsheet boundaries were integral to the business operation of the Ministry to identify work areas and to communicate with internal and external clients. As such, individual Vegetation polygons were identified with a unique POLYGON_NUMBER, based on its relationship within a mapsheet boundary. A process is required to uniquely identify a Vegetation polygon anywhere within the Province.

To meet that business requirement a formula was developed that created a consistent sized number, that was not too big, but was still able to be unique.

Based on the label position of the polygon – this may have to be replaced by the centroid, since it is possible to create a label outside of the polygon – a calculation is made between the polygon and the lower left coordinates of the mapsheet. The calculation is performed on both the northing and the easting coordinates.

At the time of conversion, when a new polygon alias name is generated for an individual polygon, the VRI polygon number and the newly created polygon alias name will be preserved in a lookup table. This feature is required for backward compatibility for reconciling on-going business practices of using polygon number as a reference name.

3.3.4 SPATIAL COMPONENTS

SPATIAL CLEANER

Before polygon sets are integrated into the VRI coverage, they must meet spatial quality criteria. These criteria include being a correctly noded coverage, not containing any slivers or spikes, and having a contiguous outer boundary. The spatial cleaning component will adjust the geometry of a polygon set to ensure that it meets the defined quality criteria.

After spatial cleaning has taken place, all submission polygons will have a contiguous outer boundary, will be noded correctly and will be suitable to be integrated into the Vegetation Resource Inventory Database.

Since some data sources (e.g. Adjustment transactions) will be expected to be fully or partially spatially clean, this component will allow some cleaning checks to be disabled under system control.

Wherever possible, currently available spatial software that performs noding and cleaning will be used to perform the required tasks. However, it may be necessary to adapt or create new tools that meet the requirements of noding, cleaning, sliver and gap detection and their subsequent removal.

This component will be a Java API, based on the existing JTS Topology Suite and JCS Conflation Suite toolsets.

TOPOLOGY INTEGRATER

Topology Integration allows a transaction polygon set to be "cut in" to the VRI coverage. Cutting in involves overlaying the transaction polygons with the existing VRI polygons in the same area, checking all sliver merging rules and modifying the new and existing polygons as required, and replacing the previous polygons with the new polygonal set.

The spatial integration rules for sliver merging and shape cleaning are described in section 6.2.1.

The component is a Java API built on the JTS Topology Suite and the JCS Conflation Suite set of tools. It also contains spatial algorithms and functions developed during the VRI Update Prototype project.

3.3.5 DATA ACCESS COMPONENTS

PROJECTED REPLICATOR

The Projected Replicator component provides the capability of replicating VRID feature attributes from the Adjusted Business Area to the Projected Business Area. Only non-spatial attributes are replicated, since the VRID polygon spatial information is stored only once.

This component will be written in Java. It will make use of the VRID Data Access API.

RESULTS SUBMISSION LISTENER

The RESULTS Submission Listener performs queries against the RESULTS database to detect when new submissions are available. It passes the transactions through the Data Validation Service into the Staging Area.

This component is written in Java.

RESULTS DATA ACCESS API

This component provides read access to the spatial and attribute data in RESULTS submissions. It is used during the RESULTS Extraction process, to

move data from the RESULTS database into the format required by the rest of the Data Preparation process.

This component is a Java API. It should allow a significant amount of reuse of the existing Data Access components in the RESULTS application.

VRID GEODATABASE READER

This component allows reading the VRID Geodatabase format into an in-memory format. It is used during the GML Generation and the Data Preparation processes.

This component will be a Java API, utilizing existing J2SE API's for reading MDB files, as well as the JUMP API for reading ESRI spatial formats.

VRID GEODATABASE WRITER

The AOI Selection/Extraction process involves the creation of an ESRI Personal Geodatabase, that is based on a defined schema. This defined schema is specific to the business requirements of the ministry to perform various editing and data sharing tasks.

The VRID Geodatabase Writer is used to generate the .mdb file according to the defined schema.

This component will be implemented in the ArcMap environment. It will likely be developed in Microsoft Visual Basic, using the ArcObjects API and standard MS data access API's.

VRID DATA ACCESS API

The VRID Data Access API is the component used by all processes which interact with the VRID database. The component provides marshalling and persistence for all entities in the VRID data model.

This component will be written in Java, using Oracle database drivers. Where necessary for reasons of security or performance some logic may be deployed as Oracle stored procedures.

ASSESSMENT LAYER SPATIAL VIEW

The Assessment Layer Spatial View allows the viewing of all VRI polygons which have been extracted from the database and are currently undergoing update.

When VRI polygons are returned for integration, the state of the parent transaction will be set to 'Inbox' and the spatial view will now exclude any polygons that are a child to that transaction.

This component will be implemented using a spatial view within Oracle.

3.3.6 PROCESS COMPONENTS

LRDW REPLICATOR

It is anticipated that the VRID will be replicated to the LRDW as a ArcSDE layer after the completion of the Projection Process. The LRDW Replicator will copy VRI data from VRID to the LRDW, making any model transformations required to adhere to the warehouse VRI data model. It is not expected that any spatial processing (other than a straight copy) will be required. It is anticipated that this process will occur on a once yearly basis.

This component will be written as a Java API.

DATA DELIVERY

Once a GML document or a VRID Geodatabase has been created, it will be delivered to the (external or internal) client who will be processing it. There are various transport options for accomplishing the delivery: FTP, via a Web site, or (if size permits) email.

This component may be developed as both a ArcMap-compatible component or a Java API.

DATA RETRIEVAL

At the conclusion of an editing exercise, either by an internal or external client, the dataset, either in GML or VRID Geodatabase format, must be delivered back to the Vegetation Resource Inventory Database. The Data Retrieval component allows this operation to take place.

Once data retrieval has taken place the dataset is passed to the Data Preparation process for submission to the Staging Area.

This component will likely be a simple FTP or Web site to which update datasets can be manually submitted.

DATA PREPARATION SERVICE

The Data Preparation Service handles preparing update transactions for insertion into the Staging Area. Transaction datasets in the Staging Area must meet specific standards for spatial and attribute cleanliness and validity. The standards are specified in the Data Preparation Process.

The service will accept data from several sources: RESULTS submissions, VRID Geodatabases from Mini-Re-Inventories and Adjustments, and Re-Inventory submissions. The appropriate components are used to translate incoming data formats into a common format for processing.

The service will run in both a scheduled mode and an event-driven mode. Scheduled processing will be used to poll for new RESULTS submissions and new Mini-Re-Inventory/Adjustment transactions.

This service involves inserting new features into the Staging Area. In order to ensure consistency, processing must take place on a transactional basis. If failure occurs during processing of a data submission, any VRID database changes must be rolled back, and the submission must be rescheduled for processing.

This component will be developed as a Java API. It will use Ministry standard frameworks for developing batch processes. The component uses the following components: BC Land Cover Classification Calculator, VegCap II Business Rule Validator, Spatial Cleaning.

INTEGRATION SERVICE

The Integration Service handles integrating transaction data sets into the VRI coverage.

The Integration Service will use the VRID transaction tables to determine all transactions that are ready to be processed. Data that is available will have already been through the Data Validation process which ensures that the data is VegCap II compliant, has correct BC Land Cover Classifications, is spatially clean, and has a contiguous boundary.

Each transaction will have a transaction origin code. This original code will determine which VRID areas the transaction dataset will be written to. Mini-Re-Inventory and Re-Inventory transactions will be written to both the Estimated and Adjusted Business Areas. Adjustment transactions will be written to the Adjusted Business Area only.

The service will support processing being triggered both on a scheduled basis and by manual request from the Management Tool. The service will supply status information and allow process control via the Management Tool.

The service will be failure-tolerant, ensuring that all processing is completed correctly even after process failure or unscheduled restarts. Since the service involves retiring existing VRI features and adding new ones, processing must take place on a transactional basis.

This component will be written as a Java API. It will use Ministry standard frameworks for developing batch processes. The component uses the following components: BEC Zone Calculator, Polygon Alias Name Generator, Topology Integration. It uses the VRID Data Access API to interact with the VRID database.

CLEANUP SERVICE

The Cleanup Service handles cleaning up the database for transactions that have the processing status of MARKED_FOR_RESUBMIT, MARKED_FOR_PURGE, or MARKED_FOR_RETRY. The service will delete the appropriate data from the pre-Staging Area, delete any error table data, and set state fields as appropriate. The rationale for having a cleanup service is that it makes the Audit Tool simpler. The Audit tool merely updates certain fields on the transaction table. The services are responsible for more complicated actions such as inserting or deleting records.

In order to ensure consistency, processing must take place on a transactional basis. If failure occurs during processing then database changes must be rolled back.

This component will be written as a Java API. It will use Ministry standard frameworks for developing batch processes.

COMPLETION UPDATE

The Completion Update invokes either the FIPSTART or the VRISTART module of VDYP7. The invocation of either of these modules will calculate pre-projection attribute values in the Adjusted Business Area.

With the completion of these pre-projection values, it will be possible to evaluate and audit the baseline calculations in a timely manner, prior to the once-yearly Projection Process.

At conversion, inventory standard records "F" will be completed by invoking the FIPSTART module of VDYP7. Inventory standard records "I" or "V" will be completed by invoking the VRISTART module of VDYP7. Completed values are stored in the Adjusted Business Area.

At integration, inventory standard records, "I" or "V" will be subject to the Completion Process by invoking the VRISTART module of VDYP7. (During integration, no inventory standard records "F" should be encountered.)

The following fields in the Adjusted Business Area will be updated as part of the Completion Update.

- VRI_LIVE_STEMS_PER_HA;
- BASAL_AREA;
- SPECIES_ID;
- SPECISE_CD;
- SPECIES_PERCENT;
- HEIGHT;
- STOCKABILITY;
- YIELD_FACTOR; and,
- FOR_COVER_RANK_CD.

DISTURBANCE EVENT UPDATE

Disturbance Events will be recorded in a separate table and will contain spatial and non-spatial attribution that describes the disturbance event.

During the Integration Process, Disturbance Events are created from VRI polygons which are indicated as having been disturbed. Disturbance Event items are assigned a disturbance_id at time of entry into the Disturbance Event table. The source VRI polygon is associated with the Disturbance event created from it. During editing of a VRI polygon, the disturbance_id will be preserved unless a new disturbance is to be recorded for that polygon. In this case, the disturbance_id will be set to NULL and the new disturbance attributes will be entered for the polygon. A disturbance_id value of NULL indicates a new

disturbance to be recorded in the Disturbance Event table. A non-NULL disturbance_id indicates that the polygon is associated with an existing disturbance, and no update to the Disturbance Event table is required.

PROJECTION SERVICE

The Projection Service implements the Projection Process.

This service will support the ability to specify the precise set of features to be projected. This will enable users to create custom runsets based on both spatial and attribute queries. It is anticipated that this will be used to project subsets of data for testing or performance reasons. In order to maintain database consistency, only one runset will be processed at a time.

The service will support processing being triggered both on a scheduled basis and by manual request from the Management Tool. The service will supply status information and allow process control via the Management Tool.

Since the Projected Business Area data is simply a copy of data already existing in the other VRID areas, there is no requirement for this process to be failure-tolerant. If premature process failure occurs, the Projection process can simply be restarted under manual control.

The service uses the following components to accomplish projection: BC Land Cover Classification Calculator, VRID Label Generator, VDYP. The service uses the VRID Data Access API to copy feature attribute data from the Adjustment Area to the Projected Area.

This component will be written as a Java API. It will use Ministry standard frameworks for developing batch processes.

3.3.7 USER INTERFACE COMPONENTS

VEGCAP II GUI (ARCGIS VERSION)

The VegCap II GUI is the user interface for managing non-spatial attributes of individual polygons within the Vegetation Resource Inventory Database.

The VegCap II GUI will work in the ArcGIS environment. It will access the table structure of the .mdb file of the VRID Geodatabase. Business validation rules will be contained in the VegCap II Business Rule Validator, which will be accessed by the VegCap II GUI.

This component will be built as a GUI component hosted in ArcGIS.

VEGCAP II GUI (JAVA VERSION)

The VegCap II GUI will also be developed as a Java component, for use within the Audit/Management application.

The VegCap II Application will work in the Java environment. It will access the attribute tables in the Staging Area. Business validation rules will be contained in the VegCap II Business Rule Validator.

This component will be built as a Java GUI application.

AUDIT TOOL

The Transaction Tool will provide the means to inspect and manage all data transactions submitted for integration into VRID. This includes Re-Inventory, Mini Re-Inventory, Adjustments and RESULTS submissions.

To support transaction auditing, the tool will allow viewing and auditing all submissions that are stored in the Staging Area. It will have no editing capability. A graphical user interface will be used to perform audit tasks, including accepting, suspending or rejecting an integration transaction.

The Audit function will support viewing georeferenced spatial vector data in the Staging Area. The viewer will allow loading other vector datasets as reference data. The spatial viewer will have the capability to view georeferenced digital imagery as backdrop to the vector data.

The Audit function will support a "virtual integration" facility. This will allow the operator to view the results of integrating an update transaction into the current VRI Features coverage, in order to fully assess the impact of the update.

This component will be built as a Java GUI application. It will use the VRID Data API component.

MANAGEMENT TOOL

The Management Tool will also support all other system management functions required by the VRID system. These include:

- Monitoring the status of system services
- Initiating services which can be manually run.
- Defining run sets for the Projection Service
- Querying the contents of the various data areas (allowing filtering and sorting by various criteria)
- Performing cleanup tasks such as deleting rows and objects from system data areas.

The Management Tool will run in four modes: Manual, Automatic, Projection, and Replication. When the tool is in manual or automatic modes the projection and replication services cannot be run. In manual mode ministry staff can manually run the preparation service, integration service, or cleanup service. In automatic mode the management tool uses round robin scheduling to allow processing time to the preparation service, integration service, and cleanup service. In projection mode only the projection service will be allowed to run. In replication mode only the replication service will be allowed to run.

This component will be built as a web application.

SELECTION / EXTRACTION TOOL

The Selection/Extraction Tool allows selecting a subset of VRI Features for extraction to a VRID Geodatabase. The extracted features will be used during editing operations.

Subsets may be selected via spatial query (for instance, based in intersection with a geometry obtained from another source) or by attribute query.

When a set of VRI Features is extracted for editing, the geometries of the extracted features will be recorded in the Assessment Layer, to allow manual conflict detection by system operators.

The tool will be written as a component in the ArcGIS environment.

3.3.8 COTS COMPONENTS

This section lists the Commercial-Off-The-Shelf Software(COTS) components used in the VRID system.

