Predictive Ecosystem Mapping

- ❑ Instructions for Ministry Representatives
- ❑ Template - Predictive Ecosystem Mapping Schedule A
- ❑ Appendix A - Task Completion Form and Project Signoff

PREDICTIVE ECOSYSTEM MAPPING

The Ministry Representative is responsible for the following documentation requirements and activities set out in "Schedule A":

Overview of Services #1

- ❑ Filling in the name of the Project Location.
- ❑ Attaching Figure 1 delineating the Location boundaries.

Overview of Services #2

- ❑ Ensuring that the technical standards and remote data capture applications are the most current available.

Schedule

- ❑ Filling in the dates by which the Services are to be completed and delivered (see Schedule Page__).

Proposal Incorporated

- ❑ Negotiating the terms of the Proposal (or sections of it) that will be incorporated into the Contract. When incorporated, the Proposal (or sections of it) becomes a binding part of the contract so it is imperative that the Ministry Representative reviews the Proposal carefully to ensure that there are no ambiguities or conflicts between the Proposal and the Contract. The Proposal must be in writing.
- ❑ Negotiating any specific standards or qualifications for the Management and Personnel providing the Services of the Contract—(i.e., if you want specific personnel to be available to work on this project, or you want personnel to have specific training or qualifications) that are to be included in the Proposal.
- ❑ Reviewing the Contractor's proposed timeline to ensure that times and dates set are appropriate and realistic for the particular Services being provided. If the Schedule includes dates and times for meetings or performing tasks—the Ministry Representative is contractually obligated to carry these things out.
- ❑ Ensuring that any unusual methodologies set out in the Proposal are appropriate and will be effective in carrying out the Services.
- ❑ Ensuring that the Contractor provides for funding of Quality Control and Quality Assurance activities through the Resources Inventory Branch of the Ministry of Environment, Lands and Parks (contact Dave.Clark@gems5.gov.bc.ca)

Ministry Contacts

- ❑ Filling in the names and addresses of Contacts.

Appendix A

- ❑ Ensuring that the Project Sign Off and Approval Form (Task Completion Schedule) is attached.

Considerations in developing the project and writing "*Request for Proposals*" for subcontractors. To be used by the Ministry Representative and Contractor.

- In an initial project meeting between the Contractor, the Ministry Representative, a Ministry GIS/data base specialist, Project Ecologist, Regional Ecologist and the subcontractor mapping team, it is essential to go over all details of the contract, steps in mapping and sampling procedures, data that will be collected in the field, and deliverable dates. Ensure that the proposed products will address the interpretive requirements. At this meeting subcontractors should submit a list of relevant, existing plot and mapped information that occurs in the study area or adjacent areas.
- Predictive Ecosystem Mapping projects may be completed within six months, but may require a field season to undertake field reconnaissance. Accuracy assessment may be undertaken in Year 2.Contractors must enter into a partnership agreement with MELP to provide quality assurance of both interim and final deliverables, to ensure data quality, compliance with standards, and to facilitate compilation into the Provincial data warehouse.
- Helicopter budget may be handled separately or directly in a contract with the subcontractor. Handling it separately for the proposal stage allows the projects to be assessed by amount of time and cost required to do the project, and allows the Contractor and Ministry Representative control over these funds.
- Need to determine the requirement for additional ecosystem map attributes, beyond PEM core attributes, that should be collected, in order to do specific interpretations (e.g., a particular animal species interpretation may require specific tree crown closure, in order to rate its habitat suitability). Attributes to consider are defined in *Standards for Terrestrial Ecosystem Mapping* (RIC 1998). As well, on-site symbols may be useful for some interpretations.
- Need to determine appropriate data sources for modeling of structural stages. This could include the use of MoF forest cover data, Forest District history update information or satellite imagery.
- TRIM maps must be used as the basemap for both 1:20,000, and 1:50,000, as well as larger scales
- All subcontractors must be approved by the Ministry Representative, due to the complex technical nature of these projects.
- If inexperienced ecosystem mapping subcontractors are involved, consideration should be given to them either mentoring under a more experienced contractor or initially assigned only a small portion of the study area. Additional sampling to familiarize such personnel with the study area and sampling techniques may be required.

