

**BIOPHYSICAL IMPACT ASSESSMENT  
ECOLOGICAL COMPONENT  
BASELINE**

**Spy Hill Lands**

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## EXECUTIVE SUMMARY

URSUS Ecosystem Management Ltd. (URSUS) was retained in August 2002 by Brown and Associates Planning Group to conduct an ecological assessment of two sections of land (Section 33-25-2w5 and Section 28-25-2w5) in the NW corner of the City of Calgary. The scope of URSUS' assessment was the terrestrial ecological component of a biophysical impact assessment. This report is the biophysical inventory and evaluation component (Phase 1) of the overall project. A companion report is being prepared that will assess the impacts of proposed land use on wildlife and habitat and will propose impact mitigation approaches.

A number of inventory, assessment and planning sources were obtained and reviewed in order to assess the local and regional ecological significance of the subject lands. Two site visits were completed on 30 August 2002 and on 26 September 2002 by URSUS senior ecologists. Natural and man-induced (disturbed) habitats on the property were classified and mapped using interpretation of 1:10,000-scale color photographs and field visits.

A habitat type classification from the Calgary Natural Areas Management Plan was followed for the purpose of regional habitat supply comparison. A literature review was used to identify rare plants and plant associations that could occur in and adjacent to the Spy Hill lands. The floristic and structural diversity of mapped habitat types was subjectively rated as high, medium or low using plant species richness measurements conducted for related habitat types within the City of Calgary. The amount of current human disturbance on habitat types was subjectively rated as high, medium or low based on evidence of human use livestock grazing pressure and the proportion of habitat that supports introduced (non-native) plant species. Areas with low levels of human disturbance and high proportions of introduced plant species were considered to have low levels of native integrity. The relative ecological significance of mapped habitat types was measured and/or subjectively rated for seven factors - floristic diversity, native habitat integrity, structural diversity, local habitat type rarity, regional rarity of habitat types, composite wildlife habitat suitability ratings, and potential of habitat types to support rare plants.

A list of the status and abundance of vertebrate wildlife species known, or expected, to occur during some portion of the year within the Spy Hill study area was developed using local, regional and provincial references and the authors' experience. From this list, vertebrate species at risk were identified based on recent regulatory status documents. Other than incidental sightings associated with the reconnaissance field visits no wildlife field surveys were conducted as part of the current study. With reference to literature, first-hand knowledge of each habitat gained during the reconnaissance site visits, and the authors' knowledge of wildlife-habitat relationships in the Calgary region, the suitability of each mapped habitat type was assessed for all vertebrate species at risk using a 5 class rating system from very low to very high.

Seven of the 10 habitat types identified by Calgary Parks and Recreation occur on the Spy Hill Study Area - Aspen Forest, Balsam Poplar Forest, Upland Tall Shrub, Low Shrub, Native Grassland, Non-native (Disturbed) Grassland and Wetland (Wet Graminoid). Twenty-eight rare plants have potential to occur in the study area. Detailed rare plant surveys have not been undertaken for this assessment. Based on plant searches on other properties, the number of rare plants found is typically a small percentage (usually <10%) of the number that could potentially occur. Two rare

plant communities were found on the property - Wolfwillow Shrubland and Bebb's Willow/Wild Red Raspberry/Wild White Geranium.

Native rough fescue grasslands (NG), (ravine) upland tall shrub (UTS) and aspen (Aw) and balsam poplar (Pb) forest likely support the highest floristic diversity on the property. Habitats with the highest levels of structural diversity are balsam poplar forest (Pb), aspen forest (Aw), and upland tall shrub (UTS), particularly in ravine settings. In the context of the Calgary region, the least common habitats found are wet graminoid and upland tall shrub in ravines.

Twenty-six vertebrate species at risk have potential to occur as summer, winter or year-round residents, migrants or transients on the Spy Hill lands comprised of 17 birds, 5 mammals, and 4 amphibians and reptiles. Fifteen of twenty-six species at risk with potential to occur on the property have habitat rated as high-very highly suitable with native grassland the most important habitat from this perspective. The property likely is important to local movement of wildlife but is not significant regionally.

