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Report Title: *Terrestrial Ecosystem Mapping of the Peace River Study Area Report – Baseline Inventory Surveys - 2007*
Project: Peace River Site C Hydro Project
Prepared By: Keystone Wildlife Research Ltd.
Prepared for: BC Hydro

NOTE TO READER:

This is a report on a study commissioned toward the development of engineering, environmental and technical work conducted to further define the potential Site C project.

For environmental studies, the focus is on the development of an environmental and socio-economic baseline around the area of the potential Site C Project. Baseline studies are generally a survey of existing conditions within a project study area.

This report and other information may be used for future planning work or an environmental assessment or regulatory applications related to the potential Site C Project.

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TERRESTRIAL ECOSYSTEM MAPPING OF THE PEACE RIVER STUDY AREA
BASELINE INVENTORY SURVEYS
2007

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Prepared for:
BC Hydro

Field Work: 2005, 2006
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Terrestrial Ecosystem Mapping of the Peace River Study Area

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ii) data collected by Keystone Wildlife Research Ltd. and/or supplied by outside sources; and

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Executive Summary

This report describes the methods and results of Terrestrial Ecosystem Mapping (TEM) completed at 1:20,000 scale for the Peace River Corridor, including the potential Site C reservoir area and the related transmission line. TEM is a provincial standard method of mapping terrestrial ecosystems. It has two components, bioterrain and ecosystems. Bioterrain characteristics include parent materials (surface rock types), terrain expression (e.g. gullying) and drainage. Ecosystems are defined as sites with distinct vegetation communities and physical characteristics such as slope, aspect, and moisture. Polygon boundaries are drawn on aerial photographs around areas with distinct bioterrain and ecosystem types. Each polygon is labelled with a number and the ecosystem and bioterrain information for that polygon is stored in a database. The polygon linework is also digitized so it can be analyzed spatially using Geographic Information Systems (GIS) software.

TEM mapping can be used to provide quantitative information about the physical and vegetation characteristics of an area of interest, and the potential impacts of various land management scenarios. The TEM mapping may be used to develop habitat maps for particular wildlife species. Habitat maps show locations of high-suitability habitat, and these may also be analysed to assess the potential effects of land management scenarios on particular wildlife species.

The study conducted was a baseline study, commissioned by BC Hydro toward the development of an environmental baseline around the area of the potential Site C Project. Baseline studies are preliminary to and not intended to be environmental effects assessment studies. Baseline studies are generally a survey of existing conditions within a project study area.

1.0 INTRODUCTION

Terrestrial ecosystem mapping of the Peace River study area was requested by BC Hydro and Power Authority as base mapping for evaluating impacts of operations, water use planning and/or future hydroelectric development. An analysis of the habitat available in the valley and adjacent plateau areas will be the principal means of quantifying the habitat values for native wildlife and plants and assessing effects of potential future projects in the area.

2.0 STUDY AREA

The Peace River study area extends from Hudson's Hope in northeastern British Columbia to the Alberta border, encompassing the core Peace River corridor downstream of the Peace Canyon Dam (Figure 1). Geographically, the core river corridor ('corridor' portions of the study area) refers to the entire river valley including the floodplain and the ascending slopes extending approximately 2 km on either side of the river's centre. Three of the larger drainages (Cache Creek, Halfway River and Moberly River) were also mapped for up to 10 km of their length. In 2006, a second area was added to the 'corridor' study area. The 'transmission line study area was defined as the route of an existing transmission line running from the GM Shrum generating station at Williston south of the Peace River to rejoin the corridor study area on the south bank of the river just southwest of Fort St. John at the potential Site C dam site. The transmission line study area includes a 500 m buffer on either side of the transmission line centreline.

The study area includes portions of 25 TRIM map sheets, and is within the Peace Forest District in the Northern Interior Forest Region. The climate is moderate and continental, with moderately warm summers and relatively cold winters (Farstad *et al.* 1965).

2.1 Ecoregion and Biogeoclimatic Classification

Ecosections are large physiographic units influenced by particular macroclimate processes and are characterized by all the plant communities and wildlife populations present (Demarchi 1996). The biogeoclimatic ecosystem classification system (BEC) describes the variation in climate, vegetation and site conditions occurring within an ecosection, and divides the area into subzones and their variants. The ecoregion, ecosection and single biogeoclimatic variant found within the study area are described below.

Ecoregion and Ecosection

The study area falls within the Peace River Basin ecoregion (Figure 1). The Peace River Basin is a wide plain that lies between rolling uplands to the north and south, and is dissected by the Peace River and its tributaries. (Demarchi 1996). The study area includes one ecosection and a single subzone variant.

Peace Lowlands

The study area lies within the Peace Lowlands (PEL) ecosection. The Peace Lowlands Ecosection is a blocky mountain area on the east side of the Rocky Mountains, with strong rainshadows (Demarchi 1996).

Biogeoclimatic Subzone

The BWBSmw1 variant covers the rolling plains that extend from near where the Rocky Mountains cross the Alberta border, north to near the Beatton River (Delong 1990). Elevations within the variant range from 750 to 1050 m. Trembling aspen (*Populus tremuloides*) is the dominant tree cover in most of the variant due to past history of frequent fires and other anthropogenic disturbance. Balsam poplar (*Populus balsamifera* ssp.) occurs on wetter depressional sites. White spruce (*Picea glauca*) is present on moist to wetter sites where there has been limited fire history. Lodgepole pine (*Pinus contorta*) occurs as a seral species on drier and poorer sites. Black spruce (*Picea mariana*) forests, often with a minor component of tamarack (*Larix laricina*), are present on organic soils. Much of the original lowland habitat along the river has been converted to agricultural crops (Delong 1990).

The BWBSmw1 is the second most active region in British Columbia for forest fires, with many relatively recent wildfires (Steve Taylor, Canadian Forest Service, pers. comm., Dec. 2005, cited in Haeussler 2005). The fire return interval is estimated at 120 years (Fort St. John Pilot Project 2006).