- Other contacts are (all area code 250):

MoF Ecology	Del Meidinger	387-6688
MELP Ecology	Dave Clark	387-9785
Terrain	Bob Maxwell/Larry Lacelle	387-9783/490-8200

GIS standards	Tim Brierley	952-6904
Data base management	Darren McKellar	356-5072
	Terry Gunning	387-9773
Regional ecologists:		
Vancouver	Fred Nuszdorfer	751-7124
Kamloops	Dennis Lloyd	828-4129
Nelson	Tom Braumandl	354-6703
Cariboo	Ray Coupé	398-4717
Prince Rupert	Allen Banner	847-7431
Prince George	Craig Delong	565-6202

PREDICTIVE ECOSYSTEM MAPPING

DEFINITIONS

In this document, acronyms and words have the following meanings:

(a) **BEC** means Biogeoclimatic Ecosystem Classification
(b) **BGC** means Biogeoclimatic (subzone, variant, phase)
(c) **Contractor** means the proponent
(d) **GIS** means Geographic Information System
(e) **KB** means knowledge base
(f) **Location** means boundaries as delineated in the attached Figure 1
(g) **MELP** means Ministry of Environment, Lands and Parks
(h) **MoF** means Ministry of Forests
(i) **PEM** means Predictive Ecosystem Mapping
(j) **Province** means Ministry of Environment Lands and Parks and/or Ministry of Forests
(k) **RIC** means Resources Inventory Committee
(l) **Subcontractor** means the PEM practitioner
(m) **TEM** means Terrestrial Ecosystem Mapping
(n) **TRIM** means Terrain Resource Information Management

PURPOSE

The predictive ecosystem map displays a hierarchy of ecosystem units including: Ecosections, Biogeoclimatic Subzone/Variant, Site Series, and certain Site Modifiers. Application of prescribed standards results in an ecosystem graphic database linked to a polygon database, a separate structural stage graphic database linked to its polygon database, and for point locations of ground samples, a graphic database linked to its point attribute database. This is supported by extensive meta data on the input data sets, the 'knowledge base" (KB), the algorithm (inferencing element) that applies the KB to the assembled input inventories to derive the ecosystem outputs. The expertise required for these projects includes a plant ecologist and a GIS/data base specialist.. A review procedure is required for predictive ecosystem mapping projects. This Schedule outlines the requirements for conducting Predictive Ecosystem Mapping.

OVERVIEW OF SERVICES

The Contractor shall:

1. Prepare predictive ecosystem spatial files, databases and associated knowledge bases for each of the included BGC units of the _____{Project Location}(see Figure 1, study area), in accordance with the current methods for predictive ecosystem mapping outlined in

the RIC manuals entitled *Standards for Predictive Ecosystem Mapping in BC* (RIC 1999), *Standards for Digital Predictive Ecosystem Mapping Data Capture in BC* (RIC 2000), and the specifications and requirements outlined in this Schedule.

(a) Provide Ministry Representative with:

- map of study area with the study area boundary clearly marked;
- survey objectives;
- summary of background and previously known information, including previously collected plot data for the project area, including an assessment of input data quality;
- technical proposal (where applicable);
- copy of contract with the subcontractor doing the GIS work (where applicable); and
- names, qualifications, references, and responsibilities of project staff and subcontractors and a statement confirming their ability to complete the project to the necessary standards.
    - Each member of the mapping project staff must be clearly qualified to either:
        - ⇒ collect plot data, by having taken a Describing Ecosystem in the Field course or having at least one year proven experience in collection of ecological data in BC; or
        - ⇒ model Terrestrial Ecosystems, by having taken the Introduction to Terrestrial Ecosystem Mapping Course or having one year proven experience in mapping ecosystems in British Columbia, using recent standards; or
        - ⇒ manipulate input data sets or implement knowledge bases in a GIS environment.
    - If inexperienced people are in the field or are involved in the mapping team, the subcontractor must provide information on how these personnel will be trained before they participate in the project.
    - Subcontractors must be approved by the Province (the Ministry of Environment, Lands and Parks' Resources Inventory Branch, Wildlife Inventory Section or the Ministry of Forests Regional Ecologists can assist in selecting ecological contractors).

