KAMLOOPS, BC

An Ecological Assessment for the Aberdeen Area Plan

Working together for the conservation of BC's grasslands

Grasslands Conservation Council of British Columbia

An Ecological Assessment for the Aberdeen Area Plan, Kamloops, B.C.

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EXECUTIVE SUMMARY

A partnership between the City of Kamloops and the Grasslands Conservation Council of British Columbia was established to complete an ecological assessment for the Aberdeen Area Plan, an area in south Kamloops slated for future development. The ecological assessment was divided into two components: a field survey and assessment where data for wildlife and plants were compiled into species lists, and the delineation of draft Ecological Communities based on the field data.

Building on the field assessment and preliminary delineations, a priority ecosystem analysis was completed, resulting in the categorization and ranking of the relative importance of ecosystem values within the study area. Priority ecological zone mapping was completed to assist development planning and to provide the means for evaluating tradeoffs between conservation and development within the study area. The study area was stratified into three zones: the “Red Zone” delineates a conservation area defined by a large concentration of high and moderate ecosystem values, including important and highly suitable habitat for species at risk and rare ecosystems. It is recommended that the activities within this zone be primarily directed towards maintaining ecological, wildlife habitat and agricultural values. The “Amber Zone” delineates a sustainable development area defined by moderate ecosystem values on the broader landscape level with specific high priority sensitive ecosystems, such as wetlands. High priority ecological features within this zone are recommended for environmental consideration as park, environmentally sensitive areas, or protected with other conservation tools. A third zone, the “Green Zone”, delineates a development area. This area has lower conservation values, but there are ecological features within this area that should be considered for urban green space or park.

In addition to the zoning recommendations, the GCC is recommending that the City of Kamloops complete a comprehensive ecosystem plan as part of the Aberdeen Area Plan, as well as a broader conservation strategy that considers a series of strategies, including, but not limited to: the designation of high priority sensitive and important ecosystems as Environmentally Sensitive Areas, the establishment of buffers and connecting corridors between high priority ecosystems, the establishment of Development Permit Areas to protect sensitive areas, and incentives such as density bonusing for developments in exchange for the retention of sensitive ecosystems. The GCC is also recommending that the city adopt the *Green Bylaws Toolkit* for use in all future land use planning exercises.

ACKNOWLEDGEMENTS

Funding for this ecological assessment was provided by the City of Kamloops. Other partners who have contributed to the Priority Grasslands Initiative include: Ministry of Agriculture and Lands, Integrated Land Management Bureau, Ministry of Environment, Ministry of Forests and Range, BC Gaming Commission; Habitat Conservation Trust Fund, The Real Estate Foundation of British Columbia, Nature Conservancy Canada, Tula Foundation, The Bullitt Foundation and Western Economic Diversification Canada.

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1. INTRODUCTION

1.1 Project Background

In 2004, the City of Kamloops developed KAMPLAN, the *Official Community Plan* for the City of Kamloops. This plan recognizes the importance of natural habitats within city boundaries, specifically grasslands and wetland habitats, which are particularly sensitive to urban development (City of Kamloops 2004). In KAMPLAN, comprehensive area plans are included to outline land use to direct growth and development. A background report for the Aberdeen Area Plan was completed by True Consulting Group in 2005. The background report, although mainly focused on infrastructure concerns, states that "New Urbanism supports preservation of agricultural lands and environmentally sensitive areas through compact development" (True Consulting Group 2005) and emphasizes KAMPLAN policies that encourage the protection of parkland and open spaces for their contribution to the quality of the Aberdeen neighborhood. The report includes environmental considerations, draft assessments of Ecological Communities, and identifies two environmentally sensitive areas: Coal Hill and Guerin Creek; however, the ecological description and information is limited and does not identify the biodiversity or other ecological values in the area.

Following the GCC's *Planning for Change* workshop in May 2007, the City of Kamloops and the Grasslands Conservation Council of British Columbia (GCC) embarked on a pilot project to complete an ecological assessment of the Upper Aberdeen area on the south side of Kamloops (Figure 1). This project was initiated on September 11, 2007. With increasing pressure for development from major landowners and a recognized gap in ecological information of the Aberdeen area, the City of Kamloops is taking steps to address information needs and to fulfill the environmental objectives of the Aberdeen Area Plan and ultimately, KAMPLAN. Conservation of natural ecosystems within urban areas is becoming a leading concern for city planning departments, and it is increasingly recognized that conservation of natural lands not only protects wildlife habitat and promotes a healthy environment, but also contributes to the quality of urban life, human experience and a healthy community. This report provides the City of Kamloops with baseline scientific information that will assist to plan for the conservation of agricultural lands and environmentally sensitive areas within the Aberdeen Area Plan. In addition, this report informs the city's planning department about the importance of natural habitats within the study area, particularly grasslands, wetlands and riparian ecosystems.

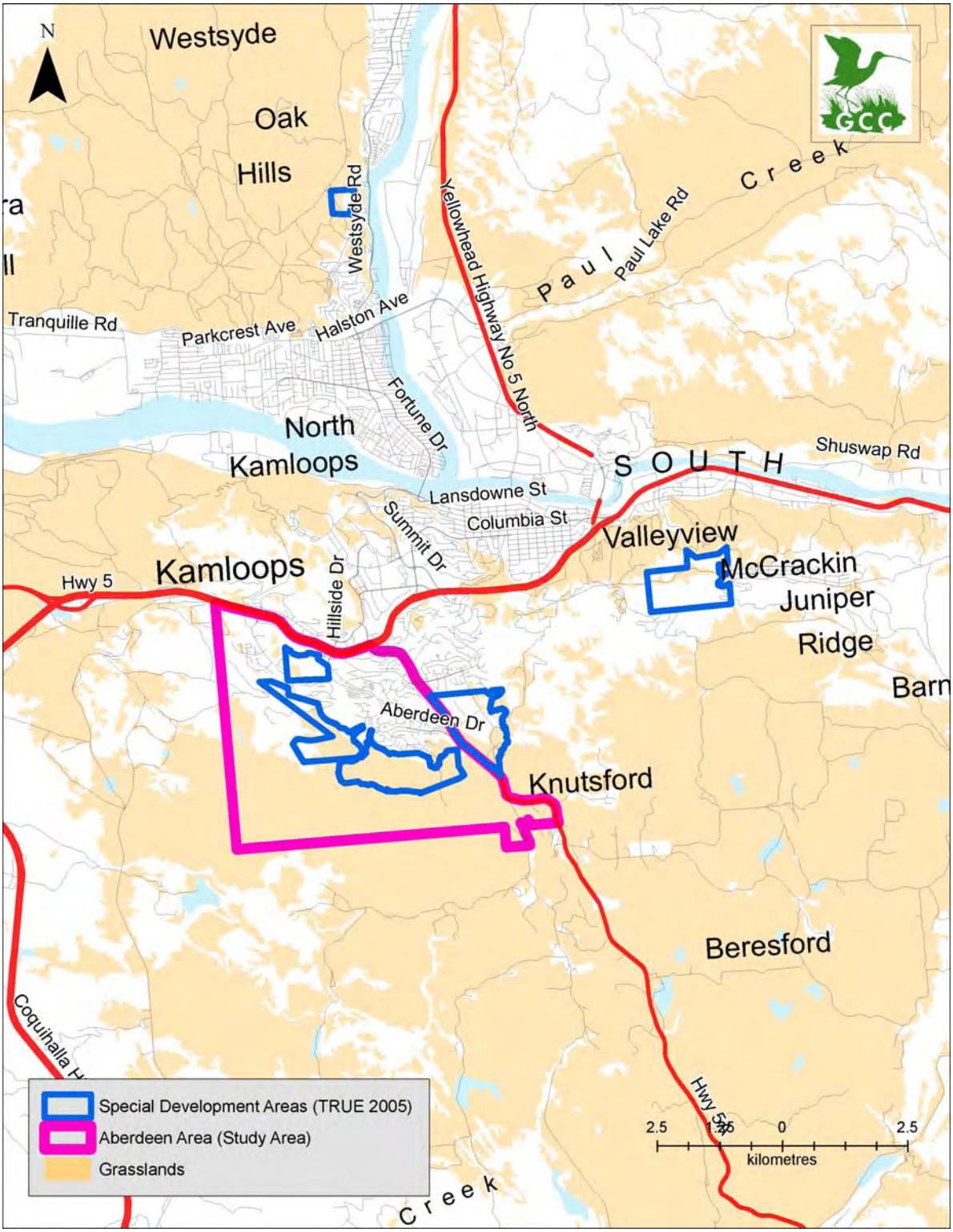

Figure 1: Map of the Aberdeen Study Area in Kamloops, British Columbia

1.2 The Study Area and Ecological Context

The study area is located in the northwest corner of an expansive grasslands-dominated landscape, which covers approximately 17,000 hectares from Kamloops to Shumway Lake (see purple dashed-dotted line, Figure 2), after which the grasslands narrow to a small corridor for several kilometres before expanding into another expansive grasslands-dominated landscape at Nicola Lake (not shown). At a more local scale, the study area constitutes the northern section of contiguous grasslands, accounting for approximately 2,200 hectares (see maroon dashed line, Figure 2). Figure 2 provides an effective visual of the fragmentation of the larger landscape caused by roads, with the exception of the contiguous 2,200 hectares in the area immediately south of the present day Aberdeen neighbourhood.

The study area is approximately 1,960 hectares, with urban development making up 26% of the land base and the remaining 74% as undeveloped land (i.e. grasslands = 59% and forest = 15%). The majority of the grasslands are working landscapes with livestock grazing being the main land use (historically, as not all grasslands are currently grazed). Land use and encroachment from roads, development and other uses influenced the spread of invasive plants in certain areas.

The GCC defines grassland as land on which grasses are the dominant plant cover (GCC 2004a)[1]. The ecosystems contained in grasslands are characterized by perennial bunchgrasses, shrubs (most often a species of sagebrush), a diverse forb component, and, in the spaces between the vascular plants, a biological soil crust comprised mainly of mosses and lichens. Grassland ecosystems are ecologically complex and are a result of long term post-glacial establishment through the interactive processes of climate, topography, soils, and natural disturbance. The Aberdeen study area grasslands, similar to the surrounding landscape, are characterized by drumlins and hummocky terrain, a topography well suited to the formation of depressions for ponds and wetlands, which are both highly valued habitats. Many of the ponds in the study area have mineral soils and are therefore alkaline: as a result, many play host to a unique community of specially adapted plants. Natural disturbance from fire is important in maintaining grassland communities, though fire suppression over most of the last century has allowed trees—in Aberdeen it is particularly Douglas-fir—to grow into sites that would have traditionally been grassland.

[1] Because of the presence and sometimes partial dominance of shrubs, in particular big sage and rabbit-brush, the term shrub-steppe is often used to describe grasslands that dominate semi-arid portions of the Pacific Northwest, including in Washington State (e.g., Daubenmire 1970).

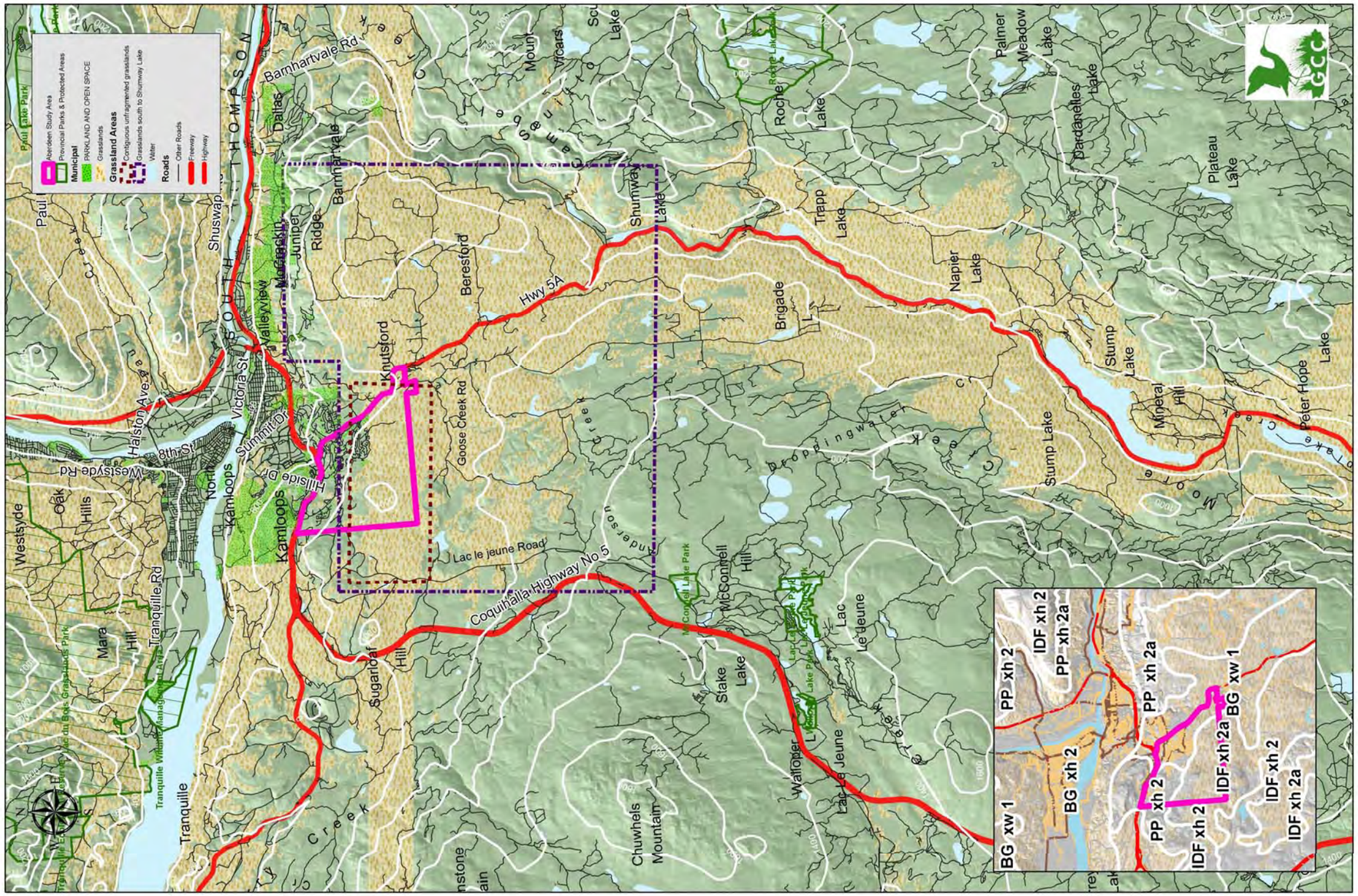

Figure 2: Map showing the Aberdeen study area in the context of the surrounding landscape, including sections of the Thompson and Nicola Basins

In the Kamloops area, the majority of natural grasslands are characterized by the following general biotic groups:

1. Bunchgrasses: in particular bluebunch wheatgrass, the most widespread species, but also Sandberg bluegrass and rough fescue. Other locally dominant grasses include Idaho fescue, species of needlegrass, and the rhizomatous species, Kentucky bluegrass.
2. Shrubs: big sage (warmer sites) and rabbit-brush (cooler sites) are the most common species, but other species are also characteristic.
3. Herbaceous species: a wide variety of herbaceous species, in particular forbs but also grasses, dominate the vegetation within and around the larger bunchgrasses and shrubs. Some of the most diverse assemblages of these plants are found in these grasslands.
4. Biological soil crusts: critical components of healthy grassland ecosystems. Comprised of complex associations of organisms that include lichens, bryophytes (including mosses and a few species of liverworts), single-celled algae, cyanobacteria, and fungal hyphae intermixed with plant roots, litter, and soil (Belnap *et al.* 2001, Belnap 2003). Soil crusts perform a number of ecological functions that contribute to the integrity and health of grassland ecosystems, including binding soil surfaces, increasing soil stability, (Belnap 2003), protecting soil from wind erosion (Neuman and Maxwell 1999), and increasing water infiltration rates (Eldridge 1993).
5. Trees: all grasslands in the Kamloops area form a mosaic of grasslands and forest with a forest edge of Douglas-fir or Ponderosa pine, or in topographically favorable areas, such as in draws, gullies and on cool aspects, an interface with Trembling aspen. Over hundreds of years, the grassland/forest interface has changed following climatic shifts and, often, some very large trees – often veterans or vets – survive within the grassland mosaic. They are mostly unaffected by fire and other disturbances, and usually benefit from periodic fire (e.g. by eliminating litter from around their bases). Once the fire regime is altered, such as with fire suppression, the seeds that these veteran trees produce become the source for much of the forest ingrowth into grasslands. Under natural conditions, these veteran trees play an important role in helping to maintain the diversity of wildlife, especially birds and insects.
6. Wildlife: Numerous animals depend on healthy and functioning grassland ecosystems for at least part of the year. Although birds and large mammals are usually evident on these landscapes, small mammals, reptiles, amphibians and large numbers of insects are dependent on them as well.

The study area can be described using the provincial Biogeoclimatic Ecosystem Classification (BEC) system, the British Columbia Ministry of Forests and

Range's method to classify and manage sites on an ecosystem-specific basis. This system is widely employed by biologists and other professionals to communicate various characteristics of any given habitat within a broad-based ecological context. Communications with Ted Lea (Ministry of Environment, Victoria) and Mike Ryan (Ministry of Forests and Range, Kamloops) have confirmed that the Aberdeen study area is both geographically and climatologically complex, and as a result, three BEC subzones have been mapped for the area: PPxh2 (Thompson Very Dry Hot Ponderosa Pine Variant), BGxw1 (Nicola Very Dry Warm Bunchgrass Variant), and IDFxh2a (Grassland Phase of the Very Dry Hot Interior Douglas-fir Variant) (Lloyd *et al.* 1990).

1.3 Objectives

The main objectives of this project are to:

1. Provide baseline information on the natural features; including wildlife, plants and lichens, as well as the distinct habitats or Ecological Communities (EC) in the Aberdeen Area Plan study area;
2. Complete an ecological assessment of the Aberdeen Area Plan study area, including flora, fauna and Ecological Communities;
3. Prioritize ecologically-based areas into Priority Ecological Zones: Conservation Areas, Sustainable Development Areas, and Development Areas; and
4. Provide guidance and recommendations to the City of Kamloops on conservation measures and future steps.

1.4 Limitations

The data, analyses and results presented in this report are based on the best available information and knowledge obtained from late season (October/November) surveys. The following are limitations to the data and results:

1. The timing of the field work was not ideal, especially for the observation of rare plant species (many of which are spring or summer-growing species and are very difficult to observe after mid-September), nor for the observation of most wildlife (especially birds and insects, with the exception of raptors);
2. For several of the Ecological Communities described in this report ,the identification is tentative due to many plants being dormant (or still in seed) at this time of the year, and follow-up work is required to gather more details;
3. The lack of previous detailed ecological or wildlife surveys in the study area required initial reconnaissance surveys that took away time from more detail surveys;

4. The results of the analysis and ecological assessment had limited review by the scientific community at large; and
5. Some vegetation units encountered in the study area were not given ecological status due to limited field time.

2. METHODOLOGY

This section summarizes the methodology used for the ecological assessment of the Aberdeen study area. The methodology included: a literature review, field surveys, consultation with experts, field work analysis, and priority ecosystem mapping and analysis. A much more detailed account of this methodology is described in Appendix B.

2.1 Literature Review

Numerous sources were reviewed in the development of this report. Much of the accessed documents and databases, especially government resources such as ecological report and species at risk data, are housed in repositories on the Internet. Table B1 in Appendix B provides a list of information sources consulted.

2.2 Field Surveys and Analysis

Field surveys were conducted in October and November 2007 for a total of nine person-days. The field work comprised of visual assessments and ground inspections based on the BC Conservation Data Centre's (CDC) draft Conservation Assessment Procedure for Element Occurrences of Ecological Communities (MOE 2007).

Visual assessments formed the basis for establishing the study area's Ecological Communities and the eight representative vegetation plot locations. Due to the limited late season field work, a number of local and provincial experts familiar with the study area were consulted to supplement the information gathered (Appendix C).

The field data gathered were not only compiled into species lists (Appendix D and E), but helped form the basis for defining and delineating Ecological Communities. Each Ecological Community is evaluated for its ecological and conservation value. Conservation evaluations – a descriptive summary of the Ecological Community – provide a standard way of comparing Ecological Communities. The content of the conservation evaluations is derived from information in Ministry of Environment (MOE) documents (2007, 2006a, 2006b, 2007c, and 2007d).

2.3 Priority Mapping and Analysis

Priority mapping and analysis consists of Terrestrial Ecosystem Mapping, community element occurrence designation, priority ecosystem analysis, species

at risk mapping and habitat potential modelling, priority category and level assignment, and priority ecological zoning.

The field survey data, in combination with a Terrestrial Ecosystem Mapping (TEM) (Resources Inventory Committee (RIC) 1998b) related GIS analysis, was used to map bioterrain units. The bioterrain unit polygons represent a combination of key topographic, abiotic and vegetative features in the study area that together form a cohesive unit relative to their landscape and ecological function. To delineate these bioterrain units, digital elevation models (DEM) and Topographical Ruggedness Index (TRI) grids are used in coordination with ortho-photograph interpretation and field data. Other GIS datasets used as mapping aids include: bedrock geology, hydrology (i.e. streams, ponds and wetlands), BC's Ministry of Forests and Range Vegetation Resource Inventory (VRI) and BEC subzones, and GCC's grasslands occurrence layer.

Once the bioterrain units were mapped, they were grouped into community element occurrences, assigned a landscape distribution pattern category (i.e. matrix, large patch, small patch and linear ecosystems) and then grouped into either base polygons or smaller encompassed polygons in preparation for the priority ecosystems analysis (See Appendix B for details).

The priority ecosystem analysis methodology used in this assessment was developed by the GCC and its partners—including experts from various disciplines—to guide a process for identifying and delineating high priority grasslands and associated ecosystems (GCC 2007). The stages of the priority ecosystem analysis applied to this assessment are described in great detail in Table B3 in Appendix B.

In the initial stages of the priority ecosystem analysis, the bioterrain base polygons were assigned a category label and ranked based on what grassland values they encompass. The primary values included: important ecosystems, species at risk, wildlife habitat, recreation and spring forage. Labels are assigned, in part, to provide an efficient way of recognizing what values a bioterrain unit contains and provides an efficient means for the subsequent priority ecological zoning assignment.

The final stage of the priority ecosystem analysis was the assignment of Priority Ecological Zones to the base polygons. This zoning method resulted in representing the study area by three distinct classes, which represent the following recommendations for land use planning:

1) **Class 1: "Green zone" – Development Area**
   There are no specific ecological concerns and the area is highly fragmented. It does not play an important role in contiguity of the highest priority areas, but where possible, specific community elements should be considered for conservation.

2) **Class 2: "Amber zone" – Sustainable Development Area**
   Development should proceed with caution and special attention should be paid to conserving small patch community elements with high priority ranking and/or connectivity value. A clear vision and plan is required to protect ecosystem values and ensure that development does not compromise core ecological values.

3) **Class 3: "Red zone" – Conservation Area**
   This area is defined by a large concentration of high and moderate ecosystem values, including important and highly suitable habitat for species at risk, as well as rare ecosystems. This area is the highest priority for conservation, and activities should be primarily directed towards maintaining ecological, wildlife habitat and agricultural values.

3. RESULTS

The following section provides the results of the Ecological Communities identification, plant and wildlife surveys, and the Priority Mapping and Analysis, including the integration of the literature review and outcomes of discussions with experts.

3.1 Ecological Communities

Of the ten Ecological Communities identified for the Aberdeen study area during field surveys, two are grassland associated, four are shallow-soiled or rock outcrop, two are forest dominated, and two are wetlands (Table 1). Because of the limited field work, some of these Ecological Communities may be divided or possibly combined in future when further studies are conducted.

Table 1: Ecological Communities in the Aberdeen Study Area

Ecological Community	Estimated proportion of study area
Grasslands **1.** Bluebunch wheatgrass-dominated Ecological Community	70%
2. Bluebunch wheatgrass-Rough fescue Ecological Community	<2%
Shallow Soil and Outcrop **3.** Bluebunch wheatgrass-dominated Ecological Community on thin soils	<10%
4. Bluebunch wheatgrass-dominated Ecological Community on talus slopes	<6%

5. Compact selaginella-dominated Ecological Community	<1%
6. Outcrop	<1%
Forests	
7. Douglas-fir-dominated	25%
8. Aspen-dominated	<10%
Wetlands	
9. Alkaline pond complex	<2%
10. Alkaline seepage slope	<01%

3.2 Plant and Wildlife Surveys

The field surveys identified 110 plant species despite the late season survey period (Appendix D). These include: three trees, nine shrubs, 57 forbs, 27 graminoids (grasses, rushes, and sedges), and 14 mosses. One of the plant species, the alkaline wing-nerved moss, is listed as Threatened on Schedule 1 on the federal Species at Risk Act (SARA) and is Red Listed by the CDC. It was found along the edges of two of the alkaline ponds in the Aberdeen study area (located in the south east and south west of the study area). This species is scattered across the drier landscapes through British Columbia and is rarely very common at any site; however, one of the Aberdeen populations of this species appears to be one of the largest in British Columbia.

The inventory of the plants (including bryophytes) and lichens in the study area is preliminary. Although the vascular plant flora is probably about 85% complete, the bryophytes and lichens are still mostly unknown; more complete spring and summer surveys should be conducted to obtain a better representation of current plant communities and the presence of rare species. It is expected that other rare species will be observed during future surveys, especially adjacent to alkaline ponds or in terrain seeps.

A list of the animals that were observed during field work is included in Appendix E. Seven hundred and thirty-three observations of 45 bird species were made, and observations or evidence of five mammals utilizing the area were also noted (Appendix F).

Based on field surveys, personal communication and compiled information from the literature review, a total of one Red Listed bird (Lewis' woodpecker), two Blue Listed birds (Sandhill crane and Sharp-tailed grouse), one Threatened bird (Common nighthawk), one Blue Listed mammal (American badger), and one Red Listed/Threatened non-vascular plant (Alkaline wing-nerved moss) have been identified in the study area.

Discussions with experts lead to the establishment of a list of potential species at risk in the study area (Table F2 of Appendix F). In addition to the confirmed

species noted above, a total of four likely and 27 possible Species at Risk may occur within the study area, and requires further investigation.

3.3 Priority Mapping and Analysis

The study area is comprised of approximately 1,960 hectares (19.6 km^2): 1,448 hectares (14.5 km^2) being intact habitat (15% forest, 59% grasslands) and the remaining 512 hectares (5.1 km^2) being developed urban areas.

Appendix F provides a series of important maps that lead to the resulting priority ecological zoning map, including Terrestrial Ecosystem Maps, badger habitat potential model, Sharp-tailed grouse habitat potential model, Great Basin spadefoot habitat potential model, priority categories and priority ecological level "ranks".

Figure 3 shows the study area stratified into three priority ecological zones: Conservation Area (Red zone), Sustainable Development Area (Amber zone) and Development Area (Green zone).

The red zone is defined by a large concentration of high and moderate ecosystem values, including important and highly suitable habitat for species at risk and rare ecosystems as defined by the CDC, and is the highest priority for conservation. The amber zone is defined by moderate ecosystem values on the broader landscape level with specific high priority sensitive ecosystems, such as wetlands. The green zone overall has lower priority values but specific community elements within this zone may have higher ecological values.

Figure 4 represents the priority ecological zoning, but showcases the special features within the amber and green zones that need to be considered in developing these areas.

Table 2 breaks down the total hectares and the number of occurrences of each zone within the study area, and Table 3 shows the same breakdown for the combination of the study area and the adjacent special development area (LU134). Special development areas are areas identified as potential for future development in the Aberdeen Area Plan Background Report (True Consulting Group 2005).

Figure 5 shows the percentages of each zone within the study area, including the area where no zone was designated because the land is already developed. Figure 6 shows the same thing for the combination of the study area and the adjacent special development area (LU134).

