Revelstoke District and Mount Revelstoke National Park Predictive Ecosystem Modelling Input Data Quality Report

Prepared for:

**MINISTRY OF ENVIRONMENT,
KAMLOOPS, BC**

Prepared by:

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Salmon Arm B.C.

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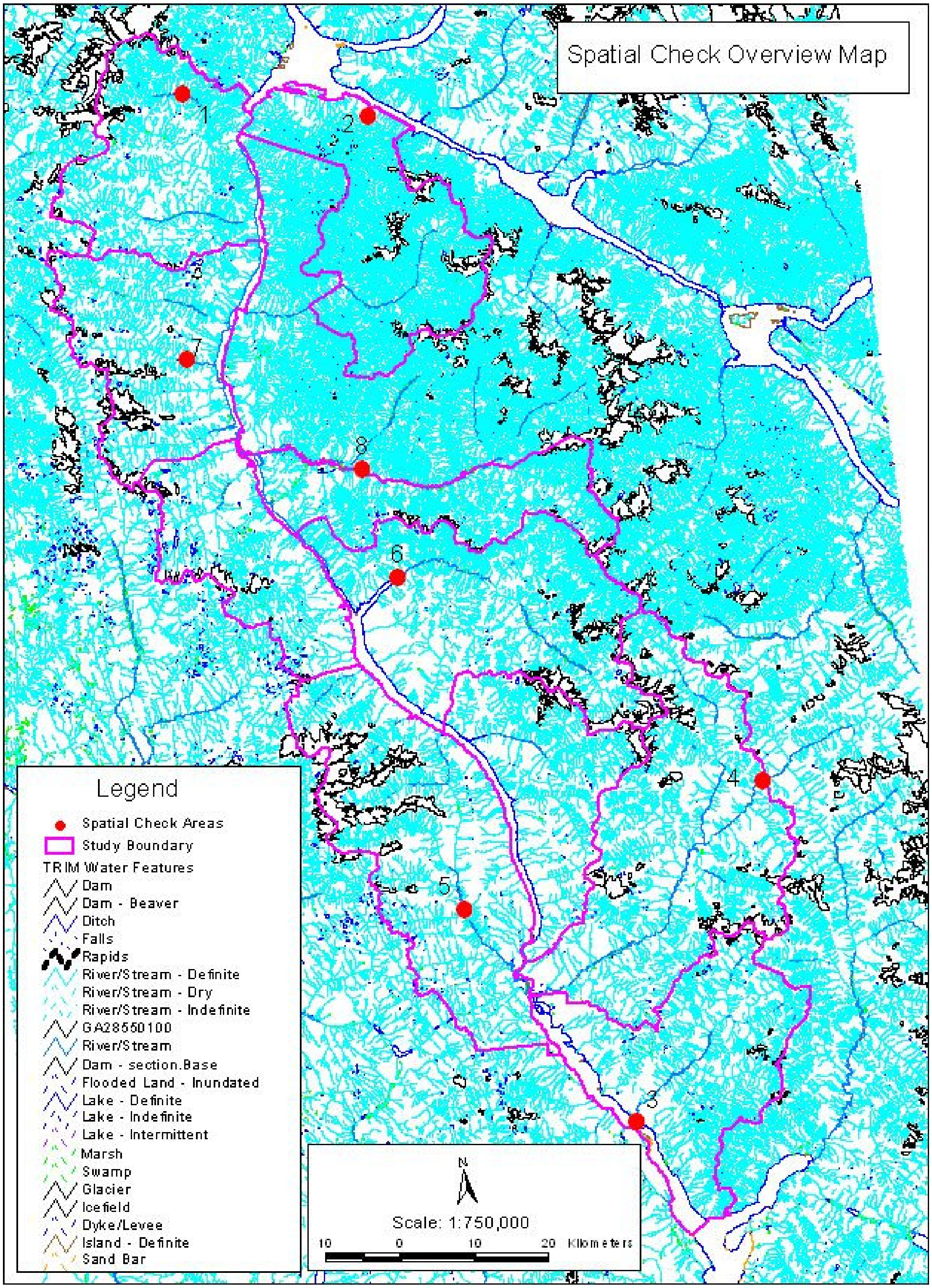
IDQ General Information

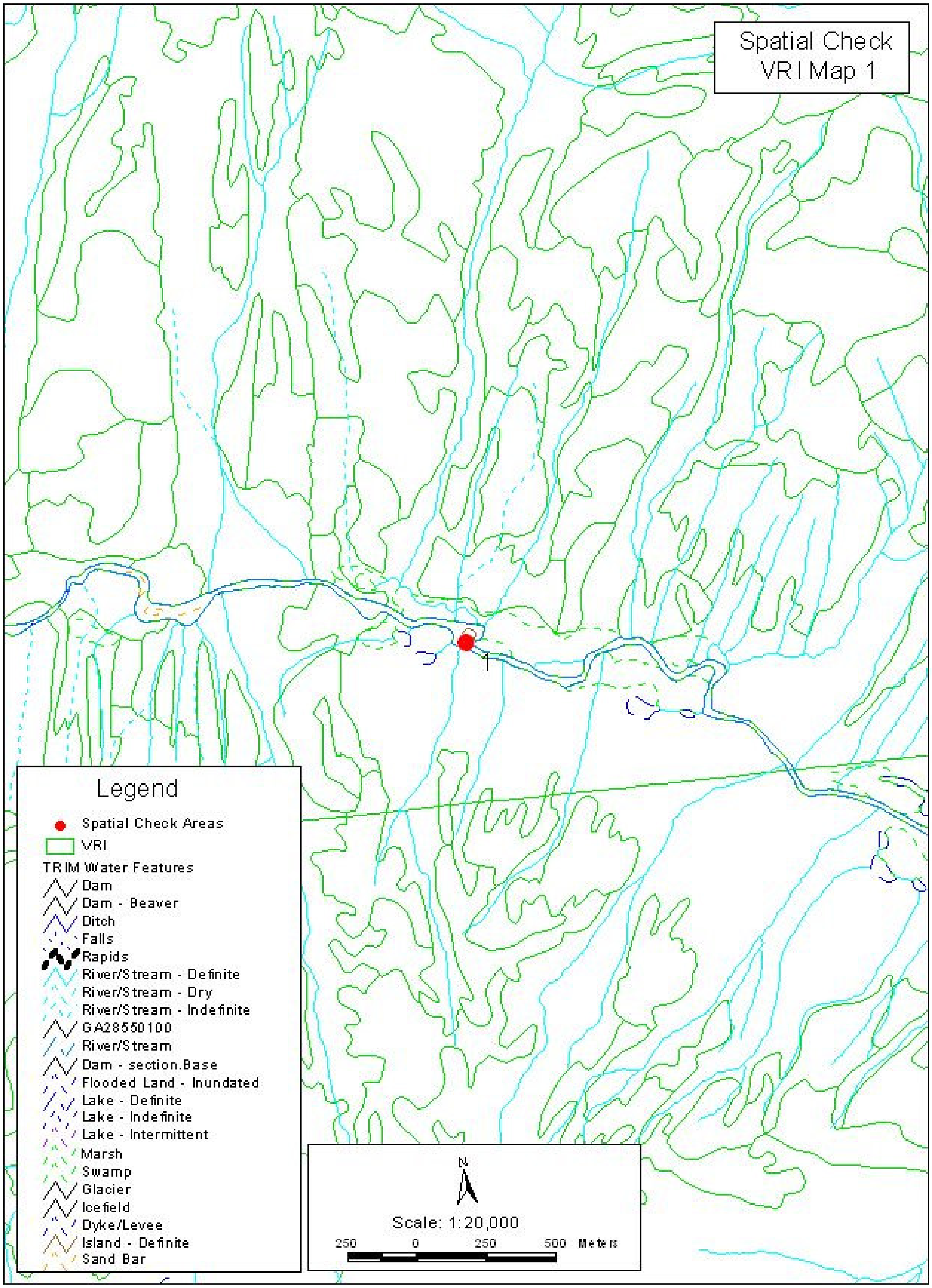
Input Data Quality Report – General Project Information	
1.0 Objectives:	The objectives of this project were to provide accurate Predictive Ecosystem Modelling (PEM) in the former Revelstoke Forest District. This analysis would use many existing inventory GIS data sets, as well as creation of new data to support PEM analysis. The methodology used is the Ecoprep/Ecogen methodology originally developed by the British Columbia MOF research branch. The methodology has been further revised to the Silvatech/MAL version of Ecoprep analysis.
2.0 **Area of Interest:**	The area of interest is located in the old Revelstoke Forest District
2.1 Mapsheets:	082K.061 082K.071 082K.081 082K.082 082K.091 082K.092 082L.080 082L.090 082L.098 082L.099 082L.100 082M.008 082M.009 082M.010 082M.018 082M.019 082M.020 082M.028 082M.029 082M.030 082M.037 082M.038 082M.039 082M.040 082M.047 082M.048 082M.049 082M.050 082M.056 082M.057 082M.058 082M.059 082M.060 082M.066 082M.067 082M.068 082M.069 082M.070 082M.076 082M.077 082M.078 082M.079 082M.080 082M.086 082M.087 082M.088 082M.089 082M.090 082M.096 082M.097 082M.098 082M.099 082M.100 082N.001 082N.002 082N.011 082N.012 082N.021 082N.022 082N.031 082N.032 082N.041 082N.051 082N.061 083D.006 083D.007 083D.008 083D.009 083D.016 083D.017 083D.018
2.2 Analysis or Landscape Units:	For the purpose of GIS analysis the area of interest was split into 10 analysis units. These analysis units, very closely, follow the existing Landscape unit boundaries. **NE (amalgamation of LU's R6 & R18)**: 082M.078 082M.079 082M.080 082M.088 082M.089 082M.090 082M.098 082M.099 082M.100 083D.008 083D.009 083D.018 **R10**: 082M.009 082M.010 082M.019 082M.020 082M.029 082M.030 082M.039 082M.040 082N.021 **R14**: 082M.038 082M.047 082M.048 082M.056 082M.057 082M.058 082M.066 082M.067 **R15**: 082M.066 082M.067 082M.076 082M.077 082M.086 082M.087 082M.088 082M.096 082M.097 082M.098 **R16**: 082M.087 082M.096 082M.097 082M.098 083D.006 083D.007 083D.008 083D.016 083D.017 083D.018 **R19**: 082M.057 082M.058 082M.059 082M.060 082M.067 082M.068 082M.069 082M.070 082N.051 082N.061 **R20**: 082K.091 082L.099 082L.100 082M.009 082M.010 082M.020 082M.030 082N.001 082N.002 082N.011 082N.012 082N.021 082N.022 082N.031 082N.032 082N.041 **R3**: 082K.061 082K.071 082K.081 082K.082 082K.091 082K.092 082L.080 082L.090 082L.099 082L.100 082N.001 082N.002 **R9 & 12**: 082M.030 082M.038 082M.039 082M.040 082M.048 082M.049 082M.050 082M.058 082M.059 082M.060 082N.021 082N.031 082N.041 082N.051 **West (amalgamation of LU's R7, R8, R11)**: 082L.098 082L.099 082L.100 082M.008 082M.009 082M.010 082M.018 082M.019 082M.020 082M.028 082M.029 082M.037 082M.038 082M.039 082M.048
3.0 Input Data Assessment and Compilation	All GIS data was checked according to PEM standards. Positional accuracy was assessed for each PEM input in relation to TRIM data and TRIM orthophotos. Data assessment accuracy's can also be found in appropriate Metadata included with project deliverables. The following GIS data was available for PEM analysis.