(b) Organize a coordination meeting with the Ministry Representative, a Ministry GIS/data base specialist, Project Ecologist, Regional Ecologist and the subcontractor mapping team to discuss:

- objectives;
- mapping methodology;
- input data;
- field data collection;

- quality assurance
- reports and other outputs; and
- project metadata

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(c) Ensure that common and botanical names of plants follow the Provincial data base: British Columbia plant species codes and selected attributes. Version 3.Data Base (Meidinger et al. 2000), that can be accessed at http://www.for.gov.bc.ca/research/spplist/

(d) Ensure that products meet provincial standards and each stage is signed off by the mapping subcontractor and by the accountable registered professional who supervised the PEM project, before submitting to the Province for approval. Each stage must be signed off by the appropriate designated Provincial Quality Assurance person, using the Project Sign Off and Approval Form (Appendix A).

(e) Provide funding for quality control/quality assurance review of the project and work with the Ministry Representative to develop a partnership agreement with the Ministry of Environment, Lands and Parks and the Ministry of Forests to undertake quality assurance of all aspects of the project.

(f) Work with Forest Service regional ecologists and provincial correlators to obtain approval of BGC boundaries and areas requiring significant adjustments to biogeoclimatic and ecosection boundaries, and approval of names and codes for project-specific mapping entities.

2. Ensure that the Services are carried out in accordance with the technical standards set out in the most up-to-date edition of the following documents:

(a) *Standards for Predictive Ecosystem Mapping – Inventory Standard. (1999).* RIC, Terrestrial Ecosystems Task Force.
(b) *Field Manual for Describing Terrestrial Ecosystems* (1998). Province of B.C.
(c) *Ecosystem Field Forms* FS882 (1-7). 1998. Province of B.C.
(d) *VENUS version 4.xx (1999)* RIC, Ecosystems Working Group
(e) *Ground Inspection Forms* and *Coding Standards* (1998). RIC, Ecosystems Working Group
(f) *Standards for Predictive Ecosystem Mapping - Digital Data Capture.* Version 1.0. (2000) RIC. Terrestrial Ecosystem Mapping (TEM) Alternatives Task Force.
(g) *Provincial Site Series Mapping Codes And Typical Environmental Conditions.* RIC, Ecosystems Working Group (http://www.elp.gov.bc.ca/rib/wis/tem/)
(h) Standard for Digital Terrestrial Ecosystem Mapping (TEM) Data Capture in British Columbia. Ecosystem Technical Standards & Database Manual. Version 3.0, 1999 RIC Ecosystems Working Group.

(i) Digital Terrestrial Ecosystem Mapping Data Capture (DC) User's Guide. 2000. RIC, Ecosystem Working Group

(j) Meidinger, Del; Lee, Tina; Douglas, George W.; Britton, Greg; MacKenzie, Will.; Qian, Hong. 2000. British Columbia plant species codes and selected attributes. Version 3. Research Branch. B.C. Ministry of Forests <URL>

(k) Howes, D.E. and E. Kenk. 1997. *Terrain Classification System for British Columbia. Revised Edition.* Manual 10. B.C. Ministry of Environment, Lands, and Parks. Victoria, B.C.

(l) Luttmerding, H.A., D.A. Demarchi, E.C. Lea, D.V. Meidinger, and T. Vold. 1990. *Describing Ecosystems in the Field.* Manual 11. B.C. Ministry of Environment, Lands, and Parks. Victoria, B.C.

(m) *A Method for Large-scale Biogeoclimatic Mapping in British Columbia* Eng, M. Version 1.0 Research Branch, B.C. Ministry of Forests, Victoria, BC.

(n) *Protocol for Quality Assurance and Accuracy Assessment of Ecosystem Maps*. Meidinger, D. 1999. Draft. Research Branch, B.C. Ministry of Forests, Victoria, BC.