ESRI ARCGIS

The ESRI ArcGIS suite of tools will be used to provide viewing and editing capability in the VRID system. ArcGIS provides the following required functionality:

- Viewing of ESRI SDE data layers
- Viewing of georeferenced digital imagery as backdrop
- Selection of features manually or by spatial and/or attribute query
- Editing tools to update coverage data
- Ability to write and read ESRI Personal Geodatabase format
- Some customization will be required for the following functions:
- Selection/Extraction of sets of VRID features for update
- Linkage to VegCap II application and Business Rule Validator

The ability to create an ESRI Geodatabase is inherent in ArcGIS and therefore no custom component will be needed to provide this feature.

Specific VRID Geodatabase templates will be constructed to accommodate the inclusion of the tables found in the Estimated Business Area, for Re-Inventory and VRI Editing exercises and the Adjustment Business Area for Adjustment Exercises. Please refer to the "VRIMS – Supplemental – Vegetation Resource Inventory Database Description" document for further discussions on the tables found in the Estimated Business Area and Adjusted Business Area.

These additional tables are required to store attribute information that will be used during either the Re-Inventory, VRI Editing or Adjustment exercises.

SPATIAL DATABASE

The VRID database requires the ability to store spatial objects as well as conventional relational tabular data. Spatial data requirements include:

- Support for polygonal spatial datatypes

- Support for georeferenced coordinate systems with millimetre precision
- efficient spatial data access (indexing)
- ability to query by spatial feature
- ability to join from spatial data tables to other relational tables
- (potential) ability to create views including spatial data
- (desirable) ability to treat spatial data exactly like other database types for purposes of copying/replication/backup
- (desirable) ability to have spatial data participate in database transactions

This will require using a commercial spatial database system. There are two possible alternatives available: ESRI ArcSDE and Oracle Spatial.

ESRI ARCSDE

ESRI ArcSDE has the advantage of being widely used within the Ministry. However, there are some limitations to its ability to integrate seamlessly into conventional database processing. In particular, ArcSDE requires a separate database connection, which means that it cannot participate in Oracle transactions. This would require extra design and development effort to provide the necessary failure-tolerant database connectivity. In addition, it is recognized that ArcSDE incurs significant costs in terms of licensing and administration.

ORACLE SPATIAL

Oracle Spatial offers a viable alternative as a spatial datastore for VRID. It provides all needed database functionality. Data processing requirements are met more easily by Oracle Spatial, since spatial functionality is fully integrated with the database system. In particular, spatial data can participate fully in database transactions, which simplifies system design and enhances reliability.

Oracle Spatial offers additional capabilities that could prove to be useful for future maintenance and enhancements. For instance, spatial data is accessible from stored procedures and triggers. Using Oracle Spatial will reduce database administration costs, since spatial data administration is identical to that for existing attribute data.

Connectivity to ESRI ArcGIS tools can be provided by enabling Oracle Spatial tables as ESRI ArcSDE layers.

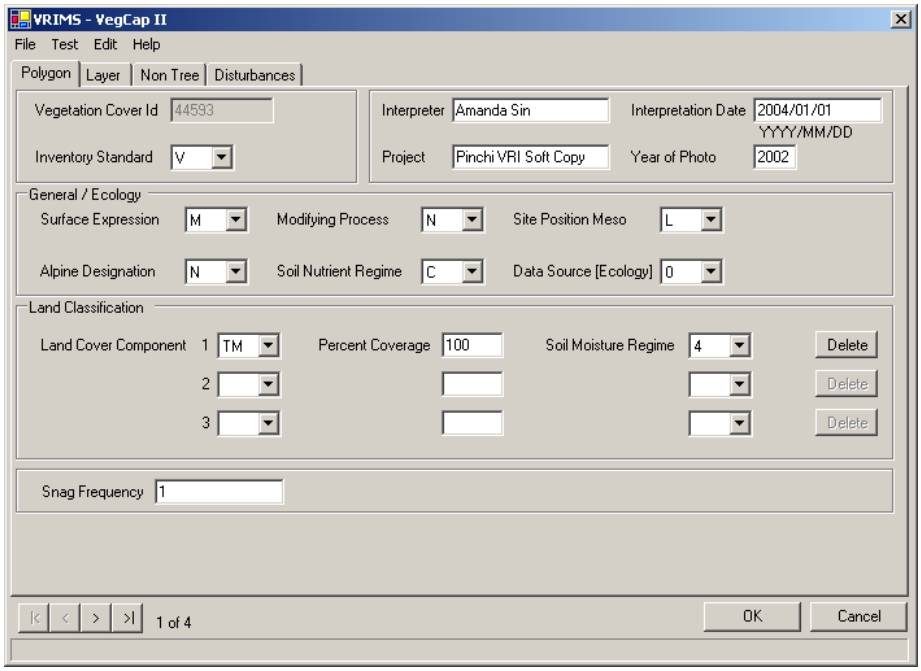
Oracle offers two levels of spatial capability. Oracle Spatial provides all supported spatial functionality, but requires a higher level license. Oracle Locator provides basic spatial storage functionality and is available in all Oracle versions. Oracle Locator functionality should be sufficient for implementing the VRIMS database, given the availability of full-function external spatial APIs such as JTS.

3.4 SCREEN DESIGNS

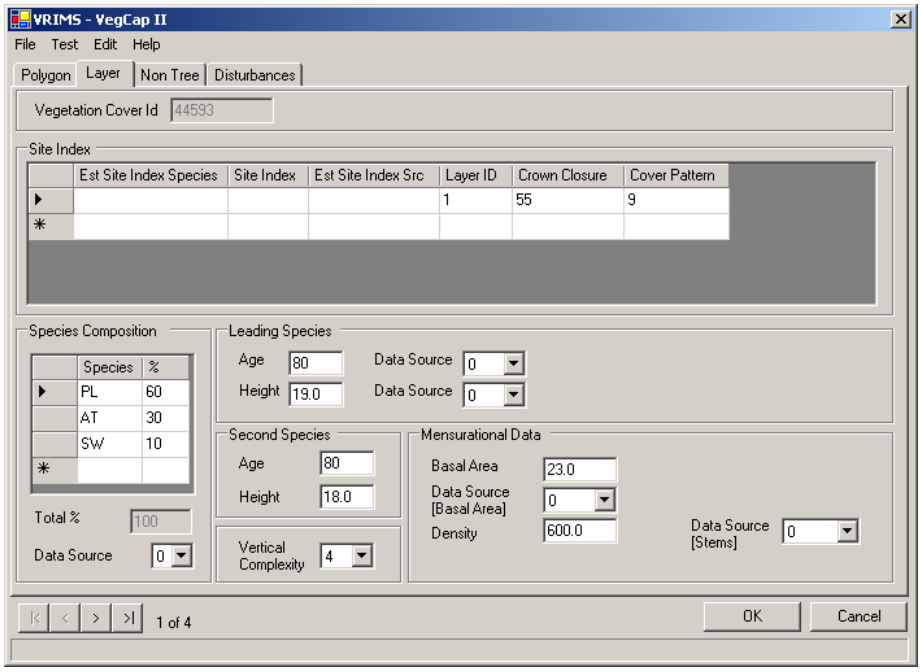
ESRI ArcMap, in relationship with ArcCatalog, is the Ministry's choice of selected tool to extract, manage and edit all Ministry Vegetation Resource Inventory data. As well, ESRI ArcMap and ArcCatalog will be used for the data preparation for External Adjustment and External Re-Inventory exercises. As such, no description, or detailed screen images will appear that describes out-of-the-box ArcMap or ArcCatalog functionality.

Screen design will be required for all client-facing applications. These applications include VegCap II, VRIMS Audit Tool, VRIMS Management Tool and the Selection and Extraction Tool.

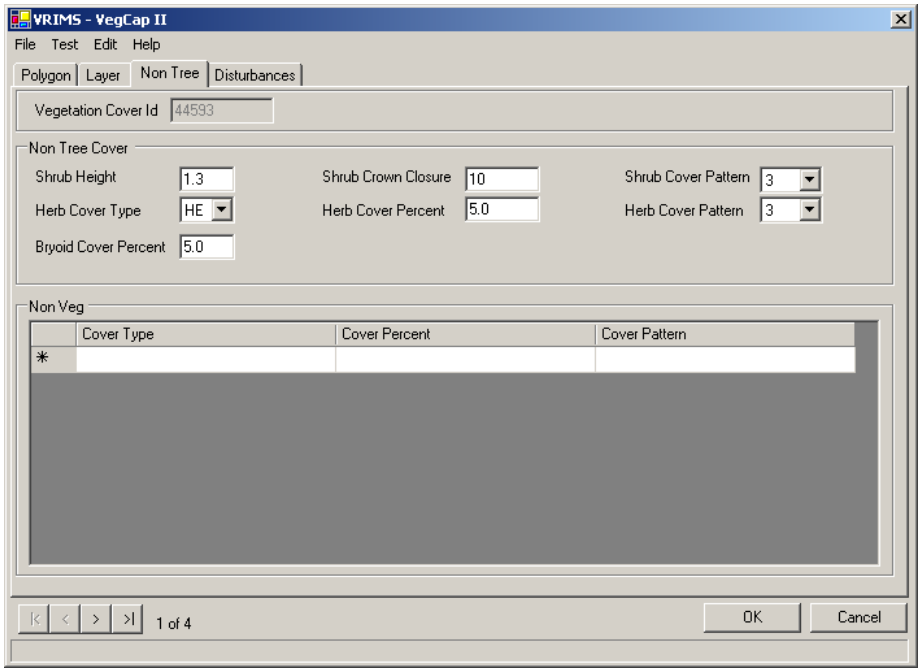
3.4.1 USER INTERFACE – VEGCAP II ARCMAP APPLICATION



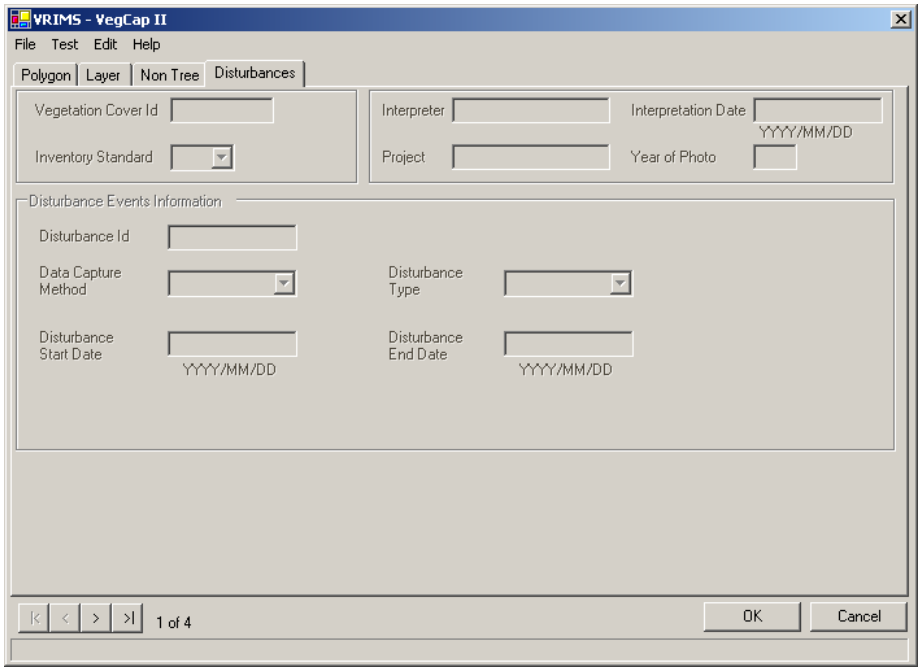
VegCap II - Polygon Tab



VegCap II - Layer Tab



VegCap II - Non Tree Layer



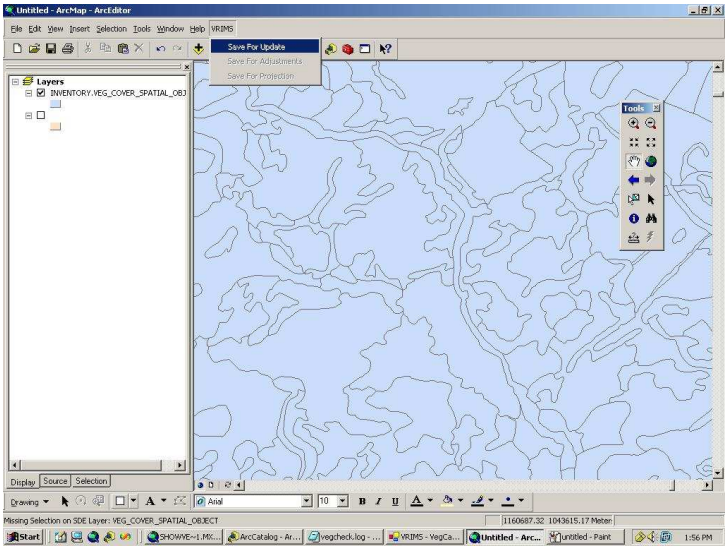
VegCap II - Disturbances Tab

3.4.2 USER INTERFACE – VRIMS SELECTION AND EXTRACTION TOOL

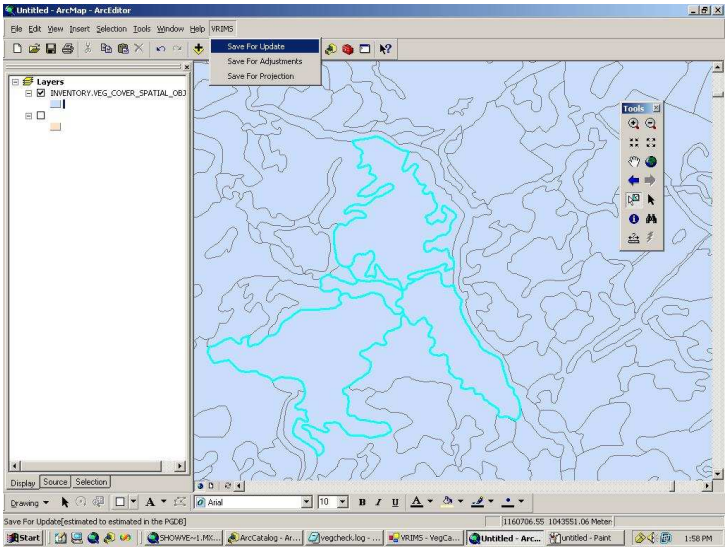
The VRIMS Selection and Extraction Tool is a ArcMap plugin written using VBA Script. The tool allows users to select, using ArcMap, an area of interest that the user wishes to extract to a ESRI PGDB.

Three options are available to the user when creating the PGDB.

- 'Save For Update' : Will save the extracted polygons and their attributes from the Estimated Business Area to a PGDB that is modelled after the Estimated Business Area.
- 'Save For Adjustment' : Will save the extracted polygons and their attributes from the Estimated Business Area to a PGDB that is modelled after the Adjusted Business Area.
- 'Save For Projection' : Will save the extracted polygons and their attributes from the Adjusted Business Area to a PGDB that is modelled after the Adjusted Business Area.