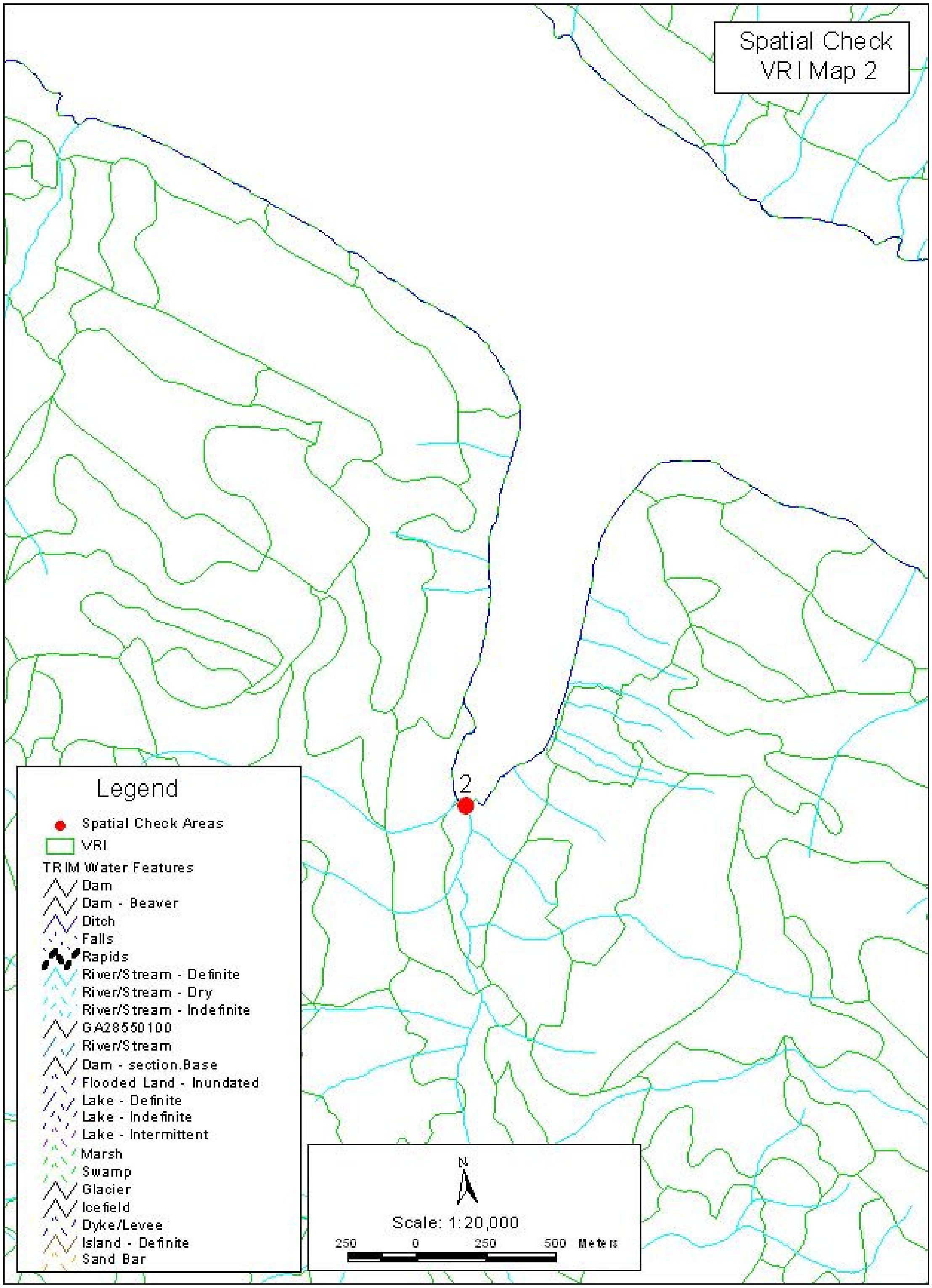
3.1 Standard Input Data	TRIM 2: RIC standard Terrain resource inventory mapping. VRI: Vegetation resource information. Some newly collected VRI and other VRI mapsheets rolled over from existing forest cover to a VRI standard. 1953 to 2004 Biogeoclimatic: 1: 100,000 Biogeoclimatic regions of area Geology: Geology information compiled from various studies by the British Columbia Ministry of Energy and Mines
3.2 Non-Standard Input Data	Satellite:

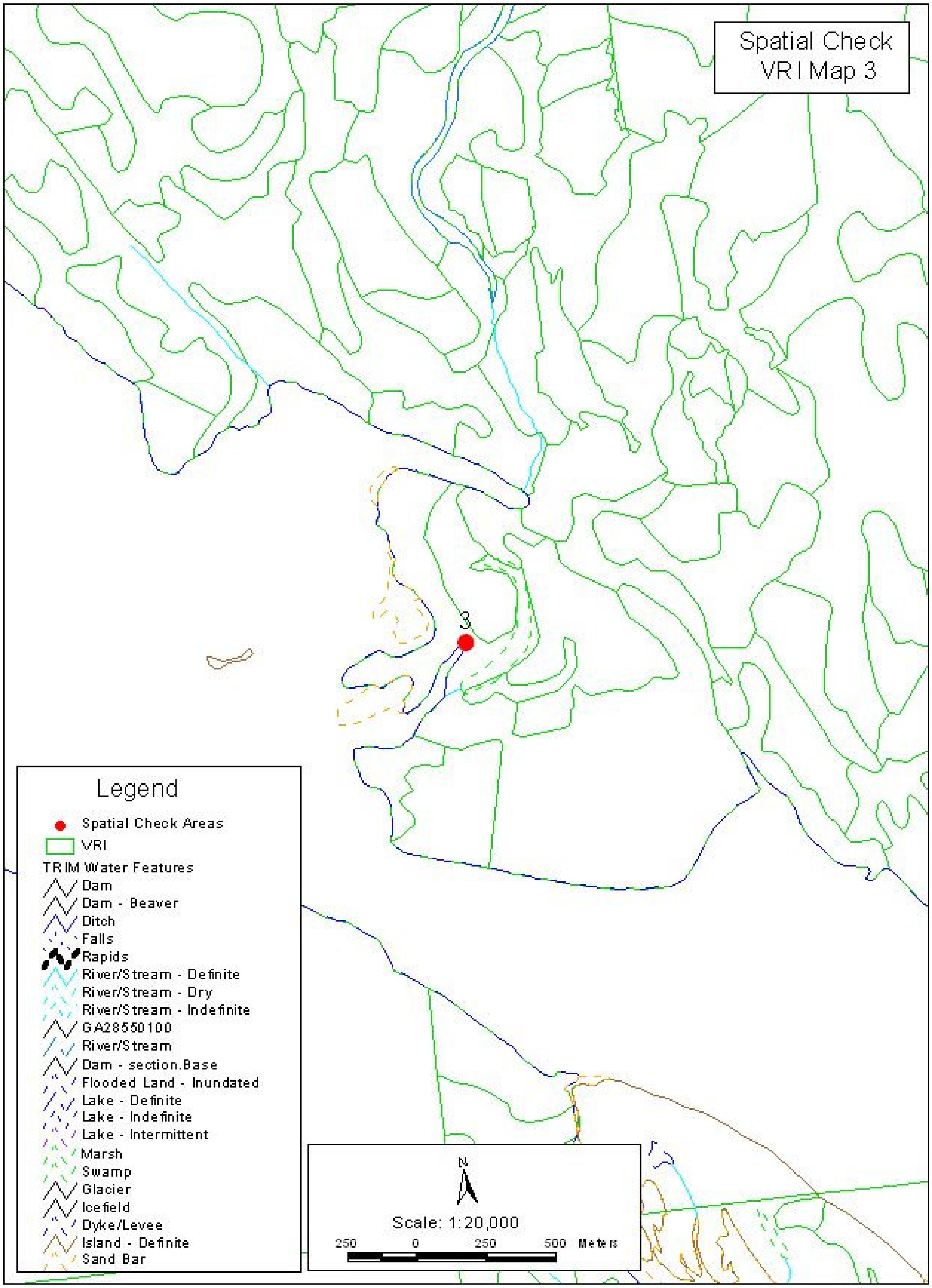

Spatial Check Overview Map
1
2
3
4
5
6
7
8
Legend
Spatial Check Areas
Study Boundary
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:750,000
10 0 10 20 Kilometers

