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TERRESTRIAL ECOSYSTEM MAPPING
McKee Peak, Abbotsford, BC

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Helen Reid, B. Sc., R. P. Bio. Completed the TEM mapping and field work and is the primary author of this report. Bioterrain typing was carried out by Gordon Butt, M. Sc., P. Ag., P. Geo., Caroline Astley, B. Sc., BIT, CEPIT and Scott Weston, M. Sc. P.Geo. assisted with field work and Scott Weston and Tania Trip, M. Sc., R. P. Bio provided senior review. Darren Brown, Environmental Coordinator provided background information about the study area and Eric Hoogenraad, provided digital map files.

Chartwell Consultants Ltd. carried out the monorestitution and digitized the polygon line work. Integrated Mapping Technologies Inc. supplied the air photos.

Executive Summary

Terrestrial ecosystem mapping (TEM) of the 660 ha McKee Peak study area was completed at a 1:15,000 scale, and follows Resource Inventory Standards Committee (RISC) standardized map codes. Field sampling was conducted during September, 2005. A total of 51 vegetation plots were sampled during the fieldwork, as per Level 1 RISC sampling standards. A total of 69 polygons were mapped for the McKee Peak study area, representing five vegetated, two non-vegetated and five anthropogenic units.

The McKee peak study area is relatively homogeneous in forest structure and type. Four forested site series were identified and mapped, all of which are nutrient-rich. The structural stage is primarily a young deciduous forest (structural stage 5), dominated by paper birch, maple and red alder. The most ecologically diverse portions of the study area are found in the southwest corner, where a variety of vegetated and non-vegetated ecosystem units are present. The presence of the large right-of-way separating the forested lands of the southern slopes of McKee Peak; however, results in a relatively fragmented forest area, with limited areas of contiguous cover.

The steep south-eastern facing slopes of McKee Peak contain maturing Douglas-fir forests interspersed with non-forested bluffs. These bluffs are ecologically significant, providing habitat for diverse plant and wildlife species.

The northeast portion of the study area contains the only western redcedar – skunk cabbage ecosystem that was observed in the study area at the time of field checking. The west-facing slopes of McKee Peak are gentler than north-facing slopes. The ecological integrity of this area (in terms of area of contiguous forest cover) has been slightly compromised by the presence of clearings within the forested area.

The numerous drainages on McKee Mountain enhance biodiversity in the landscape and provide habitat to water loving plant and wildlife species.

While the primary purpose of TEM was not to inventory rare elements, one plant and three animal species were identified during TEM field sampling: Pacific Waterleaf (blue-listed), Oregon Forestsnail (red-listed), Mountain Beaver (red-listed), and Red-legged Frog (blue-listed). A detailed wildlife and rare element survey will be completed in the spring and summer of 2006 as noted in the McKee Peak project outline.

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Acronym	Definition
BEC	Biogeoclimatic Ecosystem Classification
CDC	Conservation Data Centre
CWH	Coastal Western Hemlock
COA	City of Abbotsford
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DBH	Diameter at breast height (for tree circumference measurements)
RISC	Resource Inventory Standards Committee
SARA	Species At Risk Act
TEM	Terrestrial Ecosystem Mapping

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1.0 Introduction

Under the Local Government Act, The City of Abbotsford (COA) is responsible for land use planning within its municipal boundaries. The McKee Peak study area is a 660-ha tract of primarily undeveloped, but altered, forested land within Abbotsford that is zoned for residential development. To balance development and ecologic conservation, COA has undertaken inventory projects to help with land use decisions on McKee Peak.

An overview level biophysical inventory of the McKee Peak study area was carried out in 2004[1]. Based on recommendations from this report, COA has commissioned additional studies to further characterize ecological features on a landscape basis. In order to distinguish general ecological features, COA contracted Madrone Environmental Services Ltd. (Madrone) to conduct terrestrial ecosystem mapping (TEM) within the McKee Peak study area.

[1] Golder Associates Limited. 2004. Overview-Level Biophysical Inventory and Candidate Environmentally Sensitive Area Identification for McKee Peak Study Area, Abbotsford, B.C.

1.1 Objective

The objective of this project was to classify, map (at 1:15 000 scale) and describe the natural ecosystems of the McKee Peak study area.

1.2 Study Area

The McKee Peak study area encompasses approximately 660-ha south of Fraser River on the southeastern portion of Sumas Mountain, within the City of Abbotsford (Figure 1).

1.2.1 Biogeoclimatic Zones

According to the Biogeoclimatic Ecosystem Classification (BEC) system of BC, the McKee Peak study area is located within the Fraser Lowland Ecosection (Green and Kinka, 1994). Within the area of study, one biogeoclimatic zone and two subzones are represented: the Coastal Western Hemlock dry maritime and very dry maritime (CWHdm and CWHxm). The majority of the area is in the CWHdm, while a small area in the southeastern portion is classified as CWHxm. The CWHdm and CWHxm subzones have warm dry summers and moist mild winters with relatively little snowfall (Green and Klinka, 1994).