Selection Extraction Tool - Menu Item



Selection Extraction Tool - Menu with selection

3.4.3 USER INTERFACE – VRIMS AUDIT TOOL

The VRIMS Audit Tool will be written as .NET 1.1 application that will run in an ArcMap environment. When started the VRIMS Audit Tool will access the Staging Area for the purpose of viewing and altering the state of transactions.

Since the VRIMS Audit Tool will be used within an ArcMap environment, it will be possible to visually inspect any the polygons that are associated with any given transaction. Additionally, other feature layer information may be used as a backdrop to the transaction data being displayed within ArcMap.

The following are several examples of what the Audit Tool will look like and the behaviour associated with the tool.

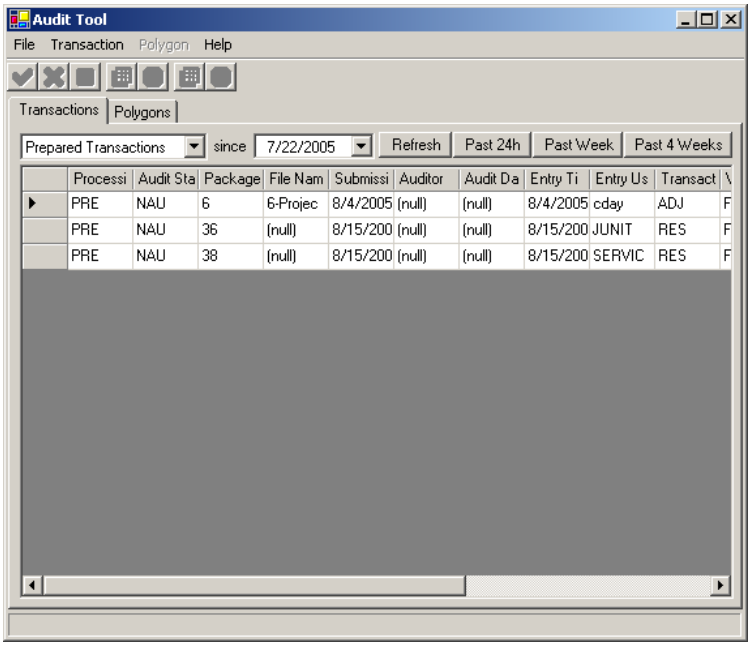
TRANSACTION TAB

The Transaction Tab, on initialization of the Audit Tool, will be populated by default with all transactions that are currently being held within the Staging Area.

A series of pre-defined filters will be available for the user to narrow down the data that is displayed within the Transaction Tab.

In future releases, filters will be customizable by the user through a filter widget.

From the Transaction Tab, users will be able to accept, defer, auto accept or reject a transaction(a transaction is a 'package' of one or more polygons, for example a PGDB would be a single transaction, but it has one or more polygons contained within).

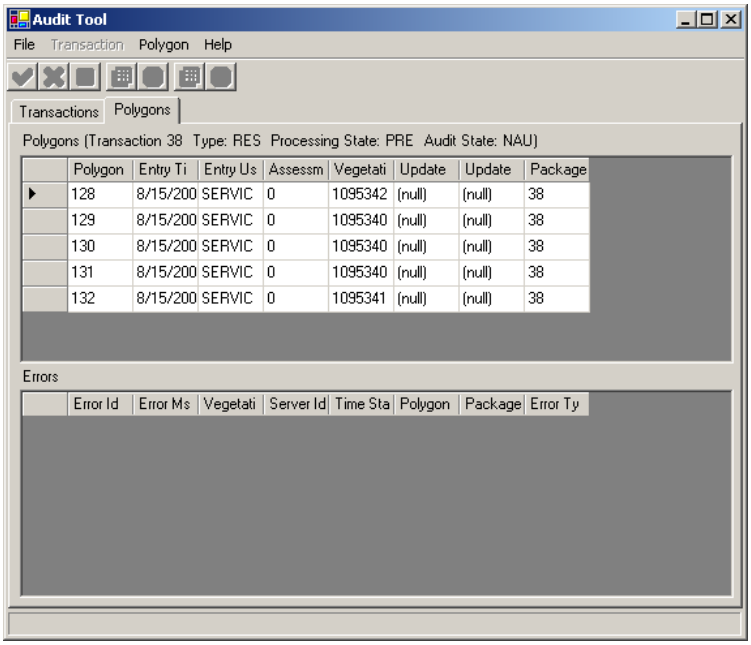


Transaction Tab

POLYGON TAB

The Polygon Tab keeps a listing of all polygons that are associated with a transaction. By selecting a transaction from the Transaction Tab, then tabbing to the Polygon Tab, a user can see the list of polygons contained within that package.

If either a spatial error or a business validation rule error has occurred for any one polygon, the user can examine the error by selecting the polygon entry within the Polygons window.

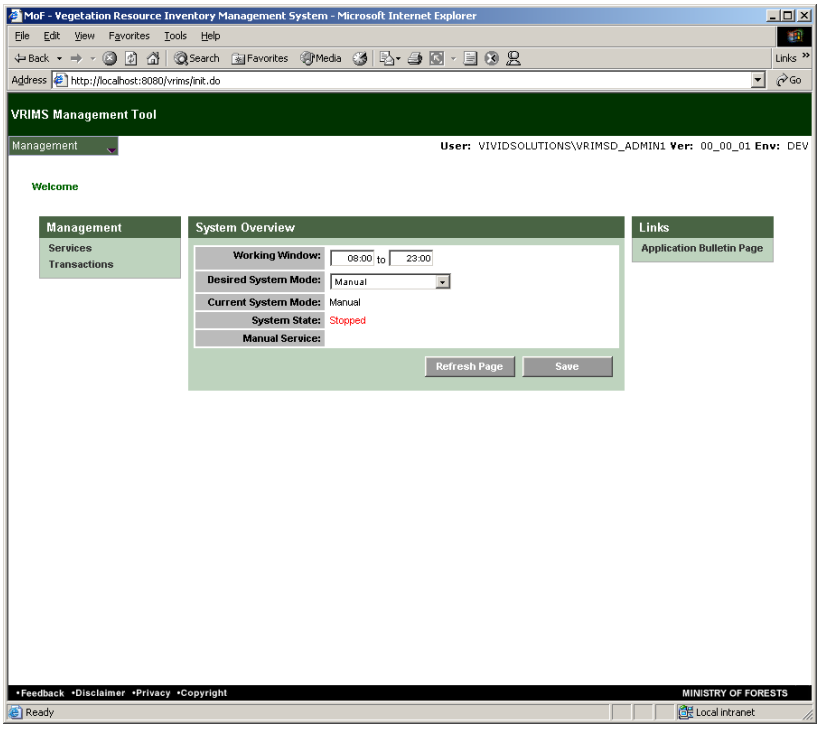


Polygon Tab

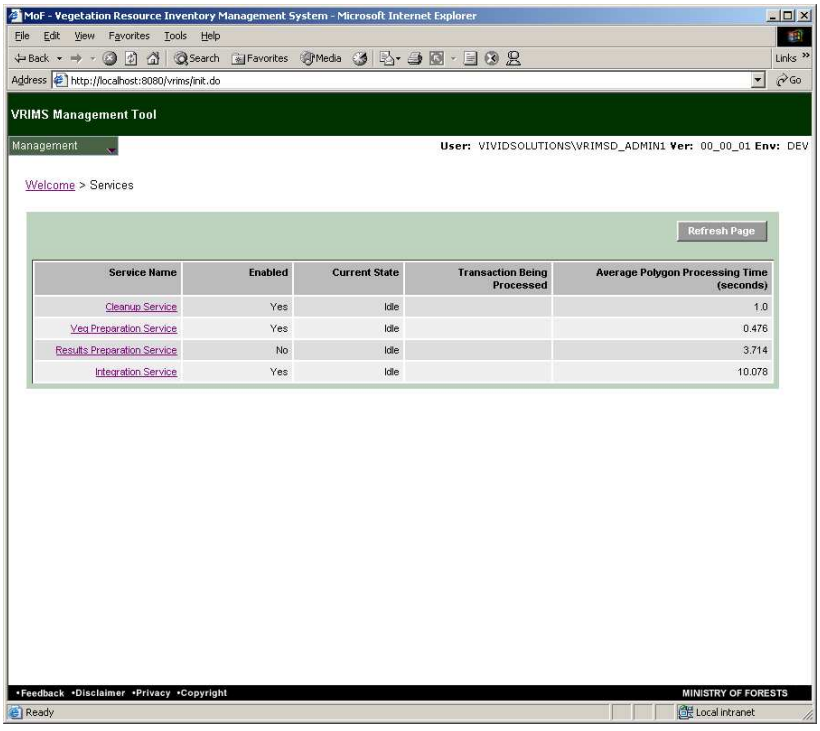
3.4.4 USER INTERFACE – VRIMS MANAGEMENT TOOL

The VRIMS Management Tool will be written as web application that supports system management functions required by VRIMS, including

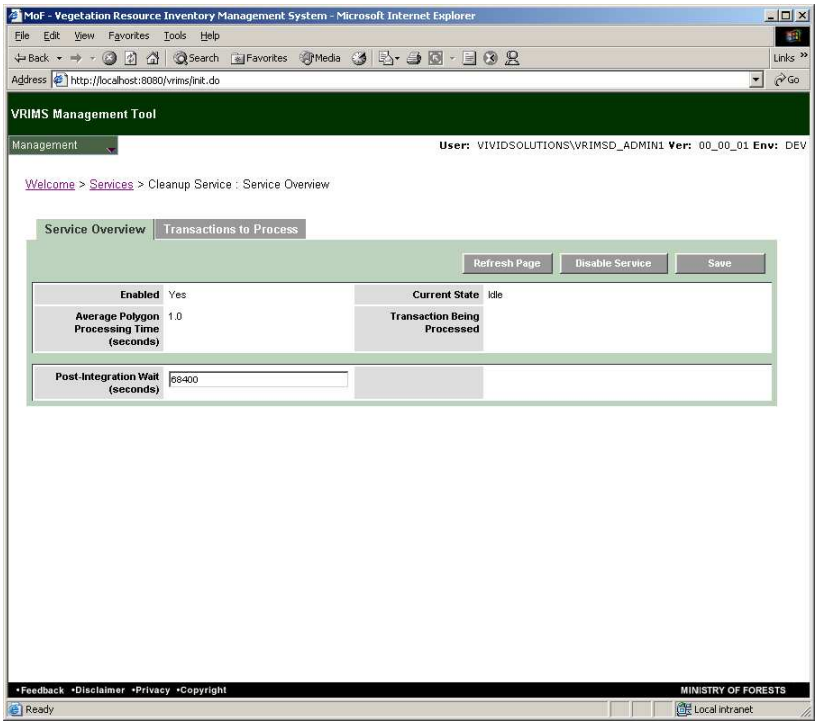
- Monitoring the status of system services
- Initiating the five services which can be manually run, including;
  - The Clean Up Service
  - The Veg Preparation Service
  - The RESULTS Preparation Service
  - The Integration Service
  - The Projection Service
- Defining run sets for the Projection Service
- Querying the contents of the various data areas (allowing filtering and sorting by various criteria)
- Performing cleanup tasks such as deleting rows and objects from system data areas.



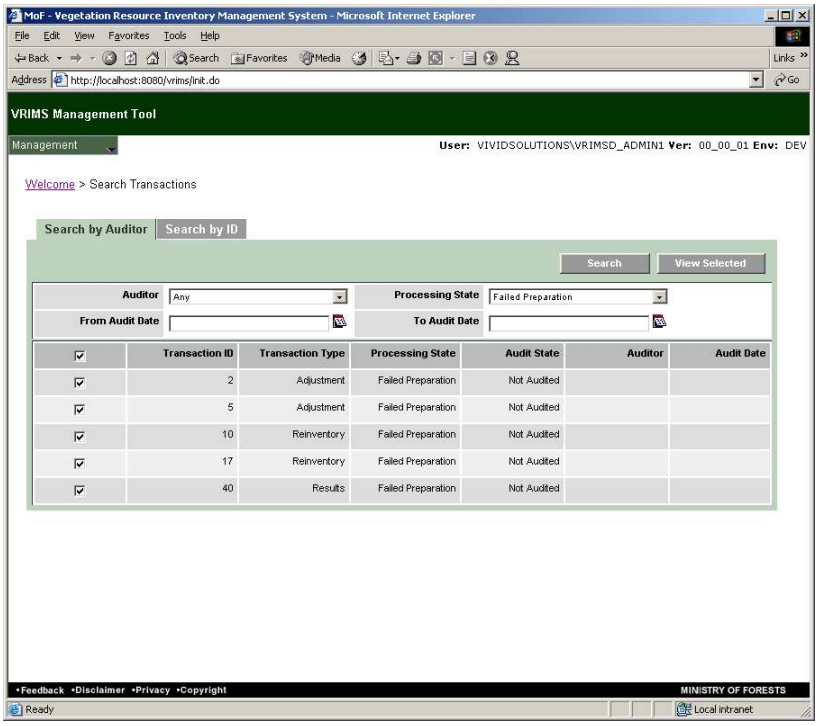
Management Tool - Home Page



Management Tool - Services Page



Management Tool - A Service Overview



Management Tool – Search Transactions

3.4.5 TOOLS AND CONVENTIONS

GUI STANDARDS

The VRIMS Audit Tool, and VegCap II will be implemented using .NET 1.1. The Selection and Extraction Tool will be created using VBA script. The VRIMS Management Tool will be a web based application based on the MOFR web application standards.

TOOLBARS

Frequently used menu options will have both iconic speed buttons, and mouse click menus. Tool Tips will be available for the iconic speed buttons.

MAIN MENU

On the client applications, standard menu bar options will be available, including File and Help.

3.5 REPORT LAYOUTS

No reports have been identified at this time. It is anticipated however, that some reporting will be required as part of the Audit Tool.

3.6 APPLICATION PROTOTYPE

Application prototyping has been completed to demonstrate both the business attribute and spatial rules required for the integration of polygons into the vegetation forest cover.

3.7 SYSTEM INTERFACES

3.7.1 CONVERTING DATA FROM THE LRDW TO THE VRID

At the time of conversion, all vegetation resource inventory data maintained in the LRDW will be processed into a conversion schema, using the LRDW Reader.

3.7.2 EXTRACTING NEW SUBMISSIONS FROM RESULTS

VRIMS must be able to poll the RESULTS database and query for new submissions. If new submissions are present, the submission must be retrieved by the RESULTS Submission Listener and the data moved from RESULTS to the VRID by the RESULTS Data Access API.