Willow groveland (a mosaic of upland tall shrub, fescue grassland and aspen forest) and upland tall shrub were rated as highly significant for six and five of seven significance criteria respectively. Balsam poplar forest was rated as high for four criteria. The regional rarity of these habitats combined with their productivity for wildlife and plants make them the most ecologically important habitats on the Spy Hill property. Given its suburban/country residential character the effects of fragmentation have already occurred to a great extent in, and especially around, the Spy Hill lands. However in the context of remaining native lands within The City of Calgary the Spy Hill lands support relatively large patches of native vegetation, particularly the willow groveland and ravine habitats.

## 1.0 INTRODUCTION

URSUS Ecosystem Management Ltd. (URSUS) was retained in August 2002 by Brown and Associates Planning Group (B & A) to conduct an ecological assessment of two sections of land (Section 33-25-2w5 and Section 28-25-2w5) in the NW corner of the City of Calgary (Figure 1). The scope of URSUS' assessment was the terrestrial ecological component of a biophysical impact assessment. Specific tasks of this assessment were:

- locating and compiling previous ecological inventory, assessment and planning reports and information relevant to the subject lands;
- scientific literature review as appropriate;
- field site reconnaissance to classify habitat types and land use characteristics; and
- assessment of the local and regional ecological significance of habitat types occurring on the lands for selected ecological attributes (e.g. plant diversity, wildlife habitat, native integrity);

This report is the biophysical inventory and evaluation component (Phase 1) of the overall project. A companion report is being prepared that will assess the impacts of proposed land use on wildlife and habitat and will propose impact mitigation approaches.

## 2.0 METHODS

### 2.1 Review of Regional Ecological Information Sources

A number of inventory, assessment and planning sources were obtained and reviewed in order to assess the local and regional ecological significance of the subject lands. The following specific documents were referenced:

- Alberta Natural Heritage Information Center Rare Plant Tracking List (2002).
- Paskapoo Slopes: habitat and environmentally significant areas maps and report (Calgary Parks and Recreation 1997).
- The City of Calgary's Natural Area Management Plan (Calgary Parks and Recreation 1994).
- Calgary Urban Parks Program biophysical assessments (GAIA et al. 1993).
- Biophysical and land use inventory and analysis of Nose Hill Park (Sentar 1993).
- Biophysical inventory and analysis of three environmentally sensitive areas within the Calgary Restricted Development Area (RDA) (Strong and Kansas 1984).
- Soil survey of the Municipal District of Rocky View No. 44, Alberta (Turchenek and Fawcett 1994).
- Soil survey of the Calgary urban perimeter (MacMillan 1987).
- Environmentally significant areas of Alberta (Sweetgrass Consultants 1997)
- Ecodistricts of Alberta – Summary of Biophysical Attributes (Strong and Thompson 1995)

### 2.2 Site Visit

Two site visits were completed. The first was a reconnaissance site visit to acquaint URSUS staff with the study area's ecology and land use. This occurred on 30 August 2002 with Ron Wrigley and Jason Maynes of Brown and Associates. The second was a detailed site visit on 26 September 2002 by URSUS senior ecologists. All habitat types on the property were visited on foot. Notes concerning vegetation, topography, landforms and wildlife habitat were taken at 59 sampling sites. Information included at these plots included vegetation association based on dominant shrubs and vascular plants; slope angle and aspect; and a subjective rating of grazing intensity. Photographs were taken of representative habitat types and land uses. All significant wildlife observations were noted. Photographs were obtained at most sites. All sites were mapped on a 1:10,000 scale color aerial photograph. Vegetation cover type classes were noted for selected air photo signatures in order to facilitate mapping of habitat types.