For each development area in the study area, and for one development area adjacent to the study area, the percentage of each zone of the Ecological Zoning Analysis is graphed as a bar (Figure 7). The Conservation, Sustainable Development, and Development percentages for each do not add up to 100% due to slight discrepancies in the zone boundary lines within the GIS environment.

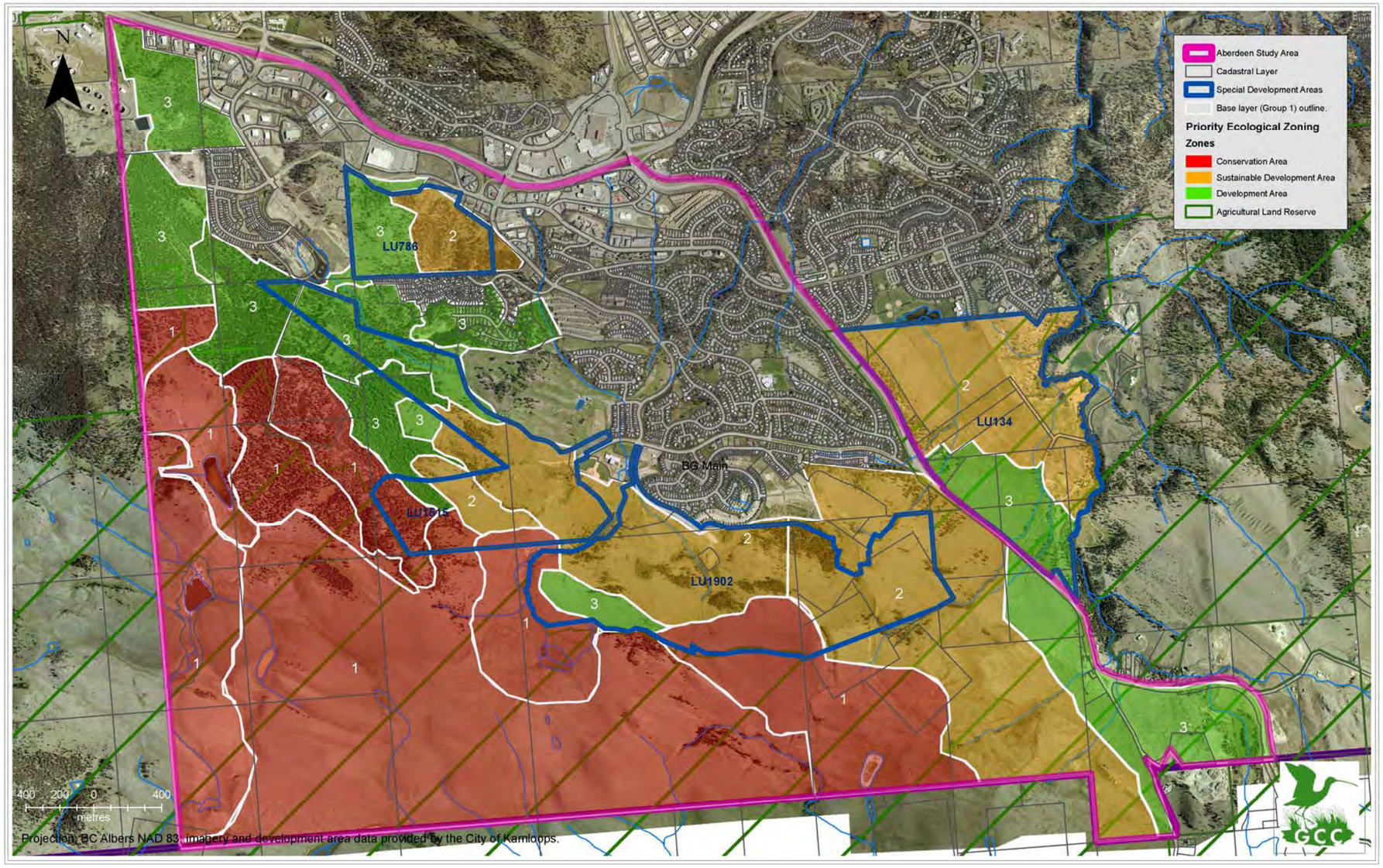

Figure 3: Map of Priority Ecological Zoning for the Aberdeen Study Area

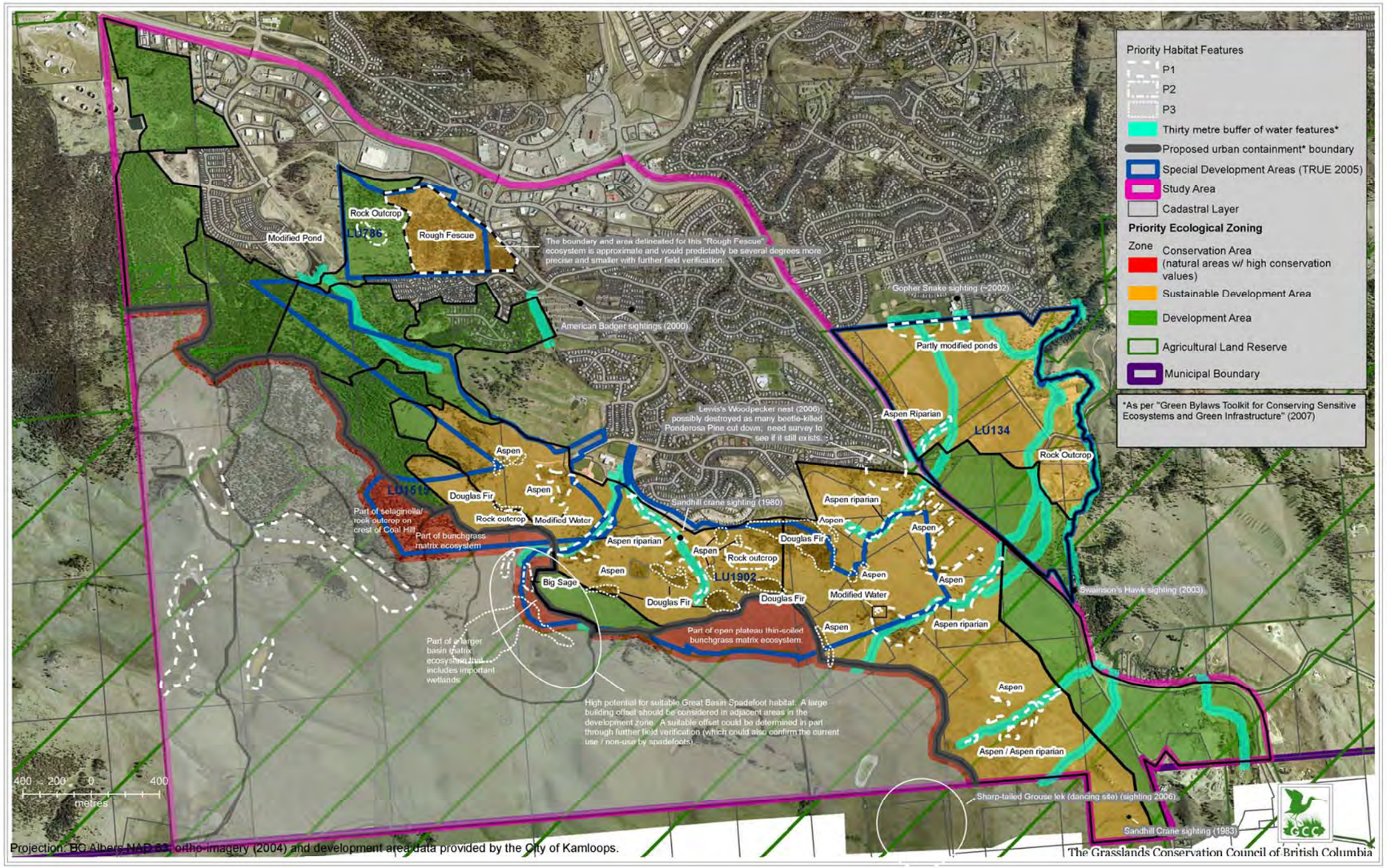

Figure 4: Map of important habitat features in the Aberdeen Study area in the context of Ecological Zoning and Special Development Areas

Table 2: Total area covered by each Ecological Zone in the Study Area.

Zone	Number of Occurrences	Hectares
Conservation	7	788
Sustainable Development	4	347
Development	11	312

Table 3: Total area covered by each Ecological Zone in the Study Area and in the adjacent Development Area (LU134).

Zone	Number of Occurrences	Hectares
Conservation	7	790
Sustainable Development	5	447
Development	12	347

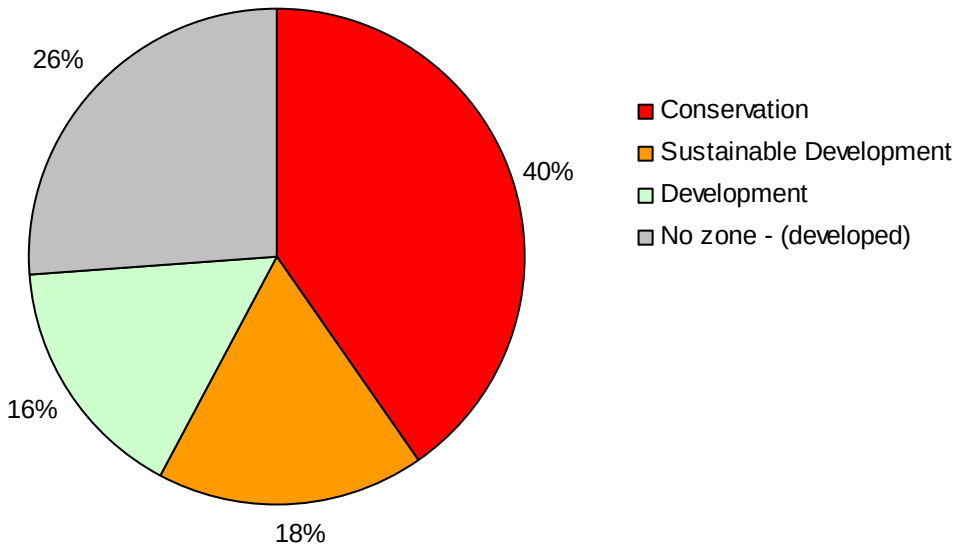

Figure 5: Percentage of study area covered by each Ecological Zone

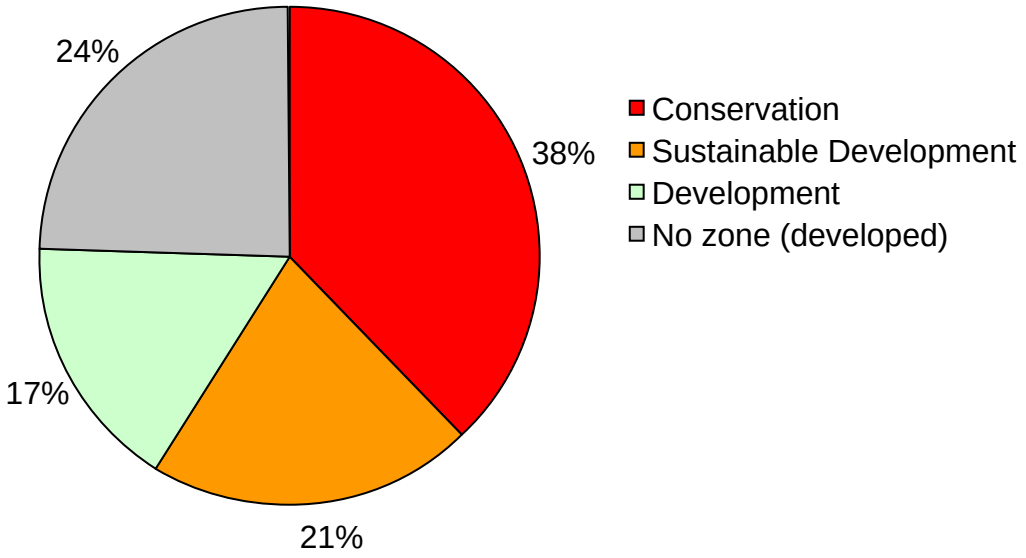

Figure 6: Percentage of study area and adjacent Development Area (LU134) covered by each Ecological Zone

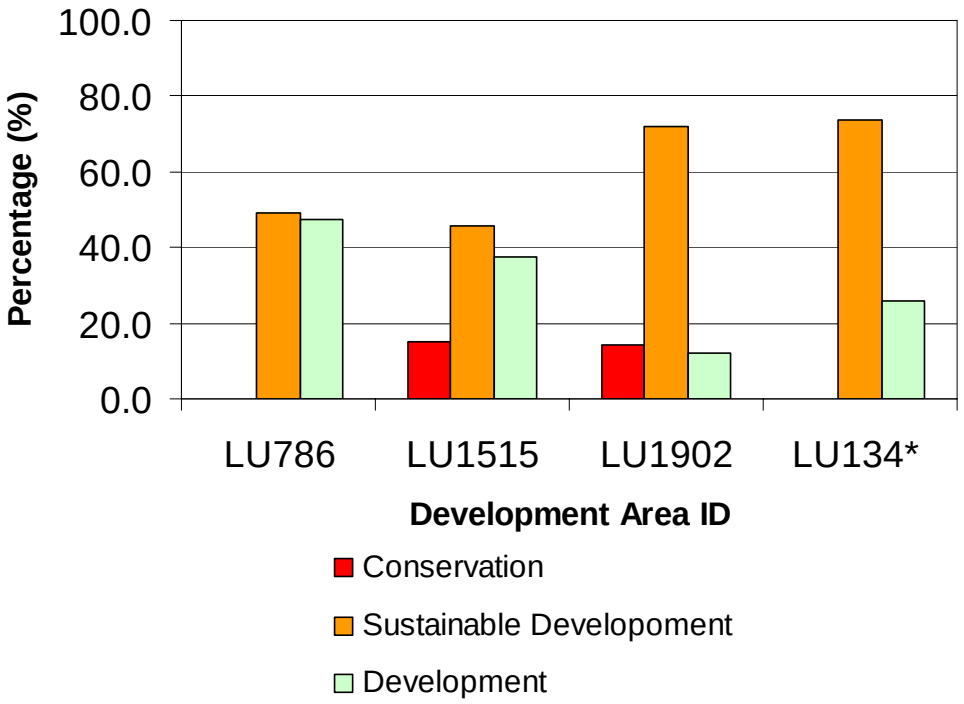

Figure 7: Percentage of Ecological Zone type in each of the four Special Development Areas

4. PLANNING FOR CONSERVATION AREAS

In 2004, the City of Kamloops developed KAMPLAN, the *Official Community Plan* for the City of Kamloops. This plan recognizes:

- New urbanism that supports preservation of agricultural lands and environmentally sensitive areas through compact development;
- Protection of parkland and open spaces for their contribution to the quality of the Aberdeen neighborhood; and
- The importance of natural habitats within city boundaries, in particular grasslands and wetland habitats, which are highly sensitive to disturbance.

As the city of Kamloops grapples with significant growth pressure over the next few decades, conservation of natural ecosystems within urban areas is becoming a leading concern. It is increasingly recognized that conservation of natural lands not only provide wildlife habitat, but they contribute to the quality of urban life, human experience and a healthy community.

4.1 Proposed Ranking of Study Area

Building on the results of the analysis where ecosystems were ranked using a Priority Ecological Zoning analysis, the study area was stratified into three areas:

1. Conservation Area (Red Zone) – This zone is defined by a large concentration of high and moderate ecosystem values including important and highly suitable habitat for species at risk, and rare ecosystems as defined by the CDC. The Red Zone is the highest priority for conservation and include natural areas with high conservation values. Activities should be primarily directed towards maintaining ecological and wildlife habitat values in this area, as well as agricultural values. A working agricultural landscape managed in a sustainable way may be consistent with conservation objectives.

2. Sustainable Development Area (Amber Zone) – this zone is defined by moderate ecosystem values on the broader landscape level with specific high priority sensitive ecosystems delineated. Figure 4 illustrates priorities for conservation within this zone. A clear vision and plan is required to protect ecosystem values and ensure that development does not compromise core values. High priority features within this zone should be zoned for environmental consideration as park, environmentally sensitive areas, or protected with other conservation tools.

3. Development Area (Green Zone) – this zone is defined as having lower conservation value. There are specific community elements within this

zone that have ecological value that could be considered for urban green space or parks.

Due to the high values found within the Red Zone, this area is proposed as a conservation area where no development should be considered. Land use should be primarily directed towards maintaining ecological, wildlife and agricultural values. In the Amber Zone, or sustainable development area, development will need to be carefully planned and ecologically sensitive areas will need to be buffered from potential adverse effects of adjacent development or other land uses.

4.2 Buffers

Sensitive ecosystems and conservation areas need to be buffered from potential adverse effects of adjacent land uses (Iverson *et al.* 2006). We recommend that the City of Kamloops consider similar buffers as presented in the Vernon Commonage Sensitive Ecosystem Inventory:

> "It is generally acknowledged that terrestrial buffers or riparian strips (30 to 60 meters) wide will effectively protect water resources. However, terrestrial habitats surrounding wetlands are important to more than just the protection of water resources. They are also essential to the conservation and management of semi-aquatic species... data clearly indicates that buffers of 15-30 meters, used to protect wetland species in many states, are inadequate for amphibians and reptiles. We propose…three terrestrial zones of protection... an aquatic buffer 30-60 meters; a core habitat (which includes the aquatic buffer): 142 to 289 meters; and an additional terrestrial buffer of 50 meters. We propose…three terrestrial zones adjacent to core aquatic and wetland habitats (1) a first terrestrial zone immediately adjacent to the aquatic habitat, which is restricted from use and designed to buffer the core aquatic habitat and protect water resources (30 to 60 meters); (2) starting again from the wetland edge and overlapping with the first zone, a second terrestrial zone that encompasses the core terrestrial habitat defined by semi-aquatic focal-group use (e.g., amphibians 159 – 290m); and (3) a third zone, outside the second zone, that serves to buffer the core terrestrial habitat from edge effects from surrounding land use (e.g. 50 meters)" (Iverson *et al.* 2006).

4.3 Wildlife Corridors

While wildlife corridors are not specifically addressed in this report, potential habitat areas suitable for wildlife corridors were assessed and integrated with the process that was used to establish the three priority ecological zones. Wildlife corridors are important as they provide animals with the ability to move freely between habitats and ecosystem types. Movement of wildlife is important to provide genetic links between populations and compensate for temporary

population declines in one habitat patch. Corridors typically include riparian draws with adjacent warm aspect grasslands and ridges, as these features are most commonly used for travel between habitats.

A more detailed analysis should be included in future land use planning exercises and constitutes a limitation in this report.

5. RECOMMENDATIONS

The GCC recommends that:

1. Additional field work be completed to verify Ecological Community assessments and ranking of ecosystems;
2. Red Zone area should be a focus for conservation/parkland acquisition, and a more detailed analysis should be completed to determine appropriate park boundaries and land uses. The City of Kamloops should determine other potential means of land acquisition and other conservation options such as conservation covenants;
3. The City of Kamloops establish an urban containment boundary as defined in Figure 4, encompassing all of the Red Zone (see Figure 3 for delineation of Red Zone). For more details on urban containment, please refer to the *Green Bylaws Toolkit* (www.greenbylaws.ca).
4. Amber Zone area should be a focus for sustainable development, and a more detailed analysis should be completed to determine boundaries for key conservation areas (Environmentally Sensitive Areas) within this zone, as well as appropriate buffers and wildlife corridors;
5. More detailed ecosystem descriptions must be provided as part of the next phase of this process, including wetland, riparian, forest (i.e. old, mature, coniferous), grassland and broadleaf woodland (e.g. aspen);
6. The City of Kamloops should complete a comprehensive ecosystem plan as part of the Aberdeen Area Plan;
7. The City of Kamloops should consider the following as part of a conservation strategy:
    - Designate Red Zone areas and special features in the Amber Zone areas as Environmentally Sensitive Areas (ESA);
    - Designate Amber Zone areas as Development Permit Areas (DPAs) and ensure that only developments and other activities compatible with the preservation, protection, restoration and enhancement of sensitive Ecological Communities occur in DPAs;
    - Provide and maintain appropriate buffers—determined by qualified professionals—around sensitive Ecological Communities. The buffer

widths and designs should be developed to reflect the specific ecosystem and wildlife habitat values;

- Provide connectivity corridors between sensitive and important Ecological Communities and conservation areas. Details for corridor widths must be determined based on scientific and ecological data;
- Protect wetlands by not allowing the in-filling of these vital areas;
- Leave dead trees for Lewis' woodpeckers and other cavity nesting birds;
- Provide greater incentives, such as density bonuses in developments in exchange for the retention of sensitive Ecological Communities;
- Eliminate large lot zoning designations in favour of cluster development zones;
- Reduce minimum lot size to permit cluster development if more than 20% natural area is retained and is not disturbed. Consider the development of cluster housing as a zoning designation;
- Design initial road and utility layouts at a landscape scale to minimize impacts to sensitive and other important Ecological Communities;
- Plan and manage recreational access to minimize impacts to sensitive Ecological Communities;
- Develop and implement a weed management strategy to minimize the spread and introduction of invasive plant species;
- Use other protection techniques such as restrictive covenants, purchase of development rights and financial incentives to leave sensitive sites intact; and
- Adopts the Green Bylaws Toolkit (http://www.greenbylaws.ca) for use in all future land-use planning exercises.

An Ecological Assessment for the
Aberdeen Area Plan,
Kamloops, B.C.

Appendices

February 22, 2008

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APPENDIX A. GLOSSARY

The following is a glossary of the technical or new terms contained with this report:

Community Element Occurrence – An element occurrence of an ecological community.

Conservation Area (Red zone) – A zone defined by a large concentration of high and moderate ecosystem values including important and highly suitable habitat for species at risk, and rare ecosystems as defined by the CDC. The Red Zone is the highest priority for conservation and include natural areas with high conservation values. Activities should be primarily directed towards maintaining ecological and wildlife habitat values in this area, as well as agricultural values. A working agricultural landscape managed in a sustainable way may be consistent with conservation objectives.

Conservation Evaluations – A standardized method of describing Ecological Communities. The evaluation includes categories such as characteristic plants, biodiversity significance, condition, and known threats. The categories were derived from numerous Ministry of Environment (MOE) documents (2007, 2006a, 2006b, 2007c, and 2007d).

Development Area (Green Zone) – A zone defined as lower conservation value. However, there are specific community elements within this zone that have ecological value that could be considered for urban green space or parks.

Ecological Community (EC) – "Characterized by a 'plant community' (a volume of relatively uniform vegetation) and the 'soil polypedon' (a volume of relatively uniform soil) upon which the plant community occurs (Pojar et al. 1987)" (MOE 2006e). The term ecological community is used by the CDC and includes "terrestrial natural plant communities and plant associations and the full range of ecosystems that occur in British Columbia" (MOE 2006e). The mapping of ecological communities, for this assessment, is based on field work and examination of aerial photographs. The primary source used to define ecological communities was CDC's draft Conservation Assessment Procedure for Element Occurrences of Ecological Communities (MOE 2007).

Element Occurrence (EO) – "An area of land or water in which a species or ecological community is present that has practical conservation value for the Element as evidenced by potential continued presence or regular recurrence at a given location. An element occurrence may represent a stand or patch of an ecological community or a cluster of stands or patches of an ecological community (NatureServe 2002)" (MOE 2006e).

Large Patch Ecosystem Element Occurrence – Large uninterrupted cover associated with environmental conditions and landforms that are less extensive than those of matrix communities. Examples of large patch ecosystems within the grasslands include coniferous forest ecosystems, north aspect fescue grasslands and some subhygric valley bottom ecosystems.

Linear Ecosystem Element Occurrence – Linear strips associated with site features or landforms that are consistently linear. Linear ecosystems may form bands around the base of large depressions such as lakes > 20 ha. Streamside riparian ecosystems (e.g., Aspen following a drainage) are the only linear ecosystem element identified in this report's mapping and analysis.

Matrix Ecosystem Element Occurrence – Extensive and often contiguous cover across a landscape. In a typical grassland, matrix ecosystems often occupy > 50% of the landscape. The mapped boundaries of a matrix ecosystem may incorporate up to 10% other ecosystems as small inclusions that cannot reasonably be mapped separately or are considered part of an integrated complex dominated by the matrix ecosystem.

Priority Ecosystem Analysis – A process for identifying and delineating high priority grassland and associated ecosystems (GCC 2007). The priority ecosystem analysis methodology utilized in this assessment was developed by the GCC and partners, including experts from various disciplines.

Priority Ecological Zoning – A method to identify and delineate higher value areas that are contiguous habitat within the broader landscape. Lesser values are given to areas that incorporate similar total surface coverage of good habitat, but of a less contiguous configuration, that is, an area that is fragmented into isolated "islands". The method also accounts for the bias towards higher priority levels (and category ranks) for large areas because the larger the area of the bioterrain unit the more likely it is to contain at least one of an important habitat, important ecosystem, or some other high value grasslands feature.

Small Patch Ecosystem Element Occurrence – Typically associated with very specific site conditions or microsites that are only very locally present on the landscape, which occupy small (≤ 20 ha and most often < 5 ha), discreet areas. Examples of small patch ecosystems include saline meadow, rock outcrop and sand dune ecosystems. Some small patch ecosystems form bands around the base of wet or saline depressions. Although these ecosystems have linear characteristics, they are considered small patch ecosystems if the depression is ≤ 20 ha.

Special Development Areas: Areas identified as potential for future development in the Aberdeen Area Plan Background Report (True Consulting Group 2005).

Sustainable Development Area (Amber zone) – A zone defined by moderate ecosystem values on the broader landscape level with specific high priority sensitive ecosystems, such as wetlands, delineated. A clear vision and plan is required to protect ecosystem values and ensure that development does not compromise core values. High priority features within this zone should be zoned for environmental consideration as park, environmentally sensitive areas, or protected with other conservation tools.

APPENDIX B. EXPANDED METHODOLOGY

The following section details the methodology used for the ecological assessment of the Aberdeen study area. Subsections include literature review, field surveys, consultation with experts, field work analysis, priority ecosystem mapping and analysis.

1.1 Literature Review

Numerous documents were reviewed during the preparation of this report. The following is a list of sources and relevant information reviewed for this ecological assessment (Table B1). The information gathered during the literature review was integrated into the results.

Table B1: Information Sources Consulted

Source	Information within source
Conservation Data Centre (CDC) Element Occurrence Database	Flora, fauna, and ecosystem locations, including sensitive information
BC Species and Ecosystems Explorer (http://www.env.gov.bc.ca/atrisk/toolintro.html)	Online searchable database of tracked (red, blue & Yellow listed, and Identified Wildlife) species and ecosystems
Species Inventory Information System (SPI) (http://srmwww.gov.bc.ca/wildlife/wsi/siwe.htm)	Database of wildlife species observations collected by government
EcoCat (http://srmapps.gov.bc.ca/apps/acat/)	Online catalogue of government ecological reports
BEC plot database	Sources for BEC Sites Series assignment and species at risk plants
Kamloops - South Thompson Sustainable Community Atlas (http://www.kamloopsatlas.com/)	Includes bird sightings for Kamloops that may not be in provincial databases
Assessment Report Indexing System (ARIS) (http://www.em.gov.bc.ca/Mining/Geolsurv/Aris/default.htm)	Online database containing mineral exploration assessment reports for the province
Abacus Mining & Exploration Corp.	Reported as a potential source of information as there is a potential mining application for the nearby Ajax pits (1 km southeast).

1.2 Field Surveys

Field work was completed on October 3rd and 11, and November 7, 13, and 14 by Terry McIntosh (botany/ecology) and on October 11, 13, and 14 by Ken

Wright (wildlife/habitats). Terry McIntosh was assisted by Tessa Richardson, biologist, on November 7.

The BC Conservation Data Centre's draft Conservation Assessment Procedure for Element Occurrences of Ecological Communities (MOE 2007) was the primary source used to assess ecosystems within the study area. The procedures used from this document include visual assessments and ground inspections.