Note: RIC documents are available in regional Ministry libraries and on the RIC website (http://www.for.gov.bc.ca/ric/standards.htm). Predictive Ecosystem Mapping documents are available through the TEM alternatives website (http://www.for.gov.bc.ca/research/temalt/) Ministry of Forests publications are available through Ministry for Forests Representatives and, in some cases, on the Ministry of Forests website. (http://www.for.gov.bc.ca/). Terrestrial Ecosystem Mapping documents are available through the TEM website (http://www.env.gov.bc.ca/rib/wis/tem)

All other listed materials are available through the regional Ministry of Environment, Lands and Parks library.

DELIVERABLES

The Contractor shall deliver the following to the Province:

1. An Input data quality assessment report. The contractor must report input data quality issues, steps taken to resolve those issues and modifications to methods and schedules. This preliminary deliverable will be included in the final INP.RTF file.

2. Spatial database in ARCinfo format of Biogeoclimatic linework at the project scale and the regional mapping scale, and intermediate coverages that were required to

produce that linework (BGC.e00), the associated polygon attributes (BGC.CSV) and the rule sets (KB) that was used to generate the linework (BGC.RTF)..

3. A preliminary listing of the mapping entities to be predicted, including proposed project-specific entities. New mapping entities are subject to approval by the Regional Ecologist or by the designated Ecological Correlator. This interim deliverable will be included in the final KNB.RTF file.

4. Predictive Ecosystem spatial database with polygon attributes (ECP.e00) and the associated spatial field plot locations with the point attributes (ECI.e00) and a linked predicted structural stage spatial database (STS.e00), all in ARCINFO-export digital format according to current Ministry of Environment, Lands and Parks standards. This is a seamless digital map of the entire project area. Submissions of individual mapsheets will NOT be accepted. Corresponding digital polygon databases for Predicted Ecosystem Units, (ECP.CSV) and for predicted structural stage (STS.csv), with all core attributes, and additional polygon attributes as agreed to with the Ministry Representative following current RIC and Ministry standards, are also required. Every point and polygon feature must have a feature code and a primary key linking the feature to a non-spatial attribute.

5. Files in CSV format (ASCII) format containing all the structured project meta data, as detailed in *Standard for Digital Predictive Ecosystem Mapping (PEM) Data Capture in BC*. This includes INP.CSV and NON.CSV, as required.

6. Files in RTF format, containing additional metadata as required by *Standard for Digital Predictive Ecosystem Mapping (PEM) Data Capture in BC*. This includes INP.RTF, (for input metadata), BGC.RTF (for rule sets associated with localized BGC units), KNB.RTF, (for final mapping entities, relationship between the input attributes and the output mapping entities, the inferencing element that applies the KB to the assembled input inventories and the accuracy assessment of the final product) and STS.RTF for the knowledge base associated with the predicted structural stage.

7. A final report with format agreed to by the Contractor and Project Ecologist. The report should include a description of the study area (geology, terrain, soils, disturbance history, methodologies, etc.), the project objectives, any other resource information collected for the study area (e.g., site index data, wildlife-habitat relationships. The report must be provided to the province in draft form for review. Following this review, revisions are to be completed by the subcontractor.

8. All project materials purchased for project, including original typed air photos, original plotsheets, maps, equipment, and loaned materials (e.g., TRIM files).

9. All final digital products in approved formats as defined in this Schedule, including "cleaned" corporate input data, ecosystem maps, field data, control points and reports used in mono-restitution, etc.

10. Milestone reports upon completion of the Services or, where the Services are phased in over more than one year, at the Ministry's fiscal year end (March 31).

Note: Milestone Report Forms are available electronically from the Ministry Representative and on the Forest Renewal BC website (http://www.forestrenewal.bc.ca/bc-stats/report.html).