### **2.3 Habitat Supply Assessment**

Natural and man-induced (disturbed) habitats on the property were classified and mapped using interpretation of 1:10,000-scale color photographs and field visits. A habitat type classification from the Calgary Natural Areas Management Plan (Calgary Parks and Recreation 1994) was followed for the purpose of regional habitat supply comparison. Areas of each mapped habitat type were measured in a GIS. The significance (rarity) of habitats found on the Spy Hill property was assessed in light of the supply of similar habitats in the Calgary region. No current inventory studies are available that provide an accurate measure of the supply of native habitat types in the greater Calgary region. The Calgary Urban Parks Project ecological inventory and assessment (GAIA 1993) provided land areas of habitat types associated with the Bow, Elbow and Nose Creek valleys. Other study areas that have quantified habitat supply in the Calgary area are Nose Hill Park (Sentar 1993) and the Calgary Restricted Development area (Strong and Kansas 1984). Published regional habitat supply mapping is not available for much of the upland areas surrounding the City of Calgary's northwest morainal upland. As such we reviewed a 1:50,000 scale digital color orthophoto (September 1999) and noted relative supply of regionally rare habitats (e.g. upland tall shrub in ravines, willow groveland) in the NW Calgary area surrounding the Spy Hill lands. Although not quantitative measures of current habitat supply, these regional studies help to identify the relative rarity of habitat types in the region.

### **2.4 Rare Plant Survey and Assessment**

A literature review was used to identify rare plants and plant associations that could occur in and adjacent to the Spy Hill lands. Primary sources of information used to develop a list of potential rare plants and associated habitats included Packer and Bradley (1984), Wallis (1987), Sentar (1993) and the Alberta Natural Heritage Information Centre's (ANHIC 2002) rare plant tracking list. Habitat affiliations of the rare plants with potential to occur in the study area were determined when sufficient information was available (Moss 1983; Johnson *et al.* 1995, Kershaw *et al.* 2001). Habitat types with potential to support the highest number of rare plants were considered to be most important.

### **2.5 Vegetation Composition and Structure Analyses**

The floristic and structural diversity of mapped habitat types was subjectively rated as high, medium or low using plant species richness measurements conducted for related habitat types within the City of Calgary (Sentar 1993; URSUS confidential report files).

### **2.6 Disturbance/Native Habitat Integrity Assessment**

The amount of current human disturbance on habitat types was subjectively rated as high, medium or low based on evidence of human use (trails, buildings, garbage etc.), livestock grazing pressure and the proportion of habitat that supports introduced (non-native) plant

species. Areas with low levels of human disturbance and high proportions of introduced plant species were considered to have low levels of native integrity.

## 2.7 Wildlife Species Occurrence and Status

A list of the status and abundance of vertebrate wildlife species known, or expected, to occur during some portion of the year within the Spy Hill study area was developed using local, regional and provincial references (Semenchuk 1992; Russell and Bauer 2000; Smith 1993; Pattie and Fisher 1999), and the authors' experience. From this list, vertebrate species at risk were identified based on recent regulatory status documents (COSEWIC 2002; AEP 2000, 2001). At risk definitions are presented in Table 1. Status and abundance definitions are presented below.

### Status

- S** summer resident, migrates out of study area for the winter
- W** winter resident, present only during late fall, winter and early spring
- R** permanent resident, present year-round although not necessarily active during winter
- M** migrant, passes through area during spring and/or fall, not normally resident at any time of the year
- T** transient, expected to occur only in passing, not normally resident at any time of the year

### Abundance

- C** common, detected whenever suitable habitat is investigated during an appropriate season
- U** uncommon, detected often, but not always, whenever suitable habitat is investigated during an appropriate season
- S** scarce, detected occasionally, but not usually, even when suitable habitat is investigated during an appropriate season
- R** rare, unexpected but could occur in any given year, would not generally be considered a regular component of the study area fauna

## 2.8 Wildlife Field Surveys

Other than incidental sightings associated with the reconnaissance field visits no wildlife field surveys were conducted as part of the current study.