An initial coarse level visual assessment was utilized, which involved walking as much of the study area as possible. This visual assessment was the basis for the initial low precision mapping of the locations and boundaries of Ecological Communities in the study area. The visual assessment also helped establish locations for plots that captured the best representation of the ecological community. Eight detailed plot assessments were completed using standard Ground Inspection Form (GIF) forms (Figure B1 and Table B2) (MOE 2007 and BCMELP & BCFM 1998).

Due to the time of year, vegetative cover estimates in Table B2 may not be representative of true cover particularly with herbaceous species because of decomposition/leaf loss in most species. Some taxa have completely died back, therefore the lists of species are low in number.

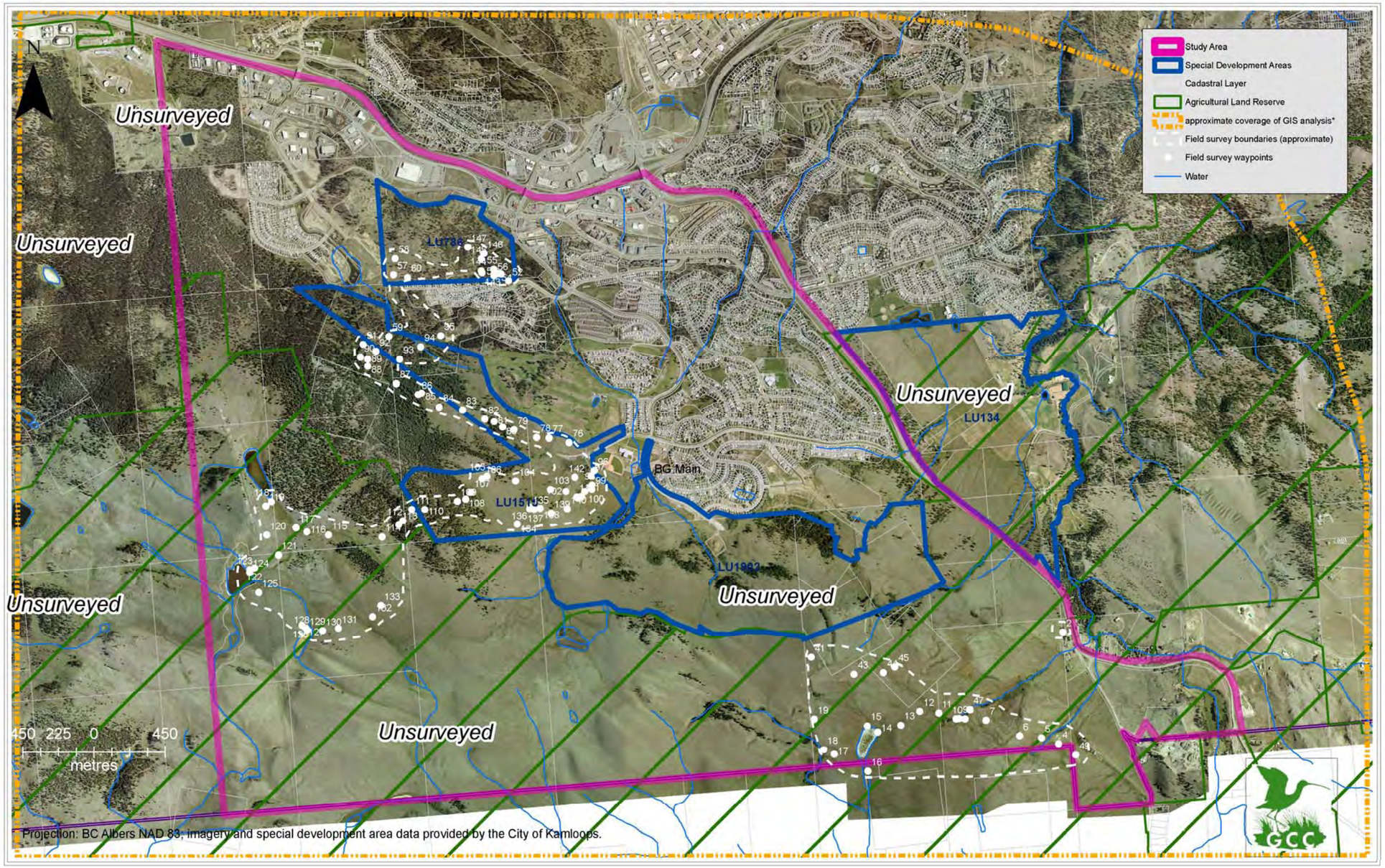

Figure B1: Map of Field Survey and Plot Locations in the Aberdeen Study Area

Table B2: Ecosystem Field Form Summary

Plot number and WP	Rep.	M/N/S	S/A/M/S	Trees	Shrubs	Herbs	Moss/ Lichen	Notes
1 (WP 76)	BB (RF)	M/M/L	3/N/toe/flat 853 m		RB 2 BS IDF	BB ~30 RF 4 knapweed 3 Junegrass 3 Sandberg bluegrass ~12 pasture sage brome sp. Yellow salsify pussytoes Holboell's rockcress death camus alum root yarrow Kent. blue grass	Syntrichia ruralis ~20 Ceratodon purpureus Bryum spp. Cladonia spp. ~5 Brachythecium albicans Total cover ~40%	gopher activity common no evidence of livestock (fenced)
2 (WP 81)	ingrowth	M/M/?	22/N/mid/flat 891 m	IDF 40	IDF 3	stiff needlegrass ~12 BG 2 brome sp. ~5 Kent. blue grass ~2 mustard sp. hound's tongue yarrow old man's whiskers strawberry alum root	Brachythecium albicans 30 Syntrichia ruralis 2 Peltigera cf. canina Rhytidiadelphus triquetris	IDF (8) - 15 -25 (38) DBH
3 (WP 86)	ingrowth	M/M/?	24/N/mid/flat 895 m	IDF 90	IDF ~15	stiff needlegrass BG Kent. blue grass	Pleurozium schreberi 2 Peltigera britannica 1 Rhytidiadelphus triquetris 1	largest tree ~60cm litter 60%

Plot number and WP	Rep.	M/N/S	S/A/M/S	Trees	Shrubs	Herbs	Moss/ Lichen	Notes
4 (WP 96)	BB (RF)	MX/M/ L	25/N/mid/flat 868 m		RB rose	BG ~20 RF 3 cinquefoil sp. Junegrass Sandberg bluegrass mullein alum root yarrow Kent. blue grass	Brachythecium albicans ~50 Syntrichia ruralis ~20 Bryum spp. Cladonia spp. Total cover ~70%	deer and coyote scat present little evidence of livestock
5 (WP 97)	aspen copse	M/M/ E-M	~15/NE/crest/ flat and to edge of gully 877 m		aspen ~25 rose 10	Kent. blue grass ~25 stiff needlegrass 4 mullein grass sp. herb spp.		aspen 7 - 18 DBH (a few larger) grazing present
6 (WP 99)	BB	MX/M/ L(M)	5/N/crest/flat 866 m		RB	BG ~20 Sandberg bluegrass ~12 mullein 4 Junegrass pasture sage brome sp. mustard sp. Yellow salsify pussytoes Holboell's rockcress Yarrow	Syntrichia ruralis ~10 Ceratodon purpureus Bryum spp. Cladonia spp. Total cover ~20%	gophers present and soil disturbance high (open soil ~30%) weeds > 10% livestock grazing present

Plot number and WP	Rep.	M/N/S	S/A/M/S	Trees	Shrubs	Herbs	Moss/ Lichen	Notes
7 (WP 103)	BB (BS)	MX/M/ L	2/N/crest/flat 920 m		BS 1 RB	BG ~20 Junegrass Sandberg bluegrass ~8 mullein old man's whiskers pasture sage pussytoes yarrow Erigeron sp. alum root yarrow	Cladonia spp. 5 Syntrichia ruralis 3 Ceratodon purpureus Bryum spp. Total cover ~35%	livestock grazing present but range condition excellent
8 (WP 123)	alkaline pond border	H/?/L	flat to 2/E/in depression 937 m			alkali saltgrass 7 Nuttall's alkaligrass 4 foxtail barley 1 Baltic rush gumweed unidentified herbs	alkaline wing-nerved moss 2 Conardia compacta Bryum sp.	some cattle use (trampling)

Rep. = Plot representing
M/N/S = **m**oisture regime (xeric/mesic/hygric)/**n**utrient regime (poor/medium/rich)/**s**uccessional status (late/mid/early) (all broad estimates)
S/A/M/S = slope/**a**spect/**m**eso slope position/**s**urface topography (within the plot); elevation follows

RB = rabbit brush, **BS** = big sagebrush, **IDF** = Douglas-fir, **BB** = bluebunch wheatgrass, **RF** = rough fescue

Plots were placed in areas that were representative of what was observed during field work. They were not necessarily placed in sites that characterize the vegetation in a GCC-derived polygon (variation is common), and some are smaller than the required size. Soils were examined surficially. For a selection of locations, general notes were written regarding the surrounding terrain, environment, and salient features (e.g., rock outcrops), and further to this field plots were completed.

Digital photographs were taken across the site to facilitate determination of EC and BEC Site Series and geographic location was determined using a Global Positioning System (GPS) unit (Appendix G).

1.3 Consultation with Experts

A number of experts in ecology and biology were consulted during this project. Additionally the GCC hired two consultants to conduct plant, ecosystem, and wildlife surveys in the study area. Ken Wright, wildlife biologist consultant, completed wildlife field inspections across the area, mainly focusing on bird species. He also prepared the majority of the wildlife component of this report. Ken MacKenzie, wildlife biologist consultant, and Mike Sarell, wildlife biologist consultant, offered comments on the wildlife data. Kristi Iverson, ecologist consultant, provided guidance on the vegetation component of the report. Other experts were consulted and are referenced throughout the report. Experts consulted are listed in Appendix C.

1.4 Field Work Analysis

Field data for wildlife and plants were compiled into species lists for the study area. These ECs were defined based on similarity of within-unit vegetation characteristics, mainly species composition and ground surface cover from field work. As much of the property was visited during the study period, but some areas were not investigated. Based on pre-field work examination of aerial photographs, it is unlikely that any distinct habitats were missed during the field work.

The Ecological Communities were each assessed for their ecological and conservation value. Conservation-based evaluation of habitats or communities is a new science and many of the available documents are in draft state. A variety of categories were used to describe and provide initial conservation evaluations for each EC. Most of the conservation categories were derived from information in Ministry of Environment (MOE) documents (2007, 2006a, 2006b, 2007c, and 2007d) which are primarily based on protocols developed by NatureServe (2007). In addition to conservation evaluations, BEC Site Series and CDC plant associations were assigned to the ECs to facilitate comparisons with current and proposed ecosystem classifications and rarity rankings. However, ecosystem classification in British Columbia is currently in a state of transition. The BEC system is most often used to describe ecosystems in field survey work; however, ecosystem ranking (i.e. red, blue and Yellow) by the CDC is done – independently of BEC – by plant association. The difficulty arises when BEC and

the CDC's classifications do not match. Discussions with the CDC (Pers. Comm. Karen Yearsley) helped match up the EC to plant associations.

1.5 Priority Mapping and Analysis

The priority ecosystem and mapping analysis consist of bioterrain delineation, community element occurrence designation, priority ecosystem analysis, species at risk mapping and habitat potential modelling, priority category and level assignment, and priority ecological zoning.

1.5.1 Bioterrain delineation

Delineation of polygons within study area was loosely based on the Terrestrial Ecosystem Mapping (TEM) methodology, which is endorsed by the provincial Resource Inventory Committee (Resources Inventory Committee (RIC) 1998b). The product created for this project is similar to a completed TEM product, but more work is needed before this product will meet all of the TEM standards. This work will likely be completed within the next year. Nevertheless, the product in its current form lends itself well to the analysis required for the ecological assessment.

The polygons delineated for this mapping project were digitized (on-screen) from high resolution (0.2 m) colour digital ortho-photographs of the study area provided by the City of Kamloops' GIS department. The polygons represent a combination of key topographic, abiotic and vegetative features in the study area that together form a cohesive unit relative to their landscape and ecological function. Together these units might represent a basin which would have some consistent hydrological and micro-climate qualities that would be conducive to the settlement of a certain community of plants and their dependent/co-dependent animal species.

For this study the particular focus was on delineating bioterrain units with potential for differential use by plants and animals. To achieve this, digital elevation models (DEM) and Topographical Ruggedness Index (TRI) grids were used in coordination with ortho-photograph interpretation. In addition GIS datasets such as bedrock geology, hydrology (i.e. streams, ponds and wetlands), BC's Ministry of Forests and Range Vegetation Resource Inventory (VRI) and BEC subzones, and GCC's grasslands occurrence layer were incorporated to delineate bioterrain units. Data from field surveys were used to verify and guide final bioterrain delineations.

Mapped results only show the units where field surveys were conducted or where there is a high level of confidence in identifying units from aerial photo interpretation. Therefore, further field surveys should be conducted to supplement this work prior to specific development planning and decision-making.

The results of the bioterrain delineation, including maps of the bioterrain units with associated EC are reported in Section 3.

1.5.2 Community element occurrence Designation

The CDC has developed a way of organizing ecosystems by broad spatial characteristics into features called community elements occurrences (shortened to community element elsewhere in this report) (MOE 2006e). A community element is a spatial feature on a defined area of land or water that meets minimum requirements for contiguous area and separation. Separation refers to a minimum distance between identical ecosystems that is to be used to distinguish separate community element. Separation requirements differ among landscape distribution pattern categories (See GCC 2007 for further details). The four community element categories are matrix, large patch, small patch, and linear ecosystems.

1. Matrix Ecosystem Element Occurrence
   Matrix ecosystems form an extensive and often contiguous cover across a landscape. In a typical grassland, matrix ecosystems often occupy > 50% of the landscape. The mapped boundaries of a matrix ecosystem may incorporate up to 10% other ecosystems as small inclusions that cannot reasonably be mapped separately or are considered part of an integrated complex dominated by the matrix ecosystem.

2. Large Patch Ecosystem Element Occurrence
   Large patch ecosystems form large uninterrupted cover associated with environmental conditions and landforms that are less extensive than those of matrix communities. Examples of large patch ecosystems within the grasslands include coniferous forest ecosystems, north aspect fescue grasslands and some subhygric valley bottom ecosystems.

3. Small Patch Ecosystem Element Occurrence
   Small patch ecosystems occupy small (≤ 20 ha and most often < 5 ha), discreet areas. Small patch ecosystems are typically associated with very specific site conditions or microsites that are only very locally present on the landscape. Examples of small patch ecosystems include saline meadow, rock outcrop and sand dune ecosystems. Some small patch ecosystems form bands around the base of wet or saline depressions. Although these ecosystems have linear characteristics, they are considered small patch ecosystems if the depression is ≤ 20 ha.

4. Linear Ecosystem Element Occurrence
   Linear ecosystems consistently form linear strips associated with site features or landforms that are consistently linear. Linear ecosystems may form bands around the base of large depressions such as lakes > 20 ha. Streamside riparian ecosystems (e.g., Aspen following a drainage) are the only linear ecosystem element identified in this report's mapping and analysis.

In preparation for the Priority Ecosystem Analysis each bioterrain unit is designated to one of two groups:

> Group 1: include matrix ecosystems and large patch ecosystems not entirely encompassed by a single ecosystem matrix. Group 1 forms the base layer by which the final results of the Priority Level and Priority Ecological Zoning maps are symbolized.
>
> Group 2: includes all small patch and linear ecosystem elements and all large patch ecosystem elements where they are encompassed by a larger matrix ecosystem element.

1.5.3 Priority Ecosystem Analysis

The Priority Ecosystem Analysis methodology was developed by the GCC and partners, including experts from various disciplines to guide a process for identifying and delineating high priority grassland and associated ecosystems (GCC 2007). The analysis for the Aberdeen Area Plan Ecological Assessment applied the following stages to the priority ecosystem analysis:

- Stage 1: Initial GIS data gathering, preparation and analysis
- Stage 2: Expert input
- Stage 3: Assessment of recreational impacts
- Stage 4: High value grasslands categories and ranking
- Stage 5: Verification and field assessment (completed by consultant)
- Stage 6: Regional connectivity and contiguity analysis
- Stage 8: Threat analyses
- Stage 9: Assignment of priority levels
- Stage 11: Digital data and portfolios

Two stages of the methodology were omitted due to time limitations and applicability; Stage 7.Representation analysis, and Stage 10. Review by regional committee. Table B3 provides a summary of the applied Priority Grasslands Initiative stages.

Table B3: Priority Grasslands Initiative Stages Analyzed for the Aberdeen Area Plan Ecological Assessment

Stages	Procedure or Process	Completed	Comments
1. Initial GIS data gathering, preparation and analysis	Important ecosystems	Partially	Conservation priority ranking for Thompson-Nicola ecosystems not complete; therefore, rarity of ecosystems are addressed through the province's red and blue listed ranking scheme and notes on site series prevalence in unpublished new BEC sites series (Lloyd) used by the GCC with permission from the author.
	Species at risk - important & Suitable habitat	Yes	
	Livestock spring forage	Yes	GIS modeling developed with input from local agrologist
	First Nations	Partially	Currently includes consideration of First Nations values by identifying any archaeological sites in grassland ecosystems, as available through the provincial data warehouse Remote Access to Archaeological Data (RAAD). No recorded archaeological sites were identified in the Aberdeen study area. However, several "pit-like" features were seen by consultant Terry McIntosh during his field surveys that might warrant further investigation. No previous archaeological field assessments are known to have occurred in the study area. In addition to archaeological data, the GCC is interested in including other First Nations values, e.g., Traditional Ecological Knowledge, but at this time – due in part to limited resources – this has not occurred.
	Recreation	Yes	GIS data layers (e.g., hiking trails)
	Wildlife habitat -ungulate winter range & waterfowl land capability	Yes	Provincial GIS datasets

Stages	Procedure or Process	Completed	Comments
2. Expert input	Important ecosystems	Partially	Expert input discussions focused on ecosystem labeling and delineation, but not conservation ranking
	Species at risk - important & Suitable habitat	Partially	Expert input discussions focused on potential of species at risk occurring on the study area
	Livestock spring forage	No	Not completed due to time limitations
	First Nations	No	Not completed due to time limitations
	Recreation	No	Not completed due to time limitations
3. Assessment of recreational impacts		Yes	Assessed during field surveys
4. High value grasslands categories and ranking		Yes	As part of this project
5. Verification and field assessment		Yes	Through field work for this project.
6. Regional connectivity and contiguity analysis		Partially	Connectivity and contiguity within study area and in a more general sense for the surrounding landscape, but not done at the regional scale (i.e., for the Thompson-Nicola region in its entirety)
8. Threat analyses	GIS analyses of urban and agricultural development risk	Not applicable	As area is under review for housing development, it is all considered under high threat and thus such an analysis is unnecessary.
9. Assignment of priority levels		yes	Priority levels assigned and further refined through new Priority Ecological Zoning analysis.
11. Digital data and portfolios		Yes (adapted version)	Digital data created and provided as part of report and report description is a modified version of the portfolio created to meet the specific requirements of this project as relevant to the Aberdeen Area planning process.

1.5.4 Species at Risk Mapping and Habitat Potential Modelling

Species at Risk point locations were considered in the analysis if they were within 10 kilometres of the Aberdeen Area Plan boundary. If a species is known to have been seen in close proximity to the Aberdeen study area, more specifically to a certain bioterrain unit, and the habitat in the bioterrain unit meets needs relevant to the life cycle of that species, than it is highly likely that this species may already be using this habitat in the bioterrain unit, or will do-so in the future. Only points falling within the study area were used to assign Important Habitat. Important Habitat – as defined by the GCC (2007) – is an area surrounding a feature that is essential to a critical part of a species' life cycle (e.g. nest, den or hibernation site). Suitable habitat was also included in the analysis. Suitable habitat is defined as areas required for individual species' survival throughout the year, including a species' persistence on the landscape; it does not include the areas already defined as Important Habitat.

The results of several GIS automated Species at Risk Models were included in the analysis, including the model for Great Basin spadefoot toad, sharp-tailed grouse and American badger. Although not directly used in the analysis because the species is not known to be in the region south of Kamloops, the Western Rattlesnake Habitat Potential Model was used to identify areas that might be important to other snake species (other snake species having similar thermoregulatory requirements).

1.5.5 Priority Category and Level Assignment

In this stage of the analysis, the bioterrain unit polygons delineated through photo interpretation and TEM-type methods and consequently divided into two groups based on CDC's community element occurrence standards (see above) are assigned a category label based on what grassland values they encompass. The values are primarily important ecosystems, species at risk, wildlife habitat, recreation and spring forage.

The category labels are made up of two parts:

1) Rank (number): assigns the relative importance of a combination of grassland values, and
2) Type (letter): provides qualitative information on how that rank was assigned.

Categories are assigned, in part, to provide an efficient way of labeling and recognizing what values a bioterrain unit contains and additionally organize the units for the subsequent Priority Level Assignment. The following figure (Figure B2) illustrates how categories are assigned to the bioterrain units according to the types of grassland values contained in those units.

The following table (Table B4) provides descriptions of the criteria used in the diagram in Figure B2. The ranking scheme assigns ranks based on the importance of a value to grasslands conservation or vice versa. Important

ecosystems and species at risk are given the highest ranking as these values are at the highest risk of disappearing from BC's grasslands regions. The assigned ranks are used to assign priority levels (next section).

All areas within the study area were considered at high risk or threat of development for the ranking process. Maps of the Priority Categories are presented in the results section of this report under the subheading *Priority Category and Level Assignment.*

1.5.6 Priority Ecological Zoning

Priority Ecological Zoning was designed to result in maps that can be easily interpreted for development planning. The method identifies and delineates higher value conservation areas that are contiguous habitat within the broader landscape. Lesser values are given to conservation areas that incorporate similar total surface coverage of good habitat, but of a less contiguous configuration, that is, a conservation area that is fragmented into isolated "islands". A fragmented conservation area(s) is more prone to degradation and may no longer be connected to integral adjacent landscapes and habitats (connectivity between adjacent areas allows necessary movement of wildlife between different habitats). The Priority Ecological Zoning will provide a means for evaluating tradeoffs between conservation and other land use needs within the study area.

The results from the Priority Category and Level Assignment do not take into account the size of the base bioterrain unit used in the analysis. This creates bias towards higher priority levels (and category ranks) for large areas because the larger the area of the bioterrain unit the more likely it is to contain at least one of an important habitat, important ecosystem, or some other high value grasslands feature. In landscape ecology this is referred to as the Modifiable Areal Unit Problem (MAUP) (Jelinski and Wu 1996).

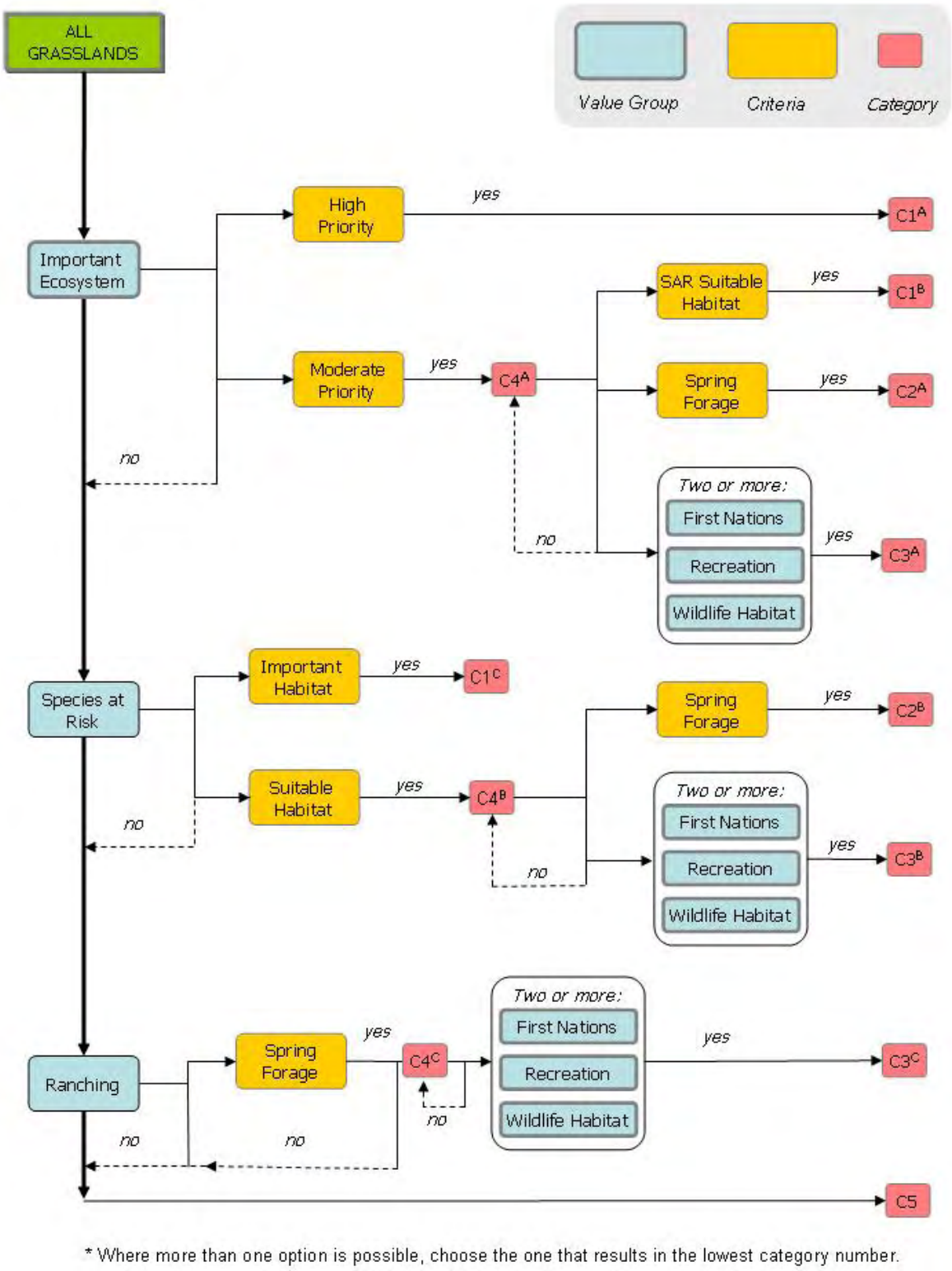

Figure B2: Diagram illustrating how Priority Category Labels based on Grassland Values are assigned to polygons (bioterrain units) on the map of the study area

Table B4: Grassland Value Descriptions

Value Group	Criteria	Description
Important Ecosystem	High Conservation Priority (1, 2, 1-P to 3-P)	High and moderate priority rankings are by the CDC's criteria, which are based on rarity and anticipated threat for the next 20 years. "P" is the abbreviation for "RP", Recruitment Priority. RP is assigned to an ecosystem with non-climax plant communities based on the ecosystems value for recruitment, through natural succession, to a climax ecosystem.
	Moderate Conservation Priority (3 to 5, 4-P, 5-P)	
Species at Risk	Important Habitat	Important habitat is an area surrounding a feature that is essential during a critical part of a species' life cycle (e.g. nest, den or hibernation site). It is comprised of available data, GIS analysis and expert input.
	Suitable Habitat	Suitable habitat is defined as areas required for individual species' survival throughout the year, including a species' persistence on the landscape. It is comprised of available data, GIS analysis and expert input.
Ranching	Spring Forage	Spring forage is grasslands associated BEC subzone variant groupings with a slope less than 40 %.
First Nations	-	This value group includes historic places and archaeological sites.
Recreation	-	This value group is a combination of government GIS databases and expert input.
Wildlife Habitat	-	This value group includes winter range predictive models for Mule deer, Bighorn sheep and Moose and land capability for waterfowl.