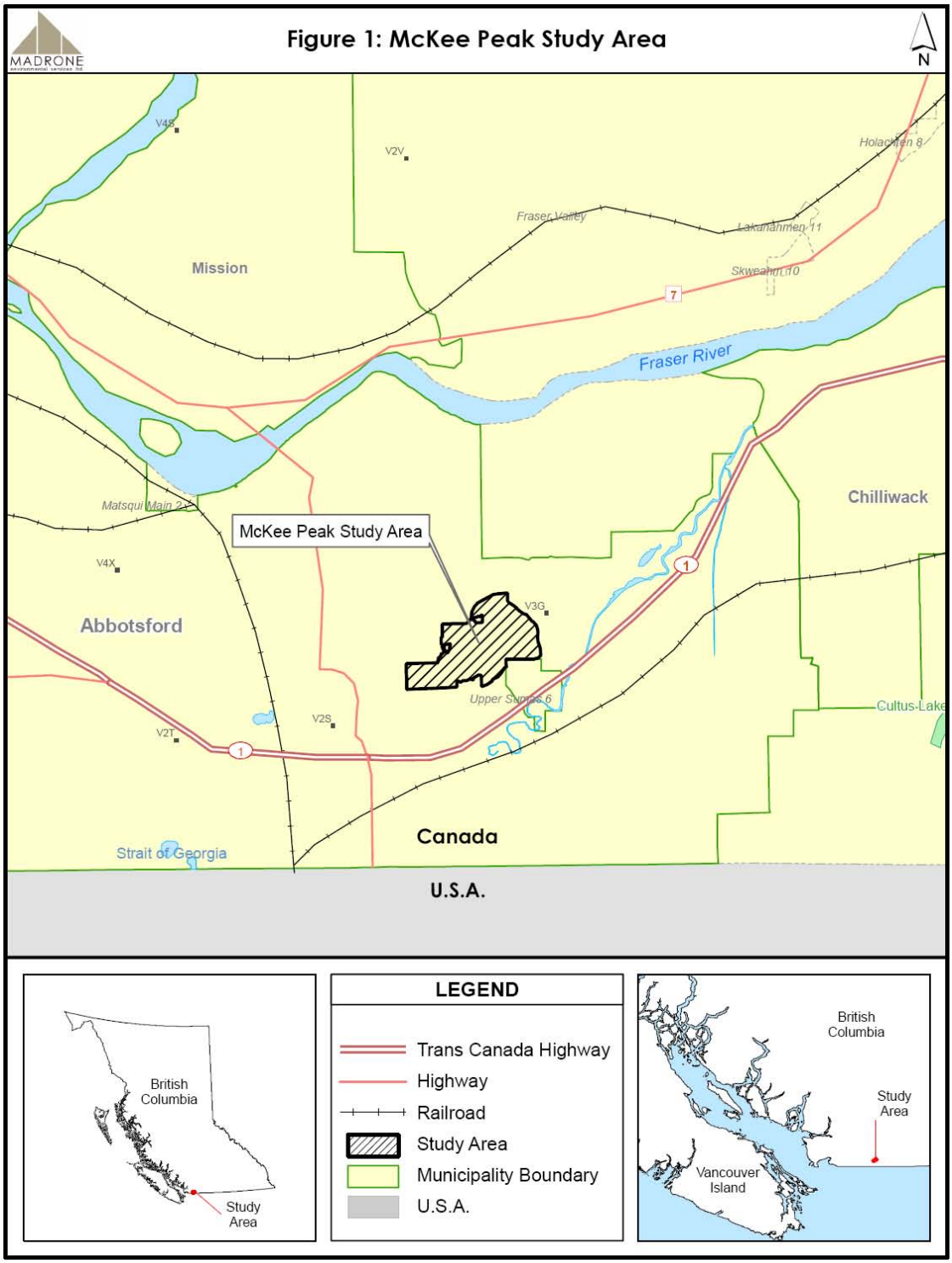

Figure 1. McKee Peak Study Area.

1.2.2 Topography and Surficial Materials

The study area includes two low elevation mountains. McKee Mountain, located in the middle portion of the area reaches an elevation of 463 m above sea level; Eagle Mountain located in the southwester corner of the area has an elevation of 300 m above sea level. The upper southeast-facing slopes of McKee Mountain are steep with interspersed bedrock cliffs. The north-facing slopes of the mountain are also steep in some areas. Slopes facing west on McKee Mountain are overall more gentle. Northeast-facing slopes of Eagle Mountain are generally steep with several gently sloping benches. A BC Hydro right-of-way is located at the base of these slopes in the valley between McKee and Eagle Mountains.

The BC Geologic Survey has mapped three bedrock types within the study area. Eocene-aged Kitsilano Formation consisting of undivided sedimentary rocks underlie the middle portion of the study area, including most of McKee Mountain. Middle Jurassic unnamed quartz dioritic intrusions underlie most of Eagle Mountain within the study area. Lower Jurassic aged Harrison Formation consisting of andesitic volcanic rocks underlie the northern portion of the study area.