## 2.9 Wildlife Habitat Suitability Assessment

With reference to literature, first-hand knowledge of each habitat gained during the reconnaissance site visits, and the authors' knowledge of wildlife-habitat relationships in the Calgary region, the suitability of each mapped habitat type was assessed for all vertebrate species at risk using the 5 class rating system outlined below.

- 0 (Very Low)**      The habitat type provides neither food nor cover for the species but may be used for travel/dispersal. The habitat type does not contribute to population viability of the species.
  
- 1 (Low)**            The habitat type may be used by the wildlife species in question, however, use is limited to travel, resting, loafing or opportunistic feeding and/or breeding. The habitat type contributes minimally to population viability of the species.
  
- 2 (Moderate)**      The habitat type is used by the species for feeding and/or breeding, but is of sub-optimal quality relative to other habitats. The habitat type may contribute significantly to population viability of the species but only during periods of low environmental stress.
  
- 3 (High)**            The habitat type is an important habitat of the species for feeding and/or breeding. The habitat type contributes significantly to population viability.
  
- 4 (Very High)**      The habitat type is essential to the species for feeding and/or breeding. Few, if any, other habitat types are important to the species. The habitat type is critical to population viability of the species.

## 2.10 Evaluation of Ecological Significance of Habitats

The relative ecological significance of mapped habitat types was measured and/or subjectively rated for seven factors as follows:

- *Floristic diversity* of habitat types;
- *Native habitat integrity* based on a subjective assessment of current human use and grazing pressure;
- *Structural diversity* of habitat types;
- *Local habitat type rarity* based on the ratio of land area of the habitat type on the subject property to the total land area of the property;
- *Regional rarity of habitat types* based on the estimated relative land area (regional supply) of the habitat type in the Calgary UPP area;
- *Composite wildlife habitat suitability ratings* of habitat types for species at risk; and
- *Potential of habitat types to support rare plants* based on literature review and habitat associations.

### 3.0 BASELINE ECOLOGICAL AND LAND-USE DESCRIPTION

#### 3.1 Ecological Regions and Landforms

All of the Spy Hill lands occur within the Foothills Parkland Subregion of the Parkland Natural Region (Alberta Environmental Protection 1994). This ecological zone is characterized by the co-occurrence of aspen forest and native grasslands typified by rough fescue (Sentar 1993). Associated with this mix of vegetation are upland shrub communities (“willow groveland”) that are transitional between forest and grassland habitats. The Foothills Parkland is a transition zone between montane woodlands to the west and foothills grasslands to the east. According to mapping by Strong and Thompson (1995), the entire Spy Hill study area occurs within the Black Diamond Upland Ecodistrict. Native aspects of this Ecodistrict are characterized by:

- 70% grassland vegetation on undulating (0.5% to 2.5%) morainal plain with moderately well drained, loam-textured black chernozem soils;
- 20% open-canopied shrub on rolling (0.5% to 2.5%) morainal plain with moderately well drained, silty loam-textured black chernozem soils; and
- 10% grassland vegetation on undulating (0.5% to 2.5%), glaciolacustrine deposits with moderately well drained, clay loam-textured black chernozem soils.

Lakes and wetlands are very rare in the Black Diamond Upland Ecodistrict. As of the mid-1990s approximately 60% of the Black Diamond Upland Ecodistrict had been cleared or disturbed (Strong and Thompson 1995).

MacMillan (1987) mapped six soil units on the Spy Hill lands. Information on soil type, landform, surface expression, drainage class and slope angle for each unit is presented below.