One solution is to remove the matrix ecosystems from the analysis. However, this was considered an unviable option. Instead, a simple analytical methodology was developed to resolve this problem (similar to methods frequently used by researchers in spatial analysis and landscape ecology). The methodology is as follows:

1. Calculate the percentage of area of P1 and P2 level Group 2 polygons (small patch, large patch, and linear patch elements) for each polygon in Group 1 - the based layer (i.e. the base maps – matrix ecosystems). For large patch ecosystems that fall into Group 1 (a special cases where a large patch is not entirely encompassed by a matrix ecosystem and warrants being treated like a matrix ecosystem in the base layer), P1 and P2 levels refer to the entire area of that polygon; so, if one of these large patches has either a P1 or a P2 designation it will receive a score of 100% in this first step. Including both P1 and P2 Priority levels ensures that both important ecosystems and important habitats, those features of the most direct relevance to conservation, are considered.

2. The resulting layer from step 1 that converts Group 2 P1/P2 areas into a percentage of Group 2, is then divided into three classes based on Jenks method (aka "Natural Breaks") which determines the best arrangement of values into classes by comparing the sum of squared differences of values from the means of their classes (Dent 1996). For this analysis the subsequent classes (rounded to an even number for display purposes) are:

   Percent of P1/P2 Group 2 Polygons in Group 1 Base Layer

   Class 1: 0 to 5 (< 5%)
   Class 2: 5 to 20 (>=5% and <20%)
   Class 3: 20 – 100 (>=20%)

   These classes represent the following recommendations for land use planning:

   1) Class 1: "Green zone" – Development Area. There are no specific ecological concerns and the area is highly fragmented. It does not play an important role in contiguity of the highest priority areas. Where possible specific community elements should be considered for conservation.

   2) Class 2: "Amber zone" – Sustainable Development Area. Development should proceed with caution and special attention should be paid to conserving/small patch ecosystem elements with high priority ranking and/or connectivity value. A clear

vision and plan is required to protect ecosystem values and ensure that development does not compromise core ecological values.

3) Class 3: "Red zone" – Conservation Area. This area is defined by a large concentration of high and moderate ecosystem values including important and highly suitable habitat for species at risk, and rare ecosystems. This area is the highest priority for conservation. Activities should be primarily directed towards maintaining ecological and wildlife habitat values in this area, as well as agricultural values.

3. Demote "Red" level polygons to "Amber" based on the following criteria:

   Measure extent of perimeter that is in contact with neighbouring polygons and calculate ratio of the length of perimeter in contact with urban area to the length of perimeters in contact with neighbouring habitat area and demote red polygons that are above a critical threshold (for this project threshold = ~2.5; i.e. 2.5 metres of urban interface for every 1 m of habitat interface).

There is great potential to add more sophisticated elements to this process, such as consideration of the number and diversity of different grassland values inside each base layer. However, so as to keep the process as transparent and simple as possible, the above solution is the only one used.

APPENDIX C. PERSONAL COMMUNICATION

The following is a list of people consulted during the preparation of this report:

Richard Doucette, Conservation Planner, Grasslands Conservation Council of British Columbia, December 7, 2007

- Provided a sighting record for Common nighthawk in the study area.

Bob Freisen, Director, Abacus Mining & Exploration Corporation, December 10, 2007

- Indicated that wildlife and plant surveys have yet to be done for their study area, in anticipation of re-opening of the Ajax mine, which lies approximately 1 km southeast of the Aberdeen study area

Bruce Harrison, Regional Biologist, Duck Unlimited Canada, December 6, 2007

- Provided access to their reconnaissance or surveys database.

Rick Howie, Principal, Aspen Park Consulting, December 7, 2007

- Provided insight on the possible wildlife species occurring in the study area based on his personal observations

Francis Iredale, Wildlife Habitat Area Biologist, Fish and Wildlife Science and Allocation Section, Ministry of Environment, December 19, 2007

- Provided insight on the occurrence of Great Basin spadefoot toad in close proximity to the study area.

Kristi Iverson, Ecologist, Iverson & MacKenzie Biological Consulting Ltd. November 8, 2007

- Provided input into the establishment of Ecological Communities.

Doug Jury, Wildlife Biologist, Fish and Wildlife Science and Allocation Section, Ministry of Environment, December 19, 2007

- Provided insight on the possible wildlife species occurring in the study area based on his personal observations

Ted Lea, Vegetation Ecologist, Wildlife Science Section, Ministry of Environment, Dec. 3 & 5, 2007

- Provided advice on the on BEC Zone boundaries in the study area and BEC Site Series designation.

Dennis Lloyd, Research Plant Ecologist and Michael Ryan, Research Ecologist, Forest Science Program, Ministry of Forest and Range, December 5, 2007

- Provided draft BEC site guides and general advice on BEC Zone boundaries in the study area.

Ken MacKenzie, Wildlife Biologist, Iverson & MacKenzie Biological Consulting Ltd. November 20, 2007

- Provided input into the wildlife species list.

Mike Sarell, Principal, Ophiuchus Consulting, November 8, 2007

- Provided input into the wildlife species list.

Ken Wright, Wildlife Biologist, independent consultant, November 4 and December 12, 2007

- Provided input into the wildlife species list.

Karen Yearsley, Plant Ecologist, BC Conservation Data Centre, December 13, 2007

- Provided advice on the assignment of plant associations to ECs.

APPENDIX D. PLANTS AND LICHENS IN THE ABERDEEN STUDY AREA

(for Life Form T = tree, S = shrub, F = forb, and G = graminoid; grasses, sedges, and rushes)

Vascular Plants **Common Name**	**Scientific Name**	**Life Form**	**EC1**	**EC2**	**EC3**	**EC4**	**EC5**	**EC6**	**EC7**	**EC8**	**EC9**	**EC10**
alfalfa	*Medicago sativa*	F	x						x			
alkali saltgrass	*Distichlis stricta*	G									x	x
arrowleaf balsamroot	*Balsamorhiza sagittata*	F		x					x			
Baltic rush	*Juncus balticus*	G									x	
big sagebrush	*Artemisia tridentata* ssp. *tridentata*	S	x									
bitterroot	*Lewisia rediviva*	F			x		x					
black-footed sedge	*Carex praegracilis*	G									x	
bluebunch wheatgrass	*Pseudoroegneria spicata*	G	x	x	x	x			x	x		
brome grasses	*Bromus* spp.	G	x	x	x	x			x	x		
brown-eyed Susan	*Gaillardia aristata*	F	x		x				x			
bull thistle	*Cirsium vulgare*	F							x			
Canada bluegrass	*Poa compressa*	G	x	x					x	x		
Canada thistle	*Cirsium arvense*	F	x						x			
cheatgrass	*Bromus tectorum*	G	x		x		x		x			
chenopod species	*Chenopodiaceae* sp.	F									x	
cinquefoil	*Potentilla* sp.	F	x	x								
cleavers	*Galium* sp.	F	x						x			
common strawberry	*Fragaria virginiana*	F	x									
creeping bentgrass	*Agrostis stolonifera*	G								x		
crested wheatgrass	*Agropyron cristatum*	G	x							x		
cut-leaf daisy	*Erigeron compositus*	F	x		x		x					
dalmatian toadflax	*Linaria dalmatica*	F	x						x			

Vascular Plants **Common Name**	**Scientific Name**	**Life Form**	**EC1**	**EC2**	**EC3**	**EC4**	**EC5**	**EC6**	**EC7**	**EC8**	**EC9**	**EC10**
dandelion	*Taraxacum officinale*	F	x									
Douglas-fir	*Pseudotsuga menziesii* var. *glauca*	T	x	x		x			x	x		
fiddleneck	*Amsinckia* sp.	F	x		x							
field chickweed	*Cerastium arvense*	F	x									
field locoweed	*Oxytropis campestris*	F	x		x				x			
fleabane species	*Erigeron* spp.	F	x		x				x			
foxtail barley	*Hordeum jubatum*	G									x	x
golden dock	*Rumex maritimus*	F									x	
golden-aster	*Heterotheca villosa*	F	x									
gumweed	*Grindelia squarrosa*	F	x								x	
Holboell's rockcress	*Arabis holboellii*	F	x		x		x					
horseweed	*Conyza canadensis*	F									x	
hound's-tongue	*Cynoglossum officinale*	F	x						x			
Idaho fescue	*Festuca idahoensis*	G	x									
junegrass	*Koeleria macrantha*	G	x	x	x		x		x			
Kentucky bluegrass*	*Poa pratensis*	G	x	x		x			x	x		
large-fruited desert-parsley	*Lomatium macrocarpum*	F	x			x						
larkspur	*Delphinium* sp.	F	x									
lemonweed	*Lithospermum ruderale*	F	x									
low pussytoes	*Antennaria dimorpha*	F	x		x							
meadow death-camas	*Zigadenus venenosus*	F	x						x			
mullein	*Verbascum thapsus*	F	x						x			
mustard spp.	mustard spp.	F	x						x	x		
needle-and-thread grass	*Hesperostipa comata*	G	x		x							

Vascular Plants **Common Name**	**Scientific Name**	**Life Form**	**EC1**	**EC2**	**EC3**	**EC4**	**EC5**	**EC6**	**EC7**	**EC8**	**EC9**	**EC10**
nodding onion	*Allium cernuum*	F					x					
Nuttall's alkaligrass	*Puccinellia nuttalliana*	G									x	
old man's whiskers	*Geum triflorum*	F	x						x			
paintbrush	*Castilleja* sp.	F	x									
pale comandra	*Comandra umbellata* var. *pallida*	F	x									
parsnip-flowered buckwheat	*Eriogonum heracleoides*	F	x				x					
pasture sage	*Artemisia frigida*	F	x		x	x	x		x			
pasture sedge	*Carex petasata*	G	x									
pinegrass	*Calmagrostis rubescens*	G							x			
ponderosa pine	*Pinus ponderosa*	T		x		x			x			
prairie rose	*Rosa woodsii*	S				x			x	x		
prickly rose	*Rosa acicularis*	S	x			x			x	x		
pussytoes	*Antennaria microphylla* sensu lato	F	x	x	x				x			
quackgrass	*Elymus repens*	G	x							x		
rabbit-bush	*Ericameria nauseosa*	S	x		x				x	x		
rayless alkali aster	*Symphyotrichum ciliatum*	F									x	
red glasswort	*Salicornia rubra*	F									x	
Rocky Mountain fescue	*Festuca saximontana*	G			x							
Rocky Mountain juniper	*Juniperus scopulorum*	S	x						x	x		
rough fescue	*Festuca scabrella*	G	x						x			
round-leaved alumroot	*Heuchera cylindrica*	F	x						x			
rush species	*Juncus* sp.	G									x	x

Vascular Plants **Common Name**	**Scientific Name**	**Life Form**	**EC1**	**EC2**	**EC3**	**EC4**	**EC5**	**EC6**	**EC7**	**EC8**	**EC9**	**EC10**
Russian olive	*Elaeagnus angustifolia*	S							x	x		
Russian thistle	*Salsola tragus*	F	x						x			
sage species	*Artemisia* sp.	F	x						x			
sagebrush Mariposa lily	*Calochortus macrocarpus*	F	x									
Sandberg's bluegrass	*Poa secunda* ssp. *secunda*	G	x		x		x					x
Saskatoon	*Amelanchier alnifolia*	S				x			x	x		
seacoast bulrush	*Bolboschoenus maritimus*	G									x	
silverweed	*Potentilla anserina*	F									x	
snowberry	*Symphoricarpos albus* var. *albus*	S							x	x		
sow-thistle species	*Sonchus* sp.	F									x	
spike-rush species	*Eleocharis* sp.	G									x	
spotted knapweed	*Centaurea biebersteinii*	F	x	x					x			
spreading needlegrass	*Achnatherum richardsonii*	G	x						x			
stiff needlegrass	*Achnatherum occidentale*	G	x	x		x			x	x		
tarragon	*Artemisia dracunculus*	F	x									
timber milk-vetch	*Astragalus miser*	F	x									
timothy	*Phleum pratense*	G	x						x	x		
trembling aspen	*Populus tremuloides*	T								x		
tufted white prairie aster	*Symphyotrichum ericoides*	F									x	x
umber pussytoes	*Antennaria umbrinella*	F	x	x								

Vascular Plants **Common Name**	**Scientific Name**	**Life Form**	**EC1**	**EC2**	**EC3**	**EC4**	**EC5**	**EC6**	**EC7**	**EC8**	**EC9**	**EC10**
Wallace's selaginella	*Selaginella wallacei*	F				x	x					
white sweet-clover	*Melilotus alba*	F	x									
willow species	*Salix* sp.	S										
woolly plantain	*Plantago patagonica*	F	x		x							
yarrow	*Achillea millefolium*	F	x		x		x		x	x		
Yellow rattle	*Rhinanthus minor*	F	x									
Yellow salsify	*Tragopogon dubius*	F	x						x			
Yellow sweet-clover	*Melilotus officinalis*	F	x							x		
Non-vascular plants	**Bryophytes and Lichens**											
	Brachythecium albicans	M	x	x					x			
	Bryum caespiticium	M	x		x		x					
	Bryum spp.	M	x		x		x					
	Ceratodon purpureus	M	x		x		x					
	Dicranum scoparium	M							x			
	Drepanocladus sp.	M									x	
	Eurhynchium pulchellum	M	x						x			
	Orthotrichum laevigatum	M							x			
	Pleurozium schreberi	M	x						x			
	Polytrichum juniperinum	M				x						
	Polytrichum piliferum	M					x					
	Pterygoneurum kozlovii	M									x	
	Rhytidiadelphus triquetris	M	x						x			
	Syntrichia ruralis	M	x	x	x	x	x		x			

Non- vascular Plants (Cont.)	Scientific Name	Life Form	EC1	EC2	EC3	EC4	EC5	EC6	EC7	EC8	EC9	EC10
	Cladina spp.	L					x					
	Cladonia poccilum	L	x	x	x	x						
	Cladonia pyxidata	L	x	x	x	x	x					
	Coelocaulon aciculare	L			x							
	crustose lichen species	L					x	x				
	Diploschistes muscorum	L	x		x		x					
	Peltigera britannica	L										
	Peltigera didactyla	L	x									
	Peltigera rufescens	L	x		x							
	Peltigera sp.	L	x									
	Umbilicaria spp.	L						x				
	Xanthoparmelia wyomingensis	L			x							

APPENDIX E. WILDLIFE DETECTED IN THE ABERDEEN STUDY AREA DURING FIELD WORK.

(Principally prepared by Ken Wright)

Totals

Birds: 45 species & 733 individuals

Mammals: 5 species

BIRDS						
Common name	**Scientific name**	**No. Obs**	**High Count**	**Total birds observed**	**Abundance (birds seen/survey)**	**Location**
American coot	*Fulica americana*	1	1	1	0.25	Makaoo Lake
American crow	*Corvus brachyrhynchos*	4	23	25	6.25	CORE AREA
American kestrel	*Falco sparverius*	1	1	1	0.25	Knutsford
American pipit	*Anthus rubescens*	2	7	8	2	~Jocko Lake
American robin	*Turdus migratorius*	2	37	40	10	CORE AREA
Bald eagle	*Haliaeetus leucocephalus*	1	1	1	0.25	Makaoo Lake
Black-billed magpie	*Pica hudsonia*	4	8	26	6.5	CORE AREA
Black-capped chickadee	*Poecile atricapilla*	2	5	6	1.5	CORE AREA
Brown creeper	*Certhia americana*	2	1	2	0.5	CORE AREA
Bufflehead	*Bucephala albeola*	1	1	1	0.25	Makaoo Lake
Clark's nutcracker	*Nucifraga columbiana*	4	6	14	3.5	CORE AREA
Common raven	*Corvus corax*	5	13	25	6.25	CORE AREA
Dark-eyed junco	*Junco hyemalis*	4	12	24	6	CORE AREA
Downy woodpecker	*Picoides pubescens*	1	1	1	0.25	CORE AREA
European starling	*Sturnus vulgaris*	3	200	210	52.5	CORE AREA
Evening grosbeak	*Coccothraustes vespertinus*	1	3	3	0.75	CORE AREA
Golden-crowned kinglet	*Regulus satrapa*	4	10	22	5.5	CORE AREA
Hairy woodpecker	*Picoides villosa*	2	2	4	1	CORE AREA
Horned lark	*Eremophila alpestris*	3	8	19	4.75	~Jocko Lake
House finch	*Carpodacus mexicanus*	4	4	10	2.5	CORE AREA

Common name	Scientific name	No. Obs	High Count	Total birds observed	Abundance (birds seen/survey)	Location
Lapland longspur	*Calcarius lapponicus*	2	18	19	4.75	Multiple obs. outside of core area (high grasslands)
Mallard	*Anas platyrhynchos*	1	2	2	0.5	Makaoo Lake
Merlin	*Falco columbarius*	2	1	2	0.5	Outside of core area
Mountain chickadee	*Poecile gambeli*	4	49	113	28.25	CORE AREA
Northern flicker	*Colaptes auratus*	3	5	11	2.75	CORE AREA
Northern harrier	*Circus cyaneus*	4	9	13	3.25	CORE AREA
Northern shrike	*Lanius excubitor*	2	1	2	0.5	CORE AREA
Pileated woodpecker	*Dryocopus pileatus*	4	2	5	1.25	CORE AREA
Pine siskin	*Carduelis pinus*	2	14	23	5.75	CORE AREA
Pygmy nuthatch	*Sitta pygmaea*	3	6	10	2.5	CORE AREA
Red crossbill	*Loxia curvirostra*	3	15	17	4.25	CORE AREA
Red-breasted nuthatch	*Sitta canadensis*	4	8	28	7	CORE AREA
Red-tailed hawk	*Buteo jamaicensis*	4	6	11	2.75	CORE AREA
Ring-necked duck	*Aythya collaris*	1	1	1	0.25	Makaoo Lake
Rough-legged hawk	*Buteo lagopus*	1	1	1	0.25	near Jocko Lake
Ruby-crowned Kinglet	*Regulus calendula*	3	1	3	0.75	CORE AREA
Sandhill crane	*Grus canadensis*	1	1	1	0.25	Jocko Lake
Savannah sparrow	*Passerculus sandwichensis*	1	3	3	0.75	Outside of core area
Sharp-shinned hawk	*Accipiter striatus*	4	2	6	1.5	CORE AREA
Sharp-tailed grouse	*Tympanuchus phasianellus*	1	3	3	0.75	west of Jocko Lake
Song sparrow	*Melospiza melodius*	1	1	1	0.25	CORE AREA
Western meadowlark	*Sterna neglecta*	2	1	2	0.5	Single obs outside of core area
White-crowned sparrow	*Zonotrichia leucophyrs*	3	3	6	1.5	CORE AREA
Wilson's snipe	*Gallinago gallinago*	1	1	1	0.25	Makaoo Lake
Yellow -rumped warbler	*Dendroica coronata*	1	1	1	0.25	Outside of core area

MAMMALS		
Common name	**Scientific name**	**Location**
Black bear	*Ursus americanus*	Tracks in mud of Makaoo Lake; scat found on grassland to west of Jocko Lake
Coyote	*Canis latrans*	western grassland area
Mule deer	*Odicolius hemionus*	Multiple observations around Douglas-fir groves outside and adjacent to core area
Red squirrel	*Tamaiscurius hudsonicus*	Omnipresent, but always tied to Douglas-fir stands
Possible pocket gopher or mole mounds	Additional species	Dirt mounds

APPENDIX F. EXPANDED RESULTS

The following section provides the results of the Ecological Communities, plant and wildlife surveys, and the Priority Mapping and Analysis. Results from the literature review and outcomes of discussions with experts are integrated in each sub-section below.

1.1 Ecological Communities

A total of ten Ecological Communities are tentatively identified for the Aberdeen study area. Each EC has distinct biotic and abiotic characteristics. However, because of variation in topography, and disturbance factors (in particular from livestock grazing and trampling and small mammal digs), these characteristics vary across the landscape for an ecological community type. Furthermore, because of the limited field work, some of these ECs may be divided up or, possibly combined in the future. Of the ten ECs, two are grassland associated, four are shallow-soiled or rock outcrop, two are forest dominated, and two are wetlands. General descriptions of each ecological community – including ecological importance – follow. Conservation evaluations for each EC are included in Appendix G. Appendix H is a collection of photographs of the ECs. A more complete synopsis of the ten Ecological Communities was compiled, which includes potential BEC Site Series and CDC plant associations and rarity ranking (Table F1). Karen Yearsley, CDC Plant Ecologist, (Pers. Comm.) provided assistance with CDC plant association assignment. Draft BEC site interpretation and identification guide for the Kamloops Forest District provided by Dennis Lloyd (a senior ecologist with the Ministry of Forest and Range and the main proponent of the BEC system in the Southern Interior grasslands) was consulted to assign the most recent, but unpublished, BEC Site Series (Lloyd 2005).

1.1.1 Grassland Ecological Communities

Grassland Ecological Communities comprise the largest vegetation component of the Aberdeen study area. Generally they are flat to north facing, and dominated by bunchgrasses and herbs. The Bluebunch Wheatgrass-dominated Ecological Community (EC1) is the largest of the communities (approx. 70 % of the study area) and is characterized principally by bunchgrasses and scattered shrubs; it is variable across the landscape mainly related to slope, aspect, and livestock use. The large extent of this EC and relative lack of disturbance – compared to similar ECs in other parts of the province – make this EC provincially significant. The plant communities contained herein are also red listed by the province.

The second grassland dominated EC is a Bluebunch Wheatgrass-Rough Fescue Ecological Community (EC2), which is an uncommon community dominated by bunchgrasses within an open forest and is found only on a few lower elevation slopes. The surveyed sites are in near pristine condition. This red-listed EC was assessed as being in excellent condition with a high biodiversity significance ranking.

The Shallow Soil and Outcrop Ecological Communities are characterized by little or no soil, which affect the nutrient and mineral availability for plants. The Bluebunch Wheatgrass-dominated Ecological Community on Thin Soils EC3) is found mainly on ridge crests over thin soils. Bluebunch wheatgrass is the dominant grass but is much shorter than on deep soil sites, but appears healthy. Needle-and -thread grass can dominate on some of these sites as well.

Bluebunch Wheatgrass-dominated Ecological Community on Talus Slopes (EC4) is characterized by steep slopes and a low plant cover, surrounded by patches of open forest. This EC is mostly in excellent condition with minimal disturbance from livestock trampling/grazing from a few trails. Compact Selaginella-dominated Ecological Community (EC5) is found adjacent to rock outcrops, often in somewhat shaded situations. This type of habitat is often important for snakes as sunning or escape terrain. There is also the potential of hibernacula sites. The biological significance of the EC is probably high.

The Outcrop Ecological Community (EC6) is closely associated with EC5 (which usually borders it) but has been separated here because, even though it is uncommon in the study area, it contains a rather unique set of species. Rock faces and outcrops are ignored in most vegetation or community analyses. This type of habitat is also often important for snakes as sunning or escape terrain. There is also the potential of hibernacula sites. Birds and small mammals may use these habitats. The biological significance of this EC is probably high.

Grasslands, the dominant plant communities, are in excellent condition. Livestock are using most of the area with only a few portions on the east side that appear to be heavily grazed (range condition assessments were not completed). The habitats that are in poor condition are the sites where large disturbances, such as roads or cleared sites have promoted the spread and establishment of noxious weeds, particularly spotted knapweed. Most of these sites are adjacent to urban areas on the lower slopes. All grassland plant communities in the study area have moderate to very high ecological values.

1.1.2 Forested Ecological Communities

Trees are the dominant plant in the two Forest Ecological Communities. It appears that, in most instances, the Douglas-fir-dominated Ecological Community (EC7) is the result of fire suppression. It is comprised of almost 100% Douglas-fir that often forms over 80% canopy closure with various layers of ingrowth present at most sites, which represents successful germination and growth years for the invading trees. The large majority of trees are under 20cm DBH; however, larger Douglas-fir trees (i.e. veterans) are scattered across the landscape, often with large amounts of litter and weeds, in particular cheatgrass, beneath them. As ingrowth develops and shade and litter increase, there is a succession from grassland species, such as bluebunch wheatgrass, to more shade tolerant species, such as stiff needlegrass, until, in the most shaded sites, there is very little or no herbaceous understory. This EC is important for open

habitat raptors for perching and nesting sites and important food sources for pileated woodpecker and grouse.

The Aspen-dominated Ecological Community (EC8) is found in and alongside gullies, especially in the higher elevation portions of the study area. They are characterized by various aged trees with a near closed to open canopy, with an understory usually dominated by rhizomatous grasses and, sometimes, shrubs. This EC has a high potential for nesting and/or cover habitat for birds and other wildlife.

Although there are conflicting views regarding the Douglas-fir dominated areas (EC7) with respect to their ecological value, the areas adjacent to grasslands are fire dependent ecosystems and due to fire suppression, they have encroached heavily onto grassland ecosystems. Therefore, since most of the Douglas-fir forested sites are a result of ingrowth they are of relatively low ecological value. Furthermore, these forested systems pose a very high fire hazard because of the dense understory and the abundance of litter. The aspen-dominated (EC8) however, is a natural ecosystem that has a much higher ecological value.

1.1.3 Wetland Ecological Communities

The wetland ECs comprise only a small percent (<1%) of the Aberdeen study area. Generally they are flat to gently sloped, and dominated by grasses, sedges, and forbs. Shrubs are absent. The Alkaline pond complex Ecological Community (EC9) is characterized, usually, by distinct vegetation zonation patterns from the edge of lake outwards (these zones have been classified as separate units in the BEC system but appear to be closely linked ecologically). Woody vegetation is absent and graminoids dominate most of the zones, except for the inner red glasswort zone, when present; the alkaline soils result from centuries of drainage into the ponds followed by evaporation into summer, leaving salts (alkali) behind. A federally threatened and provincially red listed non-vascular plant called alkaline wing-nerved moss and provincially blue listed bird – Sandhill crane – were found in this EC. Wetlands in arid ecosystems are extremely important to wildlife (MacKenzie and Moran 2004). The potential for further species at risk within this EC is also high. Finally, Alkaline seepage slope Ecological Community (EC10). This is a habitat where groundwater seepage occurs along a slope resulting in the presence of alkaline soils and characteristic plants, in particular alkali saltgrass.

The wetland communities (EC9, EC10), the uncertain seasonally-wet gully units, and the Kentucky bluegrass unit comprise a relatively small portion of the study area and therefore their ecological importance in conjunction with the surrounding landscape is very high. Wetland habitats are critical components of ecosystem function at a landscape level, especially in arid land ecosystems (Ffolliott et al. 2004, Johnson 1989, Patten 1998)[1] and arid land riparian habitats

[1] The website 'www.nrcs.usda.gov/TECHNICAL/land/pubs/ib11text.html' provides an excellent review of the importance of riparian habitats, with reference to arid land riparian habitats.

are major providers of food, shelter, and other resources for a wide variety of animal species. It is estimated that about 75 percent of the arid land animals require either primary or secondary habitats in riparian areas at some stage of their life cycles. The US Fish and Wildlife Service estimates that up to 43 percent of threatened or endangered species in arid areas rely on riparian areas for survival. In addition to the wildlife values, riparian zones provide numerous ecological services. They help to maintain water quality by filtering surface runoff, retain excess nutrients, reduce sediment flow, store water during dry periods, increase groundwater recharge, and they help to maintain elevated water tables.

1.1.4 Other Vegetation Units

Due to the limited field survey time, a total of four vegetation units have not been investigated in sufficient detail and to assign EC status. However, if given further survey opportunities, this could be done in the future. The four units include: Seasonally-wet gullies (riparian gullies), Kentucky bluegrass dominated flats and low areas, Idaho fescue, and Lower-sloped Ponderosa pine forests. Two of the four units are possibly related to the study area's complex, post-glacial drainage pattern. Appendix G provides further details.