SCHEDULE

The Contractor shall provide the Services based on the following schedule:

Service	Delivered by:
Input data quality report, including plots of graphic feature control shift	
Localized BGC units, including Alpine and parkland boundaries	
Proposed mapping entities	
Preliminary Knowledge Base and its reliability report, including required revisions to procedures and schedule	
Final spatial database files (digital map e00 files)	
Final non-spatial databases (polygon attribute databases – CSV files)	
Final metadata, (including CSV and RTF files)	
Final Report	

The Contractor shall provide the Services based on the attached Task Completion Schedule in Appendix B. This schedule must be completed and included with any materials being submitted for Quality Assurance.

Quality Reviews

Quality reviews will be made upon completion of the following tasks and submission of the associated deliverables:

⇒ **Quality Review #1**

Project planning, input data quality report, proposed mapping entities, and localized BGC .

⇒ **Quality Review #2**

* Proposed knowledge base and preliminary KB reliability report

⇒ **Quality Review #3**

* Project metadata, graphics files and associated polygon databases .

⇒ **Quality Review # 4**
- Final report

PROPOSAL INCORPORATED

The Contractor will provide the Services as described in their attached proposal:

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MINISTRY CONTACTS

All Schedule administration inquiries and submissions of deliverables shall be directed to the Ministry Representative:

Ministry Representative: **[NAME, ADDRESS] phone e-mail**

Quality Control/Quality Assurance personnel

Project Ecologist: **[NAME, ADDRESS] phone e-mail**

Terrain Correlator: **[NAME, ADDRESS] phone e-mail (if applicable)**

Regional Ecologist: **[NAME, ADDRESS]**
phone e-mail

GIS Monitor: [NAME, ADDRESS, PHONE, E-MAIL]

Project Sign Off - Task Completion Schedule for _____ PEM Project

	Project Steps	Deliverables and undertakings to be supplied by proponent / contractor	Contractor Sign-off & date	Agency (ministry rep) Sign-off & date	Notes (file names listed here are generalized. See sect. 5.2 of PEM digital data capture standards for project-specific naming conventions)
Project Planning	**Client Requirements assessment**	Determine client's interpretive needs, required Reliability (risk), available resources, timelines. Undertake a rough assessment of input data quality.		MELP WHIS MELP RIB (Agency signoff not required)	-Consider provincial, Regional priorities -Resource management plans -Decision matrix
	Project initiation meeting	info gathering, confirm all existing knowledge available to contractor, area familiarization, review of contract expectations / steps, mapping methods, Schedules, roles and responsibilities, partnership agreement for QC/QA...etc.		MELP WHIS MELP RIB (Agency signoff not required)	date and place Invite participation of FS Ecologist
Input Data preparation and evaluation	**Localized BGC**	typed photos (if applicable), rule sets, spatial databases and associated polygon data base, graphics files of intermediate coverages		FS Ecologist or MELP RIB	BGC.RTF BGC.CSV BGC.e00
	Input data quality assessment report	Contractor must report Input data Quality issues and modifications to methods and schedules		MELP WHIS	Include plots of Positional accuracy IND.RTF
Knowledge Base Development	**Mapping Entities**	Submit new proposed mapping entities for approval		FS Ecologist or MELP RIB	KBD.RTF
	Knowledge Base First iteration	Run "blank" data set through Knowledge Base Or submit test results as meta data		FS Ecologist or MELP RIB	
Project Completion	**Project Meta Data**	Submit meta data		MELP RIB	INP.RTF INP.CSV PRO.RTF PRO.CSV USR.CSV (optional) USR.RTF (optional)
	Additional meta data New inventories and derived coverages/attributes	Report meta data for Non-RIC standard inputs generated specifically for this PEM (as required)			NON.CSV NON.RTF See appendix #1 in PEM Inventory Standards

	Predicted Ecosystem Knowledge base	report final mapping entities, entity-attribute relationships, and assumptions, knowledge base reliability and reference the inferencing element		MELP RIB	KNB.RTF
	Predictive Ecosystem Map, Structural stage layer	Submit final spatial databases, associated polygon data bases		MELP RIB	ECP.e00 ECP.CSV STS.e00 STS.CSV ECI.XLS (optional) ECI.MDB (optional) ECI.e00 (optional)
	Structural Stage Knowledge base	Report structural stage entity-attribute relationships and meta data		MELP RIB	STS.RTF