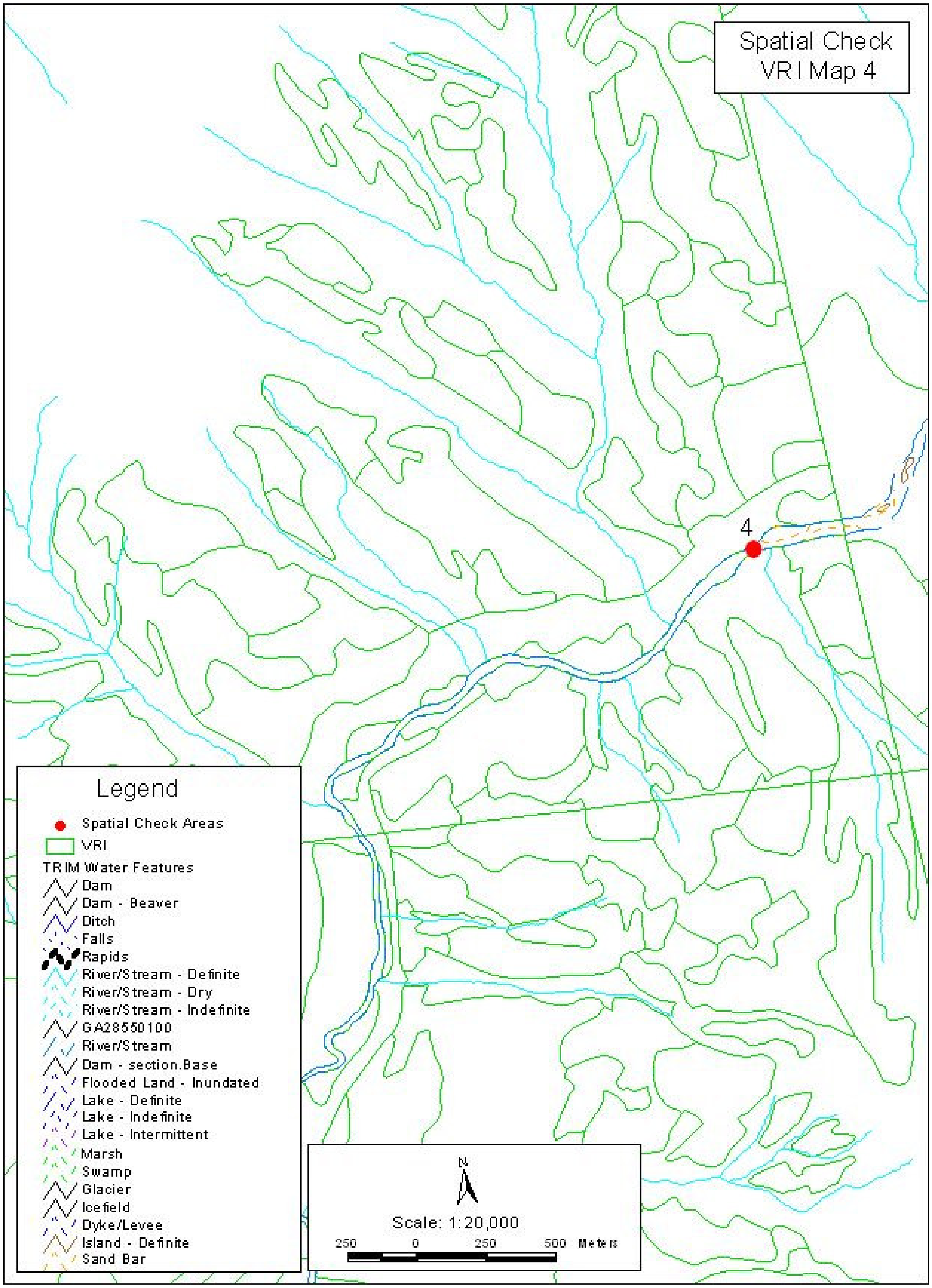
Input Data Quality Report – Standard Input Assessment – VRI	
Data Capture	
Compiling Agency:	Ministry of Forests
Compilation scale:	1:20,000
Period of content:	1953 to 2004 *(When the data was gathered)*
Period of compilation:	1953 to 2004 *(When the data was analysed or compiled)*
Delineation Method and Criteria:	VRI roll over from FC standards or VRI RIC data capture standards
Sampling Design:	VRI roll over from FC standards or VRI RIC data capture standards
Sampling Method:	VRI roll over from FC standards or VRI RIC data capture standards
Sampling Frequency:	VRI roll over from FC standards or VRI RIC data capture standards
Attribution:	VRI roll over from FC standards or VRI RIC data capture standards
Quality Assurance	
Validation Method:	Not Applicable VRI RIC data capture standards
Validation Criteria:	Not Applicable VRI RIC data capture standards
Validation Design:	Not Applicable VRI RIC data capture standards
Validation Results:	Not Applicable VRI RIC data capture standards
Quality Control	
Correlation Procedures:	Not Applicable
Map Production:	Not Applicable
Edge Matching:	Not Applicable (information was matched as is)
Line Edit:	Not Applicable
Symbol Edit:	Not Applicable
Attribute Edit:	Not Applicable
Legend Edit:	Not Applicable
Spatial Quality Control	
Edge Matching:	Coverage's were joined together and matched as best as possible. There were very few slivers were created during the append. A clean using a fuzzy tolerance of .3 removed all the slivers
Edge Matching Error:	Information was matched as is
Attribute/Label Matching:	Assessed the general attribute by looking at certain non-productive features and species. Other VRI content is impossible to check in the digital environment and will be generally assessed for content when the ecologist assesses ground sample sites in relation to forest cover.
Raster Size:	Not Applicable
Spatial Reconciliation:	Forest cover matched well with underlying TRIM, however in some areas it appears new harvest openings have been placed digitally using inaccurate hand drawn information. This only occurs in some new openings and the issue was not corrected. VRI data varied in date and format (VRI, Roll over FC) for the area of interest. Shift in forest cover was lower for recently collected VRI and greater for forest cover that had been rolled over to VRI. When assessing shifts they were deemed acceptable for use in PEM. It should be noted that new VRI is better than, older forest cover in content and general positional accuracy. The age of the forest cover also affects the number of polygons that were collected for the mapsheet, with greater stratification for more recent VRI. Spatial Check Table:

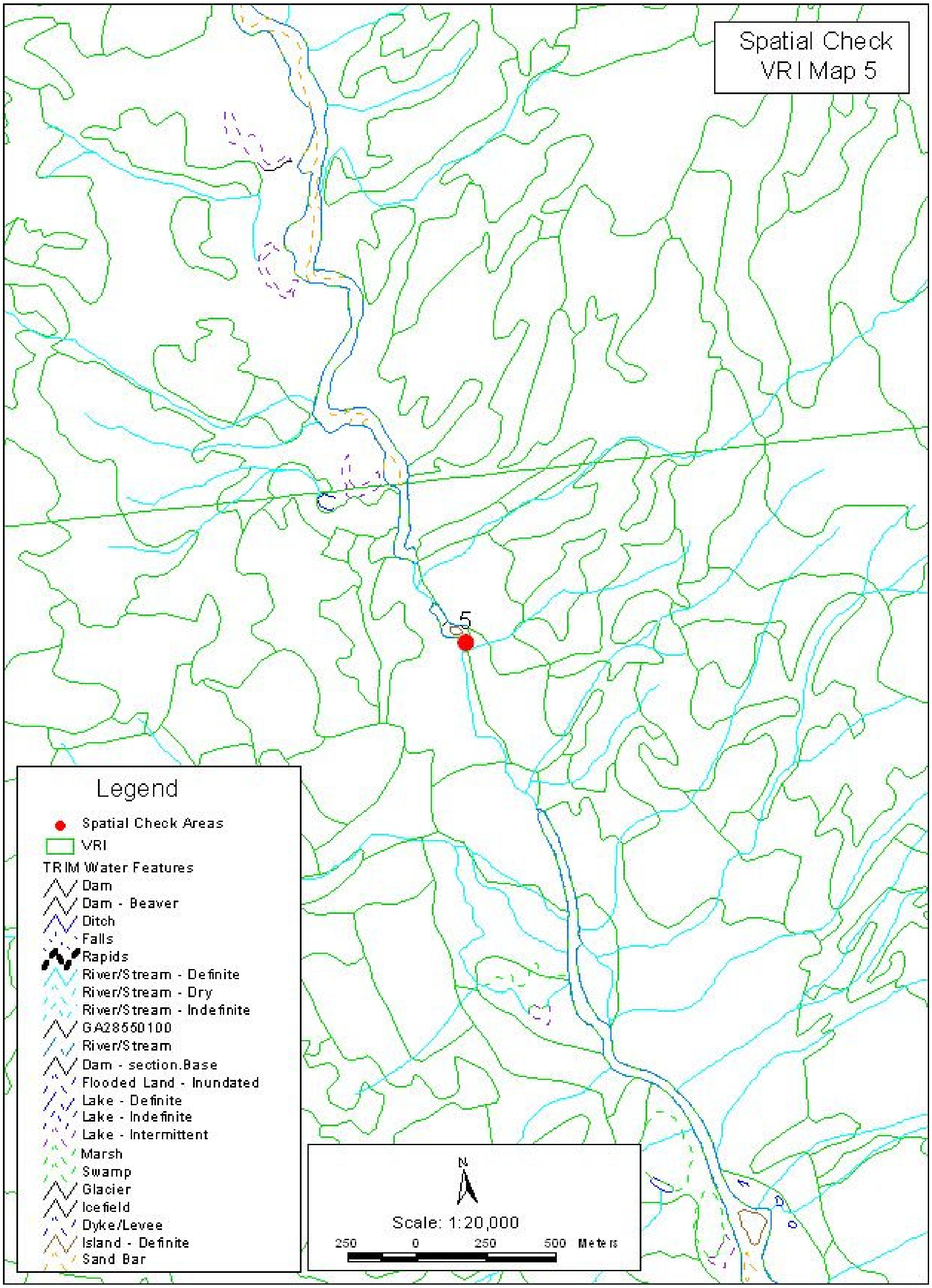
Feature Type	Count or Average Length (m)	Min Shift (m)	Average Shift (m)	Maximum Shift (m)
Polygon	8	0	4.6	30