3.7.3 REPLICATION SERVICE FROM THE VRID TO THE LRDW

On a yearly basis, the Projected Business Area of the VRID, will be copy managed to the LRDW, by means of the LRDW Replicator.

3.8 ERROR HANDLING

Individual components used within VRIMS will manage all error handling procedures as required.

3.9 HELP SYSTEM

The Java Application Standards stipulate that a single general user's guide must be provided for the application, as well as on-line context sensitive help. The text for the on-line help system must be derived verbatim from the user's guide. The mechanism for delivering on-line help could be in the form of hyperlinks that would pop-up window containing the help text.

Individual help systems will be created for specific applications that make up the Vegetation Resource Inventory Management System. For instance, the VegCap II application will have its own specific help system, as will the Audit Tool.

4. TECHNICAL REQUIREMENTS

4.1 CAPACITY

4.1.1 CONVERSION VOLUMES

Input	Conversion Volumes	Cumulative Volumes(assuming 10 year lifecycle)	Internal Storage Requirements (Gbs) (Cumulative)
Number of LRDW Polygons	7,000,000	N/A	12.5
Number of RESULTS Polygons	0	N/A	0
Number of VRID Polygons	0	N/A	0
Total			12.5 gigabytes

Conversion storage requirements will be greater than the stated 12.5 gigabytes, however it is not anticipated that the storage requirements will be exponentially larger. Additional storage space will be required to accommodate the Adjusted Business Area attribute information.

4.1.2 INPUT VOLUMES

Input	Annual Volumes	Cumulative Volumes(assuming 10 year lifecycle)	Internal Storage Requirements (Mbs) (Cumulative)
Number of LRDW Polygons	0	0	0
Number of RESULTS Polygons	20,000/year	200,000	TBD
Number of VRID Polygons	100,000/year	1,000,000	TBD
Total	120,000/year	1,200,000	TBD

Storage capacity for input volumes have not been determined at this time. However, the estimations for the volumes of polygons is considered accurate.

4.1.3 OUTPUT VOLUMES

Output	Annual Volumes	Cumulative Volumes(assuming 10 year lifecycle)
Number of LRDW Polygons	0	0
Number of RESULTS Polygons	0	0
Number of VRID Polygons	100,000	1,000,000
Total		

Any time a polygon is extracted from the VRID, it is anticipated that it will be returned to the VRID at some point, after some period of time.

4.2 SOFTWARE

4.2.1 SYSTEM APPLICATION DEVELOPMENT AND OPERATION

The following describes the current Ministry standards for developing and deploying web based application systems.

- **Oracle 9*i* RDBMS** – This is the Ministry's standard relational database management system.

- **Oracle Designer 9i and Repository** – Complying with the SDLC, this is used to in the Analysis phase to perform data modelling and functional modelling. For the Design phase the logical models are transformed to physical models, and for the Build phase, this is used to create the scripts used to create e-Registry databases.

- **Integrated Development Environment (IDE)** – This is a type of tool used by Java developers used in creation of Java classes, Java Server Pages, Java Servlets, and HTML pages. The Ministry recommends Borland's JBuilder version 4.0 or higher. Other acceptable alternatives are Oracle's JDeveloper, or an IDE that produces code compliant with the Ministry's current specified level of Java.

- **Oracle's SQL Plus and Query Builder** – These Oracle tools may be used to assist development staff while working with the Oracle database.

- **Oracle's Procedure Builder** – This may be used to create PL/SQL routines for the data conversion routines to load the VRID, or create additional functionality as required.

- **ESRI ArcSDE 9 -** Server software product used to access massively large multi-user geographic databases stored in relational database

management systems (RDBMS). It is an integrated part of ArcGIS and a core element of any enterprise GIS solution. Its primary role is to act as the GIS gateway to spatial data stored in a RDBMS.

- **ESRI ArcMap 9** – This fully featured editing environment will be used by Ministry staff to select, extract, or view spatial data in the VRID. Additionally, ArcMap will be used as the editing tool when Ministry staff edit the VRID geodatabase. ArcMap will not directly edit, or update the VRID directly.

- **Citrix Terminal Services** – Citrix Terminal Services provides secure remote office connectivity to securely deliver applications and information to remote offices and contact centers and maintain those applications and information from a central location.

4.3 HARDWARE

4.3.1 VRIMS WORKSTATIONS

Ministry staff that will be creating and editing a PGDB that has been created with VRIMS data, will access the VRIMS spatial layers by use of terminal server software located within the Ministry of Agriculture and Lands. The suite of ESRI desktop tools will be available through Citrix.

4.3.2 APPLICATION AND DATABASE SERVERS

Application, web and Database servers will be supplied and supported by the Ministry of Forests and Range's Information Management Group. All servers will be deployed with a Windows operating system environment.

Application servers will, for example, be used to pr
The Ministry's Business & Information Services Division supplies and supports the necessary hardware for the Oracle 9*i* RDBMS and ArcSDE 9.

4.4 COMMUNICATION

4.4.1 NETWORK COMMUNICATION

Ministry Staff will require network connectivity to SRM's Citrix services for accessing the ArcMap application when either selecting and extracting data from the VRID, or when directly editing the VRID geodatabases.

Network connectivity currently exist as part of standard office configuration.

4.4.2 RESULTS DATA IMPORT COMMUNICATION

Application services and automated listener's will require network connectivity to the RESULTS server, to acquire new submissions.

4.4.3 DATA EXTRACTION AND DELIVERY COMMUNICATION

Ministry staff will require network connectivity and storage capacity for the creation and access of VRID geodatabases. Once the VRID geodatabases have been created, applications services will require network connectivity to the VRID geodatabase in order to populate the tables of the geodatabase with data.

Additionally, if the VRID geodatabases are destined to external contractors, then ftp, or web facilities will be required for the management and transfer of the data.

4.4.4 DATA RETRIEVAL AND INTEGRATION COMMUNICATION

Application services and automated listeners will require network connectivity to access the storage area of the VRID geodatabases when Ministry staff, or external contractors are ready to submit them for integration to the VRID.

4.5 PERFORMANCE

There will be approximately 10 regional, non-concurrent users, accessing the VRIMS application by Citrix software. Since the Vegetation Resource Inventory Management System will not be edited directly, it is not anticipated that all users will have concurrent sessions open. Regional users will select and extract data as required and will perform editing off-line of the database.

Approximately two additional users will be tasked with auditing submissions prior to integration of new data into the VRID, as well as perform application management roles, as required. It is anticipated that these users will have direct access to the Java tools required to audit and manage the VRID.

- **VRID Database Server** – Backup and general system support for this component of the system is supplied as part of Information Management Branch's standard system services.

- **Data Replication** – The IMB will need to provide support for the data replication between the VRID operational database and the LRDW database on a to be determined basis. However it is anticipated that this operation will only be required once per year.

- **VRIMS Workstation** – The Vegetation Resource Inventory Management System will be a client server application system, utilizing ESRI's ArcMap and custom built Java tools. The software and hardware used for accessing, extracting, editing, retrieving and integrating data should comply with Ministry standard supported software and hardware.

4.6 OPERATIONS & SUPPORT

4.6.1 INTERNAL APPLICATION SERVER AND DATABASE

Backup and general system support for this component of the system is supplied as part of Information Management Branch's standard system services.

4.6.2 EXTERNAL SYSTEMS

Backup and general system support for this component of the system is supplied as part of IMB's standard system services.

4.6.3 DATA REPLICATION

The IMB will need to provide support for the data replication between the internal operational database and the external Land and Resource Data Warehouse database on a once-per-year basis, or as determined.

4.6.4 VRIMS WORKSTATION

The Vegetation Resource Inventory Management System will be deployed as a Oracle database with several Java applications. The software and hardware used for editing data extracted from the VRIMS should comply with Ministry standard supported software and hardware.

4.7 IMPLEMENTATION

5. APPENDICES

5.1 APPENDIX A: SERVER MODEL DIAGRAM

5.2 APPENDIX B: TABLE DEFINITIONS

5.3 APPENDIX C: TABLES AND THEIR INDEXES

5.4 APPENDIX D: MODULE DEFINITIONS

5.5 APPENDIX E: FUNCTION DESCRIPTIONS

5.6 APPENDIX F: CONVERSION TRANSLATION RULES

The following topics discus the various attributes or objects that require special attention at the time of conversion. Conversion issues will be dealt with on a as-needed basis when problems arise.

The application of the business validation rules will help determine what attribute data will have to be examined, when errors are generated by the business validation rules. Attribute values that are code list dependent and that generate business validation errors will have the code list examined by ministry staff to determine code list validity. Subsequent to that a review of the business rule will also be examined by ministry staff to ensure that the business rule is valid.

5.6.1 DATA CAPTURE METHOD CD

The data_capture_method_cd can be found in both the veg_vegetation_cover_polygon and the resource_inventory_history tables. The attribute field, in the INCOSADA data entry tool, provided free text entry that resulted in non-standard code values. The following is a list of those pre and post mappings that will be carried out during the conversion process.

Pre	Post
'Digitized'	7
'Digitzed'	7
'digitized'	7
'GPS'	6
'MONO'	9
'Ortho'	4
'mono'	9
'mono-res'	9
'mono-resti'	9
'soft copy'	4
'softcop'	4
'softcopy'	4
'softcoy'	4
'Landsat5'	1
'Landsat7'	2
'SPOT'	3
'Photogrammetric'	4
'Differential GPS'	5
'Non-Differential GPS'	6
'Digitizing'	7
'Scanning'	8
'Monorestitution'	9
'Tight Chaining'	10
'RESULTS'	11
'Other'	12
NULL	NULL

5.6.2 BCLCS LEVELS

There are five British Columbia Land Classification System Level attributes that can be found in the veg_vegetation_cover_polygon. Each level has a unique value of codes that help identify unique characteristics for any section of land

within British Columbia. However, the following is a list of values that are not valid for any level. All non valid values will be set to null.

Pre	Post
''	NULL
'LA'	NULL
'RI'	NULL
'BP'	NULL

5.6.3 FOREST COVER RANK CODE

The forest_cover_rank_code can be found in the tree_cover_layer table.

Pre	Post
2	NULL
3	NULL

NON VEG COVER TYPE

The non_veg_cover_type can be found in the non_vegetative_cover table.

Pre	Post
'RO'	'BR'
'RP'	'RZ'
'RT'	'TA'
'SC'	'PN'
'SI'	'PN'

5.6.4 TREE COVER PATTERN

The data found in the tree_cover_pattern, located in the tree_cover_layer table must adhere to the following business rule;

- *SET TREE_COVER_PATTERN TO NULL IF CROWN CLOSURE <1 OR NULL, ELSE CHANGE TO 9.*

5.6.5 NON VEG COVER PATTERN

The data found in the non_veg_cover_pattern, located in the non_vegetative_cover table must adhere to the following business rule;

- *WHEN NON_VEG_COVER_PATTERN = 0 CHANGE NON_VEG_COVER_PATTERN TO NULL*
- *IF NON_VEG_COVER_TYPE IS NULL, CHANGE NON_VEG_COVER_PCT TO NULL IF NON_VEG_COVER_TYPE IS NULL*
- *CHANGE NON_VEG_COVER_PATTERN TO 9 IF NON_VEG_COVER_TYPE IS NOT NULL*

5.6.6 NON PRODUCTION DESCRIPTION CODE

The non_productive_descriptor_cd can be found in the veg_vegetative_cover_polygon table.

Pre	Post
'lmm'	NULL
'A'	02
'AF'	10
'C'	42

'CL'	09
'G'	18
'GR'	06
'ICE'	01
'L'	15
'M'	62
'MUD'	26
'NA'	64
'NP'	12
'NPBR'	11
'NTA'	00
'OR'	63
'P'	60
'R'	03
'RI'	25
'RIV'	25
'S'	35
'SAND'	07
'SWAMP'	35
'TIDE'	16
'U'	54

5.6.7 TREE SPECIES

The following two rules will enforce that no data is present for data_source_age_cd, or data_source_height_cd. There is no potential for users to add this data from VegCap, however, since these two rules will be validated in the VegCap II business validation rules, then it is critical that no data exists in these fields.

If tree_species.species_id = 2 then
tree_species.data_source_age_cd must be null.

If tree_species.species_id = 2 then
tree_species.data_source_height_cd must be null.

5.6.8 LAYER ID'S – TREE COVER LAYER AND TREE SPECIES

The following is meant to eliminate layer_id's that have a layer_id of '0'. Layer_id's, after conversion, will have one of the following as a valid value; a range of between '1' to '9', or 'S'. Therefore, at time of conversion, if a layer_id = '0' for either a tree_cover_layer, or a tree_species, these records will be ignored, however, the parent record will be maintained.

Tree Layer, layer_id's that have a value of '0' were created when it was essential to preserve history information about the polygon, but no other information about the polygon was required, or was relevant. At time of conversion, any Tree Layer, layer_id's will be deleted, however the corresponding Resource Inventory History record will be preserved in the polygon history table. If a 'DI' record exists, then Disturbance Event conversion rules will apply.

Additionally, if a tree_cover_layer, or a tree_species have a value of 'V', then the following rules are to apply…

*For those records that have a Layer_ID = V; **FIRST** convert Layer_ID = 1 to Layer_ID = 2 and any subsequent Layer_Id's should be converted to n – 1, **then** convert Layer_ID = V to Layer_ID = 1.*

5.6.9 LAYER ID'S - RESOURCE INVENTORY HISTORY

Layer_id's that have a layer_id value of '0' and have an associated resource_inventory_history record were created when it was essential to preserve history information about the polygon, but no other information about the polygon was required, or was relevant. At time of conversion, any resource_inventory_history record, that has a layer_id of '0' will be deleted, however the corresponding resource_inventory_history record will be preserved in the polygon history table. If a 'DI' record exists, then Disturbance Event conversion rules will apply.

5.6.10 SITE INDEX MAPPINGS

The site index's are mentioned here since their mappings are not clearly definable from the current LRDW data model to VRIMS.

LRDW.TREE_COVER_LAYER	VRIMS.TREE_COVER_LAYER
EST_SITE_INDEX	ESTIMATED_SITE_INDEX
DERIVED_SITE_INDEX	ESTIMATED_SINDEX_SOURCE_CODE
EST_SITE_INDEX_SPECIES_CD	ESTIMATE_SITE_INDEX_SPECIES_CODE

5.7 APPENDIX G: DATA MANIPULATION RULES – STAGING AREA

5.7.1 TRANSACTION PROCESSING AND AUDIT STATES

In the following diagrams start states are represented with a dashed line and end states are represented with a thick solid line. In an attempt to show what state transitions are human initiated, and which are software initiated, the state transitions are labelled as follows:

- H – AT = Human – Audit Tool
- S – RPS = System – RESULTS Preparation Service
- S – VPS = System – VEG Preparation Service
- S – IS = System – Integration Service
- S – CS = System – Cleanup Service

The following diagram depicts the audit states for a transaction and the transitions between the audit states.