Surficial materials in the study area are primarily sandy silty glacial till. Sandy gravelly glacio-fluvial and silty rubbly colluvium deposits are also present as are silty aeolian deposits overlying till.

1.2.3 Soils

Soils throughout most of the study area are developed from stone-free wind-blown aeolian deposits that overlie glacial till and glacio-fluvial deposits. The texture of the aeolian material is mostly silt loam and drainage is well to moderately well. The soil classification is Orthic Humo-Ferric Podzol (*Soil Classification Working Group.* 1998). The overlying humus layer, composed of decayed and decaying deciduous leaves, is relatively thick, varying between 10-20 cm. This thickness (relative to typically conifer-dominated forests in this subzone) is related to the predominantly deciduous forest canopy.

1.2.4 Drainages

Three major watercourses are located in the study area with approximately 43 associated tributaries (Golder Associates Ltd., 2004). Clayburn Creek originates in the northern portion of the area on McKee Peak and flows northwesterly to Matsqui Prairie and Fraser River; Stoney Creek, a tributary to Clayburn Creek, drains the southern side of McKee Mountain and the northern side of Eagle

Mountain and flows northwesterly to Matsqui Prairie and Clayburn Creek; and Kilgard Creek originates in the eastern portion of the area and flows in a southerly direction to Sumas River on Sumas Prairie. Several unnamed tributaries drain the southern portion of the area and flow into Marshall Creek (Golder Associates Ltd., 2004) which flows to Sumas River. Several anthropogenic and natural ponds are found within the area. Springs and waterfalls area also present within the study area.

1.2.5 Land Use and Tenure

The entire McKee Peak study area is privately held by numerous landowners, and housing developments are underway in several locations within and adjacent to the study area boundary. The study area is also dissected by the following linear developments:

1. A major BC Hydro right-of-way runs northwest-southeast in the southwestern portion of the study area (Photo 1);
2. A smaller BC Hydro right-of way runs north-south near the middle of the study area; and;
3. A gas pipeline runs east-west in the southern portion of the study area (Photo 2).

An active gravel mine is located within the eastern portion of the study area. Several private businesses are also located within the study area boundary, including a Christmas tree farm, farms with large hay fields and various small acreages.

Large anthropogenic ponds are located on two private residences and one on the larger BC Hydro right-of-way (Photo 1). A smaller anthropogenic pond is situated along a drainage running in a southwesterly direction in the southwest corner of the study area.

Photo 1. Major BC Hydro right-of way located in the southwestern portion of the study area. An anthropogenic pond on Stoney Creek is visible on the left centre of photo.

Photo 2. Gas pipeline corridor located in the northern portion of the study area. This corridor runs in an east-west direction between Sumas Mountain Road and McKee Road.

Although the entire McKee Peak study area is privately owned, it is well used by hikers and mountain bikers. A network of well-used trails on the northern, eastern, and western sides of McKee Peak are maintained by local residents primarily for mountain biking (Photo 3).

Photo 3. Mountain bike trail on northern slopes of McKee Peak.

2.0 Methodology

2.1 Data Sources

This mapping project was based on 2005 1:15 000 colour aerial photography. An orthophoto showing topography and study area and legal boundaries was provided by COA. The TRIM base was also provided by COA.

2.2 Pre-typing and Ecosystem Classification

Prior to field sampling, bioterrain and ecosystem pre-typing were completed. Each polygon was classified and labeled according to the methodology documented in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RISC, 1998b). Up to three ecosystem units (site series) were assigned to each polygon.

The percentage of each unit represented within a polygon was indicated by deciles ranging from 1-10 (10-100%). Each ecosystem unit was assigned a two-letter symbol, and identified using *The Field Guide for Site Identification and Interpretation for the Vancouver Forest Region* (Green and Klinka, 1994).

Sparsely vegetated, non-vegetated, and anthropogenic units were also assigned two-letter symbols as per provincial standards (RISC, 1998b). Aspect site modifiers were applied to atypical sites, i.e. those with steep slopes (>35%), gentle slopes (<35%) and different soil textures using the current site series master coding list. Structural stages describe the current vegetation stage by the standard seven-level system as standardized by the provincial Resource Inventory Standards Committee (RISC) (1998b).

During project planning, a field verification plan was organized, where pre-typed polygons would be visited and checked for accuracy and labeling.

2.3 Field Work

Data collection followed methods in the *Field Manual for Describing Terrestrial Ecosystems* (RISC, 1998a). Ground inspection plots and visual checks were completed in the study area to achieve a Survey Intensity Level 1 (RISC, 1998b). Sixty-nine polygons were pre-typed using the air photos. Using Level 1 sampling, at least 50 polygon checks were required, based on the suggested 76 to 100%, polygon checking level.