Table F1: Ecological Communities Conservation Evaluation Summary with Potential associated BEC Site Series and CDC Plant Associations

Ecological Community	Estimated proportion of study area	Current BEC Site Series	Unpublished BEC Site Series (ranking)	CDC plant association (English name)	Prov. rank	Date of ranking	Rare faunal and floral species observed during field work	Invasive species	Disturbance
Grasslands									
1. Bluebunch wheatgrass-dominated Ecological Community	70%	BGxw1 01; IDFxh2 92	BGxw1 81(common), (?81esa (common), ?81esb (common)); IDFxh2 ?81/82 (common/common)	bluebunch wheatgrass - junegrass	Red	July 31,2002	none observed	rare except in a few disturbed sites	livestock trampling/grazing (Fig. 5) and trails, possible pocket gophers or mole mounds; human: roads, some bulldozer/back hoe activity.
2. Bluebunch wheatgrass-Rough fescue Ecological Community	<2%	PPxh2 01	PPxh2 84	rough fescue - bluebunch wheatgrass	Red	July 31,2002	none observed	rarely observed	none
Shallow Soil and Outcrop									
3. Bluebunch wheatgrass-dominated Ecological Community on thin soils	<10%	BGxw1 01; IDFxh2 92	BGxh1 ?81 (common), (?83)(uncommon); IDFxh2 ?82 (common)	bluebunch wheatgrass - junegrass	Red	July 31,2002	none observed	none observed	wind/frost; livestock trampling/grazing
4. Bluebunch wheatgrass-dominated Ecological Community on talus slopes	<6%	PPxh2 02	PPxh2 ?RT01/Ro02 (uncommon/common); IDFxh2 ?72 (very uncommon)	Douglas-fir / bluebunch wheatgrass - compact selaginella	Yellow	September 22,1994	none observed	none observed	minimum livestock trampling/grazing, a few trails
5. Compact selaginella-dominated Ecological Community	<1%	BGxw1 02; IDFxh2 92	BGxw1 Ro01/02 (scarce/uncommon); IDFxh2 ?73 (uncommon)	bluebunch wheatgrass - compact selaginella	Yellow	September 26,1994	none observed	none observed	wind/frost
6. Outcrop	<1%	none applicable	BGxw1 Site series unknown.	none applicable			none observed	none observed	wind/frost
Forests									
7. Douglas-fir-dominated	25%	PPxh2 06 (?07); IDFxh2 06	PPxh2 ?01(common); IDFxh2 ?01(dominant)	Douglas-fir / common snowberry - Saskatoon	Red	March 31,2001	none observed	cheatgrass (especially under Douglas-fir vets), other brome species, spotted knapweed, crested wheatgrass, bull thistle.	minor livestock utilization, mainly trails; roads, some bulldozer activity.
8. Aspen-dominated	<10%	BGxw1 ?08; IDFxh2 95	BGxw1 ?05(common); IDFxh2 10-YS, (08-YS) (very uncommon)	trembling aspen / common snowberry / Kentucky bluegrass	Red	June 15,2000	none observed	cheatgrass, mullein, Russian olive.	livestock trampling/grazing

Ecological Community	Estimated proportion of study area	Current BEC Site Series	Unpublished BEC Site Series (ranking)	CDC plant association (English name)	Prov. rank	Date of ranking	Rare faunal and floral species observed during field work	Invasive species	Disturbance
Wetlands									
9. Alkaline pond complex	<2%	no equivalent	IDFxh2 Gs01-03 (scarce)	alkali saltgrass - Nuttall's alkaligrass	Red	July 31,2002	Sandhill crane & Alkaline wing-nerved moss	sow-thistle species, bull thistle, brome species.	high livestock trampling and trails at most sites, man-made ditch between two ponds (presumably for better drainage).
10. Alkaline seepage slope	<01%	BGxm1 09	BGxw1 Gs01-03 (scarce)	alkali saltgrass - Nuttall's alkaligrass	Red	July 31,2002	none observed	brome species	high livestock trampling

1.2 Plants and Lichen Surveys

Approximately 100 plant species were recorded during the surveys (Appendix D). These include three trees, nine shrubs, 57 forbs, 27 graminoids (grasses, rushes, and sedges), and 14 mosses. Thirteen lichens were identified, although there are many species that remain unidentified. One of the plant species, the alkaline wing-nerved moss, is listed as Threatened on Schedule 1 of the federal Species at Risk Act (SARA) and is Red Listed on the provincial species at risk list published by the Conservation Data Centre (CDC). It was found along the edges of two of the alkaline ponds in the Aberdeen study area.

The inventory of the plants (including bryophytes) and lichens in the study area is preliminary. Although the vascular plant flora is probably about 85% complete, the bryophytes and lichens are still mostly unknown. More complete spring and summer surveys should be conducted and will result in a better representation of current plant communities and the presence of rare species. Only one rare plant species, the alkaline wing-nerved moss, was found along the edges of two alkaline ponds (located in the south east and south west of the study area). This species is scattered across the drier landscapes through British Columbia and is rarely very common at any site. However, one of the Aberdeen populations of this species appears to be one of the largest in British Columbia. It is expected that other rare species will be observed during future surveys, especially adjacent to alkaline ponds or in terrain seeps.

1.3 Wildlife Surveys

Appendix E is a list of the animals that were observed during field work in October and November. Seven hundred and thirty-three observations of 45 bird species were made. Observations or evidence of five mammals utilizing the area were also noted. One bird, the Sandhill crane, is Blue Listed by CDC.

Discussions with experts lead to the establishment of a list of potential species at risk in the study area (Table F2). The wildlife species were compiled mostly from CDC information and expert input from Rick Howie (Pers. Comm.); and the plants were compiled from expert input from Terry McIntosh. The list was compiled using CDC's BC Species and Ecosystems Explorer by searching for provincially or federally listed species at risk in PP – Ponderosa Pine, BG – Bunchgrass, and IDF – Interior Douglas-fir Biogeoclimatic (BGC) Zones within the Kamloops Forest District. Table F2 does not include species at risk found in the area that are unlikely to occur in the study area, but are in an appendix (Appendix I).

Table F2: Potential Species at Risk in the Aberdeen study area

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Birds	Short-eared Owl	Asio flammeus	Blue	SC (May 1994)	Likely	800 m south in 1999 & 2000 (CDC). Regular but unpredictable winter records in grasslands above Goose Lk Road; potential breeder as this species has bred within several km of site in Knutsford area.
	Swainson's Hawk	Buteo swainsoni	Red		Likely	100 m east in 2003 (CDC). Regular small population along Goose Lk Rd and in Knutsford area from late April - early Sept. Breeds
	Common Nighthawk	Chordeiles minor	Yellow	T (Apr 2007)	Confirmed	11 individuals seen flying over study area in the early evening of August 4, 2007 (Richard Doucette)
	Prairie Falcon	Falco mexicanus	Red	NAR (May 1996)	Possible	Migrants have been observed in Knutsford area during the spring & fall. Nesting has occurred in NW Kamloops. No nesting habitat in study area.
	Peregrine Falcon, *anatum* subspecies	Falco peregrinus anatum	Red	SC (Apr 2007)	Possible	No nesting habitat. Migrants occur in Knutsford area.
	Sandhill Crane	Grus canadensis	Blue	NAR (May 1979)	Confirmed	Confirmed during fall 2007 field work; 5 sightings from 1980 - 2001 (CDC). No nesting habitat. All birds will be migrants and most will fly over the area but some could put down on ground near wetlands.
	Barn Swallow	Hirundo rustica	Blue		Possible	Possible migrants or summer foraging if buildings nearby for nesting.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
	Lewis's Woodpecker	Melanerpes lewis	Red	SC (Nov 2001)	Confirmed	Observations of species (nest ??) on eastern side of study area near Highway 5A in 1999 (CDC)
	Long-billed Curlew	Numenius americanus	Blue	SC (Nov 2002)	Likely	300 m & 700 m south east in 2001 (CDC) Regular summer breeder in Knutsford area.
	Flammulated Owl	Otus flammeolus	Blue	SC (Nov 2001)	Possible	10 km west in 1998 (CDC) Habitat types have not been checked for suitability. Prefers IDFdk sites with older fir vets present c/w cavities. Likelihood low.
	Sharp-tailed Grouse, *columbianus* subspecies	Tympanuchus phasianellus columbianus	Blue		Confirmed	two lek sites occurs in the south west corner of the study area, which was last observed in 2001; presence of species confirmed during fall 2007 field work; two additional leks occur approximately 700m south with both last observed in 2001 (CDC). Local leks active in 2006 and likely 2007 but not confirmed.
Mammals	Townsend's Big-eared Bat	Corynorhinus townsendii	Blue		Possible	Summer forested habitats for foraging not completely known at Kamloops. No likely winter hibernaculum sites (caves, mineshafts). Occurs west of Tranquille
	Spotted Bat	Euderma maculatum	Blue	SC (May 2004)	Possible	3 km north east in 1994 (CDC) No typical cliff habitats for roosting.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Mammals (cont.)	Badger	Taxidea taxus	Red	E (May 2000)	Confirmed	Species occurs in northern part of study area (residential neighbourhoods of Aberdeen) and was last observations were in 2001. There is also occurrence of this species in similar habitat to the south (4 km away) (CDC).
Reptiles	Racer	Coluber constrictor	Blue	SC (Nov 2004)	Possible	3 km north east in 2000 (CDC)
	Gopher Snake, *deserticola* subspecies	Pituophis catenifer deserticola	Blue	T (May 2002)	Possible	approx 500 m north in 1999 & 2000; one record 700 m northeast date unknown (CDC)
Amphibians	Great Basin Spadefoot	Spea intermontana	Blue	T (Apr 2007)	Likely	Species occurs in similar bodies of water to the southeast (4 km away) (CDC); in 2006, New Gold Inc. (Rescan Environmental Services Ltd. 2007) confirmed presence 8 km west
	Western Toad	Bufo boreas	Yellow	SC (Nov 2002)	Possible	wetlands may provide breeding sites?
Vascular plants	woody-branched rockcress	*Arabis lignifera*	Blue		Possible	4 km north east in 1953 (CDC)
	sickle-pod rockcress	*Arabis sparsiflora*	Red		Possible	
	freckled milk-vetch	*Astragalus lentiginosus*	Red		Possible	3 km west in 1953 and 2 km south east in 1965 (CDC)
	many-headed sedge	*Carex sychnocephala*	Blue		Possible	

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Vascular plants (cont.)	dry-land sedge	*Carex xerantica*	Red		Possible	
	slender hawksbeard	*Crepis atribarba* ssp. *atribarba*	Red		Possible	
	low hawksbeard	*Crepis modocensis* ssp. *modocensis*	Red		Possible	
	western low hawksbeard	*Crepis modocensis* ssp. *rostrata*	Red		Possible	
	porcupinegrass	*Hesperostipa spartea*	Red		Possible	
	hutchinsia	*Hutchinsia procumbens*	Red		Possible	
	northern linanthus	*Linanthus septentrionalis*	Blue		Possible	
	bristly mousetail	*Myosurus apetalus* var. *borealis*	Red		Possible	
	Ussurian water-milfoil	*Myriophyllum ussuriense*	Blue		Possible	
	flat-topped broomrape	*Orobanche corymbosa* ssp. *mutabilis*	Red		Possible	
	mutton grass	*Poa fendleriana* ssp. *fendleriana*	Red		Possible	
	dotted smartweed	*Polygonum punctatum*	Blue		Possible	
	rough dropseed	*Sporobolus compositus* var. *compositus*	Blue		Possible	
Non-vascular plants	rusty cord-moss	*Entosthodon rubiginosus*	Red	E (Nov 2004)	Possible	

Non-vascular plants (cont.)	Alkaline wing-nerved moss	*Pterygoneurum kozlovii*	Red	T (Nov 2004)	Confirmed	

The wide variety of ecosystem types in the study area, set in the large contiguous grassland landscape provides significant value for birds and other wildlife species. It is difficult to compare this area with similar sites in the region, given the short duration of the study. However, the raptor density of the study area is higher than similar grassland ecosystems in the region. Passerines (songbirds) were quite sparse overall, but this is merely due to the late season sampling. For accurate data, additional surveys will need to be completed in the Aberdeen study area in the spring when passerine abundance is high. Late April through early June is the optimum season to undertake song bird surveys. It is expected that bird observations will increase by 20 to 30 percent when year-round observations are completed.

The Aberdeen grasslands and the associated ecosystems are important to a wide diversity of wildlife. The analysis results suggest that the study area caters to six species at risk and potentially caters to an additional 31 species. In, addition to species at risk, the habitats are important to a variety of other wildlife species (Appendix J).

1.4 Priority Mapping and Analysis

1.4.1 Bioterrain Mapping

The study area is comprised of approximately 1,960 hectares (19.6 km^2), and of this 1,448 hectares (14.5 km^2) is intact habitat, the remaining 512 hectares (5.1 km^2) being developed urban areas.

Intact habitat can be split broadly into forest and grassland areas. Of the entire study area, twenty-six percent is developed urban areas, 15% is forest, and 59 % is grasslands (Figure F1).

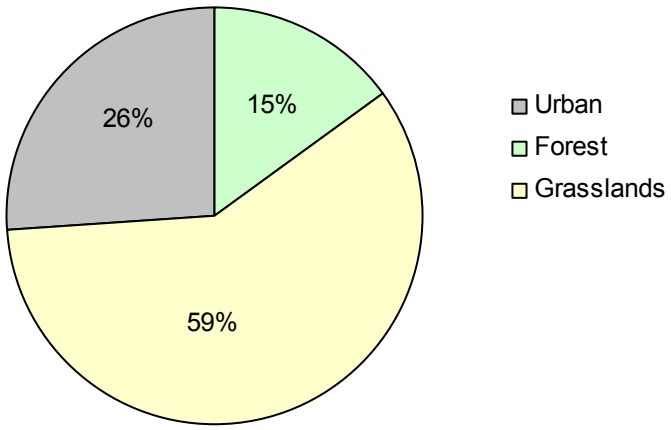

Figure F1: Percent of urban, forest, and grasslands in the study area

The bioterrain mapping process further refines the intact area of the study area into distinctive units (polygons on the map) representing a combination of topographic, abiotic, and vegetative features that are then assigned to Ecological Communities.

Figure F2 is a map of the delineated bioterrain units. The white polygons on the maps are Group 1 bioterrain units (primarily matrix ecosystems). The smaller group 2 bioterrain units are delineated in a thin black line and are small patch, large patch, and linear ecosystem elements. The label for Group 1 units is in large white font and includes the short name for the associated Ecological Community. This label also has a number in parenthesis, which is the polygon's unique identification number and can be used to reference additional attribute information contained in Table F3 below. The label for Group 2 is in light green. The label is a number that references a key contained on the right-hand side of the map. The number is used to identify from the key the Ecological Community or unique feature associated with that polygon (many of the polygons are too small to contain a legible text label). A descriptive summary for all Group 2 polygons by Ecological Community or unique feature is featured in Table F4. Table F5 provides the attribute information on each polygon (bioterrain unit) as is done for Group 1.

1.4.2 Species at Risk Mapping and Habitat Potential Modelling

The analysis focuses on four animal Species at Risk that have particular prominence in historical species sighting records in the Aberdeen study area. This does not necessarily mean that other Species at Risk are absent in the study area, but may reflect that there has been no species-specific surveys. The four species are the American badger jeffersonii sub-species, gopher snake, sharp-tailed Grouse, and Great Basin spadefoot toad. Other species with recorded sightings in the region are also discussed briefly at the end of this section. Any Species at Risk sighted within ten kilometres as per the CDC rare species database is listed in Table F2 and this would include any species within or immediately adjacent to the study area that are not included in this section.

The habitat potential model for the American badger identifies moderate to high suitable habitat for the species throughout the intact portions of the study area (Figure F3). This was expected as the American Badger has broad life history requirements and is adaptable to many environments. A limiting factor for the badger within the study area is whether it contains suitable conditions, such as plentiful prey. The presence of prey species was confirmed by field biologists; fresh gopher activity (digging/mounds) was present at several locations dispersed across the landscape. Furthermore, sightings of badgers in 2001 were recorded in the CDC database; the area surrounding these point locations are, however, now seriously degraded or lost to urban development. The animals spotted in 2001, their offspring, or other animals associated with their subpopulation have likely dispersed to adjacent habitats.

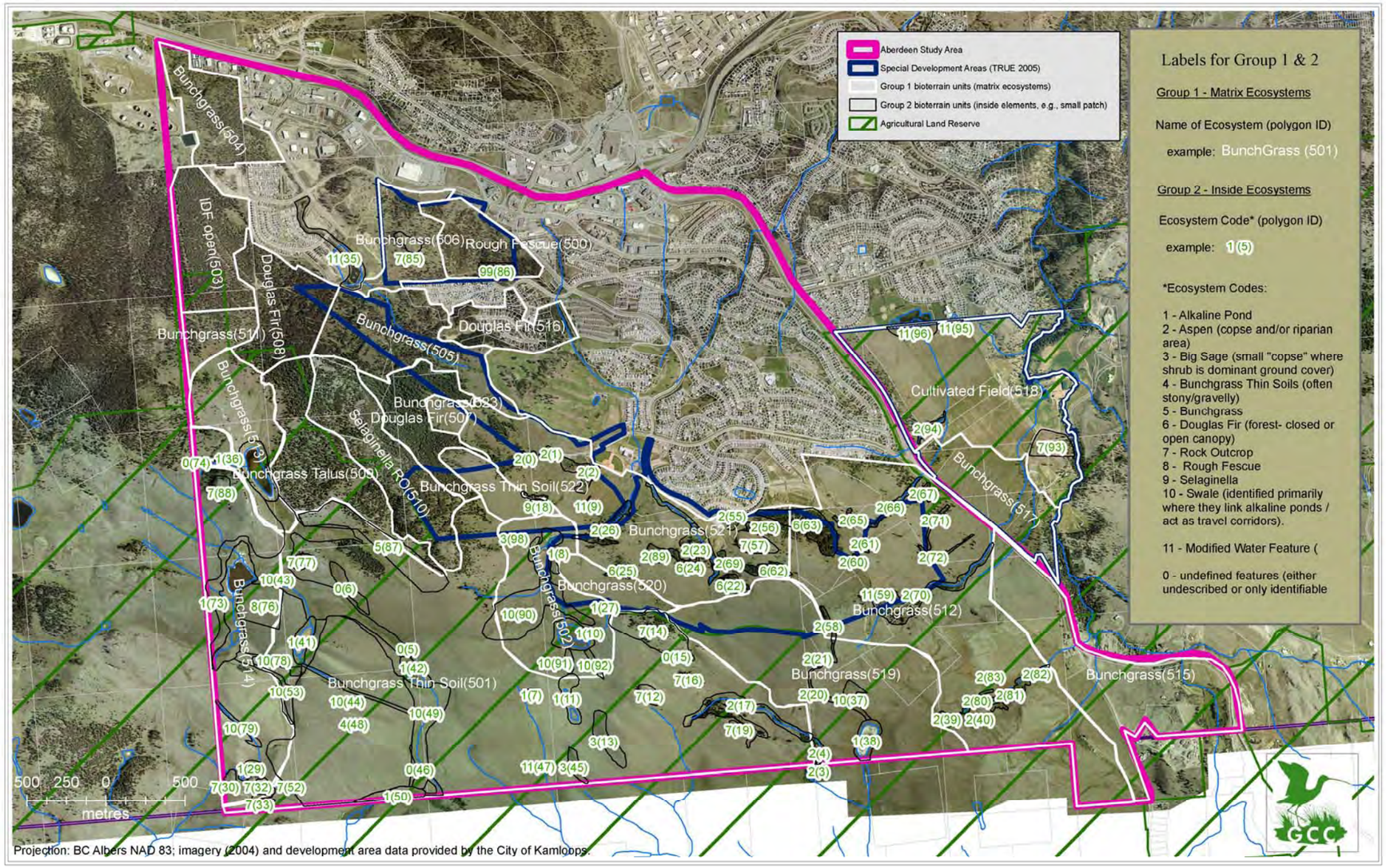

Figure F2: Terrestrial Ecosystem Mapping (TEM) for the Aberdeen Study Area

Table F3: Terrestrial Ecosystem Mapping - Matrix Ecosystem Elements (base layer) including special case Large Patch Ecosystem Elements (Group 1)

	ID	Terrain/Environment Description	Ecological Community	Short Name (used on map)	Hectares
1	500		Bluebunch wheatgrass-Rough fescue Ecological Community	Rough Fescue	23.1
2	501	Plateau – hummocky	Bluebunch wheatgrass-dominated Ecological Community on thin soils	Bunchgrass Thin Soil	391.4
3	502	Small Basin	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	55.7
4	503	Open forest	Douglas-fir-dominated	Douglas Fir	36.7
5	504		Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	29.4
6	505	Grasslands with forest in-growth	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	46.7
7	506		Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	23.2
8	507	Slope north aspect; Closed forest	Douglas-fir-dominated	Douglas Fir	27.4
9	508	forest - slope North aspect	Douglas-fir-dominated	Douglas Fir	32.7
10	509	Steep ~ west aspect (west side of Coal Hill); open forest / closed grasslands.	Bluebunch wheatgrass-dominated Ecological Community on talus slopes	Bunchgrass Talus	43.5
11	510	Crest of Coal Hill Rock Outcrops all along ridge with talus esp north slope.	Compact selaginella-dominated Ecological Community	Selaginella RO	47.7
12	511	Open Forest / Ingrown Grassland - hill crest	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	12.9
13	512	grassland - steep slope northeast aspect	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	198.9

	ID	Terrain/Environment Description	Ecological Community	Short Name (used on map)	Hectares
14	513	- lee side hill	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	37.7
15	514	Grassland - big sage transition (Big Sage becomes dominant cover over extensive landscape to the west.	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	93.7
16	515	Bunchgrass - middle elevation below the plateau	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	76.9
17	516	Forest	Douglas-fir-dominated	Douglas Fir	21.0
18	517	slope North East aspect	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	35.3
19	518	Cultivated Field	Cultivated Field	Cultivated Field	100.4
20	519	Plateau	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	107.5
21	520	Steep slope NNE aspect	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	
22	521	Hill crest	Bluebunch wheatgrass-dominated Ecological Community on thin soils	Bunchgrass Thin Soil	
23	522	Slope N aspect	Bluebunch wheatgrass-dominated Ecological Community	Bunchgrass	

Table F4: Descriptive Summary of Terrestrial Ecosystem Mapping - Small Ecosystem Elements: Large Patch / Small Patch / Linear (Group 2)

Ecological Community OR other important feature	Description	Importance	Number of Occurrences
Alkaline Pond	The majority with standing water / some dried out (ephemeral); identifiable from air photo by white saline crust along shoreline.	Many rare plants associated with this ecosystem including SARA-listed species – alkaline wing-nerved moss found at two ponds in study area and one pond immediately south of the study area. ; use by various wildlife as water source; of high importance in life cycle of spadefoot toad	12
Aspen	Either pure or mixed (with Douglas fir) copses in landscape depressions OR primarily pure along riparian areas (streams) in gullies.	Used for nesting, food and coverage by various bird species, including the Species At Risk the Lewis's woodpecker which is known to be in the area. Often correlated with riparian areas known to be of high importance in most if not all ecosystems. Vegetation is an important food source for various animals, including sharp-tailed grouse for winter feeding.	33
Big Sage	Small patches of dominant big sage coverage often on steep southwesterly facing slopes.	Habitat for insects, coverage for birds and other wildlife; cooler shaded microclimate protected from wind in otherwise extensive open landscape.	4
Bunchgrass Thin Soil	Type assigned primarily through reference to field data point locations, but also by presence of bedrock in surroundings and the coloration of the land (faintly brownish/red or grey)	Different community of plants, and therefore hosts, for various insects. Indicative of different geological characteristics with influence on the growth pattern of plants.	1
Bunchgrass	Type assigned primarily through reference to field data point locations, but also by lack of qualities observed in Bunchgrass Thin Soil Terrain (see above).	Important nesting habitat, specifically the bunchgrass species, of particular importance to sharp-tail grouse for nesting.	1

Ecological Community OR other important feature	Description	Importance	Number of Occurrences
Douglas Fir	Patches of Douglas fir in dry rocky areas and conversely in depressions. One or a few isolated trees were ignored.	Part of the matrix of ecosystems within larger grassland landscapes, provides coverage for wildlife, and hosts a different community of plants. Ecotones, the transition areas between distinct ecosystem types (e.g., grasslands and forests) are well documented as having higher associated biodiversity.	6
Rock Outcrop	Expose rock feature. Topographical Ruggedness Index (TRI) drew attention to some smaller features. Could delineate quite accurately from ortho-photo.	Rugged matrix where specifically adapted plants (e.g., mosses and lichens) may form the dominant vegetative layer. Important sunning areas and den areas to meet the thermoregulatory needs of snakes, including the At Risk gopher snake, known to be in the area. Important "safe" perches for birds.	16
Rough Fescue	Type assigned primarily through reference to field data point locations.	Like Bluebunch wheatgrass it serves as a nesting area for bird species including the Sharp-tailed grouse	1
Selaginella	Identified specifically through field survey.	Indicative of underlying soil and geology. Host to a specific community of plants.	1
Swale	Areas between topographic features (drumlins, hummocks, etc.) Herb layer appeared greener on orthophoto. Often connecting between alkaline ponds.	Provide the path of least resistance to highly important water features (in this area often alkaline ponds) and therefore important corridors for the movement of terrestrial animals; also indicative of the drainage of water into ponds and wetlands and therefore need special consideration in planning and development so as to avoid polluting them.	16

Ecological Community OR other important feature	Description	Importance	Number of Occurrences
Modified Water	Include any semi-natural feature, such as a watering hole dug by ranchers for cattle. Some may be fed by natural springs.	The human-created features, albeit unnatural (at least in part) still serve a vital role as a source of water for animals in an otherwise arid region.	7
Cultural Feature	Not included in the analysis. These were marked for potential future analysis and planning. They include intact house-type structures (cabin) and older dilapidated cabins, corrals and other ranching constructions, some possibly of cultural heritage value.	Abandoned structures are potentially nesting areas for one or more of several At Risk owl and bat species known to be in the area. Snakes may also use such structures as hibernacula as they offer protection from the elements and temperature extremes.	7

Table F5: Terrestrial Ecosystem Mapping - Small Ecosystem Elements: Large Patch / Small Patch / Linear (Group 2)

Id #	Short Description	Hectares	Id #	Short Description	Hectares
1	Aspen	0.5	50	Swale	9.4
2	Aspen	0.3	51	Alkaline Pond	2.4
3	Aspen	2.4	52	Rock Outcrop	0.0
4	Aspen	0.2	53	Rock Outcrop	0.0
5	Aspen	0.8	54	Swale	1.2
6	Big Sage	0.0	55	Modified Water	0.1
7	Big Sage	2.3	56	Aspen	0.6
8	Alkaline Pond	0.3	57	Aspen	0.2
9	Alkaline Pond	3.4	58	Rock Outcrop	2.7
10	Modified Water	0.0	59	Aspen	0.7
11	Alkaline Pond	4.1	60	Modified Water	0.0
12	Alkaline Pond	2.5	61	Aspen	0.3
13	Rock Outcrop	1.3	62	Aspen	0.1
14	Big Sage	3.1	63	Douglas Fir	1.6
15	Rock Outcrop	9.5	64	Douglas Fir	6.8
16	Fairy Ring - fungi	0.0	65	Aspen	0.2
17	Rock Outcrop	0.5	66	Aspen	0.4
18	Aspen	7.2	67	Aspen	1.4
19	Selaginella	0.9	68	Aspen	0.4
20	Rock Outcrop	0.6	69	Aspen	0.2
21	Aspen	0.2	70	Aspen	0.3
22	Aspen	0.6	71	Aspen	7.3
23	Douglas Fir	1.5	72	Aspen	0.6
24	Aspen	3.9	73	Aspen	1.0
25	Douglas Fir	1.2	74	Alkaline Pond	9.5
26	Douglas Fir	0.8	75	Cultural Feature	0.0
27	Aspen	2.4	76	Cultural Feature	0.0
28	Alkaline Pond	0.2	77	Rough Fescue	6.5
29	Douglas Fir	0.4	78	Rock Outcrop	1.1
30	Alkaline Pond	1.4	79	Swale	1.4
31	Rock Outcrop	0.6	80	Swale	1.1
32	Rock Outcrop	0.6	81	Aspen	0.3
33	Rock Outcrop	1.6	82	Aspen	1.6
34	Rock Outcrop	0.4	83	Aspen	0.4
35	Rock Outcrop	0.2	84	Aspen	0.2
36	Modified Water	4.5	85	Aspen	0.2
37	Alkaline Pond	5.8	86	Rock Outcrop	1.3
38	Swale	2.2	87	heavy disturbance	2.0
39	Alkaline Pond	3.0	88	Bunchgrass	13.4
40	Aspen	0.5	89	Rock Outcrop	1.2
41	Aspen	0.2	90	Aspen	1.1
42	Alkaline Pond	2.5	91	Swale	12.1
43	Alkaline Pond	2.4	92	Swale	0.7
44	Swale	26.3	93	Swale	0.7
Id #	**Short Description**	**Hectares**	**Id #**	**Short Description**	**Hectares**