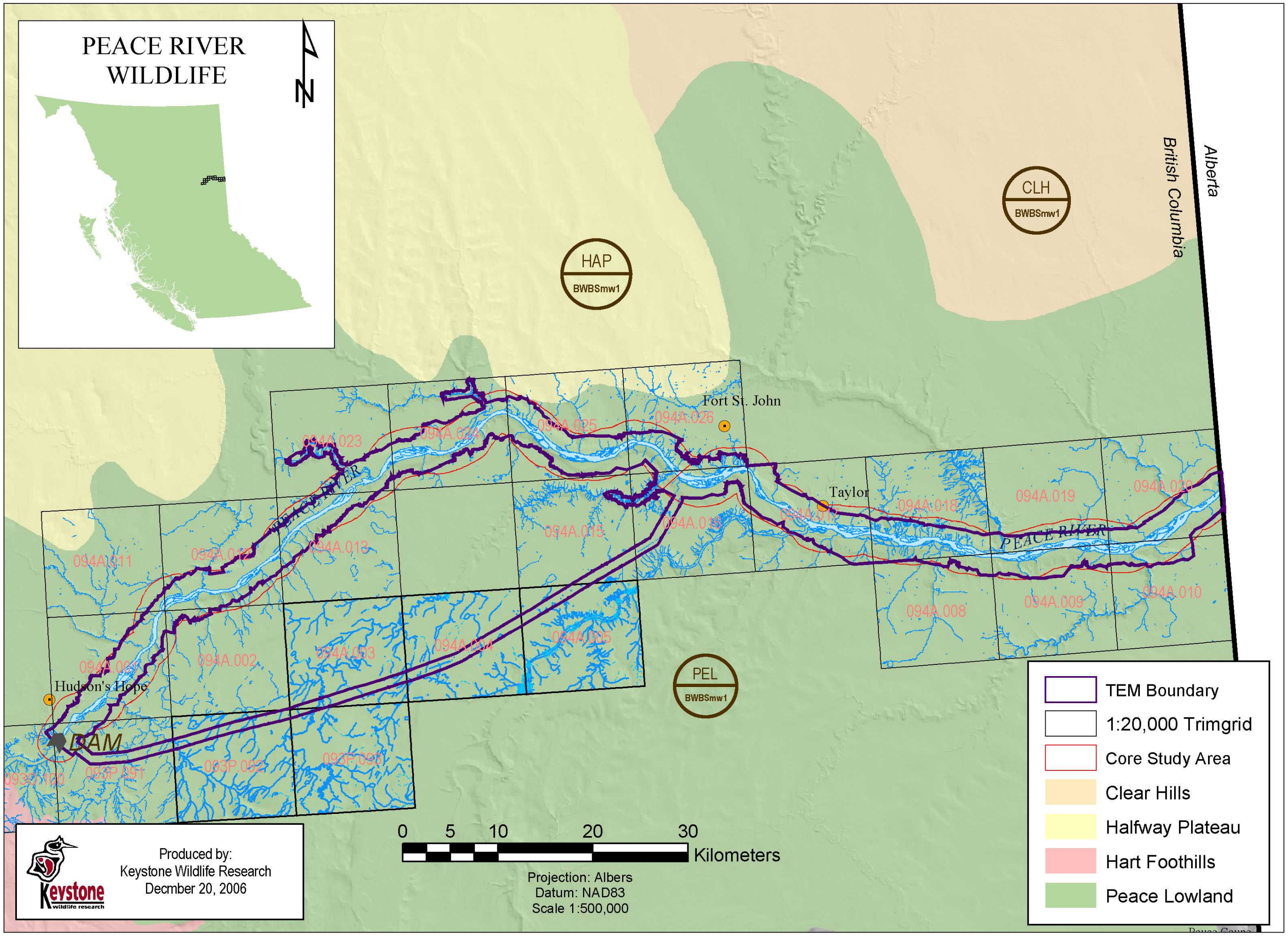

Figure 1. The Peace River Corridor and related transmission line study area.

2.2 Geology, Glacial History, and Soils

The following description of the geology the Peace River area has been reproduced from Farstad et al. (1965).

The Peace River is formed by the confluence of the Finlay and Parsnip Rivers. The Peace River is less than 480 m in elevation at Hudson's Hope and forms a steep-banked valley approximately 180 to 240 m deep and 3.2 to 6.4 km wide. The Peace River's main tributary streams (Beatton, Kiskatinaw, Pine, Moberly and Halfway) also form deeply incised valleys. The main river drainages have cut deep channels that expose the underlying Upper Cretaceous bedrock in places.

Undulating and rolling till plain interspersed with glacial lake basins forms the majority of the study area. The area is underlain by a succession of Cretaceous shales and sandstones that have been tilted gently to the northeast, east and southeast. The elevational difference between the uplands underlain by sandstone and the lowlands underlain by shales has affected the climate and vegetation, and therefore the resulting soil characteristics.

Glaciation of the study area during Wisconsin time (35,000 to 11,150 years ago) resulted in deposits of till in a pattern of parallel grooves and ridges (drumlins). The action of the Peace River and its tributaries has left a series of discontinuous benches cut into the bedrock, covered with a mantle of fluviatile debris. Smaller tributary streams have incised similar valleys with smaller benches veneered (<2 m in depth) with thinner sediment mantles. Some small or intermittent streams draining onto gentle slopes on either the former lake bottom or benches have deposited fans of poorly-sorted sediment.

The soils within the Peace River Corridor are primarily Alluvial (Farstad *et al*. 1965). Relatively minor areas of other soil types are also present (Table 1).

Table 1. Soil types present within the study area.

Name	Description
Alluvial	Undifferentiated river flat and terrace deposits
Branham	Orthic brown wooded sandy loam and fine sandy loam
Clayhurst	Degraded brown wooded gravelly sandy loam and sandy loam
Taylor	Rego black loam and clay loam
Rycroft	Black solodized solonetz clay loam and clay
Farrell	Mull regosol silt loam and silty clay loam

2.3 Wildlife

The study area is home to many species of wildlife. Larger mammals include moose (*Alces americanus*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*) and Rocky Mountain elk (*Cervus canadensis*). The PEL ecosection is the provincial benchmark for moose (RIC 1999). Black bears (*Ursus americanus*) are common, but grizzly bear (*Ursus arctos*) sightings are rare (Blood 1979; Thurber 1976). Beaver (*Castor canadensis*) are abundant along the river. Marten (*Martes americana*), weasels (*Mustela* spp.) and mink (*Neovison vison*) are taken by local trappers (Blood 1979). Fishers (*Martes pennanti*) are taken occasionally (*ibid*). Six bat species have been recorded in the study area (Kellner and Simpson 2009). Deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), red-backed vole (*Myodes gapperi*), cinereus shrew (*Sorex cinereus*) and meadow jumping mouse (*Zapus hudsonius*) are known to be present (Blood 1979), and other species of small mammals likely inhabit the river corridor. Herptile species that have been recorded include the boreal chorus frog, western toad (*Bufo boreas*), Columbia spotted frog (*Rana luteiventris*), wood frog (*Rana sylvatica*), common garter snake (*Thamnophis sirtalis*), western terrestrial garter snake (*T. elegans*) and long-toed salamander (*Ambystoma macrodactylum*) (Keystone Wildlife Research Ltd. 2009).

The area's avifauna includes numerous waterfowl species such as ducks, coots and grebes, loons, swans and geese. Common raptors are Bald Eagle (*Haliaeetus leucocephalus*) and Great Horned Owl (*Bubo virginianus*). Ruffed Grouse (*Bonasa umbellus*) are numerous in the river valleys. A variety of songbirds is present, and the deciduous and mixed forests provide habitat for several Red or Blue-listed species such as the Black-throated Green Warbler (*Dendroica virens*) and Canada Warbler (*Wilsonia canadensis*) (Keystone Wildlife Research Ltd. 2009).

2.4 Human Use of the Study Area

The Peace River area has long been occupied by aboriginal peoples. The Athapaskans (Beaver and Sekanni) were the original groups to settle in the area, with the Algonkian Cree arriving from further east shortly before Europeans arrived (Benke and Cushing 2005). Native peoples harvested a wide variety of plants including rose (*Rosa* spp.) hips, soopolallie berries (*Shepherdia canadensis*), blueberries (*Vaccinium* spp.), saskatoon berries (*Amelanchier alnifolia*), raspberries (*Rubus idaeus*), strawberries (*Fragaria* spp.), cranberries (*Viburnum edule*), gooseberries (*Ribes* spp.), wild onions (*Allium cernuum*), water lilies, cow parsnip (*Heracleum lanatum*), aspen bark, and thistle (*Cirsium* spp.) (Calverley no date). There is little information available regarding traditional ecological practices by First Nations in the study area, but native peoples inhabiting the Peace River area in northern Alberta were known to use fire as a forest management tool (Mitchell and Gates 2002).

The major settlements in the study area are the city of Fort St. John and the town of Hudson's Hope. Smaller communities are also present, mostly along Highway 29, which runs along the north bank of the river and transects the study area from east to west. Agriculture (both field crops and livestock) is a major influence on the ecosystems of the study area, where approximately 75% of the land has been estimated as suitable for vegetable, cereal and forage crops with soil capability classifications of 1 through 4 (BC Hydro 1991). Most of the agricultural activity takes place on extensive areas of private, Hydro or Crown-leased land on the north bank of the river. The Peace River valley produces most of BC's grain and canola crops (Benke and Cushing 2005). Agricultural activity on the south bank is limited due to access restrictions, although extensive areas on the south bank are within the Agricultural Land Reserve (BC Hydro 1991).

Present-day human use of the study area includes industrial activities such as oil and gas extraction and exploration, timber harvest and transportation by railway and road. Trapping and hunting occur in most areas. The Peace River itself is used for recreational boating and fishing.

3.0 METHODS

3.1 Literature Review

An initial review of existing studies was done to assemble background information for the study area. Existing 1:50,000 biophysical mapping for the area (Lea and Lacelle 1989; Thompson *et al.* 1980; Figure 2) was obtained and reviewed. Efforts were made to obtain plot data from the existing biophysical mapping projects, but only small portions of that data could be located. Soils mapping was also obtained (Farstad *et al.* 1965).

Forest cover mapping at 1:20,000 for the mapsheets included within the study area (93O.100, 94A.001-002, 008-010, 011-13, 015-20, and 023-026) was obtained for use in determining tree cover and disturbance history. The regional field guide for the BWBSmw1 (Delong 1990) and the draft seral guide (BC MoF 2002) were used to create the draft working legend. The current list of provincial mapcodes for the BWBSmw1 was downloaded from the provincial government website (RIC 2003), and the regional ecologist was contacted regarding noncorrelated units.

In early 2006, after preliminary mapping and the first session of field truthing, four additional ecosystem units were released by the Ministry of Forest for the BWBSmw1. These were the 09, 10, 11 and Wf02. Those new units have been incorporated into the mapping where appropriate. The new 10 site series (Wb06) was formerly known as the noncorrelated TS Lt-Sedge unit, and has been mapped as the TS with the permission of the Regional Ecologist (C. Delong, BC MoF, pers. comm.).