Polygons were accessed by road and by foot. The spatial location of each plot was collected using a GPS unit. During the field assessment, habitats likely to contain species listed under the federal Species at Risk Act (SARA) and rare species listed by the provincial Conservation Data Centre (CDC) were noted. Other special features, such as evidence of wildlife use and sightings, were also recorded.

2.4 Digital Mapping

Following field work, air photo line work was transferred into a digital Arc/Info compatible base using the technique of mono-restitution. Unique numbers were applied to each polygon. A data base was then built, using the labeled polygons. Plot card data were entered onto an Excel spreadsheet.

3.0 Results and Discussion

Field sampling was conducted on September 23 and 24, 2005. A total of 51 vegetation plots were sampled during the field work, as per Level 1 RISC sampling standards. Vegetation plots consisted of 16 ground inspections and 35 visual inspections (ratio of 32:68).

3.1 Terrestrial Ecosystem Mapping

As a result of the pre-typing and field verification, a total of 69 polygons were mapped within the study area and are shown on Figure 2. Five vegetated ecosystem types, two non-vegetated, and five anthropogenic units were identified. The ecosystem unit codes, descriptors and site modifiers applied to the McKee Peak TEM map are summarized in Tables 1 and 2.

Table 1. Vegetated, Non-vegetated and Anthropogenic Units Identified in the McKee Peak Study Area.

Name	Code	Site Series #
Vegetated (Forested and non-forested units)		
Douglas-fir – Sword fern	DF	04
Western redcedar – Sword Fern	RS	05
Western redcedar – Foamflower	RF	07
Western redcedar – Skunk cabbage	RC	12
Hardhack – Willow wetland	HW	00
Non-vegetated		
Cliff	CL	00
Pond	PD	00
Anthropogenic		
Disturbed – Cleared Areas	DI	00
Right- of way	RW	00
Mine (Gravel Pit)	MI	00
Rural (residences, farms etc.)	RR	00
Urban Development or in Development process	UR	00

Table 2. Site Modifier Codes Mapped for the McKee Peak Study Area.

Code	Name
w	Warm aspect slopes >35%
k	Cool aspect slopes >35%
z	Warm, very steep aspect slopes >100%
q	Cool, very steep aspect slopes >100%
j	Gentle slopes <35%
f	Fine textured soils

3.2 Vegetated Ecosystems (Forested and Non-forested Units)

Most of the area is forested by an even-aged deciduous structural stage 5 stand. Table 3 provides a summary of the five structural stages mapped for the McKee Peak study area, while Appendix I contains a detailed description of all seven stages as per RISC (1998b).

Table 3. Mapped Structural Stages for McKee Peak Study Area.

Stage	Structural Stage Descriptor
2b	Graminoid (dominated by grasses and herbs)
3a	Low Shrub
3b	Tall Shrub
4	Pole/Sapling
5	Young Forest (generally 40-80 years but may begin as early as age 30) depending on tree species and ecological conditions)

The forested portions of the study area appear to have undergone several passes of selective and/or clearcut logging, and the present stand is approximately 50 to 60 years old second growth deciduous forest. This forest is dominated by of big-leaf maple (*Acer macrophyllum*), paper birch (*Betula papyrifera*) and red alder (*Alnus rubra*). Vine maple (*Acer circinatum*) dominates the tall shrub layer. Conifers are sparse and scattered throughout the area.

Douglas-fir (*Pseutosuga menziesii*), is the dominant conifer, while small patches of Western redcedar (*Thuja plicata*) are present on more moist sites. Average tree height is approximately 25-30 m.

Most of the study area is relatively nutrient rich due to the aeolian soils and thick humus layer. This is reflected in the resulting ecosystem mapping, in that most mapped ecosystems have a rich soil nutrient regime. The northern slopes of McKee Peak generally have a fairly moist soil moisture regime, resulting in a predominance of nutrient and moisture rich ecosystems, namely Western redcedar – foamflower (site seriesRF/07) and western redcedar – sword fern (site seriesRS/05), while the south facing steep slopes contain the drier rich ecosystem Douglas-fir – sword fern (DF/04). These dry, rich ecosystems are also found on colluvial slopes. Two of these ecosystem types were sampled in the southwestern portion of the study area (Figure 2).

Most watercourses in the study area are dry near the end of the summer, but fill quickly when the rainy season begins in the fall. The presence of incised channels suggests the larger drainages are subject to significant fall/winter flows. The nutrient rich, high moisture ecosystem, RF/07, is usually present along both sides of these drainages.

One small wet, rich ecosystem (western redcedar Sitka spruce –skunk cabbage (RC/12)) was mapped on the northeastern portion of the study area along a small drainage. On this site, evidence of the provincially red-listed Mountain Beaver (*Aplodontia rufa rufa*) was observed. Appendix II provides a description of the provincial ranking system for rare plants, plant communities and wildlife.

Several small shrubby wet areas are present, where soils are shallow over bedrock. These areas consisted primarily of willows (*Salix* spp.) and hardhack (*Spirea douglasii*).

The following sections provide detailed descriptions of the vegetated ecosystem units and their associated site series that were identified within the study area.