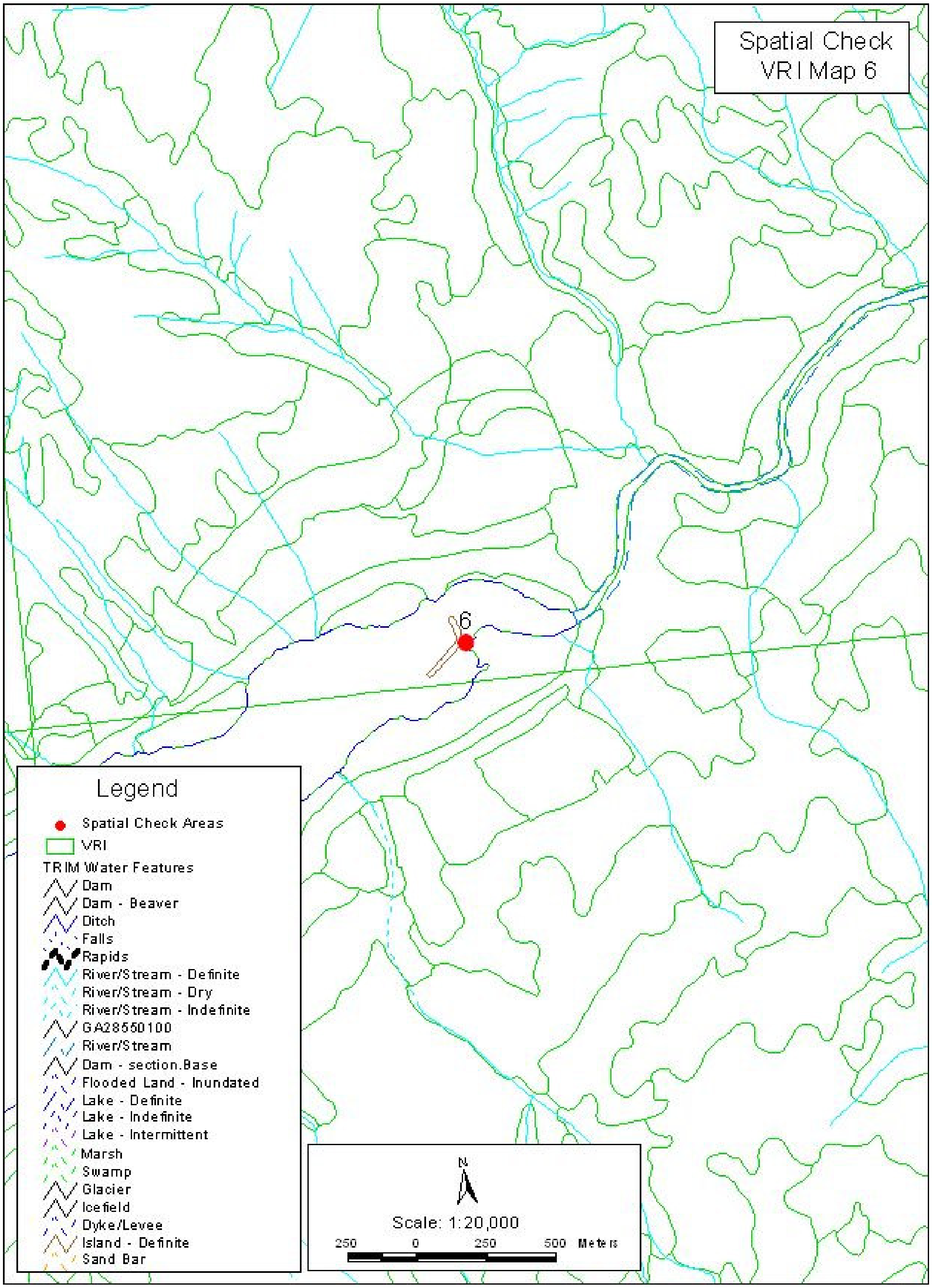

Spatial Check
VRI Map 1
1
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

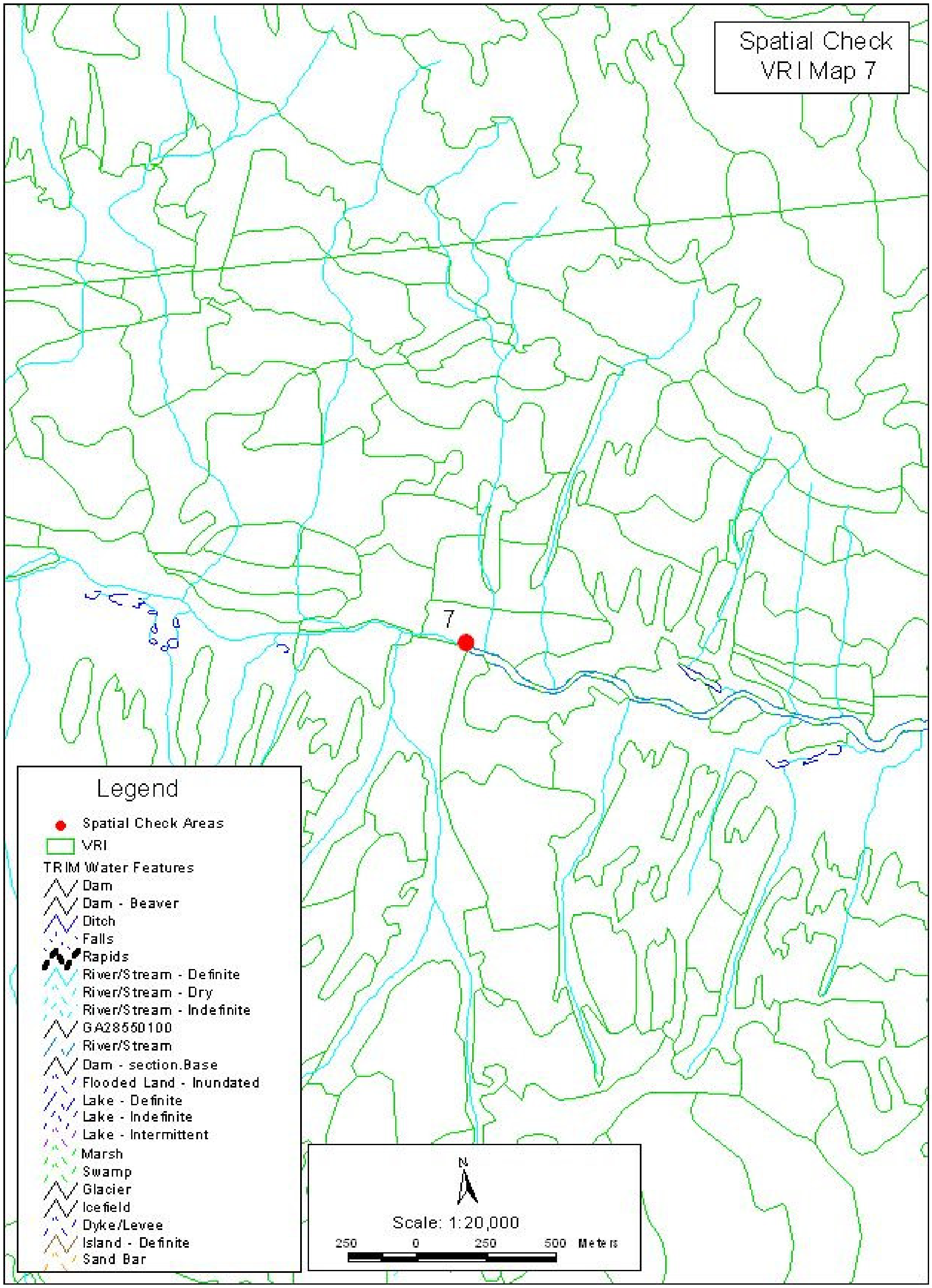

Spatial Check
VRI Map 2
2
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

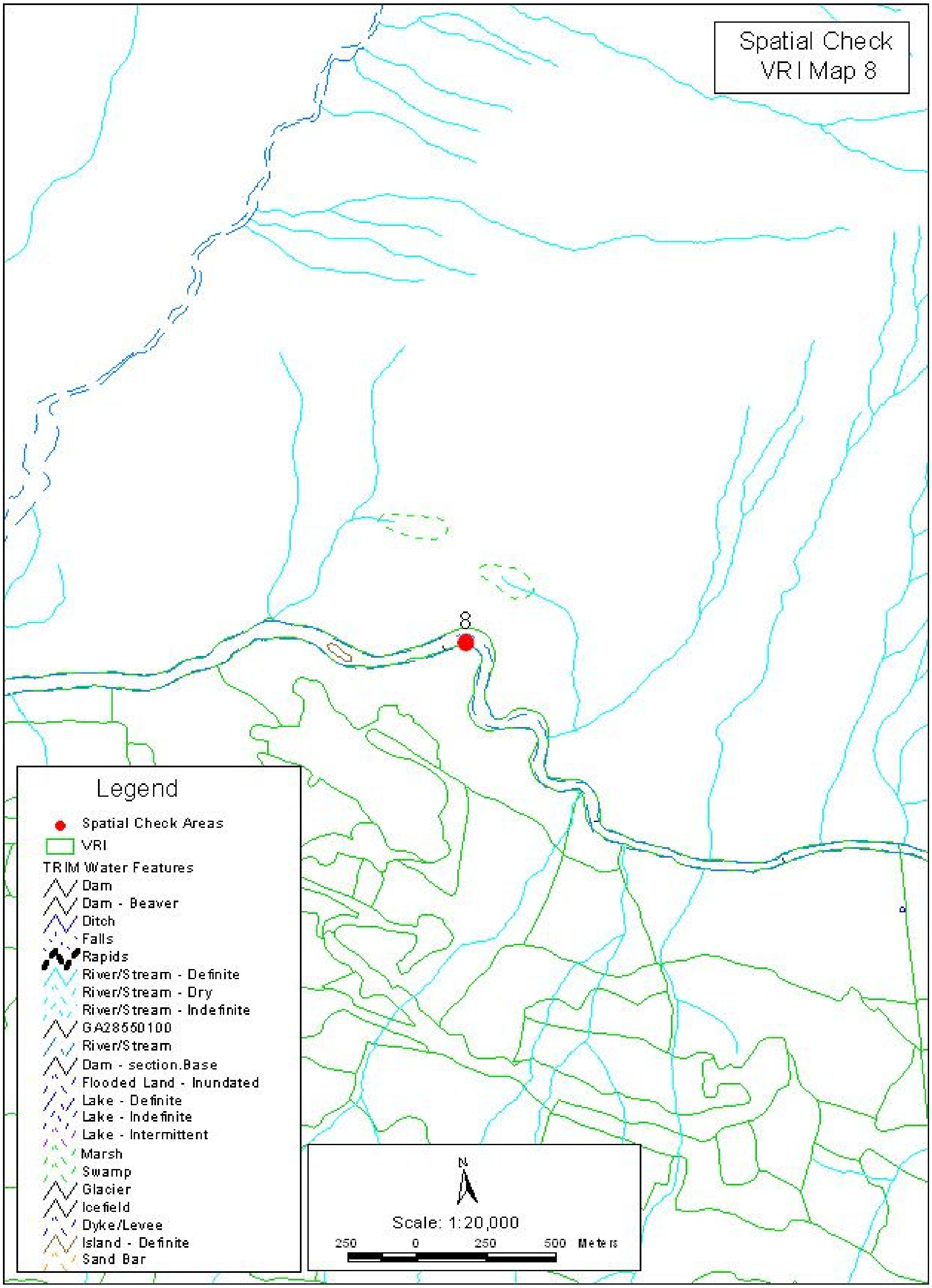

Spatial Check
VRI Map 3
3
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters


Spatial Check
VRI Map 4
4
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters


Spatial Check
VRI Map 5
5
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

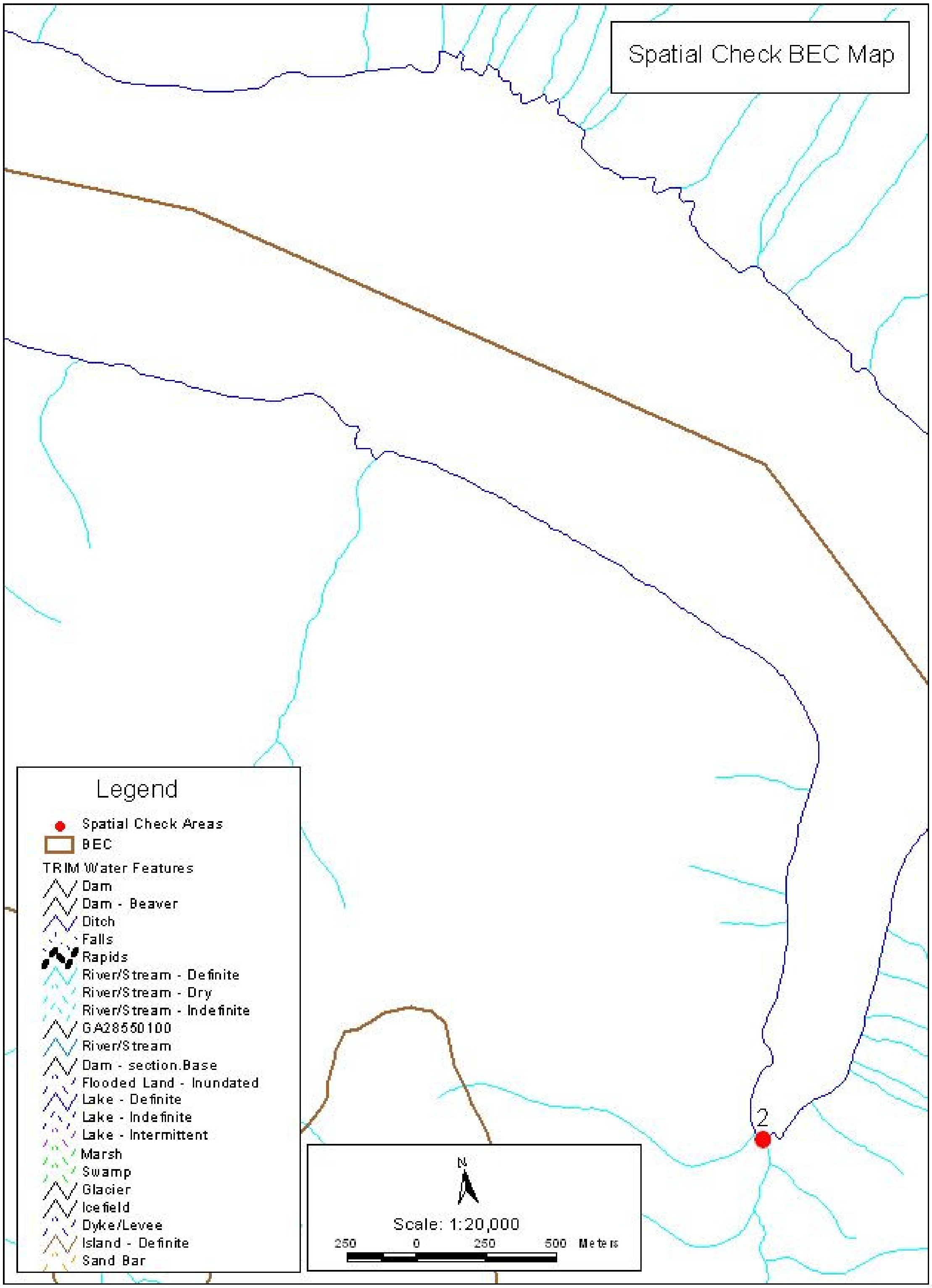

Spatial Check
VRI Map 6
6
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters


Spatial Check
VRI Map 7
7
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

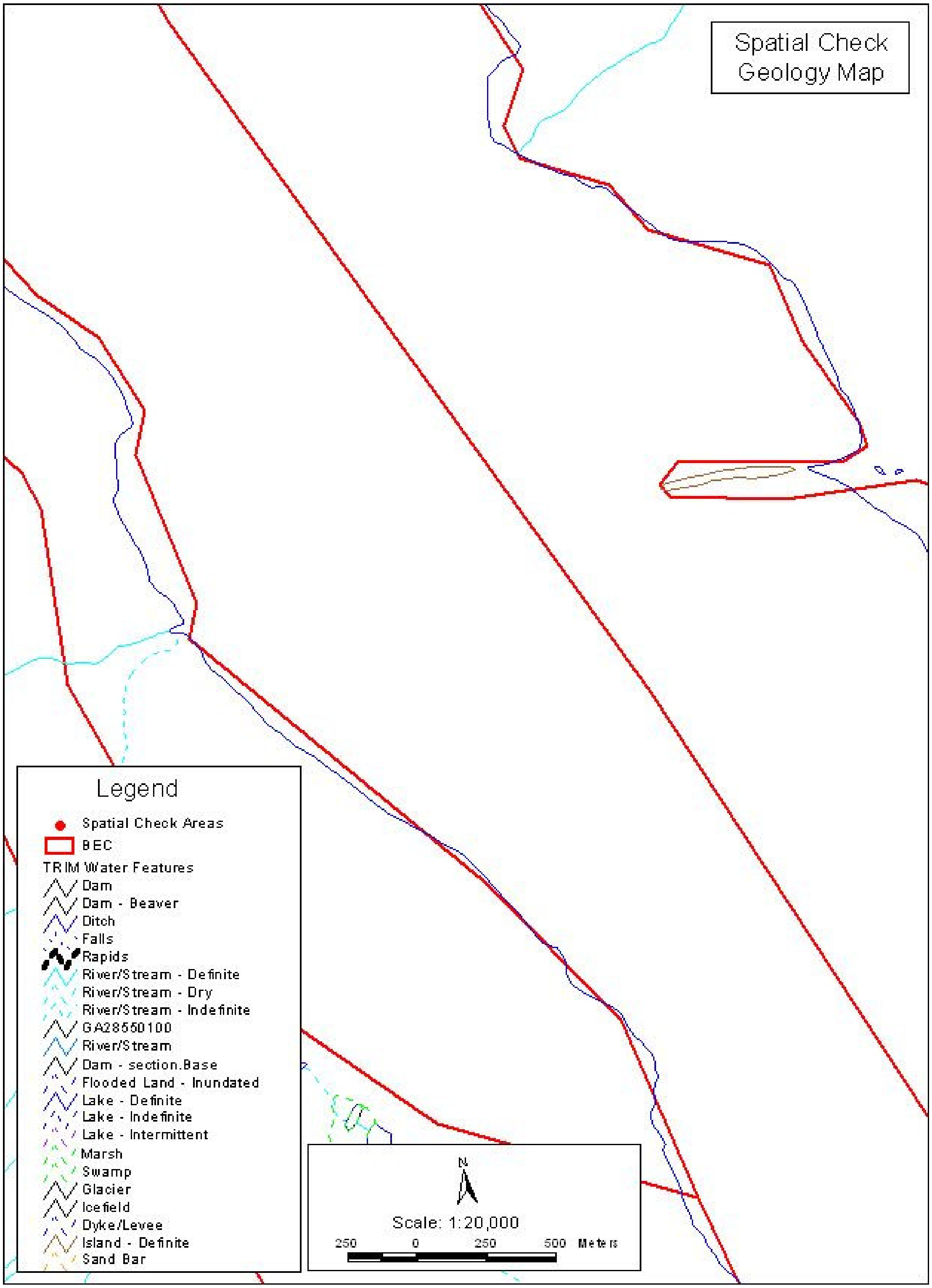

Spatial Check
VRI Map 8
8
Legend
Spatial Check Areas
VRI
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

Input Data Quality Report – Standard Input Assessment – TRIM 2	
Data Capture	
Compiling Agency:	Ministry of Sustainable Resource Management
Compilation scale:	1:20000
Period of content:	TRIM 2 Unknown
Period of compilation:	TRIM 2 Unknown
Delineation Method and Criteria:	GDBC TRIM RIC standards
Sampling Design:	GDBC TRIM RIC standards
Sampling Method:	GDBC TRIM RIC standards
Sampling Frequency:	GDBC TRIM RIC standards
Attribution:	GDBC TRIM RIC standards
Quality Assurance	
Validation Method:	Not Applicable
Validation Criteria:	Not Applicable
Validation Design:	Not Applicable
Validation Results:	Not Applicable
Quality Control	
Correlation Procedures:	Not Applicable
Map Production:	Not Applicable
Edge Matching:	Not Applicable (information was matched as is)
Line Edit:	Not Applicable
Symbol Edit:	Not Applicable
Attribute Edit:	Not Applicable
Legend Edit:	Not Applicable
Spatial Quality Control	
Edge Matching:	TRIM matched accurately
Edge Matching Error:	information was matched as is
Attribute/Label Matching:	
Raster Size:	
Spatial Reconciliation:	No spatial reconciliation is necessary

Input Data Quality Report – Standard Input Assessment – BEC	
Data Capture	
Compiling Agency:	Ministry of Sustainable Resource Management
Compilation scale:	1:100000
Period of content:	Content ranges from Legacy BEC
Period of compilation:	Unknown
Delineation Method and Criteria:	MOF Standards (see http://www.for.gov.bc.ca/hre/becweb/subsite-map/provdigital-01.htm for more information
Sampling Design:	MOF Standards
Sampling Method:	MOF Standards
Sampling Frequency:	MOF Standards
Attribution:	MOF Standards
Quality Assurance	
Validation Method:	Coverage sanctioned by MOF
Validation Criteria:	Coverage sanctioned by MOF
Validation Design:	Coverage sanctioned by MOF
Validation Results:	Coverage sanctioned by MOF
Quality Control	
Correlation Procedures:	Not Applicable
Map Production:	Not Applicable
Edge Matching:	Not Applicable
Line Edit:	Not Applicable
Symbol Edit:	Not Applicable
Attribute Edit:	Not Applicable
Legend Edit:	Not Applicable
Spatial Quality Control	
Edge Matching:	No Edge matching required (Coverage came seamless for all of Region 4)
Edge Matching Error:	No Edge matching required
Attribute/Label Matching:	Not Applicable
Raster Size:	Not Applicable
Spatial Reconciliation:	No Spatial check was concluded for this coverage because generally water features are not boundaries of BEC. General checking was done over the coverage to find locations where BEC was different on opposite shores of lakes. Where these situations occurred, the BEC fit well to TRIM (see map). The Lake features between the data sets matched quite well even though BEC was produced at 1:100000. Shifts cannot be quantified on this coverage, but general positioning can be assessed.


Spatial Check BEC Map
2
Legend
Spatial Check Areas
BEC
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

Input Data Quality Report – Standard Input Assessment – Bedrock Geology	
Data Capture	
Compiling Agency:	Ministry of Energy and Mines (MOEM)
Compilation scale:	1:100000
Period of content:	1992-2005
Period of compilation:	2005
Delineation Method and Criteria:	See http://www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/Metadata/bedrock_bc_alb_meta.htm
Sampling Design:	MOEM standards
Sampling Method:	MOEM standards
Sampling Frequency:	MOEM standards
Attribution:	MOEM standards
Quality Assurance	
Validation Method:	Not Applicable (Coverage sanctioned by MOEM)
Validation Criteria:	Not Applicable (Coverage sanctioned by MOEM)
Validation Design:	Not Applicable (Coverage sanctioned by MOEM)
Validation Results:	Not Applicable (Coverage sanctioned by MOEM)
Quality Control	
Correlation Procedures:	Not Applicable (project specific to geology studies)
Map Production:	Not Applicable
Edge Matching:	Not Applicable
Line Edit:	Not Applicable
Symbol Edit:	Not Applicable
Attribute Edit:	Not Applicable
Legend Edit:	Not Applicable
Spatial Quality Control	
Edge Matching:	No Edge matching required (Coverage came seamless for the Province)
Edge Matching Error:	No Edge matching required
Attribute/Label Matching:	Not Applicable
Raster Size:	Not Applicable
Spatial Reconciliation:	No Spatial check was concluded for this coverage. General checking was done over the coverage to see if water features in Geology generally fit well to TRIM. The Lake features between the data sets matched quite well even though geology was produced at 1:100000 (see map). Shifts cannot be quantified on this coverage, but general positioning can be assessed.