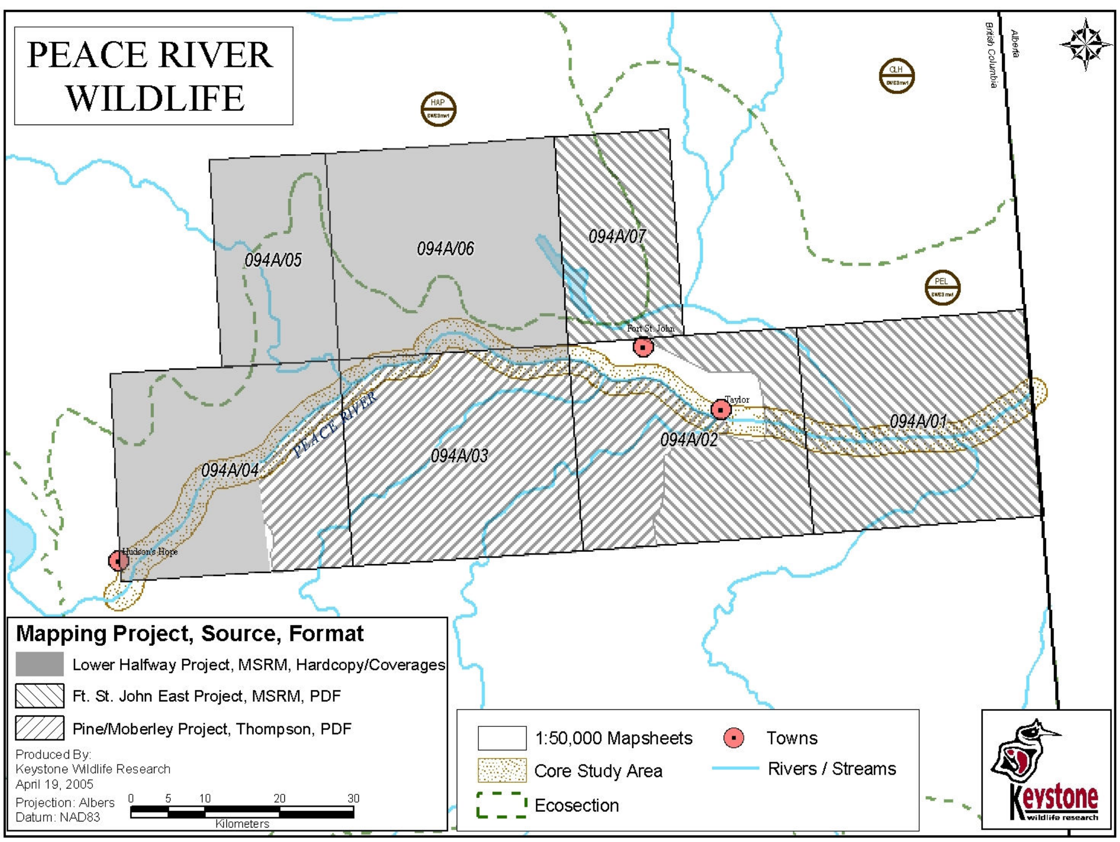

Figure 2. Existing biophysical mapping for the study area.

3.2 Preparation of Draft TEM Mapping

The ecosystem mapping methodology follows that described in ***Standard for Terrestrial Ecosystem Mapping in British Columbia*** (TEM; RIC 1998a).

Initial Bioterrain Mapping

Initial bioterrain mapping of the Peace River Corridor was completed by Sid Tsang Geoscience of Vancouver, BC and by soil scientist Wayne Blashill. The transmission line area was mapped for bioterrain by Wayne Blashill. Bioterrain mapping procedures followed Howes and Kenk (1997), RIC (1996) and RIC (1998b). The bioterrain map legend is presented in Appendix 1.

Monorestitution / Cascade Control

Photo control points were provided by Andrew Neale Digital Mapping of Victoria. Monorestitution services were provided by Baseline Geomatics of Victoria.

Pre-typing of Air Photos

A working legend and draft toposequence was prepared using the provincial field guide information. Pre-typing of ecosystem polygons was completed by Lorraine Andrusiak of KeystoneWildlife Research Ltd., and by Wayne Blashill. The airphotos with bioterrain polygons were viewed stereoscopically and the bioterrain polygons further divided into polygons representing ecosystem units. Ecosystem units, modifiers, and structural stage information for each numbered polygon was recorded onto polygon data sheets, and entered into a standard TEM database in MS Access format. The ecosystem map legend is presented in Appendix 2.

3.3 Field Sampling

TEM-targeted field sampling methods followed BC MELP and BCMoF (1998). Additional GIF and visual plots were done throughout the summer of 2006 in conjunction with other surveys (rare plants, bats, birds, amphibians). Additional plots from the Ministry of Forests data archives were obtained and were used for mapping. The survey intensity level was 4 (15-25% of polygons inspected).

3.4 Data Synthesis and Analysis

Field data were entered digitally using standard government software (VENUS, GRAVITI). At the completion of data entry, the data was reviewed and signed off by a senior staff member and then transferred to the GIS department where the field plot locations were converted to an ArcInfo points coverage. That data were reviewed to ensure that there was a one-to-one link between the field collected data and the field plot location coverage, and to ensure that UTM locations in the field corresponded with the correct polygon number noted for the plot. The provincial government's quality control software 'DC Tools' was run on the data and the data summaries were provided to the bioterrain specialist and ecologists so errors could be corrected.

Field data were analysed using the Ministry of Forests' VPRO program. The field data were reviewed and were reclassified when necessary to fit revised descriptions of the ecosystem units, and the new units released by MoF. Regional Ecologist Craig Delong reviewed data for proposed new/noncorrelated ecosystems and provided direction for classification of those plots. Updated plant lists were prepared for the ecosystem units in the study area, and the expanded legend and plot database were revised based on those edits.

The bioterrain and ecosystem information in the map database and the map linework were edited based upon the field data. A final ecosystem unit legend was prepared to describe all of the mapped ecosystem units. An expanded legend, providing detailed descriptions of mapped ecosystem units, was also prepared.

3.5 Preparation of Final Ecosystem Maps

The ecosystem map was produced in ARCINFO export format to RISC (2000, 2003) standards. A seamless coverage of the entire project area was produced, with one polygon .e00 coverage for ecosystems and one corresponding database for ecosystem units including all core attributes according to RISC (2000, 2003). A point coverage was completed, containing plot locations linked to the VENUS database with feature codes and unique identifiers linking point data to the attribute data base.

Final map linework includes ecosection, variant, bioterrain and ecosystem unit. The final map legend defines all units and symbology. Sample plot locations are also provided as a map layer.

3.6 Correlation

Several new and/or noncorrelated units were described in the map legend (Table 2). Plot data for those new units was provided to Regional Ecologist Craig Delong for review. This review and subsequent discussion resulted in the use of the units described in Table 2, in addition to those found in the field guides.

Table 2. New and/or noncorrelated map units used in the project.

Site Series	Map Code	Name
00	AS	Sw-At-Soopolallie
$07, $05	SH: ep, SC: ep	Ep-Red-osier Dogwood seral association
09	Fm02	ActSw - Red-osier Dogwood - floodplain
00	SE	Sedge Wetland
10	TS	Tamarack - Sedge - Fen
00	WH	Willow - Horsetail - Sedge - Riparian Wetland
00	WS	Willow-Sedge Wetland
00	WW	Wolf willow-Fuzzy-spiked Wildrye

In-house quality assurance routines were also completed. These included cross-checking plot location UTMs with digital map data to ensure that plots were located in the correct polygons, ensuring that plant species name codes were consistent with the most recent codes as listed in VENUS 5, using VENUS validation tools to identify errors, and using the DC Tools program to locate errors in the map database.

Feature coding is a GIS process in which a standard 10-character code that classifies the topographic features is applied to all digital spatial data. Each digital topographic feature type has its own unique code. All feature arcs, points and polygons require a feature code. The feature code describes the data types such as field plot types, ecosystems, BEC variants, and study area boundaries. A complex rule set and algorithm is used to assign the codes to each arc. The spatial relationship of the attribute data within each polygon guides the assignment of codes. Therefore, errors within the polygon attributes will result in incorrect assignment of feature codes.