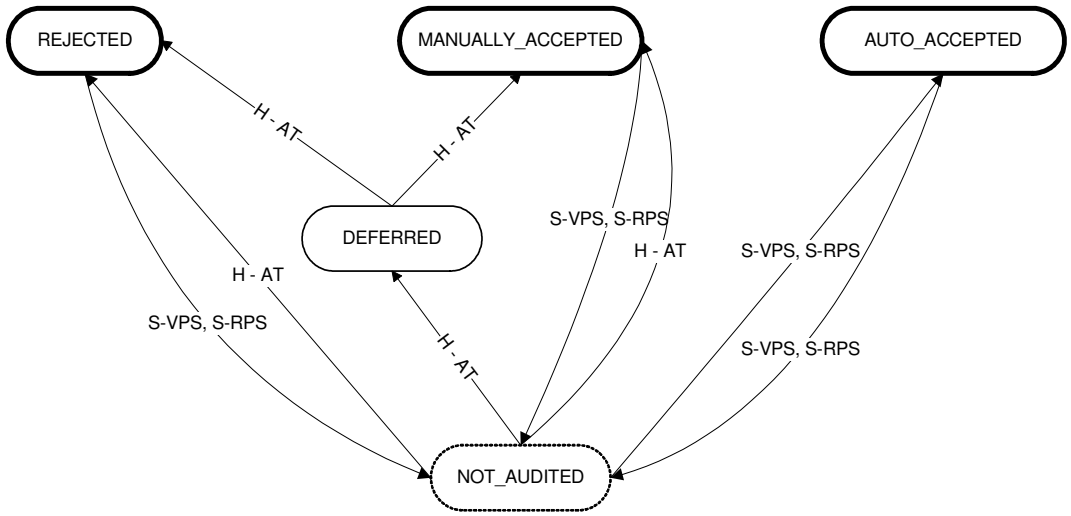


Figure 1 Transaction Audit States

Figure 2 depicts the processing states for a transaction and the transitions between the states.

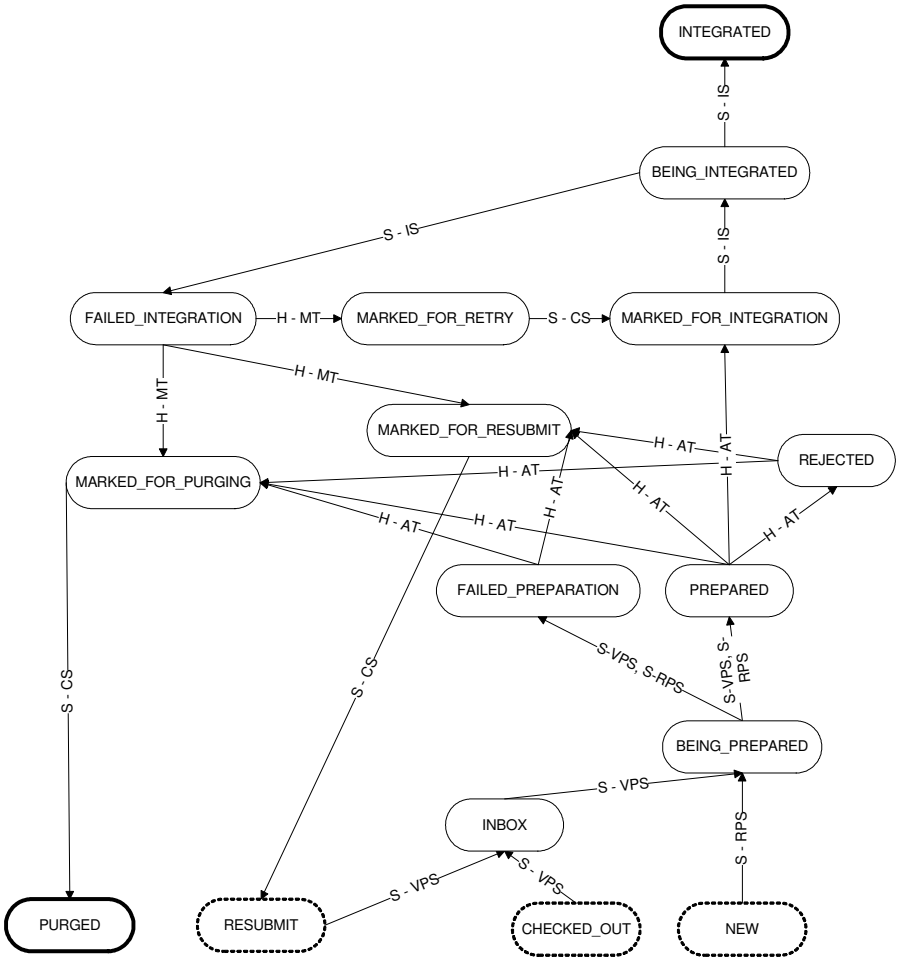


Figure 2 Transaction Processing States

Note that if an effort to clean up any failed or abandoned transactions it will be possible transition from any state other than BEING_PREPARED, BEING_INTEGRATED, or INTEGRATED to MARKED_FOR_RESUBMIT or MARKED_FOR_PURGED. This functionality will be made available through the Management Tool. These transitions were left off the diagram to make it easier to read.

5.7.2 PREPARATION

Once successfully written to the Staging Area the data will have the following state.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	NOT_AUDITED	PREPARED

In the event that any data does not pass either spatial cleaning, or business rule validations, then the data will be written to the Staging Area with the following state.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	NOT_AUDITED	PREPARATION_FAILED

5.7.3 SPATIAL CLEANER COMPONENT – RESULTS

There are two scenarios for taking RESULTS submissions. When an Opening is a "Depletion" or when an Opening is "Free To Grow". In either case, all RESULTS data will be of inventory_standard "I" and generalizations will be made about the data. If the polygon is subsequently interpreted to VRI standards, then that polygon would become a "V" record. The assumption therefore, is that a "Free To Grow" Opening could stay as a "I" record for any length of time, up until it has been brought up to a "V" record.

To determine that a RESULTS submission is 'Free To Grow', the following will be used. All other RESULTS submissions will be considered a 'Depletion'.

RESULTS.OPENING.OPEN_CATEGORY_CODE = 'FG'

RESULTS submissions are defined, from the Vegetation Inventory perspective as either a 'Depletion' or as 'Free To Grow'. There is no attribute that depicts a RESULTS Opening as a 'Depletion', however it can be generally stated that unless a RESULTS Opening has achieved a 'Free To Grow' designation it will be considered as a 'Depletion'.

If either type of RESULTS submission if found to have un-

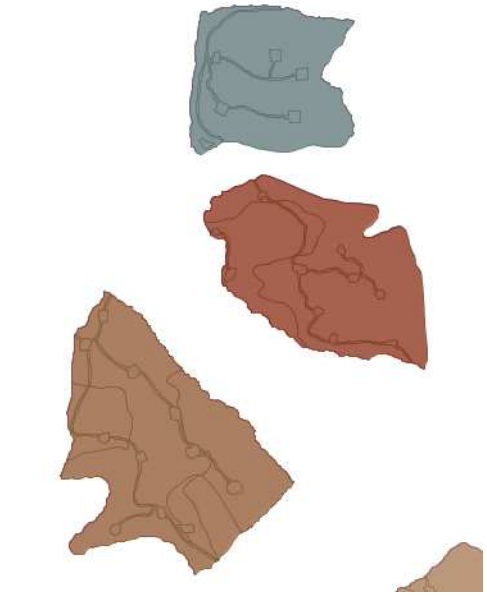
DEPLETIONS

Depletions are any RESULTS submission that still has licensee obligations associated with it. From the time a new Opening is realized, up to and including the time that the Licensee has harvested and then met all of their Silviculture obligations.

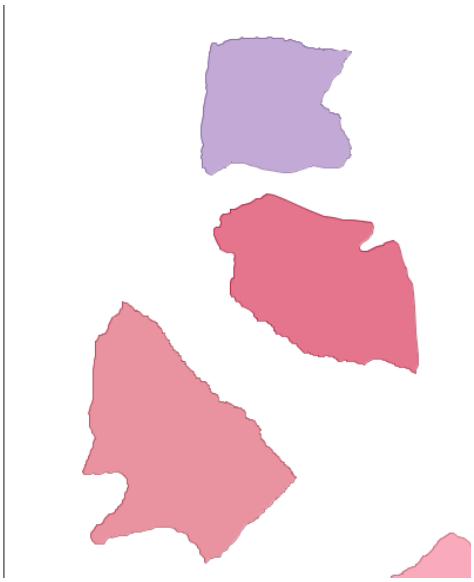
Although only the outer boundary will be preserved, referred to as the Depletion Boundary, some information from the internal Forest Cover Polygons will be utilized to generalize only a few attributes.

Depletion data will have an inventory_standard of "I" and will be subjected to inventory standard "I" VegCap validation rules.

The union of the internal Forest Cover Polygons that make up the Opening will be will be used to create the outer boundary. The attributes that make up the boundary object will be generalized based on the largest, non Wildlife Tree Patch, Forest Cover Polygon. The following figures show RESULTS submissions prior to be generalized and after being generalized.

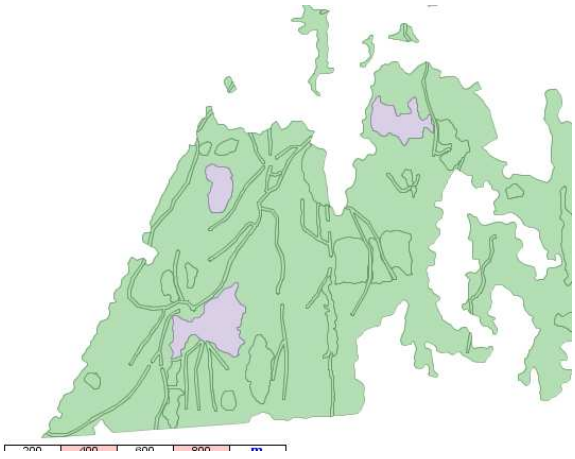


RESULTS Submission - Non Generalized

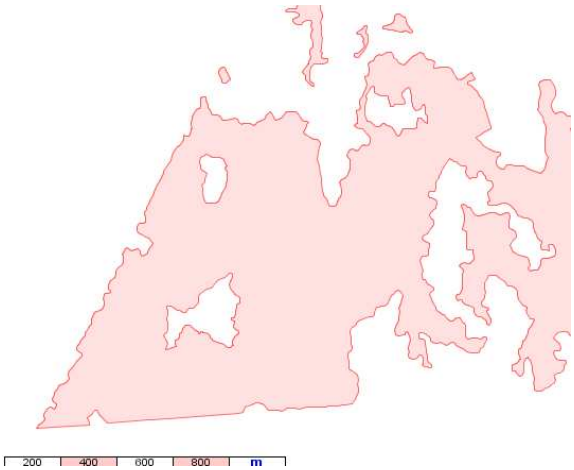


RESULTS Submission – Generalized

Internal Wildlife Tree Patches will remain within the spatial boundary of the generalized boundary object in accordance with to section 5.9.1 – 'Merging Rules for Wildlife Tree Patch Reserves'



RESULTS Submission – With WTP



RESULTS Submission – With WTP intact

SUBSEQUENT IDENTICAL OPENING SUBMISSIONS – DEPLETIONS

Subsequent, identical, Opening submissions that are "depletions", will be processed as if they were not already present in the VRID. The impacted, identical polygon already in the VRID, will be retired, and the new identical submission will take its place in the VRID.

FREE TO GROW

A Free To Grow designation against an Opening is achieved when a Licensee has met all Silviculture obligations, to all SU's or Forest Covers that compose the Opening, agreed to for that Opening. At that time, the Opening is returned to the Crown.

Free To Grow data will have an inventory_standard of "I" and will be subjected to "I" VegCap validation rules, until such time that the polygon is interpreted to VRI standards, when the inventory_standard of the polygon would be set to "V".

SUBSEQUENT IDENTICAL OPENING SUBMISSIONS – FREE TO GROW

Subsequent identical Opening submissions, that are declared "Free TO Grow", will be processed as if they were not already present in the VRID. The impacted, identical forest covers already in the VRID, will be retired, and the new identical submission will take their place in the VRID.

The new submission will be stored in the Staging Area of the Vegetation Resource Inventory Database and will have its transaction process state set to PREPARED and its transaction type set to RESULTS.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	NOT_AUDITED	PREPARED

In the event that a RESULTS submission fails any validation process, other than a geometry validation, the submission will be stored in the Staging Area and will have its transaction process state set to PREPARATION_FAILED.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	NOT_AUDITED	PREPARATION_FAILED

Please refer to the "VRIMS – Supplemental – RESULTS – VRID Mappings" Microsoft Excel spreadsheet document for mapping information.

DISTURBANCES

Within a RESULTS Opening, a forest cover polygon is considered to be disturbed if there are associated record(s) in the DISTURBANCE_RESULTS table (via a join through ACTIVITY_TREATMENT_UNIT on the OPENING_ID). If multiple disturbances are present for a polygon, the most recent disturbance will be considered (determined by the DISTURBANCE_START DATE).

Please see 'Appendix 'I' Data Manipulation Rules – Disturbances', for a complete description of how Disturbance Events will be managed.

5.7.4 GML DOCUMENTS

To make a submission, using the GML, the document will be subject to the Data Preparation Process.

Once validated, both the spatial and non-spatial components of the document will be written to the Staging Area of the Vegetation Resource Inventory Database and will have the following state.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	NOT_AUDITED	PREPARED

5.7.5 AUDIT TOOL

INITIALIZATION

On initialization of the Audit Tool, checks will be performed to discover submissions that need to be in either the Submission Window or the Transaction Window.

POPULATE THE SUBMISSION WINDOW

The following SQL will discover all submissions that are prepared, have failed preparation, have been rejected, or have failed integration.

select * from VRID.TRANSACTIONS where PROCESS_STATE IN ('PREPARED', 'FAILED_PREPARATION', 'REJECTED', 'FAILED_INTEGRATION')

The following SQL will provide a warning dialog box for Ministry staff. This will discover all submissions that were in a state of submit, and therefore ready to process, but a system failure kept them from actually from being processed.

select * from VRID.TRANSACTIONS where PROCESS_STATE = INTEGRATION_FAILED.

POPULATE THE TRANSACTION WINDOW

The following SQL will discover all submissions that have failed even before data could be put into the Staging Area:

select * from VRID.TRANSACTIONS where PROCESS_STATE = FAILED_PREPARATION and TRANSACTION_ID not in (select TRANSACTION_ID from VRI_POLYGONS).