Spatial Check
Geology Map
Legend
Spatial Check Areas
BEC
TRIM Water Features
Dam
Dam - Beaver
Ditch
Falls
Rapids
River/Stream - Definite
River/Stream - Dry
River/Stream - Indefinite
GA28550100
River/Stream
Dam - section.Base
Flooded Land - Inundated
Lake - Definite
Lake - Indefinite
Lake - Intermittent
Marsh
Swamp
Glacier
Icefield
Dyke/Levee
Island - Definite
Sand Bar
N
Scale: 1:20,000
250 0 250 500 Meters

GIS AML (Methodology) Documentation

In order to comply with both the PEM Standards version 1.0 and the draft version 2.0, the GIS methodology must be recorded in sufficient detail for another qualified PEM Practitioner to understand, evaluate and utilize the PEM. The documentation of the GIS methodology is limited to a written description of the algorithms or programmatic steps, not the programming itself. The following table describes the algorithms used in the Revelstoke PEM.

Consultant contact information	Silvatech Consulting Ltd, P.O Box 1030 Salmon Arm B.C. Canada V1E 4P2
Process Overview	Explain the overall process used to create this PEM 1. AML's are executed on source data to generate overlay coverage's and features for the creation of predictive ecosystem modelling. PEM polygons are created. 2. A resultant PEM polygon database (.dbf) is generated by the final AML, which is then brought into an Access summary program and summarized by specific criteria (Matrix summary). 3. Ecologist creates knowledge bases for ecosystem typing to be run EcoNGen. 4. SSORT Access program then takes summarized database and knowledge table and formats data for entry into EcoNGen. 5. Resultant ecosystem type is output from EcoNGen and then linked back to GIS PEM polygons. 6. Final GIS PEM coverage is created and mapped.
Area of Interest	How was the project area clipped, was a buffer created to capture features along the boundaries? All AML's were initially developed to do analysis on a Landscape basis. This AML generated the area of interest from a list of BEC zones and the Landscape/Analysis unit being analyzed (see 2.2 for areas). This program created a bounds coverage that all else would be clipped to and a buffered boundary that would also be used in clipping of source GIS data.
Pre-processing	Describe what pre-process was required to clean up or clarify the linework, rasters or attributes in any of the input layers. Cliped study area coverage's to the area of interest and also buffer clip coverage's that were necessary for features outside the analysis unit. Features outside the AOI could affect features inside the AOI, when buffered. The TRIM water feature additions of lake, marsh, swamp, sand and islands are merged into a single coverage adding the following attributes to the VRI coverage. 1 = presence of specified TRIM feature River_id = 1 Lake_id = 1 Swamp_id = 1 Island_id = 1 Marsh_id = 1 AML also combines water polygonal features from TRIM, to create a refined VRI coverage with

	TRIM water appended to VRI. Elimination of polygons < 1000 meters squared was conducted on the merging of VRI and TRIM water features to create a final VRI used in the PEMpoly.AML. -Elimination was restricted to not eliminate VRI boundaries and small TRIM polygonal water features like lakes or marshes < 1000 m squared. Many TRIM features are < 1000m2 and needed to be retained. -Elimination was allowed on swamp boundaries, which were so vast and expansive and where water polygons may have been split by VRI linework. The VRI line inside these water features was released for eliminate. -Elimination of polygons < 1000 meters squared
GRID to TIN or Raster	Describe the method of converting the TRIM files to a digital elevation mode (DEM) in the processing environment. Generates a TIN from TRIM2 DEM points and Breaklines. The TIN is generated from a buffer clip of the DEM coverage in pre-processing. The following methodology was used. CREATETIN tin_%aoi% 1 1 COVER %DEM% POINT elevation # 1 # COVER %DEM% Line -9999 softline # fcode = 'HA90200110' /* uses soft type breaklines COVER %DEM% Line -9999 hardline # fcode = 'HA90200000' /* uses hard breakline COVER %DEM% Line -9999 hardline # fcode = 'HA90200130' /* uses hard hydro breaklines COVER %DEM% Line -9999 hardline # fcode = 'HA90200140' /* uses hard man made breaklines COVER %DEM% Line -9999 hardline # fcode = 'HA90200120' /* uses hard non hydro breaklines
Slope	Describe how the slopes or slope classes were created. Define the slope classes. Purpose is to generate slope coverage's for the Area of Interest (AOI) Slope/Aspect polygons are created from TIN using the TINARC command. (TINARC <Tin coverage> <output> POLY percent) TRIM water is added to the slope aspect coverage and polygons with water attributes have the percent slope set to zero. (lakes_id = 1 or marsh_id = 1 or river_id = 1 or swamp_id = 1) The S field was then calculated in the TINARC output according to the following percents. Slope Grouping calculation S = 1 0-8% S = 2 8-25% S = 3 25-45% S = 4 45-65% S = 5 65-85% S = 6 85-130% S = 7 130+% -The slope aspect coverage was then dissolved by S field to create slope cover for the analysis unit. -Slope areas < 1000m2 were eliminated into the longest border area. Slope areas of 0 were not allowed to eliminate to a higher class. This was so flat areas of TRIM water features were prevented from receiving a slope class. -Resultant slope coverage would be an input to create PEM polygon coverage. This AML also creates slope category coverage's for analysis in subsequent AML's. Each coverage was generated from TINARC output based on reselection criteria.

	slope5_%aoi% = slopes less than, or equal to, 5% slopegt5_%aoi% = slopes greater than, 5% slope510_%aoi% = slopes between 5 and 10% slope520_%aoi% = slopes greater than 5 % or equal to, 20% slope310_%aoi% = slopes greater than 10 % or equal to, 30% slope10_%aoi% = slopes less than, or equal to, 10% slope20_%aoi% = slopes greater than, or equal to, 20%n slope30_%aoi% = slopes greater than, or equal to, 30% slope40_%aoi% = slopes greater than, or equal to, 40%
Aspect	Describe how the aspect or aspect classes were created. Define the aspect classes. Slope categories >= 2 were only calculated for AS (aspect) field. Aspect information was contained in the slope aspect coverage created in the slopes AML. The AS field was calculated as follows. AS = 0= No aspect AS = 1= Hot 91 to 235 degrees AS = 2= Warm 236 to 290 degrees AS = 3= Cool 291 to 90 degrees Categorised coverage was dissolved by AS field and aspect areas < 1000m2 were eliminated into the longest border area. Slope classes of 0 and 1 were unioned into the Aspect coverage and given no Aspect to resolve issues that may have occurred due to eliminate. Resultant aspect coverage would be an input to create PEM polygon coverage.
PEM polygons & Silver elimination	Describe how the PEM polygons were created Define the PEM tag id and any other id tags that remain in the Matrix/Resultant database. Created the PEM polygon coverage to be used in analysis from the overlay of four main coverage's. The Four coverage's that are used as inputs into the PEM polygon coverage are: Forest Cover: Generated in Pre-processing AML Aspect: Generated in Aspect AML Slope: Generated in Slopes AML BEC: Generated in Areaofinterest AML Describe the criteria used to reconcile the sliver or artefact polygons/rasters resulting from the overlay process. - Areas of < 899m2 were eliminated to the longest border area. Elimination is restricted and the following source polygons are locked down for elimination. VRI, Water (Exception Swamps),BEC - A second elimination of < 899m2 was conducted by releasing VRI polygons for elimination, while still maintaining BEC and water polygons. This eliminated the few remaining artefacts, while only affecting VRI slightly. - Resultant polygons formed resulted in final PEM polygons. A unique number in the PEM_TAG field was created for each polygon remaining in the coverage. This PEM_TAG number forms the base of what most summary analysis is conducted. The final coverage formed the base of which other data layers would be overlaid and summarized for each PEM polygon
Solar	Describe how the solar insolation was calculated.

Insolation	Define the solar insolation classes. Purpose of AML is to create solar radiation values for a four day period in August and quantify which regions of the landscape receive the most solar radiation. Creates 25Meter lattice from TIN generated in Gridtotin.aml and then runs solar radiation AML on GRID. Solar radiation values were calculated for a 4 day period in August, using a solar radiation algorithm used by MSRM. Julian dates 227 to 230 over 4-hour period intervals calculated kilojoules of energy per day. These values were then grouped in GRID into 3 classes based on our knowledge of the area and where solar radiation breaks should occur. Kilojoules of energy per day data groupings kj/per day SR grouping 0 to 77000 = 3 77000 to 85500 = 2 85500 to 150000 = 1 SR = 1 Full South-facing, no obstructions – Intensive solar radiation SR = 2 Warm aspects – east or west – moderate solar radiation SR = 3 Full North-facing, no variations – Cool solar radiation The solar values were then converted to a polygon coverage and overlaid with the PEM polygon coverage. Each PEM polygon was then calculated to the highest solar radiation category that intersected the PEM polygon. (1 being highest intensity and 3 being lowest solar intensity.) Calculated in the SR field.
Satellite	Describe how the satellite imagery classified and incorporated. Define the satellite imagery classes. Purpose is to apply a satellite classified image category to a PEM polygon. Classified Landsat satellite imagery was converted to polygons, classified into types and overlaid with the PEM polygon coverage. If the PEM polygon was greater than 50% of one satellite image class then it was given that class. This was entered into the SA field. Categories can be found in the Revelstoke PEM Legend
Geology	Describe what codes were used, how these were used, how polygons were merged, and any classes that were subsequently created. Purpose is to apply grouped bedrock type geology category to a PEM polygon. Classified Rock type coverage was overlayed with the PEM polygon coverage. If the PEM polygon was greater than 50% of one rock type class then it was given that class. This was entered into the BR field. Categories can be found PEM Legend
Bioterrain or Focussed Terrain	Describe what codes were used, how these were used, how polygons were merged, and any classes that were subsequently created. Not applicable to this PEM project