Keystone has developed a process and tool to assign correct feature codes based on polygon attributes. An iterative process to correct attributes until the polygon arcs are assigned correct feature codes was completed. Quality assurance of digital data followed ***Standard for Terrestrial Ecosystem Mapping (TEM) – Digital Data Capture in British Columbia*** (RIC 2000)***, Quality Assurance Guidelines: Terrestrial***

Ecosystem Mapping – Digital Data Capture (TEM-DDC) Review Draft (RISC 2003) and ***Standard for Digital Terrain Data Capture in British Columbia*** (RISC 2005).

Normally, an ecosystem must make up at least 20% of a polygon to be included in the polygon label (i.e. deciles of 1 are not normally used). However, some of the ecosystem units mapped were of particular importance to rare resources being studied in other programs associated with the project, so they were mapped down to deciles of 1 (10%). Those ecosystems included cutbanks (important as roosting habitat for bats), wetlands and waterbodies (important for amphibians), and the WW grasslands (see Table 2; habitat for rare butterflies and rare plant species).

4.0 TERRESTRIAL ECOSYSTEM MAPPING RESULTS

4.1 Field Sampling

TEM-targeted field sampling took place from September 2, 2005 to September 12, 2005, and from July 13-21, August 9-16, and September 9-21, 2006. Additional GIF and visual plots were done throughout the summer of 2006 in conjunction with other surveys (rare plants, bats, birds, amphibians). In total 38% of the mapped polygons were visited. A summary of the plots within the study area is presented in Table 3.

Table 3. Numbers of field survey plots completed by type in 2005 and 2006.

Plot Type	Plots required to achieve 25% inspection	Total Plots*
Full	85	119
GIF	340	599
Visual	1274	1881
Grand Total	**1699**	**2599**

*actual number of plots completed was 2941, but some polygons had multiple plots.

It was noted during field sampling that the ecosystems units of the BWBSmw1 as described in the provincial site guides (DeLong 1990; MoF 2002) did not correspond well to the ecosystems found in the Peace River Valley. Regionally, most of the BWBSmw1 is gently sloped terrain, and the ecosystems found in the steep incised valleys and gullies of the Peace River corridor did not match the descriptions of ecosystems in more typical BWBSmw1. A number of the indicator plant species described in the field guide were either present within the majority of the site series or else were missing altogether, making it difficult to distinguish the site series in the field. The working legend and draft toposequence diagrams (diagrams showing ecosystem classification by slope, aspect and slope position) were revised several times in the field, but post-field review of the plots and revisions to the working legend and site descriptions were required.

Field Plots

A total of 119 detailed plots (full), 599 ground inspections (GIFs) and 1881 visuals were completed (Table 3). The plot classification was revised from the field classification as four new ecosystem units for the BWBS were released by MoF in 2006, and because several wetland ecosystems differing in their dominant sedge species as described in the field proved to be too difficult to distinguish on air photos and were combined into more generic sedge wetland units.

4.2 Bioterrain Mapping

Eleven different types of surficial materials were mapped in the project area (Table 4).

Table 4. Surficial materials mapped in the project (definitions from Howes and Kenk 1995).

Symbol	Name	Definition
A	Anthropogenic	Artificial materials, or geological materials so modified by human activity that their original physical properties (e.g., structure, cohesion, consolidation) have been drastically altered. Anthropogenic materials were rarely mapped.
C	Colluvium	Materials that have reached their present positions as a result of direct, gravity-induced movement involving no agent of transportation such as water or ice, although the moving material may have contained water and/or ice. Colluvium was frequently mapped on the steep valley sides. Moderate slopes and hummocks were the most frequently mapped surface expressions. Slow mass movement were the most common geomorphological processes, and drainage was usually rapid to well.
F	Fluvial	Materials transported and deposited by streams and rivers; synonymous with alluvial. Fluvial materials were the most common mapped surficial materials. Plains and terraces were the most commonly mapped surface expressions. Anastamosing channelling was the most common geomorphological process, and drainage was usually moderately well-drained to imperfect.
FG	Glaciofluvial	Materials that exhibit clear evidence of having been deposited by glacial meltwater streams either directly in front of, or in contact with, glacier ice. Glaciofluvial materials were mapped less often than glaciolacustrine materials. Plain and undulating surface expressions were most commonly mapped. Gullying and meltwater channelling were the most common geomorphological processes, and drainage was generally moderate to well.
L	Lacustrine	Sediments that have settled from suspension and underwater gravity flows, such as turbidity currents, in bodies of standing fresh water, or sediments that have accumulated at their margins through the action of waves. Veneers were the most commonly mapped surface expression. Meandering channelling was the most common geomorphological process, and drainage was most often imperfect.

Symbol	Name	Definition
LG	Glaciolacustrine	Lacustrine materials deposited in or along the margins of glacial (ice-dammed) lakes; includes sediments that were released by the melting of floating ice. Glaciolacustrine materials were frequently mapped. Plains and blankets were the most commonly mapped surface expression. Irregularly sinuous channeling was the most common geomorphological process, and drainage was usually moderately well.
M	Morainal	Material deposited directly by glacier ice without modification by any other agent of transportation. Gentle slopes and blankets were the most commonly mapped surface expression. Gully erosion was the most common geomorphological process, and morainal materials were typically well-drained.
O	Organic	Sediments composed largely of organic materials resulting from the accumulation of vegetative matter. They contain at least 30% organic matter by weight (17% or more organic carbon). Organic materials were mapped in association with wetlands and low-gradient watercourses. Blankets and veneers were the most commonly mapped surface expressions. Surface seepage was the most common geomorphological process, and drainage was usually poor.
R	Rock	Bedrock outcrops and rock covered by a thin mantle (up to 10 cm thick) of unconsolidated or organic materials. Rock was rarely mapped, and slow mass movement was the most common geomorphological process.
U	Undifferentiated	A layered sequence of more than three types of surficial material outcropping on a steep, erosional (scarp) slope. Undifferentiated materials generally were found with moderately steep surface expression. Gullying and slow mass movement was the most common geomorphological process, and drainage typically well to moderate.
V	Volcanic	Unconsolidated sediments of volcanic origin. Volcanic materials were rarely mapped, and were most often found on moderate slope surface expression. Slow mass movement was the only geomorphological process mapped, and polygons generally well-drained.

4.3 Biogeoclimatic Subzone and Ecosystem Units

A total of 6843 polygons was mapped. A list of the ecosystem units mapped in the study area is provided in Table 5. A detailed description of the ecosystem units found in the study area is available in the project’s expanded legend (Andrusiak and Simpson 2007). Site series 10 (Wb06) was formerly known as the noncorrelated TS Lt-Sedge unit, and permission was obtained from the Regional Ecologist to continue to map this unit using the ‘TS’ code rather than ‘Wb06’ (C. Delong, BC MoF, pers. comm.).

Table 5. Ecosystem units mapped in the study area.

Map Code	Site Series #	Ecosystem Name
AM	01	SwAt - Step moss
AM: ap	$01	$At - Creamy peavine (seral association)
AMy: ap	$01	$At - Creamy peavine, moist (seral association)
AMk: ap	$01	$At - Creamy peavine, cool aspect (seral association)
AMw: ap	$01	$At - Creamy peavine, warm aspect (seral association)
AS	00	SwAt – Soopolallie
BL	04	Sb - Lingonberry - Coltsfoot
BL: al	$04	$At - Labrador tea (seral association)
BT	08	Sb - Labrador tea – Sphagnum
Fm02	09	ActSw - Red-osier dogwood
LL	02	Pl - Lingonberry - Velvet-leaved blueberry
LL: ak	$02	$At - Kinnikinnick (seral association)
SC	06	Sw - Currant – Bluebells
SC: ab	$05	$At – Black Twinberry (seral association)
SC: ep	$05	$Ep – red-osier dogwood (seral association)
SE	00	Sedge Wetland
SH	07	Sw - Currant – Horsetail
SH: ac	$07	$Ac – Cow parsnip (seral association)
SH: ep	$07	$Ep – Ep-Dogwood (seral association)
SO	05	Sw - Currant - Oak fern
SW	03	Sw - Wildrye – Peavine
SW: as	$03	$At - Soopolallie (seral association)
TS	10	Tamarack - Sedge – Fen
WH	00	Willow – Horsetail – Sedge – Riparian Wetland
WS	00	Willow – Sedge – Wetland

Map Code	Site Series #	Ecosystem Name
WW	00	Fuzzy-spiked Wildrye - Wolf willow
Nonvegetated/Anthropogenic Units		
CB	00	Cutbank
CF	00	Cultivated field (incl. pastures)
ES	00	Exposed soil
GB	00	Gravel bar
GP	00	Gravel Pit
LA	00	Lake
MI	00	Mine
OW	00	Shallow open water
PD	00	Pond
RE	00	Reservoir
RI	00	River
RN	00	Railway
RO	00	Rock
RW	00	Rural
RY	00	Reclaimed Garbage dump
RZ	00	Road surface
UR	00	Urban

Seral Associations

The term 'seral association' describes present vegetation where the plant association is not in a climax or near-climax state (BC MSRM 2006). Seral associations have been described in the draft field guide for the 01 - 05 and the 07 site series in the BWBSmw1 (BC MoF 2002). The seral association for the 06 site series has been mapped as the 01 due to difficulty in distinguishing the two, which have the same vegetation list in the draft seral field guide and also overlap in slopes, slope positions and soil textures (BC MoF 2002).