3.2.1 Western redcedar – Sword fern (RS)

Site Series: CWHdm / 05 CW – Sword fern

Moisture Regime: 3-4 fresh to slightly dry)

Nutrient Regime: D-E (rich-very rich)

Code: RS

These mesic rich forests are the most commonly mapped ecosystem in the study area. They are located primarily on midslope and level positions. Two structural stages were mapped within this ecosystem:

- Structural stage 5 (young forest 40-80 years)
- Structural stage 2b (grass and herb-dominated)

These sites, once dominated by Douglas-fir and other conifers, have primarily deciduous tree cover (Photo 4). Canopy cover ranges from 75 to 90% and consists of bigleaf maple, paper birch and red alder. Douglas-fir and western redcedar are sparse and scattered throughout these stands. Shrub cover is variable, ranging from 15% to 75%. Dominant shrubs are vine maple and thimbleberry (*Rubus parviflorus*). Other common shrubs include common snowberry (*Symphoricarpus albus*), red elderberry (*Sambucus racemosa*), and black swamp gooseberry (*Ribes lacustre*). Ocean spray (*Holodiscus discolor*) and Indian plum (*Oemleria cerasiformus*) are also present to a lesser extent. Herb cover is also variable between 30% - 80%. Over much of the area, sword fern (*Polystichum munitum*) and stinging nettle (*Urtica dioica*) dominate this layer. Other commonly found herbs are lady fern (*Athyrium filix-femina*), bracken fern (*Pteridium aquilinum*), piggy-back plant (*Tolmiea menziesii*), spiny wood fern (*Dryopteris expansa*) and Hooker's fairybells (*Disporum hookeri*). The moss layer is generally sparse and contains Oregon-beaked moss (*Kindbergia oregano*), lanky moss (*Rytidiadelphus loreus*), flat moss (*Plagiothecium undulatum*) and leafy mosses (*Mnium spp.*).

Photo 4. Typical western redcedar – sword fern (RS/05) site. This photo was taken near the northern boundary adjacent to a major bike trail (Plot G1).

The grass dominated sites (structural stage 2b) mapped within this site series are areas that have been cleared for building or dump sites (Photo 5). They are dominated by a variety of introduced grasses, including Timonthy (*Phleum pretense*) and orchard grass (*Dactylus glomerata*) and may contain other herbs such as Canada thistle (*Cirsium arvense*) and stinging nettle.

Photo 5. Grass dominated western redcedar-sword fern ecosystem (structural stage 2b). (Eagle Mountain, Plot V2)

3.2.2 Douglas-fir – Sword fern (DF)

Site Series: CWHdm / 04 Fd– Sword fern

Moisture Regime: 2-3 (moderately dry)

Nutrient Regime: D-E (rich-very rich)

Code: DF

These dry, rich forests are located near the top of McKee Peak and on the south-facing slopes, and are also found on steep colluvial slopes within the study area. Only structural stage 5 (young forest) was mapped for this site series.

The tree canopy averages 80%, and is dominated by bigleaf maple and paper birch. The shrub layer cover is 15% to 40%, and is usually characterized by vine maple and ocean spray. Other well-represented shrubs include dull Oregon grape (*Mahonia nervosa*), thimbleberry, and common snowberry. The herbaceous layer varies depending on the whether the site is underlain by colluvium or till soils. On colluvial slopes, western sword fern can be dense, with 80% cover in places. On these slopes, other herbs are minimal but can include licorice fern (*Polypodium glycyrrhiza*) and bracken fern. Where these ecosystems occur on till soils, herbs are more varied and sword fern is much less dense. Herbs that can be found on these sites are queen's cup (*Clintonia uniflora*), bracken fern, vanilla leaf (*Achlys triphylla*), star-flowered false solomon's seal (*Smillacina stellata*), and star flower (*Trientalis latifolia*). Mosses are sparse (Photo 6).

Photo 6. Typical drier, rich site series, Douglas-fir – sword fern, located on northwest facing slopes of McKee Mountain (G38).

3.2.3 Western Redcedar – Foamflower (RF)

Site Series: CWHdm / 07 CW – Foamflower

Moisture Regime: 5-6 (moist –very moist))

Nutrient Regime: D-E (rich-very rich)

Code: RF

These moist forests are found throughout the study area, with the highest percentage occurring on the north facing slopes of McKee Peak (Photo 7). They are also found on benches, where sites are level. Two structural stages were mapped:

- Structural stage 5 (young forest 40-80 years)
- Structural stage 2b (forb dominated)

Canopy cover averages 80%, and is dominated by paper birch, bigleaf maple, and red alder. On some sites western redcedar is well represented. The shrub layer ranges from 50% to 80% and is dominated by vine maple and salmonberry (*Rubus spectabilis*). Devil's club (*Oplopanax horridus*), red elderberry and beaked hazelnut (*Coryslus cornuta var. californica*) are usually present. The herb layer coverage ranges between 25% and 70%, and is generally dominated by piggy-back plant, stinging nettle, lady fern and sword fern. Mosses are sparse, but often the moist site indicator moss Menzie's tree moss (*Leucolepis menziesii*) is present.