Cross-product correlation	If an input layer consisted of complex labels, describe the method used to reconcile the cross product of mapping entities resulting from the overlay, polygonal or raster, of complex PEM Entities on other simple or complex PEM Entities. Not applicable to this PEM project
Landforms	Define what landform types were extracted and how these were incorporated into the Matrix/Resultant database. Purpose is to calculate the presence of line landform features in a PEM polygon and create Polygon landform coverage to be used in matrix.aml Previous Landform AML calculated many landform features into one data field. So if multiple landform features occurred in a PEM polygon the data would not reflect this. For the Revelstoke PEM we broke the Landforms into multiple fields. E.g. L1 = Rock Polygon (Polygon) L2 = Esker (Line) ..And so on For line Landform features, these fields were calculated directly into the PEM polygon coverage in this AML. The density of the line feature in each PEM polygon would influence the density ranking of each feature in the PEM polygon. This solved the issue of very small landform segments falling into PEM polygons and not being significant to contribute to the ecosystem Landform density per PEM polygon = (Landform Feature) / (PEM polygon area / 10000) L# = 0 No influence in PEM polygon L# = 1 0+ m/ha to 20 m/ha Low influence in PEM polygon L# = 2 20 m/ha to 40 m/ha (Moderate influence in PEM polygon) L# = 3 40 m/ha or greater (High influence in PEM polygon) The second portion of this AML produces a landform polygon coverage. Each type of landform is unioned to this single coverage, with column fields for each type representing 1 = presence and 0 = no presence. This coverage is used as an overlay in matrix.aml and summarized in matrixsummary. See PEM legend for a full listing of Landform features.
Adjacency	Describe how adjacency class was calculated. Define the adjacency classes. Purpose is to produce non-productive polygon coverage and their adjacency to the following items First portion of AML generates a coverage of all non-productive VRI polygons and their adjacency up 50 meters to the following items. Adj1 = 1, if adjacent to streams Adj2 = 1, if adjacent to a wetland Adj3 = 1, if adjacent to a rock outcrop Adj4 = 1, if adjacent to an alpine polygon Adj5 = 1, if adjacent to open range polygon The Non-productive coverage is then used in the Matrix.AML and the final overlay coverage. The second portion of this AML checks the 50 M adjacency of PEM POLYGONS to the following. Adjp3 = 1, if adjacent to a rock outcrop Adjp4 = 1, if adjacent to an alpine polygon Adjp5 = 1, if adjacent to open range polygon If the PEM polygon was 50m Adjacent to a feature, then the ADJp# field was calculated to 1 in the PEM polygon coverage.

Stream density or soil moisture model	Describe how the stream density was calculated, or the soil moisture model was created. Define the stream density or soil moisture classes. PEM polygons are overlayed with streams. The sum length of streams in each polygon per hectare is then calculated. The result is calculated to the PEM polygon coverage. Stream density per PEM polygon = (Stream length) / (PEM polygon area / 10000) These results are then grouped into the following categories for each PEM polygon. W = 0 No streams found in polygon W = 1 10 m/ha to 30 m/ha (low soil moisture influence) W = 2 30 m/ha to 60 m/ha (moderate soil moisture influence) W = 3 60 m/ha or greater (high soil moisture influence)
Automated Terrain/ Landform Analysis	Describe how the terrain or landform features were derived. Define the terrain or landform classes. Not applicable to this PEM methodology
Topographic features (use a separate row for each feature)	Describe how each topographic feature was derived from the TRIM and define the classes for each feature. Examples are hills, ridges, gullies, wetland benches, toes of slope, elevation, and so on. **1. Lake Wetland Benches (AML)** Produces polygon coverage of lake and wetland benches for the area of interest (AOI). For Revelstoke PEM only lakes and marshes were checked for benches. TRIM swamps were for too extensive and over captured, that would have resulted in over calculation of benches. A lake/wetland bench (LB = 1) is an area of 0-5% slope that is adjacent to a lake or wetland, extending to a maximum distance of 100m. The procedure Buffers water features 100 M and finds slopes 0-5% that share a common boundary with marsh or lake features. **2. River Benches (AML)** To generate polygon river benches around river polygons in area of interest (AOI). Only double lined rivers in TRIM are used to calculate feature. A low bench (SLB = 1) is 0-5% slopes adjacent to a double-line stream to a maximum distance of 100m A high bench (SHB = 1) is 0-5% slopes adjacent to SLB or adjacent to a 5%-20% slope up to 50 meters from a double line stream A stream terrace (ST = 1) is a 0-10% slopes adjacent to a SLB or a SHB or adjacent to 5+ - 20% slope 50 to 200 meters out from a double line stream A single coverage is produced containing (SLB, SHB, ST) values (1= presence and 0 = no presence) that are used in matrix.aml. Slope coverage's used in this AML were created in slopes.aml. 3. **Gullies (AML)** Purpose is to produce polygon coverage of gullies and their appropriate slope buffers. - Gully (G = 1) is a 20m buffer around all single-line streams that has a slope of 30% or greater -Gully Buffer (GB = 1) is a 40m buffer around all gullies (G=1), that has a slope of 30% or greater

	and is adjacent to a gully. Single polygon coverage is produced containing (G, GB) values (1= presence and 0 = no presence) that are used in matrix.aml. Slope coverage's of slope% were created in slopes.aml **4. Hills (AML)** Purpose is to generate hilltop and hill buffer polygons. - Hilltops (HT = 1) are the lowest contour lines, which would form a polygon (no dangles), with perimeter of 1200m or less - Hillbuffers (HB = 1) are areas of 20% slope or greater that are within a 40m buffer of a hilltop and adjacent to hill tops AML uses contour coverage clipped to a buffered area of interest to generate hills. Extended contours are needed for outside the AOI because hills can exist along area of interest boundary. A single coverage is produced containing (H, HB) values (1= presence and 0 = no presence) that are used in matrix.aml. Slope coverage's were created in slopes.aml **5. Ridges (AML)** Purpose of AML is to generate ridgeline, ridge-top, and ridge-buffer coverage's. Ridge Lines are generated from hypsographic breaklines in the TRIM2 DEM. -Interior Ridge Tops (RT = 1) are 20m buffered ridgelines that are greater than, or equal to, 30% slope. -Interior Ridge Buffers (RB = 1) are 40m buffers adjacent to a ridge top that have slopes greater than, or equal to, 30% slope. -Ridge top Low (RTL = 1) are 20m buffered ridgelines, that are greater than or equal to 10% slope, and less than or equal to 30% slope. A single coverage is produced containing (RT, RB, RTL) values (1= presence and 0 = no presence) that are used in matrix.aml. Slope coverage's were created in slopes.aml **6. Toe Slopes1 (AML)** Purpose is to generate two ascii-grid files of the DEM and slope grids to run in 'ScenarioSlopePosition' of SELES slopeg_%aoi% = SLOPE(%dem%,percentrise) GRIDASCII %dem% tdem_%aoi%.asc GRIDASCII slopeg_%aoi% slopeg_%aoi%.asc - Outputs should be tdem_%aoi%.asc (DEM Ascii file) and slopeg_%aoi%.asc (Slope Grid file). These are two ascii files that the SELES program uses to calculate toe slope position. **7. SELES slope program** Must have access to the latest version of SELES (Spatially Explicit Landscape Event Simulator) created by Dr. Andrew Fall of Simon Fraser University SELES program has variables to be set before processing of .asc files. Program uses .asc files exported by toes1.aml. Once processed a slope position .asc file is output.

	MOF research branch found that this program was the most effective procedure to find toe slopes, based on various approaches investigated. **8. Toe Slopes2 (AML)** Purpose is to generate toe of slope polygons for area of interest from grid-ascii files exported by SELES program. Creates polygon coverage of 1 = toe slope for input to final PEM overlay -output.asc = toes_%aoi% Tos = 1 - toe polygons where grid cell/polygon within 100m of greater than 40% slopes above, and less than 25% slopes below
Elevation	Describe how elevation ranges were derived. Define the elevation range classes. The purpose is to generate a polygon coverage, which divides BEC units, based on new elevation guidelines. For Revelstoke PEM the area of interest was broken into 11 elevation categories. Polygon coverage is created from DEM GRID and polygon coverage is grouped into elevation categories and then dissolved. E1 = ESSFvc below 1520 m E2 = ESSFvc between 1520 and 1680 m E3 = ESSFvc above 1680 m E4 = ESSFwc2 below 1440 m E5 = ESSFwc2 between 1440 and 1770 m E6 = ESSFwc2 above 1770 m E7 = ESSFwc4 below 1580 m E8 = ESSFwc4 between 1580 and 1720 m E9 = ESSFwc4above 1720 m E10 = ESSFwcw below 1700 m E11 = ESSFwcw above 1700 m A single coverage is produced containing (E) values that are used in matrix.aml.
Geographic Area	Describe how high, mid and low topographic ranges were calculated/derived; or how selected valleys/plateaus were delineated. Define the geographic range classes. Not applicable to this PEM methodology
Matrix Database	Describe the overlay order used to create the Matrix/Resultant database. Define the attribute codes that were extracted or derived from each input layer and incorporated into the Matrix/Resultant database. Purpose is to overlay all the component coverage's that were developed in previous AML's and create a matrix overlay database to be summarized in Matrix summary.MDB. The following coverages are used in the final overlay process. All coverages are unioned together to create a final overlay coverage. <u>Overlay coverage's usued in Matrix</u> PEM Polygon coverage Adjacency Polygon coverage created in adjacency.aml

Lake benches coverage created in lbenches.aml
River benches coverage created in rbenches.aml
Gullies coverage created in gullies.aml
Hills coverage created in hills.aml
Ridges coverage created in ridges.aml
Toe slope coverage created in toes1&2.aml
Elevation coverage created in elevation.aml
Landform features created in landformsnew.aml
Area of interest coverage to clip final resultant

- PEM polygon boundaries, water boundaries and BEC boundaries are then locked down and polygons < 100 m squared are eliminated.

A final PEM overlay database is output in dbase form for entry into matrix summary

<u>GIS data output to be used in matrix summary.</u>

mtx_%aoi%#	- Internal GIS coverage number
gistag,	- Internal GIS coverage number
AREA	- Area of matrix polygon overlay
pem_tag	- PEM polygon number
pem_area	- PEM polygon area
fc_%aoi%#	- internal forest cover coverage number
mapstand	- Forest cover mapstand number
Poly_id	- Forest cover polygon number
inv_stand	- Inventory Stand
feat_id	- Feature ID
npd	- Non-productive descriptor (VRI)
np_cd	- Non-productive forest code (VRI)
crn	- Crown Closure Class Groupings (Calculated groupings)
hc	- Height Class Groupings (Calculated groupings Leadspht)
age	- Age Class Groupings (Calculated groupings Ldspprjage)
Surfexpres	- Surficial Expression (VRI)
Modprocess	- Modifying Process (VRI)
Siteposmes	- Site Position Meso (VRI)
Alpinedesi	- Alpine Designation
Soilnutrrg	- Soil Nutrient Regime
Srce_ecol	- Data Source ecology
Bclcslv1	- Land cover classification 1
Bclcslv2	- Land cover classification 2
Bclcslv3	- Land cover classification 3
Bclcslv4	- Land cover classification 4
Bclcslv5	- Land cover classification 5
Nf_descry	- Non Forest Descriptor (VRI)
Intypgrpno	- Inventory Type Group (VRI)
Histcls_s	- Site Class
Histcls_ss	- Old site class
Crown_clos	- Crown Closure (VRI)
Stkclscode	- Stocking Class Code (VRI)
Site_index	- Site Index (VRI)
Live_stems	- VRI live stems per ha (VRI)
Srclivestm	- Data source VRI live stems (VRI)
Dead_stems	- Dead Stems (VRI)
Treecovpat	- Tree cover pattern (VRI)
Vertcmplx	- Vertical complexity (VRI)
Leadspage	- Lead Species age (VRI)
Leadspht	- Lead Species Height (VRI)
Ldspprjage	- Lead Species Projected Age (VRI)
Ldspprjht	- Lead Species Projected Height (VRI)