Seral associations are mapped with a two-letter lowercase seral association code that follows the regular 2-letter uppercase site series code, except in two cases. According to the provincial mapcodes list, while the regular ecosystem codes for the BWBSmw1 05 and 06 site series are SO and SC, respectively, the seral association for the 05 site series is mapped with the 06 code (05 SC:ab; C. Erwin, pers. comm.). At present, the draft seral guide (BC MoF 2002) is confusing as the seral site series are shown as occupying different areas on the edatopic grid from those given in the regional field guide for the corresponding nonseral site series.

There is no ‘rule’ for distinguishing between seral versus nonseral ecosystems. That distinction is based on a combination of the percentage of coniferous versus deciduous tree cover and the degree of development of the moss layer (C. Delong, BC MoF, pers. comm.). Within the corridor portion of the study area, seral sites typically had a poorly developed moss layer and less than 20% coniferous tree cover (Figure 3).

Within the BWBSmw1, seral associations are normally dominated by aspen, with balsam poplar as the dominant in the SH (07). A new seral association of the 07 and 05 was defined for this project in consultation with Regional Ecologist Craig Delong. The new association, :ep, was created to classify gently sloping or cool aspect sites dominated by paper birch (*Betula papyrifera*) rather than the more typical aspen.

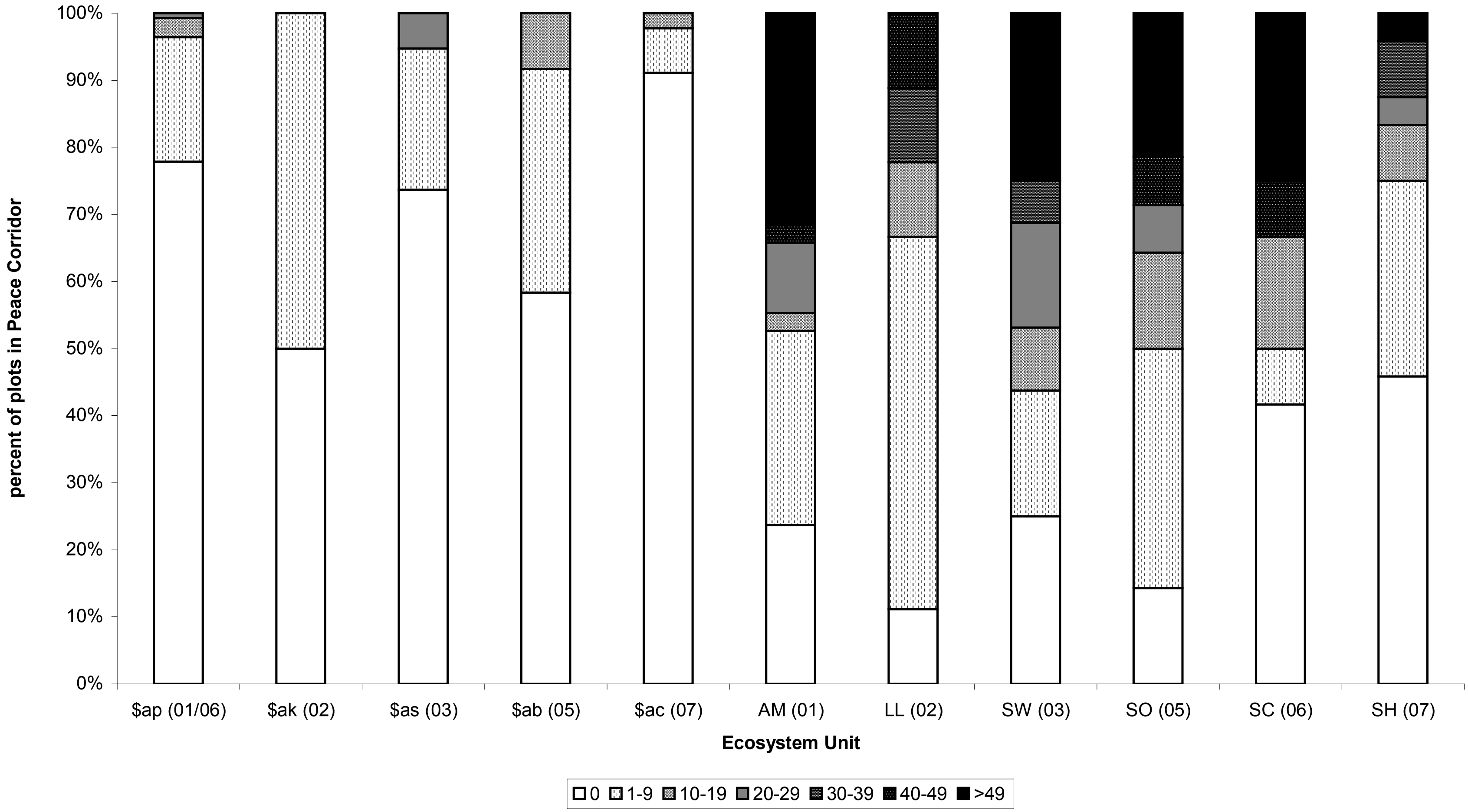

Figure 3. Percent cover of moss layer by ecosystem unit (Peace Corridor plots only).

Differences Between Study Area Ecosystems and Regional Field Guide Descriptions

Some plant species that were listed as indicator species in either the seral guide or the nonseral regional field guide were rare or absent in the study area. These include tall bluebells (*Mertensiana paniculata*), cow-parsnip (*Heracleum maximum*), oak fern (*Gymnocarpium dryopteris*), velvet-leaved blueberry (*Vaccinium myrtilloides*), devil's club (*Oplopanax horridus*), tall larkspur (*Delphinium glaucum*), and western mountain-ash (*Sorbus scopulina*).

The regional field guide key suggests using western mountain-ash and oak fern to distinguish between the 05 and 06 units, but this was problematic in the study area where oak fern was very rare and western mountain-ash was not found at all. The presence of a high cover of red-osier dogwood (*Cornus stolonifera*) was used instead to distinguish the 06 from the 05 (little to no dogwood present).

The WW noncorrelated ecosystem unit is listed in the provincial mapcodes list as 'Fuzzy-spiked Wildrye-Coyote willow', however, coyote or sandbar willow (*Salix exigua*) is a species found in moist floodplain habitats, not steep dry warm aspects. One of the most common shrubs in the WW unit is the wolf-willow or silverberry (*Elaeagnus commutata)*. We have used a revised version of the ecosystem unit name that includes wolf-willow rather than coyote willow.

In general, the ecosystems of the corridor study area seemed to have a sparser moss layer than described in the regional field guide. As an example, the average moss layer in the 01 AM ecosystem is listed as 55% cover (Delong 1999), but more than half of the 38 AM (nonseral) field plots in the corridor had moss layer cover values of <10%. The 03 SW ecosystem should have a moss layer averaging 75% cover according to the field guide, but plots in the study area averaged <10% moss cover.

There were also differences in the distribution of ecosystems, which were undoubtedly related to the incised valley terrain of the corridor study area. The 04 and 08 ecosystem units are listed as 'common' in the regional field guide, but were rarely mapped or found in the field in the corridor study area. The 04 and 08 were mapped much more frequently in the transmission line portion of the study area, on the upland plateau south of the river valley. Conversely, the 07 ecosystem unit is listed as ‘uncommon’ in the field guide, but was found extensively on the lower slopes and river terraces of the valley.

4.4 Non-vegetated, Sparsely Vegetated, and Anthropogenic Units

A number of nonvegetated, sparsely vegetated and/or anthropogenic ecosystem units were mapped (Table 4). The two most abundant ecosystems of this type are cultivated field (CF) and cutbank (CB). Cultivated fields covered extensive areas of the river terraces. Cutbanks were present on steep slopes adjacent to the river, often complexed with the sparsely-vegetated Wolf-willow-Fuzzy-spiked Wildrye (WW) unit. Many of the cutbanks were actively eroding and failed slopes, and slumping was common.