REFRESH

Each time Ministry staff accesses the Audit Tool they may wish to retrieve any new submissions that are currently residing in the Staging Area of the Vegetation Resource Inventory Database.

A 'get new' button will query the Staging Area, returning the number of new records. Ministry staff will be able to filter records based on pre-defined selection criteria. The selection criteria is currently out of scope, and will be developed as better understanding of the business requirements are made clear by Ministry

Staff. However, it is likely that the selection criteria will filter records based on TSA, District, or some other spatial administrative boundary.

The new submissions will populate a list box that has query capabilities to organize submissions by submission type, submission client, client submission code, year, audit state, process state and view state.

The OPENING_ID of all new submissions will be checked against OPENING_ID's already processed into the VRID. If they exist, then the record will have it's AUDIT_STATE set to AUTO_ACCEPTED. This will indicate that the inbound RESULTS submission is a "Subsequent Identical Opening Submission - Depletion." As well, if an inbound RESULTS submission exists, and the Opening is declared "Free To Grow", then its AUDIT_STATE will be set to AUTO_ACCEPTED In both circumstances the VIEW_STATE will be set to false.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	AUTO_ACCEPTED	MARKED_FOR_INTEGRATION

VIEW

Ministry staff may choose to perform a visual audit of the submission.

To view a submission, select the submission – only one submission at a time can be viewed, click to activate the popup menu. Select "View". Alternatively press the "View" button on the Submission Window.

Focus will move to the viewing area where the submission geometry is.

The extent of the submission geometry will be zoomed to.

The selected submission record will stay in the Submission Window – highlighted and the transaction will have the following states. If the audit state is NOT_AUDITED then is will be set to DEREFED otherwise it will be left as it is.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
TRUE	DEFERED	PREPARED
TRUE	DEFERED	FAILED_PREPERATION
TRUE	AUTO_ACCEPTED	FAILED_INTEGRATION
TRUE	MANUALLY_ACCEPTED	FAILED_INTEGRATION

ACCEPT

Ministry staff may accept one or more submissions but may or may not choose not to visually audit them.

To accept a submission, select the submission or multiple submissions by holding down ctrl + left mouse button and clicking on the submission, right mouse click to activate the popup menu. Select "Accept". Alternatively press the "Accept" button on the Submission Window. The transaction will have one of the following states.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE

TRUE	MANUALL_ACCEPTED	MARKED_FOR_INTEGRATION
FALSE	MANUALLY_ACCEPTED	MARKED_FOR_INTEGRATION

REJECT

Ministry staff may reject the submission for some reason; therefore the submission will not get processed but will still remain as a record in the submission window. Ministry staff may choose to reject the submission with or without performing a visual audit.

To reject a submission, select the submission or multiple submissions by holding down ctrl + left mouse button and clicking on the submission, right mouse click to activate the popup menu and select "Reject". Alternatively press the "Reject" button on the Submission Window. The submission will stay in the Submission Window and the transaction will have the one of following states.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
FALSE	REJECTED	REJECTED
TRUE	REJECTED	REJECTED

RETRY

If a submission failed integration then its processing state will be FAILED_INTEGRATION and ministry staff can have the submission go through the integration process again by 'retrying' the submission.

To retry a submission, select the submission or multiple submissions by holding down ctrl + left mouse button and clicking on the submission, right mouse click to activate the popup menu. Select "Retry". Alternatively press the "Retry" button on the Submission Window. The transaction will have one of the following states.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
TRUE	MANUALLY_ACCEPTED	MARKED_FOR_RETRY
FALSE	MANUALLY_ACCEPTED	MARKED_FOR_RETRY

A 'cleanup' service will periodically look for transactions in the MARKED_FOR_RETRY state and delete the associated data from the errors table and set the status to MARKED_FOR_INTEGRATION.

RESUBMIT

Ministry staff may choose that a submission must be resubmitted with corrections; therefore the submission will be removed from the Audit Tool.

To mark a submission as needing to be resubmitted, select the submission or multiple submissions by holding down ctrl + left mouse button and clicking on the submission, right mouse click to activate the popup menu and select "Resubmit". Alternatively press the " Resubmit " button on the Submission Window. The submission will be removed from the submission window and the transaction will have one of the following states.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE

TRUE	REJECTED	MARKED_FOR_RESUBMIT
FALSE	REJECTED	MARKED_FOR_RESUBMIT

A 'cleanup' service will periodically look for transactions in the MARKED_FOR_RESUBMIT state and delete the associated data from the Staging Area and the errors table and set the status to RESUBMIT.

PURGE

Ministry staff may choose that a submission is invalid and cannot be corrected. Purging the submission therefore removes the submission from the Audit Tool.

To mark a submission as needing to be purged, select the submission or multiple submissions by holding down ctrl + left mouse button and clicking on the submission, right mouse click to activate the popup menu and select "Purge". Alternatively press the "Purge" button on the Submission Window. The submission will be removed from the submission window and the transaction will have one of the following states.

VIEW_STATE	AUDIT_STATE	PROCESS_STATE
TRUE	REJECTED	MARKED_FOR_PURGE
FALSE	REJECTED	MARKED_FOR_PURGE

A 'cleanup' service will periodically look for transactions in the MARKED_FOR_PURGE state and remove the associated data from the Staging Area and the errors table and set the status to PURGED.

5.7.6 MANAGEMENT TOOL

INTEGRATE SUBMISSIONS

All submissions in the MARKED_FOR_INTEGRATION are available for integration into the Vegetation Resource Inventory Database. When the Management Tool is in automatic mode it determines the next transaction to integrate by using the following SQL:

select * from VRID.TRANSACTIONS where PROCESS_STATE = 'MARKED_FOR_INTEGRATION' order by UPDATE_TIMESTAMP DESC

When the Management Tool is in manual mode, the ministry staff manually select which of the submissions in the MARKED_FOR_INTEGRATION state should be integrated next.

If a system failure occurs while integrating a submission, the transaction processing sate will be set to INTEGRATION_FAILED.

When the Audit Tool is initialized, a query will be performed to discover any submissions that failed integration. If any record exists, then the Ministry staff will be notified, via a popup dialog window.

A report will be generated of the submissions that have not been successfully integrated into the Vegetation Resource Inventory Database.

INTEGRATION PASSED

Once the submission has been subjected to the integration process, if it has not generated an error during integration and therefore was integrated, then the transaction's processing status is set to INTEGRATED and the data is removed from the Staging Area.

A report will be generated of the submissions that have been successfully integrated into the Vegetation Resource Inventory Database.

INTEGRATION FAILED

Once the submission has been subjected to the integration process, if it has generated an error during integration and therefore could not be integrated, then the integration of that submission will be deemed to have failed, and the transaction's processing status is set to FAILED_INTEGRATION.

The submission will appear in the Audit Tool.

5.8 APPENDIX H: DATA MANIPULATION RULES – ESTIMATED AREA

5.8.1 TOPOLOGY INTEGRATER COMPONENT

DETECTION AND MERGING RULES FOR SLIVERS

During the integration process of a new polygon (the originating polygon), a spatial relic, referred to as a sliver, can be introduced. Slivers are small and usually, odd-shaped polygons, that have an area less than the Minimum Sliver Area (2 ha) or have an average width less than the Minimum Sliver Width (30 m).

Slivers will be merged with an adjacent non-originating polygon. If the sliver shares a boundary with one or more adjacent, non-originating polygons, the sliver will be merged with the adjacent polygonal which it shares the longest boundary with.

DETECTION AND MERGING RULES FOR LONG SKINNY POLYGONS

During the integration process of a new polygon (the originating polygon), new slivers, or other spatial relics can be introduced, due to data errors inherent in the Operational Database fabric. An additional spatial anomaly; Long Skinny Polygons, can also be introduced. Long Skinny Polygons are larger than 1 ha and are usually the result of merging a smaller polygon into an existing polygon, creating an outer band.

Long Skinny Polygons are less than 30 metres in width and larger than 1 ha in area, and unlike a Spike are irregular shaped, usually the result of merging a smaller polygon into an existing polygon, creating an outer band.

All Long Skinny Polygons that are less than 30 metres in width and larger than 1 ha in area and are forested should be merged with any aadjacent polygon, other than the new RESULTS submission polygon, otherwise, the Long Skinny Polygon should be ignored.

DETECTION AND MERGING RULES FOR SPIKES

During the integration process of a new polygon (the originating polygon), new slivers, or other spatial relics can be introduced, due to data errors inherent in the Operational Database fabric. An additional spatial anomaly; Spikes, can also be introduced. Spikes, which are very long, very narrow triangular areas, usually much longer than they are wide and are narrower than a given Minimum Spike Width, can be created at the edge of the newly introduced polygon. Unlike a sliver, a spike can exist in a cleaned and noded polygon but violate visual quality criteria, whereas a slivers will be eliminated during the noding and cleaning process.

All Spikes with a maximum width less than one meter and with a maximum length less than five meters will be eliminated at the time of integration. Spikes

can be clipped off their parent polygon and merged with adjacent polygons with which they share a longer boundary.

DETECTION AND MERGING RULES FOR NECK'S

During the integration process of a new polygon (the originating polygon), new slivers, or other spatial relics can be introduced, due to data errors inherent in the Operational Database fabric. An additional spatial anomaly; Necks, can also be introduced. Necks, are situations where a section of polygon has a very narrow width, while on either side the polygon has a width and area that is with normal tolerances.

Necks can be split to form two polygons with acceptable shape metrics and identical attributes.

DETECTION AND MERGING RULES FOR DENSELY POPULATED VERTICES

During the integration process of a new RESULTS polygon, the opening may have substantially denser linear geometries than the standard line segment length tolerances of the Vegetation Resource Inventory Database. This results in a significant amount of nodes, or vertices, along the linear geometry. It may be advisable to simplify the line work using a standard line segment tolerance, to reduce the density of vertices in the opening boundary.

MERGING RULES FOR 'FREE TO GROW'

For RESULTS data, from a Vegetation Inventory perspective, all OPENINGS are considered to be either in a state of 'Depletion' or 'Free To Grow'. In either state, associated data to the OPENING are managed differently.

During the integration process, if the new OPENING has been declared 'Free To Grow'; RESULTS.OPENING.OPEN_CATEGORY_CODE equals 'FG' then find all associated FOREST_COVERS for that OPENING and apply the Merging Rules for Stocking Types[see 4.2.9].

MERGING RULES FOR 'DEPLETIONS'

For RESULTS data, from a Vegetation Inventory perspective, all OPENINGS are considered to be either in a state of 'Depletion' or 'Free To Grow'. In either state, associated data to the OPENING are managed differently.

During the integration process, if the new OPENING is a 'Depletion'; RESULTS.OPENING.OPEN_CATEGORY_CODE not equal to 'FG', then find the largest FOREST_COVER.SILV_POLYGON_AREA, that is contained within that OPENING. Find the associated FOREST_COVER polygon and populate the attribute information for the VRID polygon with those of the largest FOREST_COVER.

MERGING RULES FOR RESULTS SUBMISSIONS

During the integration process, RESULTS submissions will have some impact on adjoining Vegetation Resource Inventory polygons. These impacted polygons may

be other RESULTS submissions, or VRI polygons. Rules have to be set in place to deal with how new RESULTS submissions may alter either impacted geometries, or their attributes.

If a new RESULTS submission overlaps another RESULTS polygon in the VRID, then the new RESULTS submission will take precedent, both in geometry and attribution. This is the concept of 'Last One In Wins'. Any resulting slivers will be managed by sliver detection and merging rules.

Overlapping RESULTS polygons will create exceptions in two scenarios. If a new RESULTS submission overlaps a in-situ RESULTS polygon more than 20 metres along any part of the overlapping boundary, the new RESULTS submission will have its PROCESS_STATE set to "F". Additionally, if a new RESULTS submission overlaps any TRIM feature by more than 10 metres along any part of the overlapping boundary, the new RESULTS submission will have its PROCESS_STATE set to "F".

MERGING RULES FOR RE-INVENTORIES

Re-Inventories, whether completed by Ministry staff, or an external contractor, will be managed in the same manner.

During the integration process, the Re-Inventory data will be integrated into the VRID as a single coverage, without consideration of the underlying fabric. It is assumed that the outer boundary of the Re-Inventory area will not be manipulated. However, in the event that the outer boundary has been changed, the Re-Inventory data will still be integrated into the fabric, as is.

As the length of time of a Re-Inventory is indeterminate, there is a high probability that new RESULTS submissions may be applied within the Re-Inventory area. If this is the case, when the Re-Inventory is submitted, impacted RESULTS submissions will have to be identified. The Ministry staff that is validating the Re-Inventory will be able to view both the current VRID as well as the submitted Re-Inventory. Any polygons that need to be preserved will have to be selected, stored in a VRID Geodatabase, and re-applied after the Re-Inventory has been integrated.

MERGING RULES FOR IMPACTED TRIM FEATURES

During the integration process, if the new polygon overlays a non-moveable TRIM water feature, or any other non-moveable TRIM feature, the polygon will be considered invalid and the PROCESS_STATE will be set to "F" if the tolerance of that intersection is greater than or equal to 10 meters and the new polygon will not be merged.

MERGING RULES FOR STOCKING TYPES

In RESULTS, an OPENING may have one or many FOREST_COVER polygons. Each FOREST_COVER polygon has an attribute that describes its stocking type. During the integration process, only STOCKING_TYPE_CODES that are 'ART';Artificial, 'FOR';Forested and 'NAT';Natural will retain their polygon geometries. All other STOCKING_TYPE_CODES will have their geometries merged

into the adjacent FOREST_COVER polygons, these include 'BR';Brush, 'NPL';Non-plantable, 'PL';Plantable, 'RD';Road, 'UNN';Unnatural, 'RHR';RHR - Added for Results Conversion.

MERGING RULES FOR BC LAND COVER CLASSIFICATIONS

All attributes of inventory_standard "V" records will be subjected to full VegCap validation business rules. However, in order to generate BC Land Cover Classifications, from inventory_standard "I" records, it will be necessary to apply the following business rules, since some attribute information will be generalized.

```
FOR an OPENING
  IF OPENING crown_closure is < 10 THEN
    crown_closure = 10
  ENDIF
  IF OPENING is of TYPE Free To Grow THEN
    level1 = 'V'
    level2 = 'U'
    level3 = 'T'
    level4 = 'AI' : "Application of "I" inventory_standard rules from new VegCap"
    level5 = 'AI' : "Application of "I" inventory_standard rules from new VegCap"
  ELSE
    level1 = 'V'
    level2 = 'U'
    level3 = 'T'
    level4 = 'SL'
    level5 = 'SP'
  ENDIF
ENDFOR
```

MERGING RULES FOR WILDLIFE TREE PATCH RESERVES

Wildlife Tree Patches have a minimum reserve area for each hectare harvested. A Wildlife Tree Patch may be located as a discrete reserve area within a opening boundary, as a discrete area of reserve adjacent to the opening boundary, a discrete area separated from, but not assigned to, an opening.