	Comp1	- Land cover components 1 (VRI)
	Percent1	- Land cover components percentage 1 (VRI)
	Soilmoist1	- Soil Moisture 1 (VRI)
	Comp2	- Land cover components 2 (VRI)
	Percent2	- Land cover components percentage 2 (VRI)
	Soilmoist2	- Soil Moisture 2 (VRI)
	Comp3	- Land cover components 3 (VRI)
	Percent3	- Land cover components percentage 3 (VRI)
	Soilmoist3	- Soil Moisture 3 (VRI)
	Nontreeid	- Non Tree ID (VRI)
	Shrub_ht	- Shrub Height (VRI)
	Shrubcwncl	- Shrub Crown Closure (VRI)
	Shrubcovpt	- Shrub Cover Percentage (VRI)
	Herbcovtyp	- Herb Cover Type (VRI)
	Herbcovper	- Herb cover percentage (VRI)
	Herbcovpat	- Herb cover pattern (VRI)
	Brycovper	- Bryoid Cover Percentage (VRI)
	Secspage	- Secondary Species age (VRI)
	Secspht	- Secondary Species Height (VRI)
	Secspprjag	- Secondary Species Projected age (VRI)
	Secspprjht	- Secondary Species Projected Height (VRI)
	Sp1_cd	- Rank 1 Species 1 Code (VRI)
	Sp1_per	- Rank 1 Species 1 Percentage (VRI)
	Sp2_cd	- Rank 1 Species 2 Code (VRI)
	Sp2_per	- Rank 1 Species 2 Percentage (VRI)
	Sp3_cd	- Rank 1 Species 3 Code (VRI)
	Sp3_per	- Rank 1 Species 3 Percentage (VRI)
	Act_l	- Activity Logging (VRI)
	Logend	- Logging End data (VRI)
	Act_b	- Activity Burn (VRI)
	Burnend	- Burn End data (VRI)
	lakes_id	- Lake presence 1 = yes
	river_id	- River Presence 1 = yes
	swamp_id	- Swamp Presence 1 = yes
	marsh_id	- Marsh Presence 1 = yes
	s	- Slope class
	as	- Aspect class
	beclabel	- Biogeoclimatic label
	mhresult	- Stream length / PEM polygon area / 10000
	W	- Stream density classification
	adj1	-Streams NPR adjacency
	adj2	-Wetland NPR adjacency
	adj3	-rock NPR adjacency and PEM polygon adjacency
	adj4	-alpine NPR adjacency and PEM polygon adjacency
	adj5	-open range NPR adjacency and PEM polygon adjacency
	lb	- Lake bench 1 = yes , 0 = no
	slb	- River Low bench 1 = yes , 0 = no
	shb	- River High bench 1 = yes , 0 = no
	st	- Stream Terrace 1 = yes , 0 = no
	g	- Gully 1 = yes , 0 = no
	gb	- Gully Buffer 1 = yes , 0 = no
	ht	- Hill top 1 = yes , 0 = no
	hb	- Hill Buffer 1 = yes , 0 = no
	rt	- Ridge Top 1 = yes , 0 = no
	rb	- Ridge Buffer 1 = yes , 0 = no
	rtl	- Ridge Top Low 1 = yes , 0 = no
	tos	- Toe slope 1 = yes , 0 = no
	e	- Elevation category

	sa - Satellite Classification Category sr - Solar Radiation category l1 - Rock landform 1 = yes , 0 = no l4 - Slide landform 1 = yes , 0 = no l6 - Flooded area landform 1 = yes , 0 = no l8 - Moraine landform 1 = yes , 0 = no l9 - Skree landform 1 = yes , 0 = no l11 - Glacier landform 1 = yes , 0 = no l14 - Islands landform 1 = yes , 0 = no l15 - Sand Bar landform 1 = yes , 0 = no l16 - Pit landform 1 = yes , 0 = no l2 - Esker landform 1 = yes , 0 = no l3 - Cliff/Scarp landform 1 = yes , 0 = no l5 - Beaver Dam landform 1 = yes , 0 = no l13 - Ridge landform 1 = yes , 0 = no l17 - Rock bluffs landform 1 = yes , 0 = no l18 - Depressions landform 1 = yes , 0 = no l19 - Cliff drop off landform 1 = yes , 0 = no l20 - Cliff drop indefinite landform 1 = yes , 0 = no br -Bedrock Type (as grouped in PEM Legend)
Matrix Summary or similar program	Describe the process used to merge multiple sub-polygons back into the PEM polygons. Describe what SQL groupings were created to lump ranges of values within a feature class. A final GIS output database is summarized in **matrix summary** by PEM_TAG to give polygon area summaries and group overlay data into categories by percentage of PEM_TAG polygon area. The program has been provided with deliverables. Summary fields in the matrix summary output will have the (_P) designation. For Example: Landform L2 in the GIS data will output a summary field of L2_P. Polygon features will be summed as follows. _P = 1 greater than or equal to 5% and less than 20% of the PEM polygon area _P= 2 greater than 20% and less than 50% of the PEM polygon area _P= 3 greater than 50% of the PEM polygon area Other features calculated in Matrixsummary to be used in creation of knowledge tables. All definitions can be found in the PEM legend document. SF Slope grouping of PEM polygon SFC Slope grouping of PEM polygon (different from SF) H Forest Height grouping of PEM polygon CC Crown closure grouping A Age Grouping **SSORT** Once data has been summarized in Matrix summary a second Access program is used to prepare the data for EcoNGen. Knowledge Bases and matrix summarized data are input to SSORT and an ECONGEN data format is generated.. SSORT program has been provided with deliverables
Final Matrix database structure	Describe the structure of the final Matrix Database – the order of the fields. Output table from Matrix Summary PEM_TAG Unique polygon number

	AREA_SUM	Sum Area
	PEM_AREA	PEM polygon Area
	MAPSTAND	VRI Mapstand Identifier
	POLY_ID	
	INV_STAND	
	FEAT_ID	
	NPD	Non-Productive Descriptor
	NP_CD	Non-productive code
	CRN	Crown Closure class (see legend table for groupings)
	HC	Height class (see legend table for groupings)
	AGE	Age class (see legend table for groupings)
	~Below are attributes carried through Matrix summary (See previous 4.24 matrix outputs for definitions)~	
	SURFEXPRES	
	MODPROCESS	
	SITEPOSMES	
	ALPINEDESI	
	SOILNUTRRG	
	SRCE_ECOL	
	BCLCSLV1	
	BCLCSLV2	
	BCLCSLV3	
	BCLCSLV4	
	BCLCSLV5	
	NF_DESCR	
	INTYPGRPNO	
	HISTCLS_S	
	HISTCLS_SS	
	CROWN_CLOS	
	STKCLSCODE	
	SITE_INDEX	
	LIVE_STEMS	
	SRCLIVESTM	
	DEAD_STEMS	
	TREECOVPAT	
	VERTCMPLX	
	LEADSPAGE	
	LEADSPHT	
	LDSPPRJAGE	
	LDSPPRJHT	
	COMP1	
	PERCENT1	
	SOILMOIST1	
	COMP2	
	PERCENT2	
	SOILMOIST2	
	COMP3	
	PERCENT3	
	SOILMOIST3	
	NONTREEID	
	SHRUB_HT	
	SHRUBCWNCL	
	SHRUBCOVPT	
	HERBCOVTYP	
	HERBCOVPER	
	HERBCOVPAT	
	BRYCOVPER	

	SECSPAGE SECSPHT SECSPPRJAG SECSPPRJHT SPC1 SP1_PER SPC2 SP2_PER SPC3 SP3_PER ACT_L LOGEND ACT_B BURNEND LAKES_ID RIVER_ID SWAMP_ID MARSH_ID S AS BECLABEL MHRESULT W ADJ1 ADJ2 ADJ3 ADJ4 ADJ5 LB SLB SHB ST G GB HT HB RT RB RTL TOS E SA SR L1 to L20 Landforms Specified in Legend or matrix output above SH BR ** Calculated definitions in Matrix summary ** See Legend definitions LB_P SLB_P SHB_P ST_P G_P GB_P HT_P HB_P RT_P RB_P	

	RTL_P TOS_P SH_P SF SFC HST CCOC A D L1_P L4_P L6_P L8_P L9_P L11_P L14_P L15_P L16_P L18_P SP1 SP2 SP3
Other AML's	Describe any other AML's that were used in the PEM process. Define any classes of values that were created to assist in the use of this information. No other AML's were used in this project.
Engine Processor	Describe which engine processor was used to merge the Matrix/Resultant database with the Knowledge Tables and what programming was used to create it. Information is then processed by the ecologist through EcoNGen version 1.0c from the Ministry of Forests Research Branch website.
Structural Stage	Describe how the Structural Stage layer was created – what attributes were used to derive the structural stage of the polygon. Define the Structural Stage classes. TSS 3 = Shrub (1 to 20 years) - corresponds to Structural Stage codes in DEITF manual TSS 4 = Pole/sapling (20 to 40 years) TSS5 = Young (40 to 80 years) TSS 6 = Mature (80 to 240 years) TSS 7 = Old (240+ years) Note structural stage 2 is missing since it must be applied after the ecosystem label has been ascribed. This is a post-processing module that may not have been requested by the Client.
Seral Stage	Describe how the Seral Stage layer was created – what attributes were used to derive the seral stage of the polygon. Define the Seral Stage classes.

Seral Stage	**Name**	**Description**
NV	Non-Vegetated	talus, rock, roadways, gravel pits; urban developments
PS	Pioneer Seral	1st stage of regeneration – herb and shrub species are dominant; less than 1 year for cutblocks.

	ES	Early Seral	Between 20 and 50 years; self-thinning has not occurred.
	YS	Young Seral	Between 51 and 100 and years old for ICH; Between 51 and 120 years old for ESSF;
	MS	Maturing Seral	Between 101 and 250 and years old for ICH; Between 121 and 250 years old for ESSF; thinning has occurred; is a dominant canopy with and understory developing (shrub to intermediate canopy)
	OS	Overmature Seral	Greater than 250 years old; now has a multilevel, uneven age canopy with more shade tolerant species.
Data checking process	Describe the process used to verify that the data carried forward correctly to the final PEM polygons. data was checked by the GIS Analyst and then resultant data sets were given to they ecologist and could be further checked as a QA procedure. A secondary QA check had Sample PEM polygons selected after running through Matrix summary and checked to see if summaries were coming out correct. These summaries were also visually loaded into Arcview and themed. Themed summary information was visually checked against source input data to see if discrepencies existed and GIS analysis was performing correctly.		