4.4 Site Modifier Symbols

Site modifiers are used to indicate ecosystems occurring in environmental conditions that are not typical for that particular ecosystem. Site modifiers are used to indicate particular topography, moisture and soil conditions. Up to two site modifiers can be used in a polygon map label. Site modifiers used in the Peace River TEM project are listed below (Table 6).

One new modifier ‘b’ was defined for the project (approved by TEM correlator Corey Erwin, Victoria). The ‘b’ modifier was used to identify sites where the 09 floodplain ecosystem occurred as sparse to dense balsam poplar regenerating on river gravel bars (Figure 4). Those sites had a very sparse herb layer and are subject to frequent disturbance by floodwaters.

Table 6. Mapped site modifiers.

Modifier	Definition
a	occurring on active floodplain
b	occurring on gravel bars
c	coarse-textured soils
d	deep soils
f	fine-textured soils
g	gullying occurring, or in a gully bottom
h	hummocky terrain
j	gentle to moderate slope, <25% slope
k	cool aspect (285-135 deg.), 25-100% slope
m	medium-textured soils

Modifier	Definition
n	fan or cone
p	peaty material at the surface
q	very steep (>100% slope) cool aspect (285-135 deg.)
r	ridge
s	shallow soils (20-100 cm to bedrock)
t	terrace
v	very shallow soils (<20 cm to bedrock)
w	warm aspect slope (135 to 285 deg.; slope 25-100%)
y	moister than average
z	Very steep (>100% slope) warm aspect (135-285 deg.)

Figure 4. Gravel bars revegetating with balsam poplar were mapped using a 'b' modifier defined for the project.

4.5 Structural Stage

Standard TEM structural stage definitions were used to describe seral stages of mapped ecosystems (Table 7). Most of the area had structural stages 2 (including significant areas of cultivated field) or 5 in its first decile. Only 223 ha were mapped as structural stage 7 (old forest) in its first decile. A summary of structural stages mapped (first decile only) is presented in Table 8.

Table 7. Structural stage definitions (RIC 1998a).

Structural Stage	Definition
1	Sparse/bryoid (< 20 yrs since major disturbance unless disclimax ecosystem)
1a	Sparse (less than 10% vegetation cover)

Structural Stage	Definition
1b	Bryoid (bryophyte and lichen-dominated communities (>50% of total vegetation cover))
2	Herb (< 20 yrs old unless disclimax)
2a	Forb-dominated (dominated by non-graminoid herbs)
2b	Graminoid-dominated (dominated by grasses, sedges, reeds and rushes)
2d	Dwarf Shrub (dominated by dwarf woody species)
3	Shrub (shrubs <10 m tall, < 20 yrs old for forested sites)
3a	Low Shrub (shrubs < 2 m tall)
3b	Tall Shrub (shrubs 2-10 m tall)
4	Pole /Sapling (trees > 10 m tall & usually < 40 yrs old)
5	Young Forest (trees > 10 m tall & 40-80 yrs old)
6	Mature Forest (trees > 10 m tall; 80-140 yrs old)
7	Old Forest (trees > 10 m tall; >140 yrs old)

Table 8. Area mapped by structural stage (first decile only).

Structural stage	Hectares	Percent of total
none*	6852	10.7
1	2040	3.2
2	10659	16.7
3	7817	12.2
4	9604	15.0
5	18355	28.7
6	8414	13.2
7	223	0.3
Total	**63965**	100.0

*River, lake, pond, open water, urban, railway, reservoir, road, and rural are mapped without structural stages.

5.0 MAP RELIABILITY

Several factors influence the reliability of the map. Road access was poor in a number of areas, especially on the south bank of the Peace River and in some portions of the transmission line, so field-truthing plots were limited in those areas. The presence of large areas of private land placed further constraints on field-sampling, although most of the area adjacent to the river is either Crown or BC Hydro land. Some areas remained unsampled if field crews could not locate the property owner for access permission. The forest cover maps were not particularly detailed for many areas of young seral forest, which was mostly typed as 'nonproductive brush'.

The Peace river itself has an enormous influence on the ecosystems that develop within its flood zone. The presence or absence of gravel bars and floodplain communities is dependent on the current state of flooding, and the recent flood history determines structural stage. The creation of the Williston Reservoir has changed the river's normal flood regime and ecosystems along the river's banks are undergoing successional changes that would not normally occur in an unregulated system (Benke and Cushing 2005). It is still unclear how succession will progress over time, which of course will be dependent on the flow management regime of the dam. Further changes in the water regime may result in additional changes to the successional processes within the study area.

Human activities such as agriculture, timber harvest and oil/gas development also affect the area's ecosystems. Seismic lines are a prominent feature of the landscape from the air. Active timber harvest was ongoing in several locations visited in the field, and map polygons were being converted from structural stage 6 to structural stage 3. Evidence of recent construction of gas wells and their infrastructure was also apparent. Although no large fires occurred during field-sampling, the landscape around the Peace River is heavily influenced by periodic fires, and fire return interval and fire history greatly affect the ecosystems that will develop in any particular area.

The ecosystem classification for the BWBSmw1 has a good deal of overlap in characteristics between site series. It is difficult to separate a number of units, especially those that are adjacent on the edatopic grid. Some units are defined as having a broad range of characteristics (e.g. the 04 unit, which can be submesic to hygric). There are plans to revise the ecosystem classification for the BWBSmw1 in the future (C. Delong, BC MoF, pers. comm.), so it is likely that these ambiguities will be addressed in the future.

There were limited data collected for bioterrain field-truthing (approximately 235 polygons checked). The reliability of the bioterrain mapping should be considered low. This is not expected to affect the interpretations made from the ecosystem mapping as field-truthing visitation for the ecosystem mapping was considerably higher (see Table 3).

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7.0 PERSONAL COMMUNICATIONS

Craig Delong, Regional Landscape Ecologist, BC Ministry of Forests, Prince George.

Corey Erwin, Vegetation Ecologist, BC Ministry of Environment, Victoria.

Appendix 1. Bioterrain Map legend.

PEACE TEM TERRAIN LEGEND

(1) TERRAIN UNIT SYMBOLS

Simple Terrain Units: e.g., texture ----> gFt - J <---- process
surficial material ____/ ____ surface expression

Note: Two or three letters may be used to describe any characteristic other than surficial material, or letters may be omitted if information is lacking.

Composite Units: Two or three groups of letters are used to indicate that two or three kinds of terrain are present within a map unit.

e.g., Mv · Rs indicates that "Mv" and "Rs" are of roughly equal extent

Mv/Rs indicates that "Mv" is more extensive than "Rs" (about 2/1 or 3/2)

Mv//Rs indicates that "Mv" is much more extensive than "Rs" (about 3/1 or 4/1)

Stratigraphic Units: Groups of letters are arranged one above the other where one or more kinds of surficial material overlie a different material or bedrock:

e.g., $\frac{Mv}{Rr}$ indicates that "Mv" overlies "Rr".

/$\frac{Mv}{Rr}$ indicates that "Rr" is partially buried by "Mv"

(2) MATERIALS

A	Anthropogenic materials	Artificial materials, and materials modified by human actions such that their original physical appearance and properties have been drastically altered.
C	Colluvium	Products of gravitational slope movements; materials derived from local bedrock and major deposits derived from drift; includes talus and landslide deposits.
E	Eolian sediments	Sand and silt transported and deposited by wind; includes loess.
F	Fluvial materials	Sands and gravels transported and deposited by streams and rivers; floodplains, terraces and alluvial fans.
F^A	"Active" fluvial materials	Active deposition zone on modern floodplains and fans; active channel zone.
F^G	Glaciofluvial materials	Sands and gravels transported and deposited by meltwater streams; includes kames, eskers and outwash plains.
L	Lacustrine sediments	Fine sand, silt and clay deposited in lakes.
L^G	Glaciolacustrine sediments	Fine sand, silt and clay deposited in ice-dammed lakes.
M	Till	Material deposited by glaciers without modification by flowing water. Typically consists of a mixture of pebbles, cobbles and boulders in a matrix of sand, silt and clay; diamicton.
O	Organic materials	Material resulting from the accumulation of decaying vegetative matter; includes peat and organic soils.
R	Bedrock	Outcrops, and bedrock within a few centimetres of the surface.
U	Undifferentiated materials	Different surficial materials in such close proximity that they cannot be separated at the scale of the mapping.