During the integration process, if the new RESULTS submission contains(is within the outer boundary) a Forest Cover polygon that is designated as a Wildlife Tree Patch Reserve; FOREST_COVER.SILV_RESERVE_CODE = 'W', and the Wildlife Tree Patch Reserve polygon has full attribution; species, age, height, etc, and the Wildlife Tree Patch Reserve is greater than or equal to 1 hectare in area, then merge the Wildlife Tree Patch Reserve, using its own attribution.

If the new RESULTS submission contains(is within the outer boundary) a Wildlife Tree Patch Reserve polygon and the Wildlife Tree Patch Reserve is less than to 1 hectare in area, then do not merge the Wildlife Tree Patch Reserve.

If the new RESULTS submission contains(is within the outer boundary) a Wildlife Tree Patch Reserve polygon and the Wildlife Tree Patch Reserve has no attribution; species, age, height, etc, and the Wildlife Tree Patch Reserve is

greater than or equal to 1 hectare in area, then merge the Wildlife Tree Patch Reserve, using the attribution that is available by the impacted VRID polygon.

If the RESULTS submission has a Wildlife Tree Patch Reserve, but the Wildlife Tree Patch Reserve is not contained(is outside of the outer boundary) and has no attribution of its own from RESULTS, then do not merge.

INTEGRATE

All submissions that are in the MARKED_FOR_INTEGRATION processing state are available to be integrated into the operational database. These transactions will be picked up when the Topology Integration Pipeline is run.

If a system failure occurs while processing a submission, the transaction's processing state is set to FAILED_INTEGRATION. These transactions will appear in the Audit Tool.

5.8.2 POLYGON ALIAS NAME GENERATOR COMPONENT

Polygon Alias Names will be constructed of the 7 characters that identify the 1:20,000 mapsheet and the 6 digit number that is the result of the calculations between the polygon and the lower left hand coordinate of the mapsheet. This difference is divided by 17; the maximum difference of all Mapsheets within the Province, between the lower right easting and the lower left easting, divided by 1000.

Unique values will be preserved even in closely formed polygons. A cluster of small polygons can still achieve unique numbers when centroid distances of +12 or –12 of a meter in the X, or +12 or –12 in the Y are maintained.

```
MAPSHEET << GET MAPSHEET
MAPSHEET_NAME = MAPSHEET.NAME

MAPSHEET.X = MAPSHEET_NAME.COORDINATES.LL.X
MAPSHEET.Y = MAPSHEET_NAME.COORDINATES.LL.Y

POLY << GET POLYGON
POLY.X = POLY.CENTROID.X
POLY.Y = POLY.CENTROID.Y

A = (POLY.X – MAPSHEET.X) / 17
IF A < 100 THEN
   AS_STRING(CONCAT("0", A))
B = (POLY.Y – MAPSHEET.Y) / 17
IF B < 100 THEN
   AS_STRING(CONCAT("0", B))
POLY_ALIAS_NUMBER = AS_STRING(CONCAT(A, B))

POLY_ALIAS_NAME = CONCAT(MAPSHEET_NAME, POLY_ALIAS_NUMBER)
```

If the Polygon Alias Name is to incorporate year within the naming convention, then the 2 digit year could be inserted between the mapsheet name and the unique polygon number.

5.8.3 DISTURBANCE EVENTS

Please see 'Appendix 'I' Data Manipulation Rules – Disturbances', for a complete description of how Disturbance Events will be managed.

Please refer to the "VRIMS – Supplemental – History Code Mappings" Microsoft Excel spreadsheet for further reference information.

5.8.4 INTEGRATION SERVICE COMPONENT

PROCESS STATE TABLES

Prior to the integration of any submission into the Vegetation Resource Inventory Database, a submission must have a Processing State of MARKED_FOR_INTEGRATION.

If the submission has been successfully integrated into the Vegetation Resource Inventory Database then its processing state will be INTEGRATED.

If the processing state is MARKED_FOR_INTEGRATION then the submission is queued and is ready to be processed. The submission can have a state change of either INTEGRATED or FAILED_INTEGRATION.

If the submission is FAILED_INTEGRATION, the submission has not been integrated into the Vegetation Resource Inventory Database and needs attention by the audit operator. A reason code associated with the failure will be identified. If a submission has failed to integrate for any reason, other than as a result of a system malfunction, it is anticipated that the submission and the reason for its failure will be documented by Ministry staff, the client notified of the reason for the failure and the submission will either be resubmitted or purged.

5.9 APPENDIX I: DATA MANIPULATION RULES – DISTURBANCES

Disturbance Events are categorized as 'Managed' or 'Unmanaged'.

A **Managed Disturbance Event** originates from RESULTS. It occurs in an Opening and is reported by the Licensee. It can be either a natural or man-made disturbance. A disturbance event is maintained within RESULTS in the DISTURBANCE_RESULTS table.

An **Unmanaged Disturbance Event** originates from the update process. It can be either a natural or man-made disturbance. It is identified on a as-needed basis by Ministry staff by providing details about the disturbance during the update process.

In VRIMS both Managed and Unmanaged disturbance events are modelled and processed identically.

5.9.1 VRIMS DISTURBANCE EVENT MODEL

A disturbance event is represented in the VRIMS database in the following ways:

- As a record within the DISTURBANCE_EVENT table. This table preserves the historical record of the disturbance with the state at the time of its data capture; and,

- As attribution on the polygon in the VEGETATION_COVER_SPATIAL_OBJECT table which originated the disturbance. This information about the disturbance has the same lifecycle as the VRI polygon and will be retired when the polygon is replaced by new polygons.

In the DISTURBANCE_EVENT table a disturbance event has the same geometry as the VRI polygon which originated the disturbance. Additionally the record contains the following attribution to describe the disturbance event:

- DISTURBANCE_EVENT_ID
- DISTURBANCE_END_YEAR
- DISTURBANCE_START_YEAR
- INTERPRETER
- INTERPRETATION_DATE
- PROJECT_NAME
- REFERENCE_YEAR
- DISTURBANCE_TYPE_CODE
- DATA_CAPTURE_METHOD_CODE

Each record in the DISTURBANCE_EVENTS table has a unique key. The VRI Polygon which originated the Disturbance Event is associated to the disturbance event via this key (using the VEGETATION_COVER_SPATIAL_OBJECT.DISTURBANCE_EVENT_ID field). In addition, other successive VRI polygons may be associated with the disturbance event via this key.

In the VEGETATION_COVER_SPATIAL_OBJECT table a disturbance event is represented by the following fields:

- DISTURBANCE_EVENT_ID
- DISTURBANCE_TYPE_CODE

- DISTURBANCE_START_YEAR
- DISTURBANCE_END_YEAR
- DISTURBANCE_CODE

Each DISTURBANCE_EVENT record has a single originating VRI polygon which carries its ID. There may also be other successive VRI polygons which also carry the disturbance event ID.

For a VRI polygon which is associated with a DISTURBANCE_EVENT record (i.e. by containing its DISTURBANCE_EVENT_ID), all disturbance-related fields must have values identical to the corresponding fields in the DISTURBANCE_EVENTS record.

5.9.2 HANDLING DISTURBANCE EVENTS FROM RESULTS

A RESULTS Opening will be considered to have had a disturbance occur within its opening boundary, if the RSLT_ACTIVITY_TREATMENT_UNIT.DISTURBANCE_CODE IS NOT NULL, when the RSLT_OPENING and the RSLT_ACTIVITY_TREATMENT_UNIT are joined by opening_id. The most recent disturbance will be considered (determined by the ATU_START DATE).

Although the activity treatment unit is captured as a unique shape that may well be different than either the opening boundary, or a forest cover polygon, for the purposes of VRIMS, the disturbance will be generalized over the entire opening. This will ensure that the shape of the VRIMS-RESULTS boundary and the shape of the disturbance are the same.

If it is determined that a disturbance has occurred within any of the forest cover polygons that have gone into making up the VRIMS-RESULTS polygon, then the most recent disturbance will be considered (determined by the DISTURBANCE_START DATE) and its attributes will be applied to the entire VRIMS-RESULTS polygon. This will ensure that the shape of the VRIMS-RESULTS boundary and the shape of the disturbance are the same.

The type of the disturbance is described by the RSLT_ACTIVITY_TREATMENT_UNIT.DISTURBANCE_CODE field. Only the values in {Burnt Wildfire, Flood, Slide, Logged, Pest (beetle), Rehabilitation, Salvage, Windblow} are processed as disturbances in VRIMS. Since RESULTS uses its own set of codes to describe a disturbance, translation between the codes will have to take place.

RESULTS DISTURBANCE CODE	RESULTS DISTURBANCE CODE DESCRIPTION	VRIMS DISTURBANCE TYPE CODE	VRIMS DISTURBANCE TYPE CODE DESCRIPTION
B	BURNT WILDFIRE	NB	WILDFIRE
F	FLOOD	NF	FLOODING
I	SLIDE	NS	SLIDE
L	LOGGED	L	LOGGING
P	PEST (BEETLE)	I	INSECTS
R	REHABILITATION	R	SITE REHABILITATION
S	SALVAGE	L	LOGGING
W	WINDBLOW	NW	WINDTHROW

If a disturbance has occurred, the disturbance information is mapped to the VEGETATION_COVER_SPATIAL_OBJECT as follows:

VEGETATION_COVER_SPATIAL_OBJECT	
DISTURBANCE START YEAR	RSLT_ACTIVITY_TREATMENT_UNIT.DISTURBANCE_CODE.ATU_START_DATE
DISTURBANCE END YEAR	NULL
DISTURBANCE CODE	"DI"
DISTURBANCE TYPE CODE	RSLT_ACTIVITY_TREATMENT_UNIT.DISTURBANCE_CODE

Note: All VRI polygons generated from RESULTS will have an inventory_standard of 'I'.

SUBSEQUENT IDENTICAL OPENING SUBMISSIONS – DISTURBANCES

When a RESULTS disturbance has been identified for an Opening, the most recent disturbance will be generalized across the entire Opening.

However, if a licensee submits the Opening again, the application that determines whether or not a disturbance exists, has no knowledge of any previous disturbances within the VRIMS database that may already exist.

During the Integration Process, no checks will be carried out to discover if an identical Disturbance Event has exists for RESULTS submission.

5.9.3 HANDLING DISTURBANCE EVENTS DURING CONVERSION

DISTURBANCE_EVENT records will be created for **each** disturbance history record associated with a disturbed VEG_VEGETATION_COVER_POLYGON. For each record the disturbance geometry is the polygon geometry, and the attribution is taken from one of the associated disturbance history records.

disturbance events are only originated by VEG_VEGETATION_COVER_POLYGONS that have at least one RESOURCE_INVENTORY_HISTORY record with a SILV_BASE of 'DI' and a DAMAGE_AGENT_CD in { 'A', 'B', 'BE', 'BG', 'BR', 'BW', 'D', 'F', 'I', 'K', 'L', 'N', 'R', 'S', 'T', 'U', 'V', 'W'}.

VEGETATION_COVER_SPATIAL_OBJECT	
DISTURBANCE START YEAR	RESOURCE_INVENTORY_HISTORY.ACTIVITY START DATE
DISTURBANCE END YEAR	RESOURCE_INVENTORY_HISTORY.ACTIVITY END DATE
INTERPRETER	VEG_VEGETATION_COVER_POLYGON.INTERPRETER
INTERPRETATION DATE	VEG_VEGETATION_COVER_POLYGON.INTERPRETATION_DATE
PROJECT NAME	VEG_VEGETATION_COVER_POLYGON.PROJECT
REFERENCE YEAR	VEG_VEGETATION_COVER_POLYGON.DATE_OF_PHOTOGRAPHY
DISTURBANCE CODE	RESOURCE_INVENTORY_HISTORY.SILV BASE
DISTURBANCE TYPE CODE *	RESOURCE_INVENTORY_HISTORY.SILV_TECHNIQUE
DISTURBANCE SUB TYPE CODE **	RESOURCE_INVENTORY_HISTORY.DAMAGE_AGENT_CD
DATA CAPTURE METHOD CODE	VEG_VEGETATION_COVER_POLYGON.MD_CAPTURE_METHOD_CD

** Codes for this table come from the FIP Relational Data Dictionary version 2.0 page 1 (Activity_CD).*

*** Codes for this table come from the FIP Relational Data Dictionary version 2.0 pages 3 – 6 (Activity_Sub_CD) which I am providing as an attachment.*

5.9.4 HANDLING DISTURBANCE EVENTS DURING UPDATE

Selection/Extraction Process
When polygons are extracted from the VRID, the attributes extracted to the PGBD include the disturbance event attributes.

For polygons that have been indicated as disturbed the extracted polygon has a non-null DISTURBANCE_EVENT_ID and DISTURBANCE_TYPE_CODE. For polygons that are not disturbed the extracted polygon has a null DISTURBANCE_EVENT_ID and DISTURBANCE_TYPE_CODE.

Update Process
There are five use cases for managing disturbance information during an update.

A. An existing polygon is not disturbed, and is not updated or replaced with a disturbance.

B. An existing polygon is disturbed, and there is no change to the type of disturbance.

C. An existing polygon is disturbed, and there is a change to the type of disturbance.

D. A new polygon is indicated as having a new disturbance.

E. A new polygon is indicated as being disturbed by an existing disturbance. (This can happen when an existing polygon is divided into two or more new impacting polygons, and the existing disturbance information is desired to be maintained on one or more of the new polygons.)

In use case A, there is no change to the disturbance event information. The DISTURBANCE_EVENT_ID and DISTURBANCE_TYPE_CODE remain null. *This state indicates that there is no new disturbance to be processed*.

- DISTURBANCE_EVENT_ID is null
- DISTURBANCE_TYPE_CODE is null

In use case B, there is no change to the disturbance event information. The DISTURBANCE_EVENT_ID and DISTURBANCE_TYPE_CODE remain unchanged. *This state indicates that there is no new disturbance to be processed*.

- DISTURBANCE_EVENT_ID is not null
- DISTURBANCE_TYPE_CODE is not null

In use case C, when the disturbance type is changed this is considered to be a new disturbance event. The change causes the current DISTURBANCE_EVENT_ID to be set to null. The DISTURBANCE_TYPE_CODE is set to the new value of the disturbance type. *This state indicates that there is a new disturbance to be processed*.

- DISTURBANCE_EVENT_ID is null
- DISTURBANCE_TYPE_CODE is not null

In use case D the DISTURBANCE_EVENT_ID of the new polygon is null and the DISTURBANCE_TYPE_CODE is set to the value of the new disturbance type. *This state indicates that there is a new disturbance to be processed*.