45	Swale	1.8	94	Rock Outcrop	3.7
46	Big Sage	1.3	95	Aspen	0.7
47	Cultural Feature	0.0	96	Modified Water	0.7
48	Modified Water	0.1	97	Modified Water	2.2
49	Bunchgrass Thin	76.4	98	Big Sage	0.7
			99	Big Sage	0.6

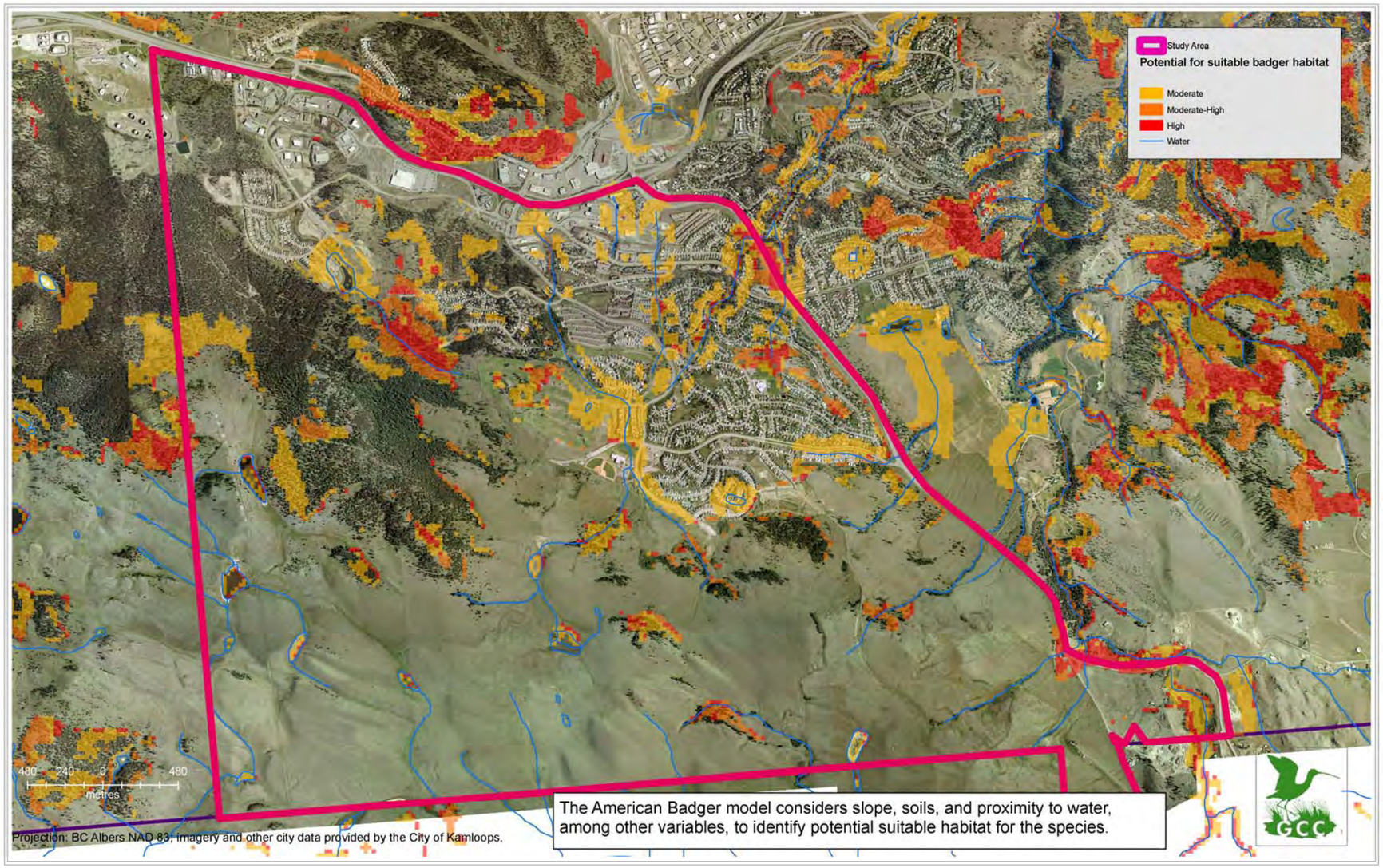

Figure F3: Habitat Potential Model for American Badger in the Aberdeen Study Area

Adjacent areas include Kenna Cartwright park to the north – an isolated fragment cut off from areas to the south by the Trans-Canada highway (although the park is still a valuable piece of the larger landscape matrix as it serves as a corridor between areas to the north and south) - and Aberdeen grasslands to the south which are more extensive, contiguous grassland ecosystems.[2] There have also been many badger sightings in similar grassland habitat to the south of the study area, and Broad Ecosystem Inventory GIS data (BEI) indicate that this is an important area for badgers (Figure F3).Movement of badgers between areas south of the Aberdeen study area into the study area is highly likely and probable. Future badger inventory surveys should be considered for the Aberdeen study area.

Gopher snakes are reported in the CDC database for areas to the north of the study area, approximately 0.5 kilometres away. The gopher snake has more general habitat requirements compared to other snake species at risk, e.g., the western rattlesnake, which is not known to occur in areas south of the Thompson Rivers. However, one of their main sources of prey, its namesake - the gopher - is available in the area as reported in the field survey. Furthermore, the intact parts of the Aberdeen study area contain a suitable mosaic of open, forested, and rocky areas necessary for the thermoregulation requirements of snakes (Resources Inventory Committee (RIC) 1998a). The GCC does not have a habitat potential model for the Gopher Snake; the western rattlesnake model was used, although only as a guide, to identify warm (southern exposures / high solar radiation, i.e., not in the shade) and rocky areas, which as thermoregulation goes, is more of an issue for reptiles during the winter months, than is keeping cool in the summer.

Three major leks (a gathering place of species) for sharp-tailed grouse occur in the Aberdeen study area, one inside the study area in the southwest quadrant, and two less than one kilometre south of the study area on the plateau. The flat open area of grasslands found in the southern half of the study area, and in areas immediately to the south of the study area's southern boundary, are typical of the open grasslands that sharp-tailed grouse prefer for lek sites. Openness is an important requirement of a lek site because it enables the bird to detect predators that may be attracted by the male's noisy, highly active mating ritual (B.C. Ministry of Water, Land and Air Protection. 2004a). These grouse display areas are occupied both in spring and for a short period in fall. Thus, a juvenile bird becomes acquainted with the site some six months before it becomes functional as a mating ground (Ritcey 1995). Sharp-tailed grouse have strong site fidelity to lek sites and may return to the same site year after year if the habitat remains unchanged and disturbance by humans is not too great (B.C. Ministry of Water, Land and Air Protection. 2004a). Because site fidelity is so strong, and the mating ritual strongly correlated to mating success, keeping areas that are known

[2] The main threat to badgers is collisions with moving vehicles while attempting to cross roads, especially during the crepuscular (dawn/dusk) hours when badgers are particular active and not highly visible by drivers (Hoodicoff 2003). A large contiguous habitat where these movements across roads can be kept to a minimum is (and will continue to be) integral to this species long term survival.

to be lek sites intact is crucial to maintaining a viable population of the species. GCC's expert input for the sharp-tail habitat potential model suggests a 1.5 kilometre buffer around lek-sites to protect them from disturbance (Figure F4) (B.C. Ministry of Water, Land and Air Protection, 2004a). Such buffers were created around the lek site identified in the southwest quadrant of the study area, and the lek sites just outside the study area to the south of this quadrant; these buffers extend partially into the urban areas of the Aberdeen neighbourhood. However, these buffers are conservative estimates where a precautionary principle has been applied, and therefore these lek sites are likely still highly viable and being used.

There are no known spadefoot toad sightings within the study area, likely because no surveys have been conducted here. However, surveys conducted in 1994, four kilometres southeast of study area, identified multiple breeding habitats similar to those in the study area, and it is likely that other subpopulations occur within the study area, as well as in association with one or all of the alkaline pond Ecological Community. Additionally the GCC's spadefoot habitat potential model identifies several highly suitable areas in the southwest corner of plan area (essentially corresponding to red zones of the ecological zoning analysis) associated with shallow ponds and depressions (Figure F5).

Other species sightings inside the study area have been recorded for Lewis woodpecker and Sandhill Crane.

Lewis' woodpecker is highly associated with riparian Aspen stands and forest-grassland interface Douglas fir stands (Fenger *et al*. 2006). Sightings have been made of Lewis' Woodpecker in and immediately adjacent to the study area. No nests have been specifically identified but certainly many of the small forested areas in the grasslands and adjacent to it are suitable. Aspen in particular are important for the bird's use as nest sites for this and other cavity nesting bird species (Newlon 2005). Lewis' woodpecker are more mobile relative to some of our other Species at Risk (spadefoot toad/sharp-tailed grouse) so contiguity of habitat may be slightly less of an issue for this species, although still undoubtedly is important. Fenger *et. al.* (2006) recommend a 100-m activity free buffer zone around known nest sites during the breeding season.

Sandhill crane identified at several locations (in association with shallow waterbodies and grasslands. These sightings would most likely be stopovers on fall migration so connectivity and contiguity is not such a specific issue for this species either (B.C. Ministry of Water, Land and Air Protection 2004b).

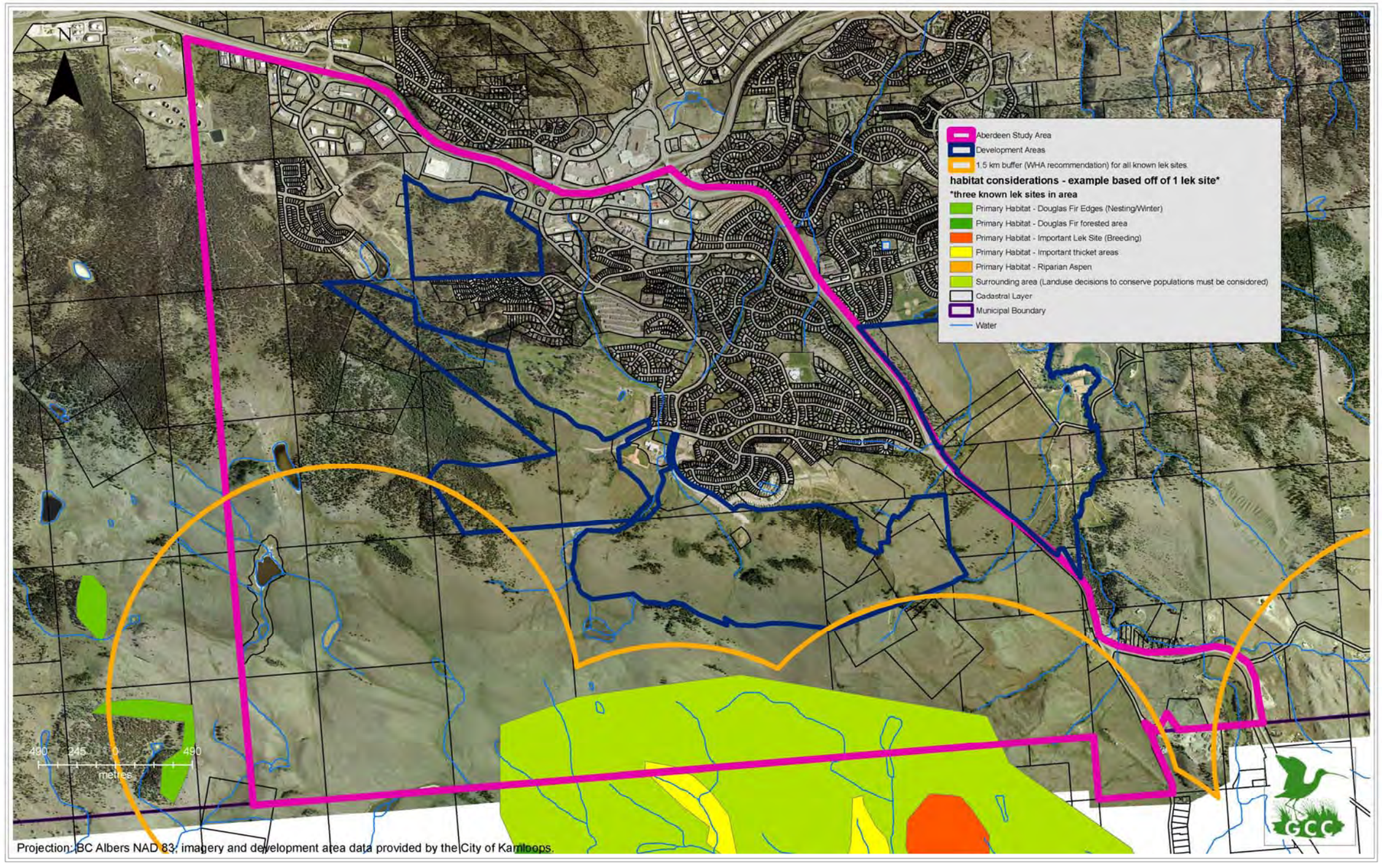

Figure F4: Potential Habitat Model for Sharp-tailed Grouse in the Aberdeen Study Area

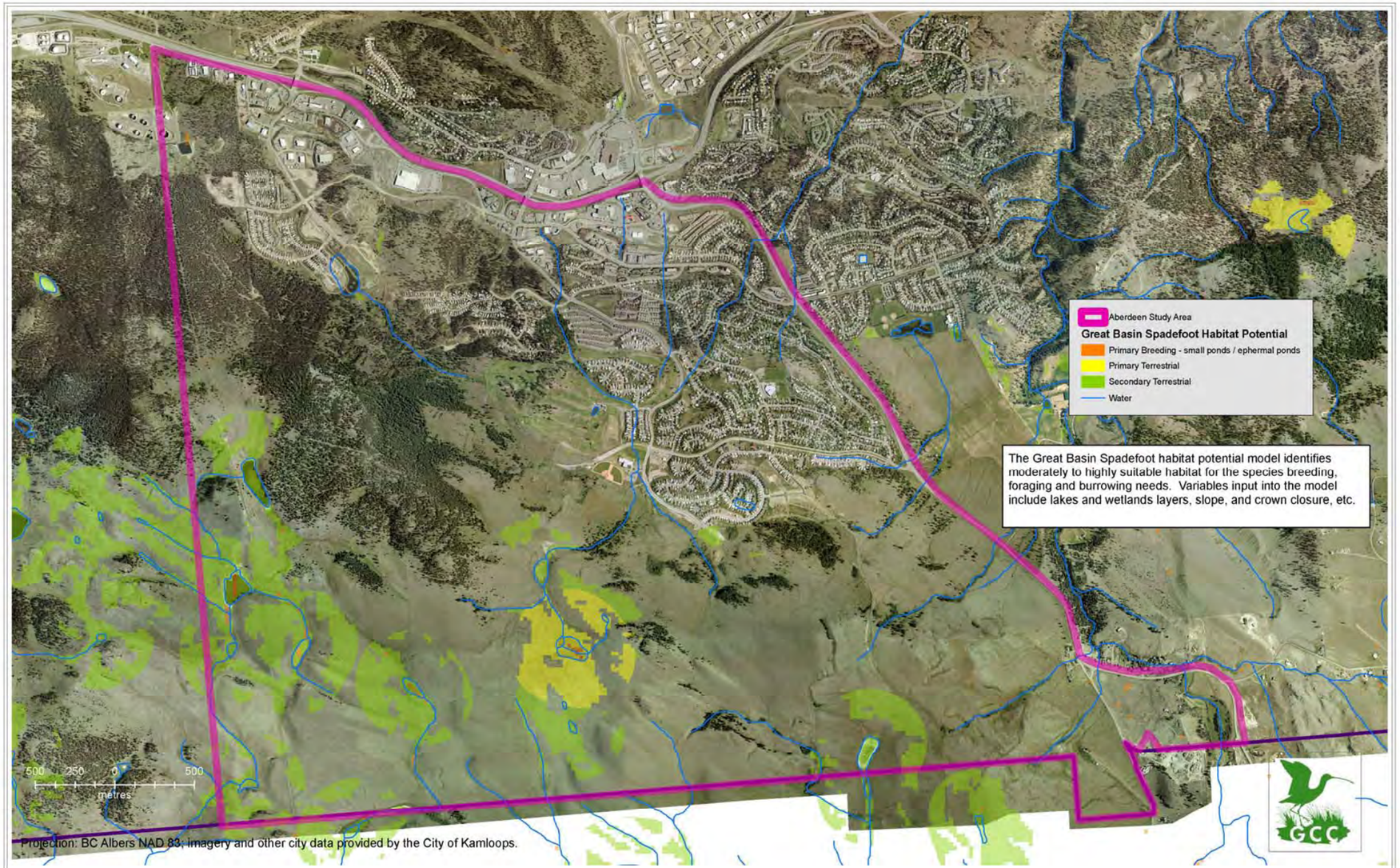

Figure F5: Habitat Potential Model for Great Basin Spadefoot in the Aberdeen Study Area

1.4.3 Priority Categories and Levels

The results of the Priority Category Assignment are illustrated in Figure F6. The priority categories are symbolized to imply no particular hierarchy in the categories; Priority Categories organize polygon data but are not for ranking. The categories provide a way to trace the grassland values associated with each polygon upon completion of the analysis. This allows for sensitivity testing of the methods and analysis and is an efficient reference method.

Figure F7 shows mapped results of the Priority Level Assignment. For these results, a hierarchy is implied by the colour symbolizing the polygon. Priority Levels are a ranking system with low numbers representing high priority and high numbers lower priority. Red symbolizes Priority Level 1 (P1), orange - Priority Level 2 (P2), Yellow – Priority 3, green – Priority 4, and blue Priority 5. Labels P1 through to P5 are also included (for those with color-blindness).

A little over half the study area is ranked as high priority and approximately three quarters of the intact habitat areas are ranked high priority. The high ranking means that there are one or more grassland values within the polygon. Grassland values include important habitat, suitable habitats, important ecosystems, wildlife and spring forage as described in Priority Category Analysis.

The Priority Ecological Zoning results differ from the priority levels because they consider some additional factors. The first difference is that the Ecological Zoning analysis assigns a zoning designation based on the smaller group 2 polygons found within the larger base group 1 polygons. More specifically, the larger polygons, which consist primarily of matrix ecosystems, get designated into a specific zone based on the value (i.e., important or rare ecosystems) and size (area) of the smaller polygons within them. Furthermore, a larger polygon can be demoted to a lower ranked zone if it is separated from other intact habitat; if it has a high amount of urban area around it. For example, a polygon completely surrounded by urban development becomes an isolated "island" of intact habitat, which depreciates its ecological value and its importance for conservation.

Figure F8 shows the study area stratified into three broad areas or zones: 1) Conservation Area (Red zone); 2) Sustainable Development Area (Amber zone); and 3) Development Area (Green zone).

The red zone is defined by a large concentration of high and moderate ecosystem values including important and highly suitable habitat for species at risk, and rare ecosystems as defined by the CDC. This becomes the highest priority for conservation. The amber zone is defined by moderate ecosystem values on the broader landscape level with specific high priority sensitive ecosystems, such as wetlands. The green zone overall has lower priority values but specific community elements within this zone may have higher ecological values.

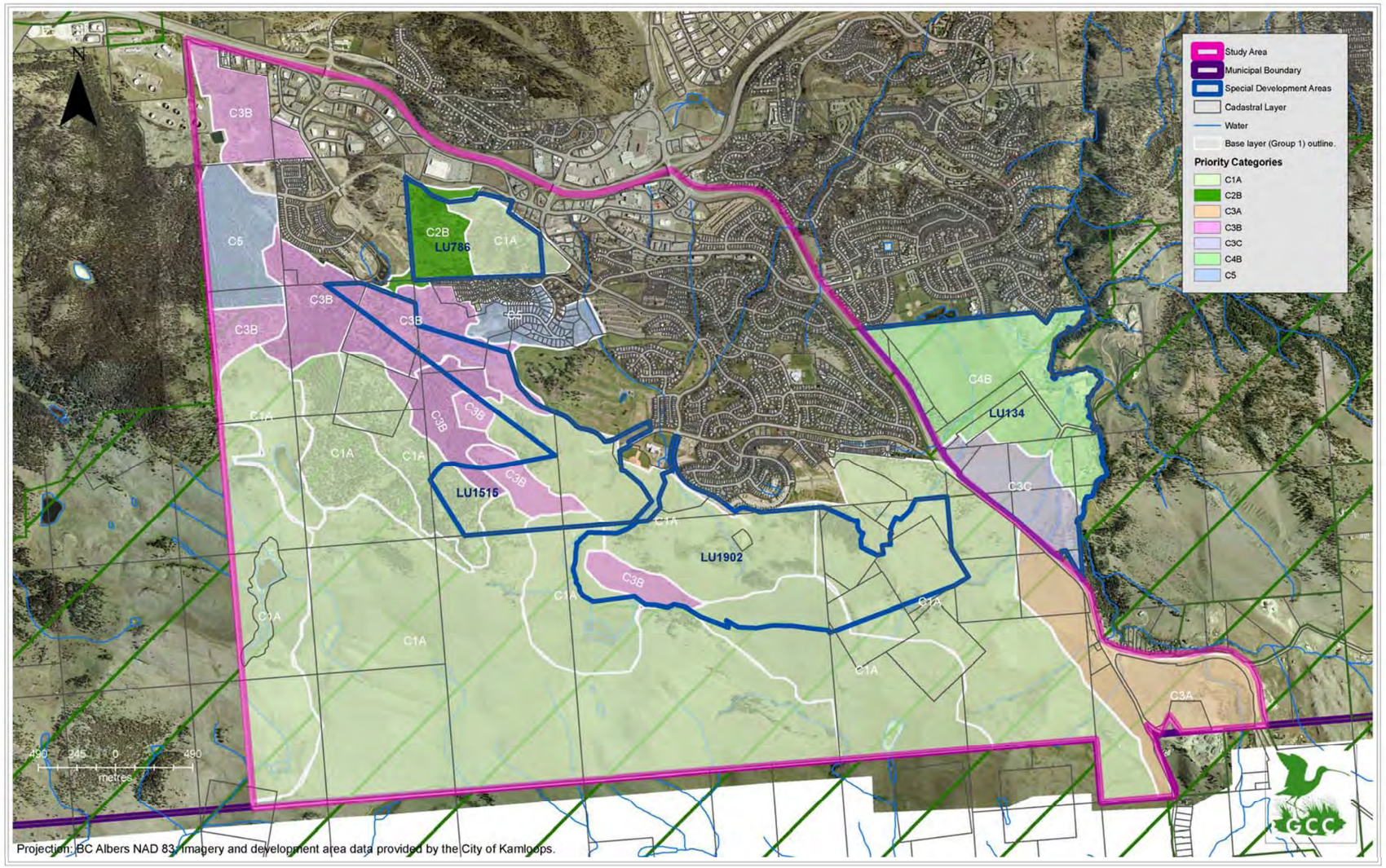

Figure F6: Map showing Priority Category assignment in the Aberdeen Study Area

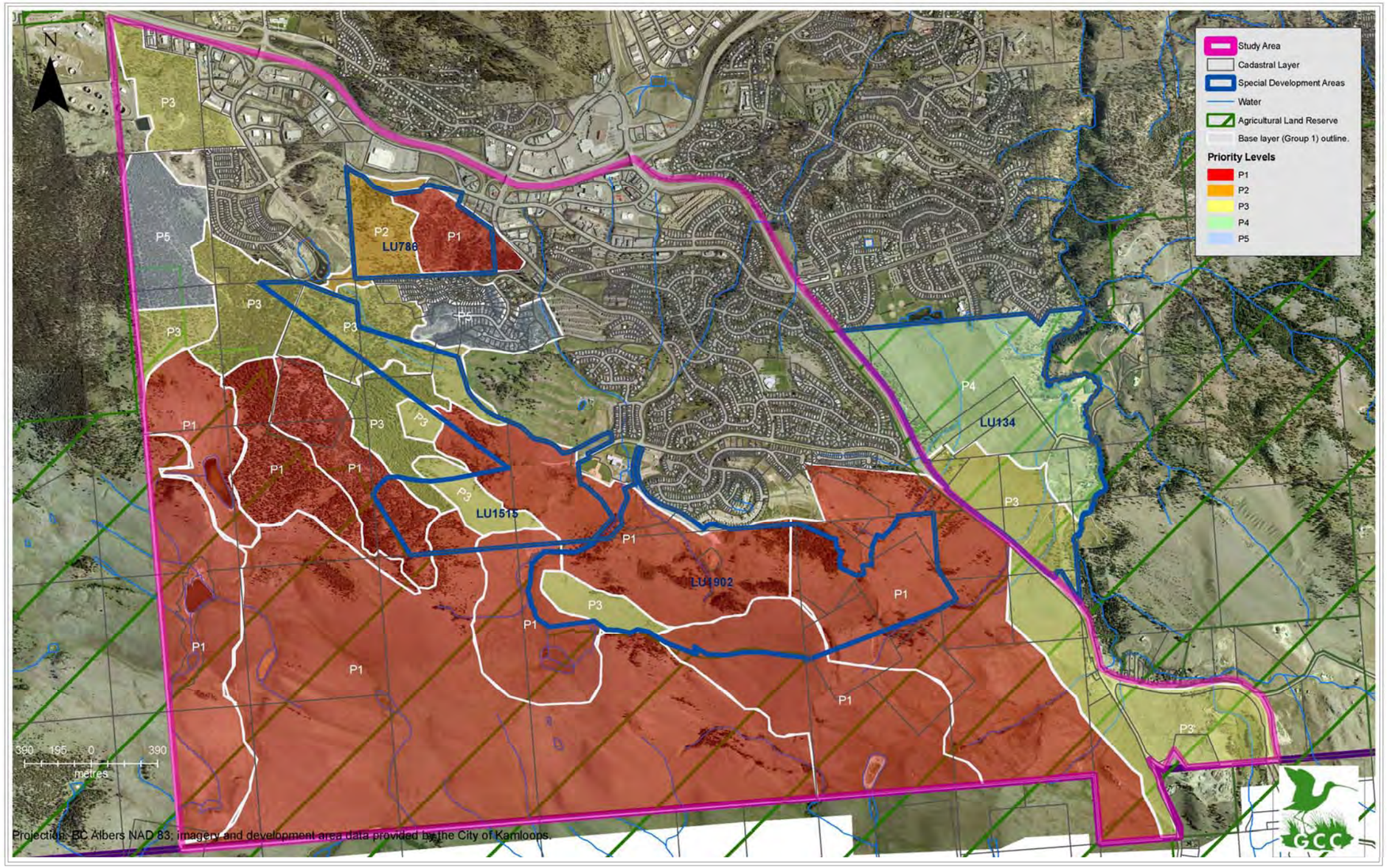

Figure F7: Map showing Priority Level assignment in the Aberdeen Study Area

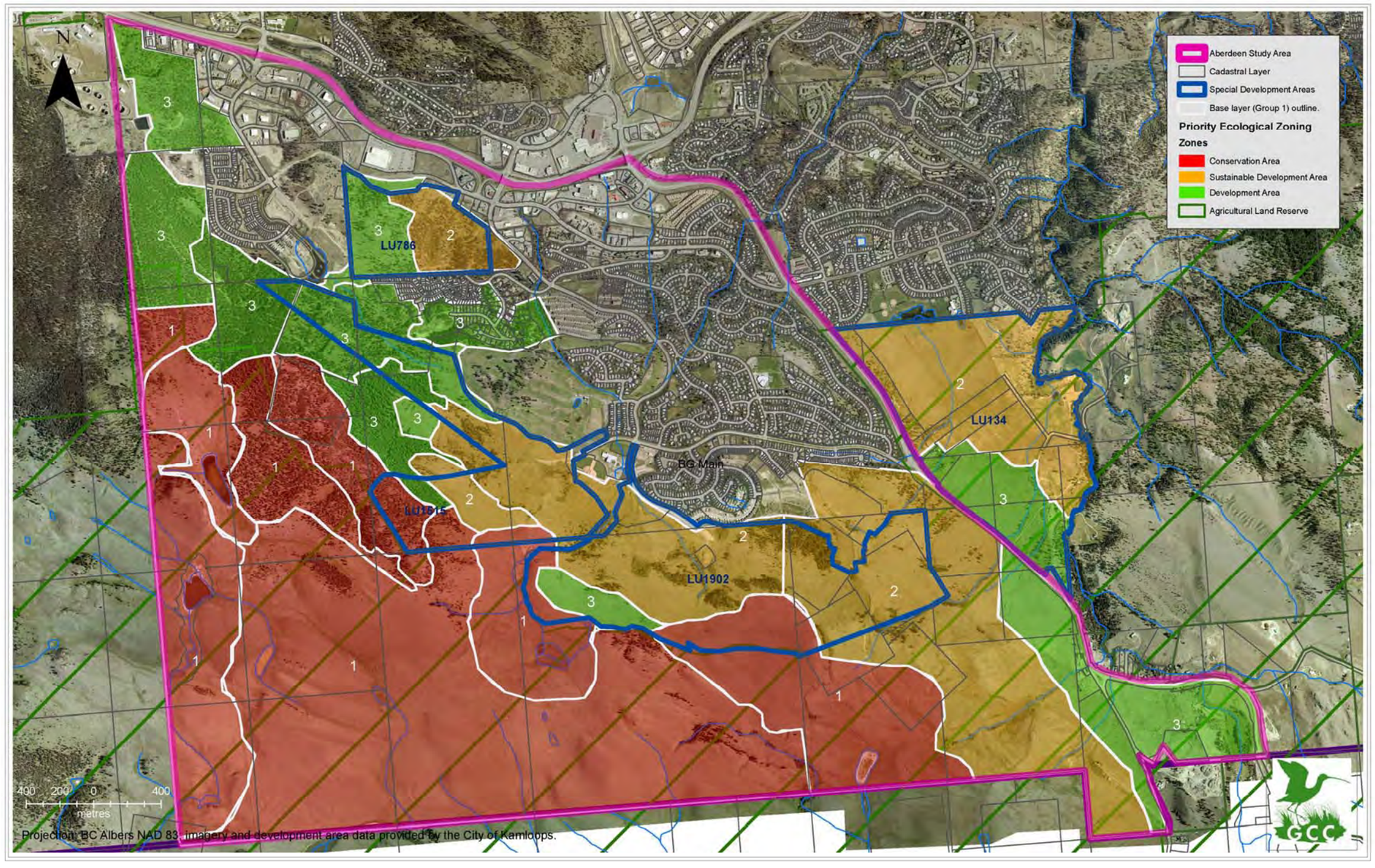

Figure F8: Map showing Priority Ecological Zoning in the Aberdeen Study Area

Figure F9 represents the priority ecological zoning, but showcases the special features within the amber and green zones that need to be considered in developing these areas.