(3) TEXTURE

Specific Clastic Terms

c	clay	< 2μm	k	cobbles	64 - 256 mm
z	silt	62.5 - 2μm	b	boulders	> 256 mm
s	sand	2 mm - 62.5μm	a	blocks	angular boulders
p	pebbles	2 - 64 mm			

Common Clastic Terms

f	fines	any or all of c, z, and fine s
d	mixed fragments	pebbles and larger clasts in a matrix of fines
g	gravel	any or both of p and k
r	rubble	angular gravel
x	angular fragments	mix of both r and a
m	mud	mix of both c and z
y	shells	shell or shell fragments

Organic Terms

e	fibric
u	mesic
h	humic

(4) SURFACE EXPRESSION

a	moderate slope(s)	predominantly planar slopes; 15-26^{O} (27-49%)
b	blanket	material >1-2m thick with topography derived from underlying bedrock (which may not be mapped) or surficial material
c	cone	a fan-shaped surface that is a sector of a cone; slopes 15^{O} (27%) and steeper
d	depression	enclosed depressions
f	fan	a fan-shaped surface that is a sector of a cone; slopes 3-15^{O} (5-27%)
h	hummocky	steep-sided hillocks and hollows; many slopes 15^{O} (27%) and steeper
j	gentle slope(s)	predominantly planar slopes; 3-15^{O} (5-27%)
k	moderately steep slope	predominantly planar slopes; 26-35^{O} (49-70%)
m	rolling topography	linear rises and depressions; <15^{O} (27%)
p	plain	0-3^{O} (0-5%)
r	ridges	linear rises and depressions with many slopes 15^{O} (27%) and steeper
s	steep slope(s)	slopes steeper than 35^{O} (70%)
t	terrace(s)	stepped topography and benchlands
u	undulating topography	hillocks and hollows; slopes predominantly <15^{O} (27%)
v	veneer	material <1-2m thick with topography derived from underlying bedrock (may not be mapped) or surficial material; may include outcrops of underlying material
w	variable thickness	material of variable thickness with topography derived from underlying bedrock (may not be mapped) or surficial material
x	thin veneer	a subset of v (veneer), where there is a dominance of surficial materials about 10-25 centimeters thick

(5) GEOLOGICAL PROCESSES, SUB-CLASSES and SUBTYPES

B	Braiding channel	Channel zone with many diverging and rejoining channels; channels are laterally unstable.
D	Deflation	Removal of sand and silt particles by wind action.
E	Glacial meltwater channels	Areas crossed by meltwater channels that are too small or too numerous to map individually.
F	Failing	Slope experiencing slow mass movement, such as sliding or slumping (unknown or unspecified activity).
H	Kettled	Area includes numerous small depressions and/or lakes where buried blocks of ice melted.
I	Irregularly sinuous channel	Channel displays irregular turns and bends.
J	Anastamosing channel	Channels diverge and converge around semi-permanent islands.
L	Surface seepage	Zones of active seepage often found along the base of slope positions.
M	Meandering channel	Channel characterized by regular turns and bends.
R	Rapid mass movement	Slope or parts of slope affected by processes such as debris flows, debris slides and avalanches, and rockfall.
U	Inundated	Areas submerged in standing water from a seasonally high watertable.
V	Gullying	Slope affected by gully erosion.

Mass Movement Sub-Classes

-F"	Slow mass movement (initiation zone)	-R"	Rapid mass movement (initiation zone)
-Fe	Earthflow	-Rb	Rockfall
-Fm	Slump in bedrock	-Rd	Debris flow
-Fs	Debris slide	-Rf	Debris fall
-Fu	Slump in surficial material	-Rr	Rockslide
-Fx	Slump-earthflow	-Rs	Debris slide
		-Rt	Debris torrent

Mass Movement and Gullying Subtypes

-F1	Active slow mass movement	V1	Single gully
-F2	Inactive slow mass movement	V2	Gully sidewall

(6) SOIL DRAINAGE CLASSES

x	extremely rapidly drained	water is removed from the soil very rapidly in relation to supply
r	rapidly drained	water is removed from the soil rapidly in relation to supply
w	well drained	water is removed from the soil readily but not rapidly
m	moderately well drained	water is removed from the soil somewhat slowly in relation to supply
i	imperfectly drained	water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season
p	poorly drained	water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen
v	very poorly drained	water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen

Where two drainage classes are shown:
if the symbols are separated by a comma, e.g., “w, i”, then no intermediate classes are present;
if the symbols are separated by a dash, e.g., "w-i", then all intermediate classes are present.

Appendix 2. Ecosystem Map legend.

BC Hydro and Power Authority

Terrestrial Ecosystem Mapping of the Peace River Study Area
Portions of map sheets 093O100, 093P091-93, 094A001-005, 094A008- 013, 094A015-020, and 094A023-026
Scale 1:20,000

January 2007

1. INTRODUCTION

The Peace River study area extends from Hudson's Hope in northeastern British Columbia to the Alberta border, encompassing the core Peace River corridor. Geographically, the core river corridor refers to the entire river valley including the floodplain and the ascending slopes extending approximately 2 km on either side of the river. The study area includes portions of 19 TRIM map sheets, and is within the Peace Forest District in the Northern Interior Forest Region. Terrestrial ecosystem mapping of the area was requested by BC Hydro and Power Authority as base mapping for future strategic planning of the area. A second sub-area was added to the project, consisting of the route of the existing transmission line on the south side of the river, extending from the Peace Canyon Dam north and east to the bank of the Peace River just south of Fort St. John. The transmission line study area includes a corridor extending 500 m on either side of the existing transmission line.

The ecosystem mapping methodology used is standard Terrestrial Ecosystem Mapping (TEM; Resources Inventory Committee 1998a). There are three levels of ecosystem classification applicable to this map: the ecosection unit, biogeoclimatic units (subzones) and ecosystem units. Ecosections are large physiographic units influenced by particular macroclimate processes and are characterized by all the plant communities and wildlife populations present (Demarchi 1996). The biogeoclimatic ecosystem classification system (BEC) describes the variation in climate, vegetation and site conditions occurring within an ecosection, and divides the area into subzones and their variants. Ecosystem units are defined for each subzone and are indicated in the map label by a 2-letter code, with site modifiers if applicable, followed by the structural stage at the time the area was mapped. Ecosystems were mapped according to Delong (1990), BC MSRM (2003) and MoF 2002.

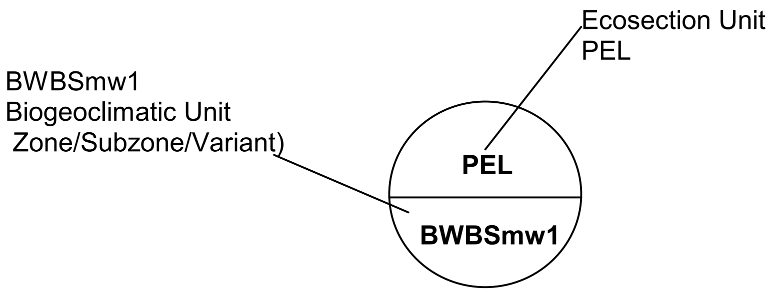
The study area falls within the Peace River Basin ecoregion. The study area includes a single ecosection and a single subzone variant.

2. MAP BOUNDARIES

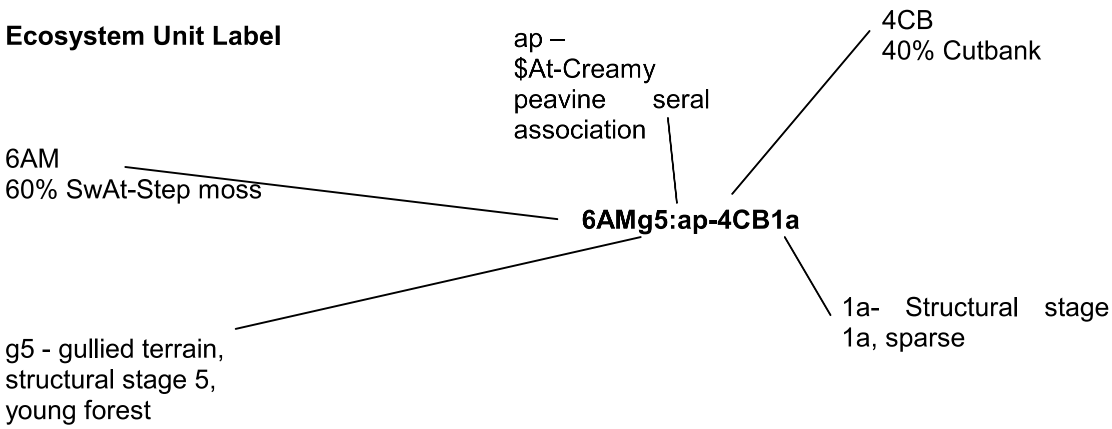
Ecosection Boundary
Study Area Boundary
Ecosystem Map Unit

3. MAP LABEL FORMAT

Ecosection and Biogeoclimatic Unit Label



Ecosystem Unit Label



4. ECOSECTIONS

Peace Lowlands

The study area lies within the Peace Lowlands (PEL) ecosection. The Peace Lowlands ecosection is a blocky mountain area on the east side of the Rocky Mountains, with strong rainshadows (Demarchi 1996).