<b>Soil Unit</b>	<b>Parent Material</b>	<b>Surface Expression</b>	<b>Drainage</b>	<b>Slope Angle</b>	<b>Primary Soil</b>
DVG1	Moraine	Rolling	Well	2% to 9%	Black Chernozem
DVG2	Moraine	Rolling	Well	2% to 9%	Black Chernozem
DVG3	Moraine	Ravine	Well to rapid	16% to 45%	Black Chernozem
FSH3	Glaciolacustrine/ Moraine	Veneer/ rolling	Moderately Well	2% to 5%	Black Chernozem
SCO2	Glaciofluvial	Fan/Ridged	Rapid	2% to 9%	Black Chernozem
SPY1	Moraine	Hummocky	Well – poorly	6% to 45%	Black Chernozem

The majority of the study area is located on upland rolling and hummocky morainal plain. A major ravine transects the southeastern portion of the section 33-25-2w5. This drainage system has its headwaters at the western edge of the property and eventually flows into Beddington Creek five kilometers to the northeast. No flowing surface water was observed in this ravine. Orthic Black Chernozem soils dominate the property. Other secondary soils include Orthic Dark Gray Chernozems, Dark Gray Luvisols, Rego Black Chernozems and Orthic Humic Gleysols. The gleysolic soils occur in moist swales and depressions.

### **3.2 Vegetation and Habitat Supply**

Conservation of an appropriate supply of native vegetation and habitat is a cornerstone of conservation biology and is generally considered to be the primary management tool for the protection of biological diversity (Meffe *et al.* 1997). Native habitats considered to be in short supply (rare) in a regional context are considered to be more significant than abundant habitats in the context of preserving landscape diversity and the plant and animal species that these landscapes support (Noss 1993; Council on Environmental Quality 1993; Noss and Cooperrider 1994).

Calgary Parks and Recreation (1994) developed a habitat classification and mapping system for the City of Calgary. Seven of the 10 habitat types identified by this system occur on the Spy Hill study area.

- Aspen Forest
- Balsam Poplar Forest
- Upland Tall Shrub
- Low Shrub
- Native Grassland
- Non-native (Disturbed) Grassland
- Wetland (Wet Graminoid)

Anthropogenic features (buildings, corrals) were also mapped as a separate habitat type.

Although fall conditions prevailed during the site visit it was possible to broadly classify the vegetation communities based on senesced plant materials. All vegetation polygons mapped in the study site were visited at least once. The ecological characteristics of each of the habitat types occurring on the Spy Hill study area are described below including their supply on the property.

### ***Native Aspen Forest (Aw)***

Native aspen (*Populus tremuloides*) forest comprises 18.3-ha (3.5%) of the study area. Native aspen forest is distributed primarily as small groves embedded in a mosaic with tall willow shrub and fescue grassland. The largest of these groves are mapped and found on rolling ground moraine (DVG2) within two large patches of aspen-willow-fescue in the east-central and northern ¼ of the property (Figure 1). Another stand of aspen forest occurs on west-facing slope of the till knoll in the SW corner of the property.

Level sites on moraine support primarily Aspen/Rose-Buckbrush and Aspen/Snowberry communities. These types were also recognized by Calgary Parks and Recreation (1997), Sentar (1993b) and Strong and Kansas (1984). Shrub cover is dense consisting of buckbrush (*Symphoricarpos alba*), prickly rose (*Rosa acicularis*), gooseberry (*Ribes oxycanthoides*), wild red raspberry (*Rubus idaeus*), and a scattered cover of saskatoon (*Amelanchier alnifolia*). Typical herbaceous plants based on related studies are hairy wild rye (*Elymus innovatus*), meadow rue (*Thalictrum spp.*), reed grass (*Calamagrostis canadensis*), wild vetch (*Vicia americana*), and northern bedstraw (*Galium boreale*). An Aspen/Saskatoon/Rose plant community was found on the west facing till slope. This is similar to the Aspen/Saskatoon/buckbrush community reported by Strong and Kansas (1984). Common understory plants in this association were northern bedstraw, meadow rue, wild strawberry (*Fragaria virginiana*), violet (*Viola spp.*), pea vine (*Lathyrus ochroleucus*) and hairy wild rye.

### ***Balsam Poplar Forest (Pb)***

Six small stands of balsam poplar (*Populus balsamifera*) occur at the central portion of the eastern border of the study area (Figure 1). These stands range in size from 0.14 to 0.70-ha and total 3.2-ha (0.6% of study area). Aspen trees are co-dominant with balsam poplar. These stands most closely approximate the Balsam poplar/Rose/Buckbrush type reported by Strong and Kansas (1984).