Photo 7. Western redcedar foamflower (RF/07) site located on a bench on Eagle Mountain the southwestern portion of the study area (Plot G3).

Where sites are not treed and herbs dominate (structural stage 2b), grasses, sedges, rushes and other moisture loving herbaceous plants dominate. These grassy areas are primarily located along the right-of-ways (Photo 8).

Photo 8. Herbaceous (2b) unit located along gas pipeline corridor located in the northeastern portion of the study area (Plot V16).

3.2.4 Western redcedar Sitka Spruce - Skunk cabbage (RC)

Site Series: CWHdm / 12 CwSs – Skunk Cabbage

Moisture Regime: 7 (wet)

Nutrient Regime: D-E (rich-very rich)

Code: RC

This wet, rich ecosystem (Photo 9) was mapped in only one location in the study area and is adjacent to Clayburn Creek near the northeastern boundary. Water was present in small pockets throughout this watercourse at the time of field sampling. Mountain beaver burrows were found along the upper drier edges of this site.

Structural stage of this ecosystem is 5 (young forest 40-80 years). Canopy cover is 90% and is dominated be western redcedar, bigleaf maple and red alder.

The dense shrub layer has 65% coverage, and is dominated by salmonberry and vine maple with scattered red elderberry and black twinberry (*Lonicera involucrate*. Herbaceous cover is 20% and is dominated by skunk cabbage (*Lysichiton americanum*). Other herbs including lady fern, sword fern, spiny wood fern, piggy-back plant and stinging nettle are also well represented. Soils are very dark and humus rich on this site.

Photo 9. Herb layer typical of Western redcedar-skunk cabbage site (Plot G18)

3.2.5 Willow – Hardhack wetland (WH)

Site Series: 00

Code: N/A

During field verification sampling, the Willow-Hardhack wetland (WH) ecosystem was found in two areas on McKee Mountain (plotsV30 and V33). These sites are too small to be mapped at a 1: 15 000 scale, so are represented only as plot points on the ecosystem map.

These wetter areas are shrub dominated and the structural stage is 3b (shrubs 2-10 m) (Photo 10). The 80% shrub cover is dominated by willows (*Salix spp.*) with some scattered trees including red alder, paper birch and black cottonwood (*Populous balsamifera spp. Trichocarpa*) in the upper layers 2-10 m. Lower shrubs (under 2 m) include hardhack, thimbleberry, red-osier dogwood (*Cornus stolonifera*), devil's club and vine maple.Herbs are sparse (5%) and include lady fern and sword fern.

Photo 10. Wetland, located on bench on the upper north facing slopes of McKee Peak (Plot V30).

3.3 Introduced Species

Surprisingly, an abundance of introduced non-native species was not observed during field sampling. The majority of introduced species are found in open grassy clearings, right-of ways, and along new roads. Numerous introduced grasses, such as reed canary grass (*Phalariac arundinacea*), and orchard grass (*Dactylis glomerata*) were found in such areas. These would have come from adjacent farms and urban areas. Other invasives include western dock (*Rumex occidentalis*), Canada thistle (*Cirsium arvense*), Scotch broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus procerus*), great mullein (*Verbascum thapsus*) and common burdock (*Arctium minus*).

3.4 Ecological Values of the Study Area

An important use of TEM mapping is to establish the basis for interpreting the natural ecosystems for rare elements, special ecological features and biodiversity. Several significant environmental features were identified during TEM mapping and are summarized below:

- In terms of ecosystems and soil, the entire study area, is relatively rich. Herbs, shrubs and forest throughout the area are growing vigorously.

- Numerous seepage sites eventually form and/or contribute to the many watercourses present within the study area. This and humus rich soils contribute to the unusually moist and rich ecosystem in the area.
- The numerous drainages on McKee Mountain enhance biodiversity in the landscape and provide habitat to water loving plant and wildlife species.
- Compared to other low-elevation areas in the Lower Fraser Valley, the study area represents an uncommon extent of contiguous forest cover, with a low level of fragmentation. This contributes to habitat connectivity, retaining a high level of biodiversity.
- Accordingly, the biological condition of landscape is such that parts of the study area have high potential conservation value. A detailed rare element survey, to be completed in 2006, will provide more information regarding the occurrence and locations of rare plants and wildlife.
- One large Douglas-fir veteran (old growth) was found in the southeastern portion of McKee Peak in Polygon 1. Other large (>80 cm dbh) mature Douglas-fir trees were found scattered throughout the study area. Veteran trees provide important habitat for a number of wildlife species, and are significant in that they represent remnants of the old forest.
- Introduced species occurrence is relatively low considering the surrounding urbanization and the recreational use of the area.