Table F6 breaks down the total hectares and the number of occurrences of each zone within the study area, and Table F7 shows the same break down for the combination of the study area and the adjacent special development area (LU134).

Figure F10 shows the percentages of each zone within the study area including the area where no zone was designated because the land is already developed. Figure F11 shows the same thing for the combination of the study area and the adjacent special development area (LU134).

For each Development Area in the study area, and for one development area adjacent to the study area, the percentage of each zone of the Ecological Zoning Analysis is graphed as a bar (Figure F12). The Conservation, Sustainable Development, and Development percentages for each do not add up to 100% because zone lines when delineated in the GIS in places did not align perfectly with the Development Area Boundary (this could be resolved by redrawing the lines with snapping options on).

Table F6: Total area covered by each Ecological Zone in the Study Area

Zone	Number of Occurrences	Hectares
Conservation	7	788
Sustainable Development	4	347
Development	11	312.

Table F7: Total area covered by each Ecological Zone in the Study Area and in the adjacent Development Area (LU134)

Zone	Number of Occurrences	Hectares
Conservation	7	790
Sustainable Development	5	447
Development	12	347

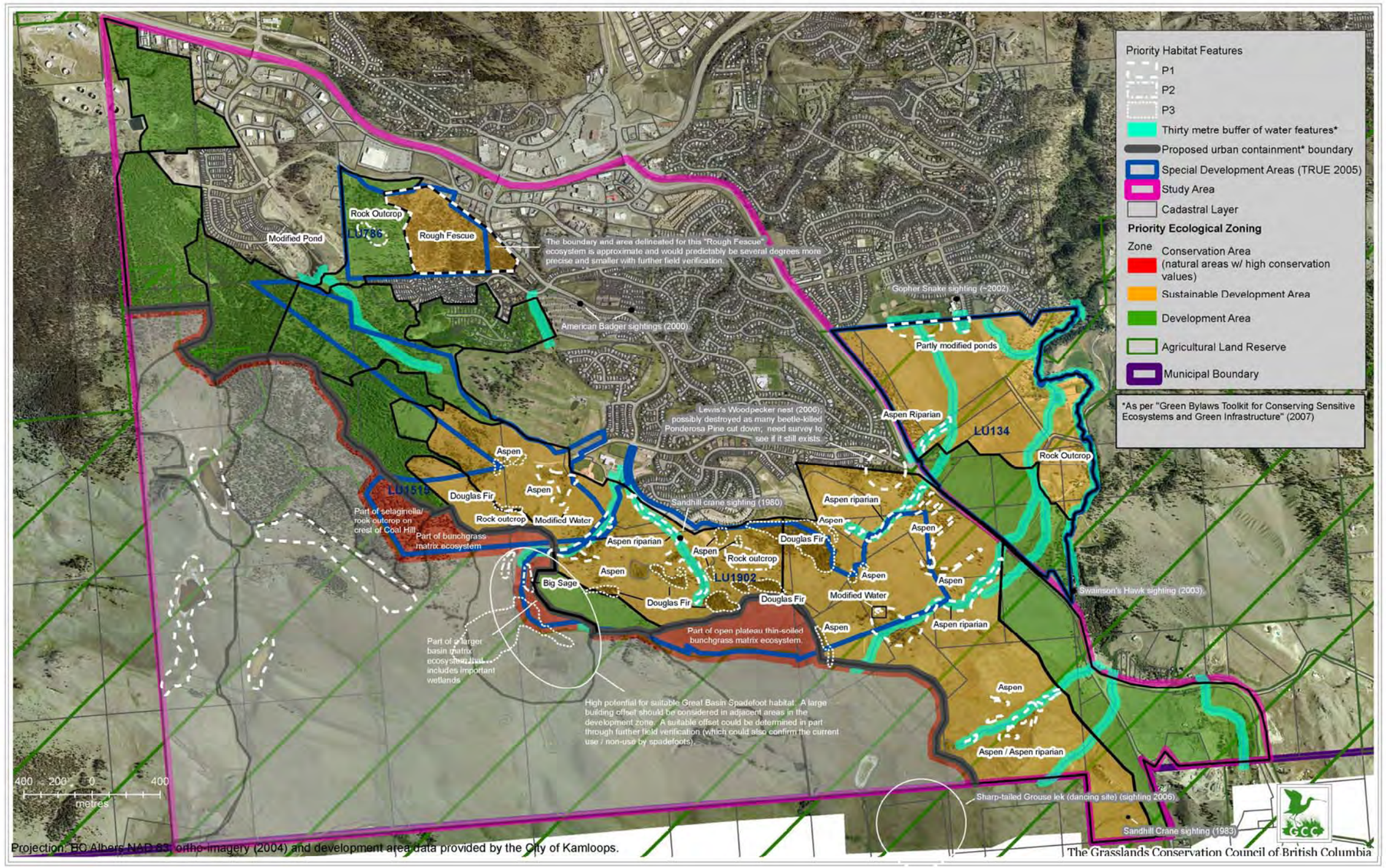

Figure F9: Map of Priority Ecological Zoning for the Aberdeen Study Area

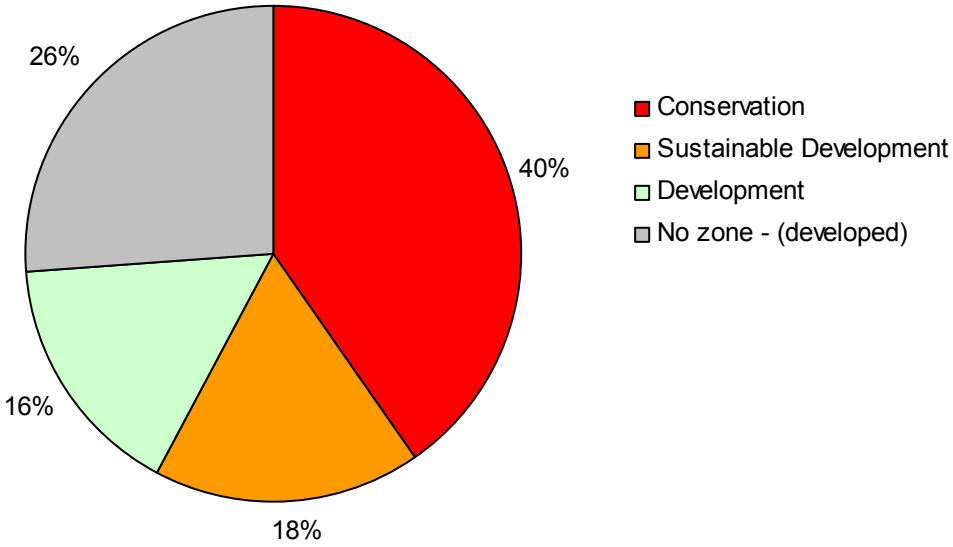

Figure F10: Percentage of Study area covered by each Ecological Zone

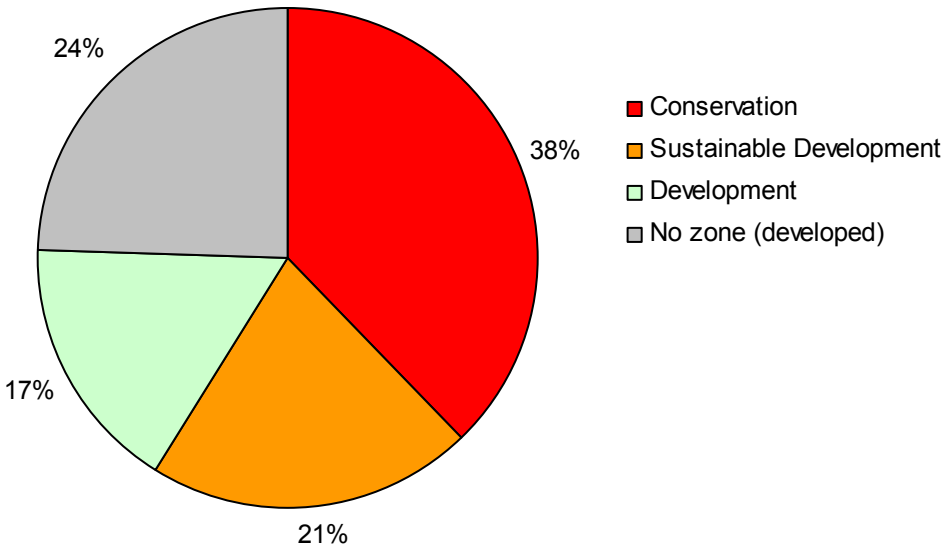

Figure F11: Percentage of Study Area and adjacent Development Area (LU134) covered by each Ecological Zone

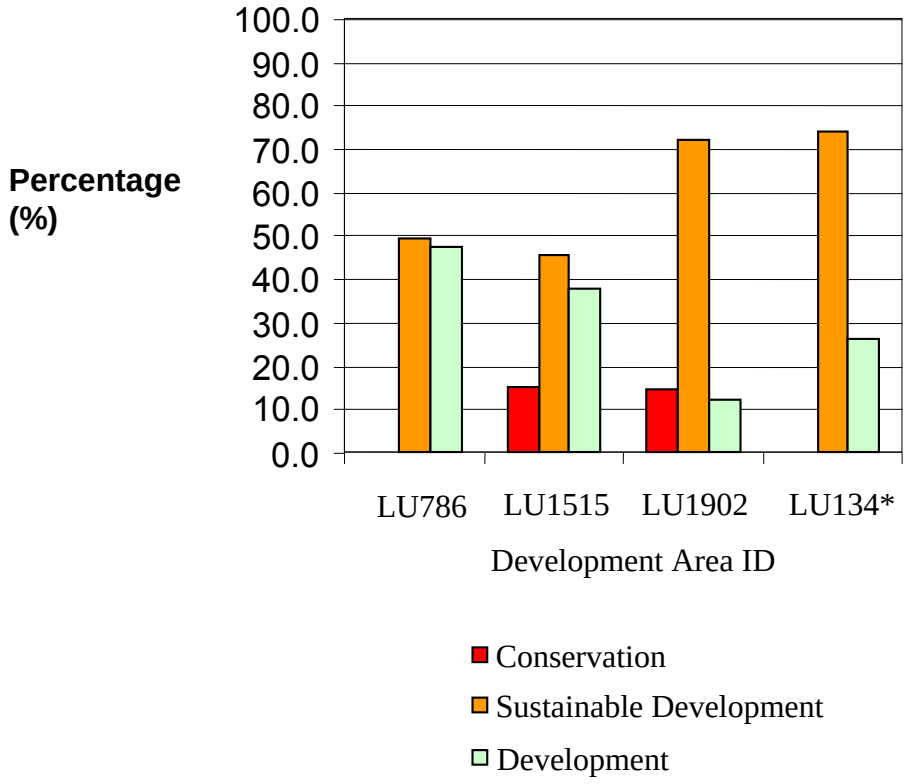

Figure F12: Percentage of Ecological Zone Type in each of the four special Development Areas

APPENDIX G. DETAILED DESCRIPTION OF ECOLOGICAL COMMUNITIES

This appendix provides detailed descriptions of the observed Ecological Communities in the Aberdeen study area. The categories, used to describe and provide initial conservation evaluations for each ecological community, were derived from numerous MOE documents (2007, 2006a, 2006b, 2007c, and 2007d). The first portion of this appendix describes each category and the second part contains the detailed draft conservation evaluation of each ecological community.

Description

General description: this provides a general ecological context for each EC.

Estimated proportion of study area: the proportion of the EC in the study area as best determined from field work and the interpretation of aerial photographs.

Characteristic plants: dominant and non-dominant vascular plant indicators for each EC.

Biological crust: a general description of the cover and main components of the crust for each EC.

Non-native plants: a list of non-native (alien) plant species.

Wildlife: wildlife observed in the EC during field surveys.

Rare species: known rare taxa for each EC are listed; 'rare' refers to being listed on the federal Species at Risk Act (SARA), by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as Red or Blue by the British Columbia Conservation Data Center (CDC).

Tentative BEC classification: although ECs are roughly equivalent to some BEC site series, ECs are considered here to be ecological units designed for conservation purposes. Therefore, an EC may include more than one BEC Site Series.

Elevation: general elevations of each EC.

Slope: general slopes of each EC.

Aspect: general aspects of each EC.

Soils: soils of each EC.

Disturbance: any form of disturbance observed in an EC, both natural and human related.

Evaluation

Biodiversity Significance: this is a subjective assessment of the significance of the EC's biodiversity based on the author's experience in the provincial grassland areas.

Condition: the ecological health of an ecological community; including, successional stage, vegetation composition and structure, stability, ecological processes, disturbance regimes, alteration of the environment via physical or chemical processes, and changes in species composition are all factored in to the assessment of condition (MOE 2007), but time did not allow for many of these characteristics to be assessed; condition values are: excellent, good, fair, or poor.

Key Environmental Factors: this includes any features in the EC that are considered important across the ecological landscape.

Potential for rare organisms: this includes CDC species that might occur in an EC.

Global/BC/regional importance: this is a value that indicates ecological importance of the EC outside the study area.

Connectivity: this indicates whether the EC is connected to similar communities elsewhere.

Cultural: this notes whether there are known cultural (primarily First Nations) values in an EC.

Known threats: threats within an EC are listed here.

Protection Urgency: This is a subjective assessment based on the author's experience in the provincial grassland areas.

Management Urgency: This is a subjective assessment based on the author's experience in the provincial grassland areas.

A. Grassland Ecological Communities

Grassland Ecological Communities comprise the largest vegetation component of the Aberdeen study area. Generally they are flat to north facing, and dominated by bunchgrasses and herbs. Shrubs rarely cover more than 1% of the landscape, although isolated patches occur.

EC1. Bluebunch wheatgrass-dominated Ecological Community

Description

General description: this is the largest of the communities and is characterized principally by bunchgrasses and scattered shrubs; it is variable across the landscape mainly related to slope, aspect, and livestock use.

Estimated proportion of study area: 70%

Characteristic plants: *Dominants*: bluebunch wheatgrass, Sandberg bluegrass (especially in drier areas), Junegrass, pussytoes, yarrow; *non-dominant indicators*: rough fescue, needle-and-thread grass (on shallow soils; this may be a distinct community-type), big sagebrush, rabbit-bush, cinquefoil species, fleabane species, Holboell's rockcress, field locoweed, round-leaved alumroot (cooler sites), old man's whiskers (cooler sites), Mariposa lily.

Biological crust: 10 - >90% cover (depending on disturbance); *Dominants*: *Cladonia* spp. *Brachythecium albicans* (on cooler sites); *non-dominant indicators*: *Syntrichia ruralis*, *Ceratodon purpureus* (increases in disturbed sites), *Diploschistes muscorum*.

Non-native plants: all rare except in a few disturbed sites; cheatgrass, small brome species, Kentucky bluegrass, spotted knapweed, Yellow salsify, Yellow rattle.

Wildlife: most birds and all mammals in Appendix E.

Rare species: none observed.

Tentative BEC classification: BGxw1: 81, (?81esa, ?81esb); IDFkh2 ?81/82

Elevation: ~850 - 1030 m.

Slope: flat to > 25^{o}

Aspect: flat to 40^{o}- 260^{o}

Soils: deep to shallow, usually somewhat stony/gravelly.

Disturbance: livestock trampling/grazing (Fig. 5) and trails, possible pocket gophers or mole mounds; human: roads, some bulldozer/back hoe activity.

Evaluation

Biodiversity Significance: High.

Condition: mostly excellent to good, although some eastern portions are fair to poor because of livestock utilization.

Key Environmental Factors: large extent and in mainly good to excellent range condition; high real and potential biodiversity.

Potential for rare organisms: low to medium.

Global/BC/regional importance: much less disturbed than similar ECs in other parts of the province.

Connectivity: high connectivity with grasslands to the east, south, and west.

Cultural: unknown.

Known threats: disturbance from livestock heavy to moderate on east side, minor on west side; development.

Protection Urgency: high.

Management Urgency: low.

EC2. Bluebunch wheatgrass-Rough fescue Ecological Community

Description

General description: this is an uncommon community dominated by bunchgrasses within an open forest and is found only on a few lower elevation slopes; the surveyed sites are in near pristine condition.

Estimated proportion of study area: <2%

Characteristic plants: *Dominants*: bluebunch wheatgrass, rough fescue, Junegrass; *non-dominant indicators*: Ponderosa pine (dead), Douglas-fir, umber pussytoes, pussytoes, balsamroot.

Biological crust: 40 - 60% cover; *Dominants*: *Cladonia* spp. *Brachythecium albicans*; *non-dominant indicators*: *Syntrichia ruralis*.

Non-native plants: rare spotted knapweed.

Wildlife: none observed.

Rare species: none observed.

Tentative BEC classification: PPxh2: 84.

Elevation: 750 m. (10 U 684870 5614192)

Slope: 10^{o} - 15^{o}

Aspect: ~ 70^{o}

Soils: unknown.

Disturbance: none in the one site examined.

Evaluation

Biodiversity Significance: high.

Condition: excellent.

Key Environmental Factors: excellent condition.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: none with similar communities; isolated by forest.

Cultural: unknown.

Known threats: development.

Protection Urgency: high.

Management Urgency: high.

B. Shallow Soil and Outcrop Ecological Communities

EC3. Bluebunch wheatgrass-dominated Ecological Community on thin soils

Description

General description: this community is found mainly on ridge crests over thin soils; bluebunch wheatgrass is the dominant grass but is much shorter than on deep soil sites, but appears healthy; needle-and -thread grass can dominate on some of these sites as well.

Estimated proportion of study area: <10%

Characteristic plants: *Dominants*: bluebunch wheatgrass, Sandberg bluegrass, Junegrass, cut-leaf daisy, pasture sage; *non-dominant indicators*: needle-and-thread grass (occasionally dominant), rabbit-bush, yarrow, field locoweed.

Biological crust (Fig. 8): 5 - >75% cover (depending on disturbance); *Dominants*: *Cladonia* spp., *Xanthoparmelia wyomingensis*, *Coelocaulon aciculare*, *Syntrichia ruralis*, *Ceratodon purpureus*.

Non-native plants: none observed.

Wildlife: none observed.

Rare species: none observed.

Tentative BEC classification: BGxh1: ?81, (?83); IDFxh2: ?82

Elevation: ~850 - 1030 m.

Slope: flat to > 5^{o}

Aspect: flat to all aspects.

Soils: stony/gravelly.

Disturbance: wind/frost; livestock trampling/grazing.

Evaluation

Biodiversity Significance: unknown.

Condition: mostly excellent.

Key Environmental Factors: unknown.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: unknown, but patches are usually isolated from each other.

Cultural: unknown.

Known threats: disturbance from livestock heavy to moderate, or absent.

Protection Urgency: unknown.

Management Urgency: unknown.

EC4. Bluebunch wheatgrass-dominated Ecological Community on talus slopes

Description

General description: this community is characterized by steep slopes and a low plant cover, surrounded by patches of open forest.

Estimated proportion of study area: <6%

Characteristic plants: *Dominants*: bluebunch wheatgrass; *non-dominant indicators*: Saskatoon, Douglas-fir, rose species, (dead ponderosa pine).

Biological crust: 10 - <60% cover; *Dominants*: *Cladonia* spp., *Syntrichia ruralis*.

Non-native plants: none observed.

Wildlife: none observed.

Rare species: none observed.

Tentative BEC classification: PPxh2: ?RT01/Ro02); IDFxh2: ?72.

Elevation: ~950 - 1050 m.

Slope: 15 - 30^{o}

Aspect: 250 - 270^{o}.

Soils: talus.

Disturbance: minimum livestock trampling/grazing, a few trails.

Evaluation

Biodiversity Significance: unknown.

Condition: mostly excellent.

Key Environmental Factors: unknown.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: unknown.

Cultural: unknown.

Known threats: disturbance from livestock.

Protection Urgency: unknown.

Management Urgency: unknown.

EC5. Compact selaginella-dominated Ecological Community

Description

General description: this community is found adjacent to rock outcrops, often in somewhat shaded situations.

Estimated proportion of study area: <1%

Characteristic plants: *Dominants*: compact selaginella, Sandberg bluegrass, Junegrass, cut-leaf daisy, pasture sage; *non-dominant indicators*: bluebunch wheatgrass, parsnip-flowered buckwheat.

Biological crust: 15 - >65% cover; *Dominants*: *Cladonia* spp., *Polytrichum piliferum*, *Syntrichia ruralis*, *Cladina* spp. many unidentified lichens.

Non-native plants: none observed.

Wildlife: none observed; this type of habitat is often important for snakes as sunning or escape terrain, may also be hibernacula sites.

Rare species: none observed.

Tentative BEC classification: BGxw1: Ro01/02; IDFkh2: ?73.

Elevation: ~920 - 1060 m.

Slope: flat to > 75^{o}

Aspect: flat to all aspects.

Soils: stony/gravelly or rock.

Disturbance: wind/frost.

Evaluation

Biodiversity Significance: probably high.

Condition: mostly excellent.

Key Environmental Factors: unknown.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: unknown.

Cultural: unknown.

Known threats: none observed.

Protection Urgency: unknown.

Management Urgency: unknown.

EC6. Outcrop Ecological Community

General description: this community is closely associated with EC5 (which usually borders it) but has been separated here because, even though it is uncommon in the study area, it contains a rather unique set of species; rock faces and outcrops are ignored in most vegetation or community analyses.

Estimated proportion of study area: <1%

Characteristic plants: compact selaginella absent or with low cover.

Biological crust: 15 - >100% cover; *Dominants*: mainly unidentified crustose and foliose lichens (including *Umbilicaria* sp. shown in Fig 11.)

Non-native plants: none observed.

Wildlife: none observed; this type of habitat is often important for snakes as sunning or escape terrain, may also be hibernacula sites. Birds and small mammals may utilize these habitats.

Rare species: none observed.

Tentative BEC classification: BGxw1: unknown.

Elevation: ~980 - 1060 m.

Slope: flat to > 90^{o}

Aspect: flat to all aspects.

Soils: none.

Disturbance: wind/frost.

Evaluation

Biodiversity Significance: probably high.

Condition: probably good.

Key Environmental Factors: unknown.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: unknown.

Cultural: unknown.

Known threats: none observed.

Protection Urgency: unknown.

Management Urgency: unknown.

C. Forest/ Ecological Communities

EC7. Douglas-fir-dominated Ecological Community

Description

General description: this is a difficult community to characterize as it appears, in most instances, to be the result of fire suppression; it is comprised of almost 100% Douglas-fir that often forms >80% canopy closure; various layers of ingrowth are present at most sites, representing successful germination and growth years for the invading trees; the large majority of trees are under 20cm DBH; most areas appear, because of the high density of the stands and the abundant litter, to be high fire hazards; veteran Douglas-fir trees are scattered across the landscape (Fig. 14), often with large amounts of litter and weeds, in particular cheatgrass, beneath them (this makes these vets more susceptible to damage by fire); as ingrowth develops and shade and litter increase, there is a succession from grassland species, such as bluebunch wheatgrass, to more shade tolerant species, such as stiff needlegrass, until, in the most shaded sites, there is very little or no herbaceous understory.

Estimated proportion of study area: 25%

Characteristic plants: *Dominants*: Douglas-fir; *non-dominant indicators*: rose species, stiff needlegrass, Kentucky bluegrass (possibly native), pinegrass.

Biological crust: 0 - 2 (- >90% rare) cover (depending on disturbance); *Dominants*: *Cladonia* spp. (probably different species than in open grasslands), *Brachythecium albicans*; *non-dominant indicators*: *Peltigera britannica*, *Peltigera* species, *Pleurozium schreberi*, *Rhytidiadelphus triquetris*, *Dicranum scoparium*.

Non-native plants: cheatgrass (especially under Douglas-fir vets), other brome species, spotted knapweed, crested wheatgrass, bull thistle.

Wildlife: Important for open habitat raptors for perching and nesting sites; important food sources for pileated woodpecker and grouse.

Rare species: none observed.

Tentative BEC classification: PPxh2: ?01; IDFxh2: ?01.

Elevation: ~850 - 1030 m.

Slope: flat to > 25^{o}

Aspect: flat to 40^{o}- 260^{o}

Soils: unknown.

Disturbance: minor livestock utilization, mainly trails; roads, some bulldozer activity.

Evaluation

Biodiversity Significance: low.

Condition: fair to poor because of ingrowth.

Key Environmental Factors: large extent and has caused reduction of grasslands.

Potential for rare organisms: low.

Global/BC/regional importance: minimal.

Connectivity: none; reduces connectivity of grasslands at the regional level.

Cultural: unknown.

Known threats: development.

Protection Urgency: low.