5. BIOGEOCLIMATIC SUBZONE VARIANTS

Boreal White and Black Spruce moist, warm Peace variant (BWBSmw1)

The BWBSmw1 variant is found on the rolling plains that extend from near where the Rocky Mountains transect the Alberta border, north to near the Beatton River (Delong 1990). Surficial parent materials are mainly finer-textured lacustrine deposits on lower elevations, medium-textured morainal tills on the higher ridges and plateaus, coarse glaciofluvial deposits at the interface of the till, and lacustrine and organic deposits scattered throughout (Thompson *et al.* 1980). Elevation ranges from 750 to 1050 m. Aspen forests are common due to past history of frequent fires. Balsam poplar/black cottonwood occur on moister sites. White spruce is present on moist to wetter sites where there has been limited fire history. Lodgepole pine occurs as a seral species on drier and poorer sites. Black spruce forests, often with a minor component of tamarack, are common on organic soils. Much of the original lowland habitat has been converted to agricultural crops (Delong 1990).

6. MAPPED ECOSYSTEMS FOR THE PEACE RIVER

Map Code	Site Series #	Ecosystem Name	Assumed Modifiers	Typical Conditions	Moisture Regime
AM	01	SwAt - Step moss	dfj	gentle to moderate slope, deep fine-textured soils	submesic - mesic
AM: ap	01-$	$At - Creamy peavine (seral association)	dfj	gentle to level slope, deep fine - textured soils	submesic - mesic
AMy: ap	01-$	$At - Creamy peavine, moist (seral association)	dfj	gentle to level slope, moisture receiving, deep fine - textured soils	mesic - subhygric
AMk: ap	01-$	$At - Creamy peavine, cool aspect (seral association)	dfj	significant slope, cool aspect, deep fine - textured soils	mesic
AMw: ap	01-$	$At - Creamy peavine, warm aspect (seral association)	dfj	significant slope, warm aspect, deep med - textured soils	submesic
AS	00	SwAt – Soopolallie	dmw	significant slope, warm aspect , deep med - textured soils	xeric - submesic
BL	04	Sb - Lingonberry - Coltsfoot	dfj	level to gentle slope, deep fine - textured soils	submesic to subhygric
BL: al	04-$	$At - Labrador tea (seral association)	dfj	level to gentle slope, deep fine-textured soils	subhygric
BT	08	Sb - Labrador tea – Sphagnum	djp	level to depressional, deep peaty soils	subhygric - subhydric
Fm02	09	ActSw - Red-osier dogwood		level, coarse – textured soils, medium bench floodplain	submesic to hygric
LL	02	Pl - Lingonberry - Velvet-leaved blueberry	cdj	level to gentle slope, deep coarse - textured soils	submesic to subxeric
LL: ak	02-$	$At - Kinnikinnick (seral association)	cdj	level to gentle slope, deep coarse - textured soils, often on dry ridges and terraces	submesic to subxeric
SC	06	Sw - Currant – Bluebells	dfj	gentle slope, moisture receiving, deep fine - textured soils	mesic - subhygric
SC: ab	05-$	$At – Black Twinberry (seral association)	dfj	gentle to moderate slope, moisture receiving, deep fine textured soils, typically cool aspect	mesic - subhygric

Map Code	Site Series #	Ecosystem Name	Assumed Modifiers	Typical Conditions	Moisture Regime
SC: ep	05-$	$Ep – red-osier dogwood (seral association)	dfj	moderate to steep slope, deep, fine textured soils, typically cool aspect	mesic - subhygric
SE	00	Sedge Wetland	djp	level to depressional, deep peaty soils, included Will MacKenzie's wetland classification (Wf01, Wm01)	subhygric - hydric
SH	07	Sw - Currant – Horsetail	cdj	level to gentle slope, deep coarse-textured soils,	subhygric to hygric
SH: ac	07-$	$Ac – Cow parsnip (seral association)	cdj	level to gentle slope, deep med to coarse-textured soils	subhygric - hygric
SH: ep	07-$	$Ep – Dogwood (seral association)	cdj	level to gentle slope, deep med to coarse-textured soils	subhygric - hygric
SO	05	Sw - Currant - Oak fern	dfj	gentle to moderate slope, moisture receiving, deep fine - textured soils, typically cool aspect	submesic - subhygric
SW	03	Sw - Wildrye – Peavine	cdj	gentle slope, deep coarse - textured soils	submesic to mesic
SW: as	03-$	$At - Soopolallie (seral association)	cdj	gentle slope, deep coarse - textured soils	submesic - mesic
TS	10	Tamarack - Sedge – Fen	djp	level to depressional, deep peaty soils	subhydric - hydric
WH	00	Willow – Horsetail – Sedge – Riparian Wetland	djm	low bench floodplain, coarse – textured soils, adapted from Will MacKenzie's wetland classification (Fl01, Fl03 & Fl05)	subhygric - hygric
WS	00	Willow – Sedge – Wetland	j	level to depressional swamps, adapted from Will MacKenzie's wetland classification (Ws03, Ws06)	subhygric to subhydric
WW	00	Fuzzy-spiked Wildrye - Wolf willow	dmw	significant slope, warm aspect, deep med - textured soils	xeric - subxeric

*site modifier 'b' is a project-defined modifier used to denote an ecosystem occurring specifically on gravel bars (C. Erwin, pers. comm.).

7. SITE MODIFIERS

a	active floodplain
b	gravel bar
c	coarse-textured soils
d	deep soils
f	fine-textured soils
g	gullying occurring, or in a gully bottom
h	hummocky terrain
j	gentle to moderate slope, <25% slope
k	cool aspect (285-135 deg.; 25-100% slope)
m	medium-textured soils
n	fan or cone
p	peaty material at the surface
q	very steep cool aspect (285-135 deg.; >100% slope)
r	ridge
s	shallow soils (20-100 cm to bedrock)
t	terrace
v	very shallow soils (<20cm to bedrock)
w	warm aspect slope (135 to 285 deg.; slope 25-100%)
x	Drier than typical
y	moister than typical
z	very steep warm aspect (135 to 285 deg.; slope >100%)

8. ANTHROPOGENIC, SPARSELY VEGETATED OR NON-VEGETATED SITES

CB	Cutbank	RE	Reservoir
CF	Cultivated field (incl. pastures)	RI	River
ES	Exposed soil	RN	Railway
GB	Gravel bar	RO	Rock
GP	Gravel Pit	RW	Rural
LA	Lake	RY	Reclaimed Garbage dump
MI	Mine	RZ	Road surface
OW	Shallow open water	UR	Urban
PD	Pond		

9. STRUCTURAL STAGE

1	Non-vegetated/Sparse (< 20 yrs since major disturbance unless disclimax ecosystem)
1a	Non – vegetated (less than 5% vegetation cover)
1b	Sparse (bryophyte and lichen-dominated communities) (less than 10% cover of vascular plants)
2	Herb (< 20 yrs old unless disclimax)
2a	Forb-dominated (dominated by non-graminoid herbs)
2b	Graminoid-dominated (dominated by grasses, sedges, reeds and rushes)
2d	Dwarf Shrub (dominated by dwarf woody species)
3	Shrub (shrubs <10 m tall, < 20 yrs old for forested sites)
3a	Low Shrub (shrubs < 2 m tall)
3b	Tall Shrub (shrubs 2-10 m tall)
4	Pole /Sapling (trees > 10 m tall & usually < 40 yrs old)
5	Young Forest (trees > 10 m tall & 40-80 yrs old)

6 Mature Forest (trees > 10 m tall; 80-140 yrs old)
7 Old Forest (trees > 10 m tall; >140 yrs old)

10. DATA SOURCES

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11. CREDITS

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