3.5 Rare Species Observed during TEM Fieldwork

While the primary purpose of TEM was not to inventory rare elements, one plant and three animal species were identified during TEM field sampling: Pacific Waterleaf (blue-listed), Oregon Forestsnail (red-listed), Mountain Beaver (red-listed), and Red-legged Frog (blue-listed). Pacific waterleaf and Oregon forestsnails were found alongside the drainages of McKee Mountain (see Figure 2, Plot 39). Mountain beaver burrows were found within Polygon 2. The polygon is associated with Clayburn Creek and supports the wet rich ecosystem Western redcedar – Skunk cabbage. Adult Red-legged Frogs were found along the gas pipeline within Plot 17 (see Figure 2). A summary of the rare species observations are listed in Table 4.

A detailed wildlife and rare element survey will be completed in the spring and summer of 2006 as noted in the McKee Peak project outline. Based on known occurrences of other rare species in the area, such as phantom orchid (*Cephalanthera austiniae*), silver-hair moss (*Fabronia pusilla*) and peregrine falcon (*Falcon peregrinus*), it is anticipated that during the spring and summer surveys additional rare species will be noted.

Table 4. Rare species observations, locations, ecosystem type and provincial rank.

Rare Species observation during this study	Location	Ecosystem	Provincial Rank*
Mountain Beaver (*Aplodontia rufa*)	Northeast corner near McKee Road and Sumas Road intersection (Plot 18)	Western Redcedar – Skunk cabbage, RC/12	Red-listed
Red-legged Frog (*Rana aurora*)	Along gas pipeline (Plot 17)	Western Redcedar – Foamflower, RF/07	Blue-listed
Oregon Forestsnail (*Allogona townsendiana*)	North facing slopes of McKee Mountain, near main trail (Plot 39)	Western Redcedar – Foamflower, RF/07	Red-listed
Pacific Waterleaf (*Hydrophyllum tenuipes*)	North facing slopes of McKee Mountain, near main trail (Plot 39)	Western Redcedar – Foamflower, RF/07	Blue-listed

*Refer to Appendix II for provincial ranking definitions.

4.0 Conclusions

Terrestrial ecosystem mapping (TEM) of the 660-ha McKee Peak study area was completed at a 1:15 000 scale, and follows Resource Inventory Standards Committee (RISC) standardized map codes. Field sampling was conducted during September, 2005. A total of 51 vegetation plots were sampled during the field work, as per Level 1 RISC sampling standards. A total of 69 polygons were mapped for the McKee Peak study area, representing five vegetated, two non-vegetated and five anthropogenic units.

The McKee peak study area is relatively homogeneous in forest structure and type. Four forested site series were identified and mapped, all of which are nutrient-rich. The structural stage is primarily a young deciduous forest (structural stage 5), dominated by paper birch, maple and red alder. The most ecologically diverse portions of the study area are found in the southwest corner, where a variety of vegetated and non-vegetated ecosystem units are present. The presence of the large right-of-way separating the forested lands of the southern slopes of McKee Peak; however, results in a relatively fragmented forest area, with limited areas of contiguous cover.

The northeast portion of the study area contains the only western redcedar – skunk cabbage ecosystem that was observed in the study area at the time of field checking. The west-facing slopes of McKee Peak are gentler than north-facing slopes. The ecological integrity of this area (in terms of area of contiguous forest cover) has been slightly compromised by the presence of clearings within the forested area.

The steep south-eastern facing slopes of McKee Peak contain maturing Douglas-fir forests interspersed with non-forested bluffs. These bluffs are ecologically significant, providing habitat for diverse plant and wildlife species.

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Appendix I. Standardized Structural Stages and Codes.

(As per "Table 3.3" from the *Standard for Terrestrial Ecosystem Mapping in British Columbia*, Resources Inventory Committee, 1998b.)

Structural Stage	**Description**
Post-disturbance stages or environmentally induced structural development	
1 Sparse/bryoid[2]	Initial stages of primary and secondary succession; bryophytes and lichens often dominant, can be up to 100%; time since disturbance less than 20 years for normal forest succession, may be prolonged (50–100+ years) where there is little or no soil development (bedrock, boulder fields); total shrub and herb cover less than 20%; total tree layer cover less than 10%.
Substages	
1a Sparse2	Less than 10% vegetation cover;
1b Bryoid2	Bryophyte- and lichen-dominated communities (greater than ½ of total vegetation cover).
Stand initiation stages or environmentally induced structural development	
2 Herb[2]	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, grasslands, **flooding**, intensive grazing, intense fire damage); dominated by herbs (forbs, graminoids, ferns); some invading or residual shrubs and tress may be present; tree layer cover less than 10%, shrubby layer cover less than or equal to 20% or less than 1/3 of total cover; time since disturbance less than 20 years for normal forest succession; may herbaceous communities are perpetually maintained in this stage.
Substages	
2a Forb-dominanted[2]	Herbaceous communities dominated (greater than ½ o the total herb cover) by non-graminoid herbs, including ferns.
2b Graminoid-dominated[2]	Herbaceous communities dominated (greater than ½ of the total herb cover) by grasses, sedges, reeds, and rushes.
2c Aquatic[2]	Herbaceous communities dominated (greater than ½ of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b).