Management Urgency: high (to reduce the fire hazard).

EC8. Aspen-dominated Ecological Community

Description

General description: aspen communities are found in and alongside gullies, especially in the higher elevation portions of the study area; they are characterized by various aged trees with a near closed to open canopy; the understory is usually dominated by rhizomatous grasses and, sometimes, shrubs.

Estimated proportion of study area: <10%

Characteristic plants: *Dominants*: trembling aspen, rose species, Kentucky bluegrass (possibly native), stiff needlegrass; *non-dominant indicators*: Douglas-fir, snowberry, rabbit-bush.

Biological crust: 0 - ?; none observed (high litter and vascular plant cover).

Non-native plants: cheatgrass, mullein, Russian olive.

Wildlife: none observed; probably high nesting and/or cover habitat for birds and other wildlife.

Rare species: none observed.

Tentative BEC classification: BGxh1: ?05; IDFxh2: 10-YS, (08-YS).

Elevation: ~800 - 1000 m.

Slope: flat to > ~15^{o} (often in gullies of variable slope).

Aspect: mainly north-facing, but on all aspects.

Soils: unknown.

Disturbance: livestock trampling/grazing, berm construction (Fig. 15).

Evaluation

Biodiversity Significance: unknown.

Condition: probably fair; reduced because of livestock utilization.

Key Environmental Factors: unknown.

Potential for rare organisms: low.

Global/BC/regional importance: unknown.

Connectivity: unknown.

Cultural: unknown.

Known threats: disturbance from livestock.

Protection Urgency: unknown.

Management Urgency: unknown.

D. Wetland Ecological Communities

These communities comprise only a small percent (<1%) of the Aberdeen study area. Generally they are either flat to gently sloped, and dominated by grasses, sedges, and forbs. Shrubs are absent.

EC9. Alkaline pond complex Ecological Community

Description

General description: these complexes are characterized, usually, by distinct vegetation zonation patterns from the edge of lake outwards (these zones have been classified as separate units in

the BEC system but appear to be closely linked ecologically); woody vegetation is absent and graminoids dominate most of the zones, except for the inner red glasswort zone, when present; the alkaline soils result from centuries of drainage into the ponds followed by evaporation into summer, leaving salts (alkali) behind.

Estimated proportion of study area: <2%

Characteristic plants: *Dominants*: foxtail barley, alkali saltgrass, Nuttall's alkaligrass, red glasswort; *non-dominant indicators*: golden dock, Baltic rush, rush species, seacoast bulrush, black-footed sedge, spike-rush species, rayless alkali aster, silverweed, chenopod species, horseweed, tufted white prairie aster.

Biological crust: 0 - >50% cover (depending on disturbance); *Dominants*: *Drepanocladus* sp., alkaline wing-nerved moss (both species only common on one part of different sites); *non-dominant indicators*: *Bryum* spp.

Non-native plants: sow-thistle species, bull thistle, brome species.

Wildlife: Wilson's snipe, sandhill crane, ring-necked duck, mallard, American coot, bufflehead.

Rare species: alkaline wing-nerved moss near rock along shore (SARA Threatened; CDC Red Listed), sandhill crane (CDC Blue Listed).

Tentative BEC classification: IDFxh2: Gs01-03.

Elevation: ~850 - 970 m.

Slope: flat to > 5^{o}

Aspect: flat to all aspects.

Soils: stony/gravelly to fine textured; high Ph.

Disturbance: high livestock trampling and trails at most sites (Fig. 18), man-made ditch between two pond (presumably for better drainage; Fig. 19).

Evaluation

Biodiversity Significance: high.

Condition: ranging from excellent to poor because of livestock utilization at some sites.

Key Environmental Factors: wetlands that attract wildlife (more important in arid ecosystems than forested ecosystems).

Potential for rare organisms: high.

Global/BC/regional importance: high.

Connectivity: unknown.

Cultural: unknown.

Known threats: disturbance from livestock heavy to moderate.

Protection Urgency: high.

Management Urgency: high.

EC10. Alkaline seepage slope Ecological Community

Description

General description: this is a habitat where groundwater seepage occurs along a slope resulting in the presence of alkaline soils and characteristic plants, in particular alkali saltgrass.

Estimated proportion of study area: < 01%

Characteristic plants: *Dominants*: alkali saltgrass; *non-dominant indicators*: not reported.

Biological crust: 0 - >50% cover (depending on disturbance); *Dominants*: none reported; *non-dominant indicators*: *Bryum* spp., *Ceratodon purpureus*.

Non-native plants: brome species.

Wildlife: none observed.

Rare species: none observed.

Tentative BEC classification: BGxw1xh2: Gs01-03.

Elevation: ~750 - 850 m.

Slope: ~ 2 - 5^{o}

Aspect: north to east.

Soils: gravelly fines; high Ph.

Disturbance: high livestock trampling.

Evaluation

Biodiversity Significance: high.

Condition: mostly fair to poor because of livestock utilization.

Key Environmental Factors: unknown.

Potential for rare organisms: moderate.

Global/BC/regional importance: high.

Connectivity: unknown.

Cultural: unknown.

Known threats: Disturbance from livestock heavy.

Protection Urgency: high.

Management Urgency: high.

E. Uncertain Vegetation Units

These units have not been investigated in detail and, as such, have not been given EC status, although this may be done at some point. The first unit (and possibly the second) is related to the study areas complex, post-glacial drainage pattern.

1. Seasonally-wet gullies (riparian gullies) are found on some slopes and appear closely related to aspen copses, probably because of the higher availability of water; some of these gullies have been bermed presumably to gather water in spring for livestock.
2. Kentucky bluegrass dominates some fairly extensive flats and low areas in the upper west side of the study area; these may reflect heavy livestock use in the past but this is unknown.
3. Idaho fescue appears to be the dominant grass on an extensive slope on the east side of the property; however, field conditions were poor that day, and no plants had any flowering stalks remaining to confirm identification.
4. Ponderosa pine forests may be present on lower slopes (at this time they are included in Douglas-fir-dominated Ecological Community).

F. Disturbed Sites

Numerous flats, roadsides, and piles of soil and other debris are common along the lower edges of the grasslands. Knapweed can dominate in these sites (>85% cover).

APPENDIX H. SAMPLE PHOTOGRAPHS OF ECOLOGICAL COMMUNITIES

EC1: Bluebunch Wheatgrass-dominated Ecological Community (near WP125)

EC1: Bluebunch Wheatgrass-dominated Ecological Community (near WP114)

Livestock-degraded EC1 (near WP5)

EC2: Bluebunch Wheatgrass-Rough Fescue Ecological Community (near WP147)

EC3: Bluebunch Wheatgrass-dominated Ecological Community on Thin Soils (near WP24)

Biological crust (mainly lichens) in EC3 (near WP24)

EC4: Bluebunch wheatgrass-dominated Ecological Community on talus slopes (near WP113)

EC5: Compact selaginella-dominated Ecological Community (near WP 109)

EC6: Outcrop Ecological Community surrounded by EC5 (surrounded by EC5; near WP 136)

EC7: Douglas-fir-dominated Ecological Community (near WP 80)

EC7: Douglas-fir-dominated Ecological Community (near WP 86)

Douglas-fir veteran in EC7 (near WP 107)

EC8: Aspen-dominated Ecological Community showing constructed berm in gully (near WP 10)

EC8: Aspen-dominated Ecological Community (near WP 100)

EC9: Alkaline pond complex Ecological Community (near WP 118)

EC9: Alkaline pond complex Ecological Community (near WP 126)

APPENDIX I. POTENTIAL SPECIES AT RISK IN THE ABERDEEN STUDY AREA

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Birds	Western Grebe	Aechmophorus occidentalis	Red		Unlikely	No habitat; all local records from large lakes such as Kamloops & Nicola.
	Great Blue heron, *herodias* subspecies	Ardea herodias herodias	Blue		Possible	Concentrations of this species mostly occur along South Thompson River (CDC), but there are ponds in the study area.
	Short-eared Owl	Asio flammeus	Blue	SC (May 1994)	Likely	800 m south in 1999 & 2000 (CDC). Regular but unpredictable winter records in grasslands above Goose Lk Road; potential breeder as this species has bred within several km of site in Knutsford area.
	Burrowing Owl	*Athene cunicularia*	Red	E (Apr 2006)	Unlikely	Reintroduction sites not in vicinity of study area
	American Bittern	Botaurus lentiginosus	Blue		Unlikely	No suitable habitat. All records from more extensive wetlands near large lakes.
	Swainson's Hawk	Buteo swainsoni	Red		Likely	100 m east in 2003 (CDC). Regular small population along Goose Lk Rd and in Knutsford area from late April - early Sept. Breeds
	Common Nighthawk	Chordeiles minor	Yellow	T (Apr 2007)	Confirmed	11 individuals seen flying over study area in the early evening of August 4, 2007 (Richard Doucette Pers. Comm.)
	Lark Sparrow	Chondestes grammacus	Red		Unlikely	small breeding population in the valley bottom at Kamloops. No suitable habitat in study area.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Birds (cont.)	Bobolink	Dolichonyx oryzivorus	Blue		Unlikely	7 km north in 2002 (CDC). All local records from alfalfa/timothy hayfields near Tranquille. No habitat in study area.
	Prairie Falcon	Falco mexicanus	Red	NAR (May 1996)	Possible	Migrants have been observed in Knutsford area during the spring & fall. Nesting has occurred in NW Kamloops. No nesting habitat in study area.
	Peregrine Falcon, *anatum* subspecies	Falco peregrinus anatum	Red	SC (Apr 2007)	Possible	No nesting habitat. Migrants occur in Knutsford area.
	Sandhill Crane	Grus canadensis	Blue	NAR (May 1979)	Confirmed	Confirmed during fall 2007 field work; 5 sightings from 1980 - 2001 (CDC). No nesting habitat. All birds will be migrants and most will fly over the area but some could put down on ground near wetlands.
	Barn Swallow	Hirundo rustica	Blue		Possible	Possible migrants or summer foraging if buildings nearby for nesting.
	Western Screech-Owl, *macfarlanei* subspecies	Megascops kennicottii macfarlanei	Red	E (May 2002)	Unlikely	Very few local records. All associated with lowland riparian habitats. No typical habitat in study area.
	Lewis's Woodpecker	Melanerpes lewis	Red	SC (Nov 2001)	Confirmed	Observations of species & nest on eastern side of study area near Highway 5A in 1999 (CDC)
	Long-billed Curlew	Numenius americanus	Blue	SC (Nov 2002)	Likely	300 m & 700 m south east in 2001 (CDC) Regular summer breeder in Knutsford area.
	Flammulated Owl	Otus flammeolus	Blue	SC (Nov 2001)	Possible	10 km west in 1998 (CDC) Habitat types have not been checked for suitability. Prefers IDFdk sites with older fir vets present c/w cavities. Likelihood low.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Birds (cont.)	American Avocet	Recurvirostra americana	Red		Unlikely	6 km west in 1994 (CDC). Prefers alkali ponds with small island for nest. Possibly migrants could stopopver briefly if wetlands have invertebrate populations.
	Williamson's Sapsucker, *thyroideus* subspecies	Sphyrapicus thyroideus thyroideus	Red	E (May 2005)	Unlikely	6.5 km south in 1995 (CDC). Typical habitat at these latitudes includes older Douglas Fir c/w aspens for nest sites. Only a few scattered records at higher elevations.
	Brewer's Sparrow, *breweri* subspecies	Spizella breweri breweri	Red		Unlikely	No suitable habitat. Recorded periodically around Kamloops but restricted to Big Sagebrush habitats.
	Sharp-tailed Grouse, *columbianus* subspecies	Tympanuchus phasianellus columbianus	Blue		Confirmed	two lek sites occurs in the south west corner of the study area, which was last observed in 2001; presence of species confirmed during fall 2007 field work; two additional leks occur approximately 700m south with both last observed in 2001 (CDC). Local leks active in 2006 and likely 2007 but not confirmed.
Insects	Monarch	Danaus plexippus	Blue	SC (Nov 2001)	Unlikely	Likely no Milkweed as host plant. All observations from lower valley bottom near Kamloops.
Mammals	Townsend's Big-eared Bat	Corynorhinus townsendii	Blue		Possible	Summer forested habitats for foraging not completely known at Kamloops. No likely winter hibernaculum sites (caves, mineshafts). Occurs west of Tranquille
	Spotted Bat	Euderma maculatum	Blue	SC (May 2004)	Possible	3 km north east in 1994 (CDC) No typical cliff habitats for roosting.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Mammals (cont.)	Wolverine, *luscus* subspecies	Gulo gulo luscus	Blue	SC (May 2003)	Unlikely	No suitable habitat.
	Fisher	Martes pennanti	Blue		Unlikely	No suitable habitat.
	Western Small-footed Myotis	Myotis ciliolabrum	Blue		Unlikely	Seems to prefer some larger waterbodies and riparian associations such as along South Thompson River.
	Fringed Myotis	Myotis thysanodes	Blue	DD (May 2004)	Unlikely	Seems to prefer some larger waterbodies and riparian associations such as along South Thompson River.
	Bighorn Sheep	Ovis canadensis	Blue			
	Great Basin Pocket Mouse	Perognathus parvus	Red		Unlikely	Preferred habitats are lower grasslands along Thompson Valley.
	Badger	Taxidea taxus	Red	E (May 2000)	Confirmed	Species occurs in northern part of study area (residential neighbourhoods of Aberdeen) and was last observations were in 2001. There is also occurrence of this species in similar habitat to the south (4 km away) (CDC).
	Grizzly Bear	Ursus arctos	Blue	SC (May 2002)	Unlikely	No habitat; outside typical range.
Reptiles	Western Painted Turtle - Intermountain - Rocky Mountain Population	Chrysemys picta pop. 2	Blue	SC (Apr 2006)	Unlikely	No typical wetland habitat.
	Racer	Coluber constrictor	Blue	SC (Nov 2004)	Possible	3 km north east in 2000 (CDC)
	Western Rattlesnake	Crotalus oreganus	Blue	T (May 2004)	Unlikely	Very few sightings on the south of the South Thompson River (CDC). Likely too high despite some upper elevation records above hot grasslands.

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
	Gopher Snake, *deserticola* subspecies	Pituophis catenifer deserticola	Blue	T (May 2002)	Possible	approx 500 m north in 1999 & 2000; one record 700 m northeast date unknown (CDC)
Amphibi-ans	Great Basin Spadefoot	Spea intermontana	Blue	T (Apr 2007)	Likely	Species occurs in similar bodies of water to the west (2 km) (Francis Iredale Pers. Comm.) and southeast (4 km) (CDC); in 2006, New Gold Inc. (Rescan Environmental Services Ltd. 2007) confirmed presence 8 km west
	Western Toad	Bufo boreas	Yellow	SC (Nov 2002)	Possible	wetlands may provide breeding sites?
Vascular plants	pink agoseris	*Agoseris lackschewitzii*	Blue		Unlikely	
	Geyer's onion	*Allium geyeri* var. *tenerum*	Blue		Unlikely	unlikely as vegetation is very sparse
	western dogbane	*Apocynum* x *floribundum*	Blue		Unlikely	
	woody-branched rockcress	*Arabis lignifera*	Blue		Possible	4 km north east in 1953 (CDC)
	sickle-pod rockcress	*Arabis sparsiflora*	Red		Possible	
	silvery sagebrush	*Artemisia cana* ssp. *cana*	Red		Unlikely	
	threadstalk milk-vetch	*Astragalus filipes*	Blue		Unlikely	Discovered in BEC plot # K99-031 8 km north (Lloyd); 2.5 km north east in 1983 (CDC)
	freckled milk-vetch	*Astragalus lentiginosus*	Red		Possible	3 km west in 1953 and 2 km south east in 1965 (CDC)
	silvery orache	*Atriplex argentea* ssp. *argentea*	Red		Unlikely	
	wedgescale orache	*Atriplex truncata*	Red		Unlikely	
	Mexican mosquito fern	*Azolla mexicana*	Red	T (May 2000)	Unlikely	

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Vascular plants (cont.)	tall beggarticks	*Bidens vulgata*	Red		Unlikely	
	blue grama	*Bouteloua gracilis*	Red		Unlikely	
	Hudson Bay sedge	*Carex heleonastes*	Blue		Unlikely	
	porcupine sedge	*Carex hystricina*	Blue		Unlikely	
	lakeshore sedge	*Carex lenticularis* var. *lenticularis*	Red		Unlikely	
	many-headed sedge	*Carex sychnocephala*	Blue		Possible	
	dry-land sedge	*Carex xerantica*	Red		Possible	
	Cusick's paintbrush	*Castilleja cusickii*	Red		Unlikely	
	western centaury	*Centaurium exaltatum*	Red		Unlikely	
	American chamaerhodos	*Chamaerhodos erecta* ssp. *nuttallii*	Blue		Unlikely	
	thyme-leaved spurge	*Chamaesyce serpyllifolia* ssp. *serpyllifolia*	Blue		Unlikely	
	pigmyweed	*Crassula aquatica*	Blue		Unlikely	
	slender hawksbeard	*Crepis atribarba* ssp. *atribarba*	Red		Possible	
	low hawksbeard	*Crepis modocensis* ssp. *modocensis*	Red		Possible	
	western low hawksbeard	*Crepis modocensis* ssp. *rostrata*	Red		Possible	
	awned cyperus	*Cyperus squarrosus*	Blue		Unlikely	
	crested wood fern	*Dryopteris cristata*	Blue		Unlikely	
	purple-leaved willowherb	*Epilobium ciliatum* ssp. *watsonii*	Blue		Unlikely	

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Vascular plants (cont.)	Hall's willowherb	*Epilobium halleanum*	Blue		Unlikely	
	giant helleborine	*Epipactis gigantea*	Blue	SC (May 1998)	Unlikely	
	scarlet gaura	*Gaura coccinea*	Red		Unlikely	
	dwarf groundsmoke	*Gayophytum humile*	Blue		Unlikely	
	slender mannagrass	*Glyceria pulchella*	Blue		Unlikely	
	mock-pennyroyal	*Hedeoma hispida*	Red		Unlikely	
	mountain sneezeweed	*Helenium autumnale* var. *grandiflorum*	Blue		Unlikely	
	porcupinegrass	*Hesperostipa spartea*	Red		Possible	
	hutchinsia	*Hutchinsia procumbens*	Red		Possible	
	western St. John's-wort	*Hypericum scouleri* ssp. *nortoniae*	Blue		Unlikely	
	Howell's quillwort	*Isoetes howellii*	Red		Unlikely	
	poverty-weed	*Iva axillaris* ssp. *robustior*	Red		Unlikely	
	prairie pepper-grass	*Lepidium densiflorum* var. *pubicarpum*	Red		Unlikely	
	northern linanthus	*Linanthus septentrionalis*	Blue		Possible	
	false-pimpernel	*Lindernia dubia* var. *anagallidea*	Blue		Unlikely	
	silvery lupine	*Lupinus argenteus* var. *laxiflorus*	Red		Unlikely	
	Suksdorf's lupine	*Lupinus bingenensis* var. *subsaccatus*	Red		Unlikely	
	hairy water-clover	*Marsilea vestita*	Red		Unlikely	
	purple oniongrass	*Melica spectabilis*	Blue		Unlikely	

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Vascular plants (cont.)	bristly mousetail	*Myosurus apetalus* var. *borealis*	Red		Possible	
	Ussurian water-milfoil	*Myriophyllum ussuriense*	Blue		Possible	
	needle-leaved navarretia	*Navarretia intertexta*	Red		Unlikely	
	satinflower	*Olsynium douglasii* var. *inflatum*	Red		Unlikely	
	northern adder's-tongue	*Ophioglossum pusillum*	Blue		Unlikely	
	flat-topped broomrape	*Orobanche corymbosa* ssp. *mutabilis*	Red		Possible	
	mutton grass	*Poa fendleriana* ssp. *fendleriana*	Red		Possible	
	dotted smartweed	*Polygonum punctatum*	Blue		Possible	
	toothcup meadow-foam	*Rotala ramosior*	Red	E (May 2000)	Unlikely	
	peach-leaf willow	*Salix amygdaloides*	Red		Unlikely	
	Booth's willow	*Salix boothii*	Blue		Unlikely	
	rivergrass	*Scolochloa festucacea*	Red		Unlikely	Discovered in BEC plot # 9628827 7 km west (Lloyd)
	lance-leaved figwort	*Scrophularia lanceolata*	Blue		Unlikely	
	plains butterweed	*Senecio plattensis*	Blue		Unlikely	
	Oregon checker-mallow	*Sidalcea oregana* var. *procera*	Red		Unlikely	
	scarlet globe-mallow	*Sphaeralcea coccinea*	Red		Unlikely	

Class	Common name	Latin name	BC listing	COSEWIC listing	Occurrence in the study area	Comments
Vascular plants (cont.)	slender wedgegrass	*Sphenopholis intermedia*	Blue			
	prairie wedgegrass	*Sphenopholis obtusata*	Red		Unlikely	
	rough dropseed	*Sporobolus compositus* var. *compositus*	Blue		Possible	
	sheathing pondweed	*Stuckenia vaginata*	Blue		Unlikely	
	Okanogan fameflower	*Talinum sediforme*	Blue	NAR (May 1990)	Unlikely	
Non-vascular plants	rusty cord-moss	*Entosthodon rubiginosus*	Red	E (Nov 2004)	Possible	
	Alkaline wing-nerved moss	*Pterygoneurum kozlovii*	Red	T (Nov 2004)	Confirmed	

APPENDIX J. POTENTIAL WILDLIFE IN THE ABERDEEN STUDY AREA FOR HABITATS AND BIOGEOCLIMATIC UNITS USED BY CHARACTERISTIC AND LISTED GRASSLAND FAUNA IN THE THOMPSON-PAVILION (ADAPTED FROM GCC 2004)

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Reptiles and Amphibians											
Common Garter Snake		X		X	X	X	X	X	X	X	
Gopher Snake	B	X	X		X		X	X			
Great Basin Spadefoot	B			X	X	X		X		X	X
Long-toed Salamander		X		X	X	X	X	X	X		
Northern Alligator Lizard			X		X	X	X			X	
Painted Turtle	B			X			X			X	
Racer	B		X		X					X	
Rubber Boa	B	X	X		X	X					
Spotted Frog				X	X	X	X	X	X	X	
Western Garter Snake		X	X	X	X	X	X	X		X	X
Western Rattlesnake	B		X		X	X	X	X			
Western Skink	B		X		X	X	X			X	
Western Toad			X	X	X	X	X	X	X	X	
Birds											
American Coot				X		X	X	X	X	X	

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
American Crow		X	X	X	X	X	X	X	X	X	
American Kestrel		X	X	X	X	X	X	X	X	X	
American Robin		X			X	X	X	X	X	X	
American Wigeon		X		X		X	X			X	
Barn Swallow		X		X	X	X	X	X	X	X	
Barrow's Goldeneye		X	X	X	X	X	X			X	
Black-billed Magpie			X		X	X	X	X	X	X	
Blue Grouse		X	X	X	X	X	X	X	X	X	
Bobolink	B				X	X		X		X	
Brewer's Blackbird		X	X		X	X	X	X	X	X	
Brown-headed Cowbird			X		X	X	X	X	X	X	
Bufflehead		X		X	X	X	X			X	
Burrowing Owl	R				X	X					X
Canada Goose		X	X	X	X	X	X	X	X	X	
Canvasback				X		X	X	X	X	X	
Clark's Nutcracker			X		X	X	X	X	X	X	
Cliff Swallow				X	X	X	X	X	X	X	
Common Goldeneye		X	X	X		X	X	X	X	X	
Common Loon				X		X	X	X		X	

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Common Nighthawk			X	X	X	X	X	X	X	X	
Common Poorwill			X		X	X	X	X	X	X	
Common Raven		X	X	X	X	X	X	X	X	X	
Cooper's Hawk		X	X	X	X	X	X	X	X	X	
Eared Grebe				X	X	X	X	X		X	
Eastern Kingbird		X		X	X	X	X	X	X	X	
Flammulated Owl	B	X	X					X	X	X	X
Golden Eagle		X		X	X	X	X	X	X	X	
Great Blue Heron	B	X			X	X		X			
Great Horned Owl		X	X	X	X	X	X	X	X	X	
Greater Scaup				X		X	X	X	X	X	
Hairy Woodpecker		X	X			X	X	X	X	X	
Horned Lark					X		X	X	X	X	X
Killdeer				X	X	X	X	X	X	X	
Least Sandpiper				X	X	X	X	X	X	X	
Lesser Scaup				X		X	X	X	X	X	
Lewis's Woodpecker	B		X		X	X	X	X		X	
Long-billed Curlew	B				X		X				
Mallard		X		X	X	X	X	X	X	X	
Marsh Wren				X		X	X	X	X	X	
Merlin		X	X	X	X	X	X	X	X	X	

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Mountain Bluebird					X	X	X	X		X	
Mourning Dove		X	X		X	X	X	X	X	X	
Northern Flicker		X	X		X	X	X	X	X	X	
Northern Pygmy Owl		X	X	X	X	X	X	X	X	X	
Northern Saw-whet Owl		X		X				X		X	
Osprey			X	X	X	X	X			X	
Pileated Woodpecker		X	X			X	X	X	X	X	
Prairie Falcon	R			X	X						X
Pygmy Nuthatch		X	X		X	X	X	X	X	X	
Red-breasted Nuthatch		X	X		X	X	X	X	X	X	
Redhead				X		X	X			X	
Red-tailed Hawk		X	X	X	X	X	X	X	X	X	
Red-winged Blackbird				X		X	X	X	X	X	
Rock Wren					X	X	X	X	X	X	
Ruddy Duck				X						X	
Ruffed Grouse		X	X	X	X			X	X	X	
Rufous Hummingbird			X		X			X	X	X	
Spotted Towhee		X	X					X	X	X	
Sharp-tailed Grouse	B				X		X		X		X

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Sora		X		X	X			X			
Swainson's Hawk	B			X	X			X	X	X	
Tundra Swan				X				X	X	X	
Turkey Vulture			X		X			X	X	X	
Vaux's Swift		X	X	X	X			X	X	X	
Vesper Sparrow					X			X	X	X	
Western Bluebird			X		X						
Western Kingbird			X		X						
Western Meadowlark			X		X			X	X	X	
Western Screech-Owl	R	X	X		X			X			
White-breasted Nuthatch		X	X					X	X	X	
White-throated Swift	B			X	X	X				X	
Yellow -headed Blackbird				X	X			X	X	X	
Mammals											
Badger	R		X		X	X	X	X			X
Beaver		X		X				X	X	X	
Big Brown Bat		X		X	X			X	X	X	
Black Bear		X	X		X			X	X	X	
California Bighorn Sheep	B					X	X	X			X

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Coyote		X	X	X	X			X	X	X	
Deer Mouse		X	X	X	X			X	X	X	
Hoary Bat			X	X	X			X	X	X	
Little Brown Myotis			X	X	X			X	X	X	
Long-tailed Vole		X		X	X			X	X	X	
Long-tailed Weasel		X	X	X	X			X	X		
Meadow Jumping Mouse				X	X				X	X	
Meadow Vole		X	X	X	X			X	X	X	
Mule Deer		X	X	X	X			X	X	X	
Muskrat				X				X	X	X	
Northern Bog Lemming				X	X				X	X	
Red Fox		X	X	X	X			X	X	X	
Red Squirrel		X	X					X	X	X	
Rocky Mountain bighorn	B		X		X					X	
Rocky Mountain Elk			X	X	X			X	X	X	
Striped Skunk		X		X	X			X	X	X	
Western Long-eared Myotis			X	X				X	X	X	
White-tailed Deer		X	X	X	X			X	X	X	
Yellow -bellied Marmot			X		X			X	X	X	

Life-Form/Common Name	Status	Aspen	Parkland	Wetland	Steppe	BGxh2	BGxw1	PPxh2	IDFdk1	IDFxh1	IDFxh2
Yellow-pine Chipmunk		X	X		X			X	X	X	
Yuma Myotis		X	X	X	X			X	X	X	

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