- DISTURBANCE_EVENT_ID is null
- DISTURBANCE_TYPE_CODE is not null

In use case E the DISTURBANCE_EVENT_ID is non-null and the DISTURBANCE_TYPE_CODE is non-null. The DISTURBANCE_EVENT_ID and the DISTURBANCE_TYPE_CODE should preserve the original values (although this will not be checked by the system). *This state indicates that there is no new disturbance to be processed*.

- DISTURBANCE_EVENT_ID is not null
- DISTURBANCE_TYPE_CODE is not null

The following table summarizes the allowable states for the disturbance fields resulting from an update, and the disturbance processing performed during integration.

DISTURBANCE_EVENT_ID	DISTURBANCE_TYPE_CODE	ACTION
Null	Null	No Disturbance; no action
Null	Not Null	New Disturbance; create new disturbance event
Not Null	Null	Not allowed
Not Null	Not Null	Existing Disturbance; no action

5.9.5 HANDLING DISTURBANCE EVENTS DURING INTEGRATION

When a polygon is integrated (i.e. after it is returned to the Staging Area and is in a valid state to be accepted to be cut-in), it is assessed to determine if it should be processed as a new disturbance. A polygon is a new disturbance if the following conditions are present;

- DISTURBANCE_EVENT_ID is null
- DISTURBANCE_TYPE_CODE is not null

When a polygon is processed as a new disturbance the following events take place.

- A new DISTURBANCE_EVENT record is created in the DISTURBANCE_EVENT table. The record is assigned a unique DISTURBANCE_EVENT_ID. The id is set as the value of the DISTURBANCE_EVENT_ID field in the originating VEGETATION_COVER_SPATIAL_OBJECT record.

- The following information is copied from the originating VEGETATION_COVER_SPATIAL_OBJECT to the new DISTURBANCE_EVENTS record.

VEGETATION_COVER_SPATIAL_OBJECT	DISTURBANCE_EVENTS

	DISTURBANCE EVENT ID
DISTURBANCE START YEAR	DISTURBANCE START YEAR
DISTURBANCE END YEAR	DISTURBANCE END YEAR
INTERPRETER	INTERPRETER
INTERPRETATION DATE	INTERPRETATION DATE
PROJECT NAME	PROJECT NAME
REFERENCE YEAR	REFERENCE YEAR
DISTURBANCE TYPE CODE	DISTURBANCE TYPE CODE
DATA CAPTURE METHOD CODE	DATA CAPTURE METHOD CODE
GEOMETRY	GEOMETRY

5.9.6 DISTURBANCE EVENT CALCULATOR

The Disturbance Event Calculator is used to determine if a new VEGETATION_COVER_SPATIAL_OBJECT polygon is affected by an existing disturbance. This information is used in VDYP during the Adjustment Process.
During the integration process all undisturbed VRI polygons (i.e. that have null values for DISTURBANCE_EVENT_ID and DISTURBANCE_TYPE_CODE) are processed by the Disturbance Event Calculator.

A VRI polygon is considered as being affected by an existing disturbance if there is an overlap between the VRI polygon and a polygon in the DISTURBANCE_EVENT table.

If it is determined that a VRI polygon is affected by an existing disturbance, then the DISTURBANCE_CODE of the VEGETATION_COVER_SPATIAL_OBJECT is set to 'DI'. Note that the DISTURBANCE_EVENT_ID in the polygon is not set to the id of disturbance event.

5.10 APPENDIX I: INTEGRATION RULES

1. Integration will occur by submission date in ascending order (i.e. oldest submission date to newest submission date).

2. For each polygon in the Disturbance:

   2.1. Overlay the Disturbance polygon onto the current Vegetation Cover and determine all of the Vegetation Cover polygons (VEGETATION COVER SPATIAL OBJECT) that intersect with the Disturbance polygon.

   2.2. If any of the intersected Vegetation Cover polygons is non-modifiable, modify the Disturbance polygon so that the Disturbance polygon no longer intersects the non-modifiable Vegetation Cover polygon. The two polygons will now share a common boundary.

   A Vegetation Cover polygon is considered non-modifiable if the VEGETATION COVER POLYGON RAW.NON PRODUCTION DESCRIPTION CODE is any of **LA, RI, RE, RZ,** or **SW** (Lake, River/Stream, Reservoir, Road Surface, Salt Water) or one of the polygon's NON VEGETATIVE COVER RAW records has a NON VEG COVER PCT >= 70 and a NON VEG COVER TYPE of **LA, RI, RE, RZ,** or **OC** (Lake, River/Stream, Reservoir, Road Surface, Ocean).

   2.3. Remove each of the Vegetation Cover polygons that are non-modifiable from the list of intersected Vegetation Cover polygons.

   2.4. For each of the remaining intersected Vegetation Cover polygons, process as follows:

      2.4.1. If the Vegetation Cover polygon is completely contained within the Disturbance polygon, expire the Vegetation Cover polygon and associated Collected and Adjusted entity entries.

      2.4.2. If the Vegetation Cover polygon is not completely contained within the Disturbance polygon, modify the boundary of the Vegetation Cover polygon, so the Vegetation Cover polygon no longer intersects the Disturbance polygon. The two polygons will now share a common boundary.

         2.4.2.1. If the modified Vegetation Cover polygon results in two or more polygons (i.e. the Disturbance polygon split the Collected Vegetation Cover polygon in two or more pieces):

            2.4.2.1.1. Create a new Vegetation Cover polygon for each resulting polygon.

            2.4.2.1.2. To the largest of the newly created Vegetation Cover polygons, create a new polygon name for the Vegetation Cover polygon. For the remaining newly created Vegetation Cover polygons, create a new polygon name for each polygon.

            2.4.2.1.3. For each of the newly created Vegetation Cover polygons, the attributes for the polygons' associated Collected and Adjusted entity

entries will be inherited from the parent Vegetation Cover polygon.

2.4.2.1.4. Expire the parent Vegetation Cover polygon and its associated Collected and Adjusted entity entries.

2.4.2.2. Calculate the area of the new/modified polygon(s) and assign each polygon a new GUID.

2.5. For each of new/modified Vegetation Cover polygons from Step **2.4**, if the area of the Vegetation Cover polygon is greater than or equal to the sliver threshold go to step **2.7**. The sliver threshold is measured in ha and determines the minimum size for a polygon so that it is not considered a sliver. The sliver threshold must be a configurable variable of the system. Current consensus is to set the sliver threshold to 1 ha.

2.6. For all Vegetation Cover polygons less than the sliver threshold (these polygons will now be referred to as slivers), attempt to dissolve the sliver.

2.6.1. Processing of the slivers will occur by sliver area in ascending order (i.e. smallest sliver area to largest sliver area).

2.6.2. Find all Vegetation Cover polygons that are adjacent (i.e. share a common boundary) to the sliver, except for Vegetation Cover polygons that are non-modifiable.

2.6.2.1. If there are no adjacent Vegetation Cover polygons and the sliver is not fully surrounded by the Disturbance polygon:

2.6.2.1.1. Modify the spatial component of the Disturbance polygon to include the sliver.

2.6.2.1.2. Expire the sliver's Vegetation Cover polygon and its associated Collected and Adjusted entity entries.

2.6.2.2. If there are no adjacent Vegetation Cover polygons and the sliver is fully surrounded by the Disturbance polygon, then do nothing. Leave the sliver in the Vegetation Cover.

2.6.2.3. If there is 1 adjacent Vegetation Cover polygon:

2.6.2.3.1. Modify the spatial component of the adjacent Vegetation Cover Polygon to include the sliver.

2.6.2.3.2. Recalculate the area of the adjacent Vegetation Cover polygon.

2.6.2.3.3. Assign a new GUID to the adjacent Vegetation Cover polygon.

2.6.2.3.4. If the adjacent Vegetation Cover polygon is itself a sliver, but adding the two slivers together has resulted in the polygon exceeding the sliver threshold, then remove the adjacent Vegetation Cover polygon from the sliver list.

2.6.2.3.5. Expire the sliver's Vegetation Cover polygon and its associated Collected and Adjusted entity entries.

2.6.2.4. If there are 2 or more adjacent Vegetation Cover polygons, then create a weighting for each of the adjacent polygons (see the **Weighting Rules** below).

2.6.2.5. Pick one adjacent Vegetation Cover polygon to dissolve the sliver into. The adjacent Vegetation Cover polygon with the largest weighting will be the one that is picked. If two or more Vegetation Cover polygons have the same largest weighting, the Vegetation Cover polygon with the largest area will be picked. If two or more Vegetation Cover polygons have the same largest area, the Vegetation Cover polygon with the smallest Polygon Identifier will be picked. Modify the spatial component of the picked adjacent Vegetation Cover polygon to contain the sliver. Expire the sliver's Vegetation Cover polygon and its associated Collected and Adjusted entity entries. Flag the modified Vegetation Cover polygon as requiring manual review. The manual review is required because dissolving the sliver may have resulted in a "finger".

2.7. Create a Vegetation Cover polygon from the information of the Disturbance polygon.

2.8. Create Collected and Adjusted entity entries for the new Vegetation Cover polygon. Refer to several of the appendixes for mappings for RESULTS and Disturbance Events. The Adjusted entities will be a mirror image of the Collected entities with the exception of the entities and attributes that do not exist in the Collected data. These attributes that will be set to NULL.

Update the Disturbance record to indicate the Disturbance has been processed.

WEIGHTING RULES

1. Compare Species 1 (TREE SPECIES RAW.SPECIES CD where FOR COVER RANK CD = 1 and SPECIES ID = 1) for the sliver and the adjacent polygon. Assign 2 points for a match on Species 1; otherwise assign 0 points.

2. Compare Species 2 (TREE SPECIES RAW.SPECIES CD where FOR COVER RANK CD = 1 and SPECIES ID = 2) for the sliver and the adjacent polygon. Assign 2 points for a match on Species 2; otherwise assign 0 points.

3. Compare the Age Class (using the table below convert TREE SPECIES RAW.AGE where FOR COVER RANK CD = 1 AND SPECIES ID = 1 to Age Class) of the sliver and the adjacent polygon. Assign 1 point for an exact match on Age Class, assign 0.5 points if the Age Classes differ by 1, and assign 0 points if the Age Classes differ by more than 1.

AGE CLASS	LOWER LIMIT (YEARS)	UPPER LIMIT (YEARS)
1	1	20
2	21	40
3	41	60
4	61	80
5	81	100

6	101	120
7	121	140
8	141	250
9	251 +	

4. Compare the Height Class (using the table below convert TREE SPECIES RAW.HEIGHT where FOR COVER RANK CD = 1 AND SPECIES ID = 1 to Height Class) of the sliver and the adjacent polygon. Assign 3 points for an exact match on Height Class, assign 0.5 points if the Height Classes differ by 1, and assign 0 points if the Height Classes differ by more than 1.

HEIGHT CLASS	LOWER LIMIT (M)	UPPER LIMIT (M)
1	0	10.4
2	10.5	19.4
3	19.5	28.4
4	28.5	37.4
5	37.5	46.4
6	46.5	55.4
7	55.5	64.4
8	64.5 +	

5. Compare the Crown Closure Class (using the table below convert TREE COVER LAYER RAW.CROWN CLOSURE where FOR COVER RANK CD = 1 AND SPECIES ID = 1 to Crown Closure Class) of the sliver and adjacent polygon. Assign 1 point for an exact match on Crown Closure Class, assign 0.5 points if the Crown Closure Classes differ by 1, and assign 0 points if the Crown Closure Classes differ by more than 1.

CROWN CLOSURE CLASS	LOWER LIMIT (%)	UPPER LIMIT (%)
1	0	5
2	6	15
3	16	25
4	26	35
5	36	45
6	46	55
7	56	65
8	66	75
9	76	85
10	86	95
11	96	100

6. Compare Estimated Site Index (TREE COVER LAYER RAW.EST SITE INDEX where FOR COVER RANK CD = 1) of the sliver and adjacent polygon. Assign 1 point for an exact match on Estimated Site Index, and assign 0 points if the Estimated Site Indices differ.

   Sum up all the assigned points. This is the weighting for the adjacent polygon.

5.11 APPENDIX J: SECURITY SPECIFICATIONS

This section defines the roles which interact with the VRID system. Roles are used to categorize and control interaction with system resources and facilities. Roles can apply to both human and machine actors (e.g. services), although typically each role applies specifically to one or the other.

The roles are currently presented at a high level of granularity, for maximum precision. In the final system design some roles may be coalesced to reduce implementation and management complexity. It is also understood that Security Roles should be based on operational roles. However, at this time those operational roles are not well known.

5.12 APPENDIX K: EDIT SECURITY ROLES

5.12.1 VRI EDIT ROLE

- Can submit data from a VRI Edit exercise.

5.12.2 ADJUSTMENT EDIT ROLE

- Can submit data from an Adjustment exercise.

5.12.3 RE-INVENTORY EDIT ROLE

- Can submit data from a Re-Inventory exercise.

5.13 APPENDIX L: AUDIT SECURITY ROLES

5.13.1 VRI EDIT AUDIT ROLE

- Has access to the Audit Tool.
- Has access to the Management Tool.
- Can accept or reject VRI Edit transactions.

5.13.2 ADJUSTMENT AUDIT ROLE

- Has access to the Audit Tool.
- Has access to the Management Tool.
- Can accept or reject Adjustment transactions.

5.13.3 RE-INVENTORY AUDIT ROLE

- Has access to the Audit Tool.
- Has access to the Management Tool.
- Can accept or reject Re-Inventory transactions.

5.13.4 AUDIT ROLE

- Has access to the Audit Tool.
- Has access to the Management Tool.
- Accepts or Rejects any transactions.
- Can start the Auditing Process.
- Can start the Integration Process.

5.14 APPENDIX M: SYSTEM MANAGEMENT SECURITY ROLES

5.14.1 EDIT ROLE

5.14.2 EXTRACTION ROLE

- Can start the Selection / Extraction Process.
- Can start the GML Generation Process.

5.14.3 INTEGRATION ROLE

- Has access to Management Tool.
- Can start and stop the Integration Process.

5.14.4 PROJECTION ROLE

- Has access to Management Tool.
- Can define sets to be processed.
- Can start and stop the Projection Process.

5.14.5 VIEWER ROLE

- Can view the business level data sources within the Vegetation Resource Inventory Database; i.e. Assessment Layer Spatial View, Estimated Business Area.

5.14.6 LRDW REPLICATION ROLE

- Has access to the Management Tool.
- Can start and stop the LRDW Replication Process.

5.14.7 SERVICE ROLE

The role that all service processes will use to access required data and system resources.

6. DOCUMENT SIGN-OFF

The undersigned have read and agree with the content of this document.
The Detailed Design Document has been reviewed and approved by:

<Name> <Title> <Client>	Date
<Name> <Title> <Client>	Date