Structural Stage	Description
2d Dwarf shrub[2]	Communities dominated (greater than ½ of the total herb cover) by dwarf woody species such as *Phyllodoce empetriformis, Cassiope mertensiana, Cassiope tetragona, Arctostaphylos arctica, Salix reticulata*, and *Rhododendron lapponicum*. (See list of dwarf shrubs assigned to the herb layer in the *Field Manual for Describing Terrestrial Ecosystems*).
3 Shrub/Herb[3]	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, grasslands, **flooding**, intense grazing, intense fir damage); dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree layer cover less than 10%; shrub layer cover greater than 20% or greater than or equal to 1/3 of total cover.
Substages	
3a Low shrub[3]	Communities dominated by shrub layer vegetation less than 2 m tall; may be perpetuated indefinitely to environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 20 years for normal forest succession.
3b Tall shrub[3]	Communities dominated by shrub layer vegetation that are 2–10 m tall; may be perpetuated indefinitely by environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 40 years for normal forest succession.
Stem exclusion stages	
4 Pole/Sapling[4]	Trees greater than 10m tall, typically dense stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually greater than 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy – this often occurs by age 30 in vigorous broadleaf stands, which are generally younger than coniferous stand at the same structural stage; time since disturbance ins usually less than 40 years for normal forest succession; u to 100+ years for dense (5,00015,000+ stems per hectare) stagnant stands.
5 Young Forest[4]	Self-thinning has become evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped); vigorous growth and a more open stand than in the pole/sapling sate; time since disturbance is generally 40–80 years but may begin as early as age 30, depending on tree species and ecological conditions.

Structural Stage	Description
Understory reinitiation stage	
6 Mature Forest[4]	Trees established after the last disturbance have matured; a second cycle of shade tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for biogeoclimatic group A[5] and 80–250 years for group B[6].
Old-growth stage	
7 Old Forest[4]	Old, structurally complex stands composed mainly of shade-tolerant and regenerating tree species, although older seral and long-lived trees from a disturbance such as fire may still dominate the upper canopy; snags and **coarse woody debris** in all stages of decomposition typical, as are patchy understories; understories may include tree species uncommon in the canopy, due to inherent limitations of these species under the given conditions; time since disturbance generally greater than 140 years for biogeoclimatic group A[5] and greater than 250 years for group B[6].

In the assessment of structural state, structural features and age criteria should be considered together. Broadleaf stands will generally be younger than coniferous stands belonging to the same structural stage.

Substages 1a, 1b, and 2a-d should be used if photo interpretation is possible, otherwise, stage 1 and 2 should be used.

Substages 3a and 3b may, for example, include very old krummholz less than 2 m tall and very old, low productivity stands (e.g., gob woodlands) less than 10 m tall, respectively. Stage 3, without additional substages, should be used for regenerating forest communities that are herb or shrub dominated, including shrub layers consisting of only 10%-20% tree species, and undergoing normal succession toward climax forest (e.g., recent cut-over areas or burned areas).

Structural stages 4–7 will typically be estimated from a combination of attributes based on forest inventory maps and aerial photography. In addition to structural stage designation, actual age for forested units can be estimated and included as an attribute in the database, if required.

Biogeoclimatic Group A includes BWBSdk, BWBSmw, BWBSwk, BWBSvk, ESSFdc, ESSFdk, ESSFdv, ESSFxc, ICHdk, ICHdw, ICHmk1, ICHmk2,ICHmw3, MS (all subzones), SBPS (all subzones), SBSdh, SBSdk, SBSdw, SBSmc, SBSmh, SBSmk, SBSmm, SBSmw, SBSwk1 (on plateau), and SBSwk3.
Biogeoclimatic Group B includes all other biogeoclimatic units.

Appendix II: BC CDC Provincial Status Rankings for Rare Elements.

All rare entities tracked by the B.C. Conservation Data Centre have been assigned provincial and global conservation status ranks (see separate Ranking sheet or the Species Ranking in British Columbia brochure at http://wlapwww.gov.bc.ca/wld/documents/ranking.pdf for an explanation of the CDC ranking system). Most entities also have a designation on the Provincial Red or Blue list. Definitions of the Red and Blue lists, and the relationship between list status and the CDC provincial conservation status rank ("S" rank) are explained below.

The provincial conservation status rank will always be less than or equal to the global rank. An element cannot be given a provincial status that indicates it is more common locally than globally.

Provincial Status List

Red List:

Includes any indigenous species or subspecies that have, or are candidates for Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.

Blue List:

Includes any indigenous species or subspecies considered to be of Special Concern (formerly Vulnerable) in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Yellow List:

Any indigenous species or subspecies (taxa) that is not at risk in British Columbia. The CDC tracks some Yellow listed taxa which are vulnerable during times of seasonal concentration (e.g., breeding colonies)