### ***Upland Tall Shrub (UTS) and Willow Groveland (GRV)***

Calgary Recreation and Parks (1994) considered upland tall shrub (UTS) communities to include stands of saskatoon, chokecherry, water birch and willow growing on the “lower, more moist portions of a slope, or in protected ravines”. Upland tall shrub on the property occurs on north facing ravine slopes and on rolling and to a lesser extent hummocky ground moraine. We mapped areas of tall willow groveland (GRV) on rolling moraine as complexes. Approximately 30% of these groveland mosaics are comprised of clumps of tall willow. Taking into account this percentage as well as ‘pure’ stands, the total amount of upland tall shrub in the study area is approximately 62.4% or 12.1% of the property.

The largest contiguous patch of this habitat type is found along the north-facing slope of the major ravine that transects the north-center of the property (Figure 1). Two smaller/narrower patches of this type occur in less well-developed ravines to the west and north of the major

ravine. Vegetation found here is closely related to the Willow-Snowberry type reported by Sentar (1993) for Nose Hill Park, where it occurs on a north-facing slope of the Porcupine Valley. Low volumes of groundwater discharge (Sentar 1993) likely maintain this community. Allen (2002) reported a similar habitat type as being rare in the Foothills Parkland subregion – Bebb’s Willow/Wild Red Raspberry/Wild White Geranium.

Tall willow groveland are situated on rolling ground moraine (DVG2) within two large patches of aspen-willow-fescue in the east-central and northern ¼ of the property (Figure 1). These shrub stands are closely related to the Willow/Grass community type that was described by Strong and Kansas (1984). Willow shrubs are 2.5 to 4-m tall and dominated by Bebb’s willow (*Salix bebbiana*).

Another upland shrub habitat in the study area was a semi-open Willow/Snowberry-Rose/Hairy Wild Rye stand located on steep north and east-facing slopes of the morainal knoll in the SW corner of the study area. Four small stands of wolfwillow-rough fescue also occurred in the SW portion of the property.

### ***Low Shrub (LS)***

Continuous mappable stands of low shrub were not common in the study area. The two largest of these were found in the northern portion of the study area abutting the eastern border (Figure 1). These were mixed stands of rose (*Rosa acicularis*) and buckbrush (*Symphoricarpos occidentalis*) with rough fescue grassland. Another large mappable stand of buckbrush-rose low shrubland was located on the south-facing slopes of the major ravine. Buckbrush-rose vegetation also occurs as very small patches in the area mapped as willow groveland (GRV) on Figure 1. Low shrub comprises approximately 10% of the willow groveland habitat type. Taking into account the low shrub in GRV and the pure stands, the total land area of low shrub on the Spy Hill lands is approximately 29.7-ha (5.8% of property).

### ***Native Grassland (NG)***

Native grasslands on the Spy Hill lands occur as pure stands or as a component of the willow groveland mosaic (Figure 1). Native grassland comprises approximately 60% of the areas mapped as willow groveland (GRV) in Figure 1. Total land area of native grassland on the Spy Hill subject lands is approximately 88.2-ha or 17.1% of the property.

Three relatively large patches of native grassland occur in the northeast portion of the study area on gentle morainal slopes (Figure 1). Native grassland also dominates the south-facing slopes of the large ravine and the south and west-facing aspects of the morainal knoll in the southeast corner of the property. The dominant species of grass on near level to gently sloping, well and moderately well drained sites with little grazing were rough fescue (*Festuca scabrella*) and Parry’s Oat grass (*Danthonia parryi*). On steeper sites (e.g. ravine slopes) and in areas of heavier grazing an increased occurrence of needle grass (*Stipa* spp.), june grass (*Koeleria cristata*), wheatgrass (*Agropyron* spp.) and bluegrass (*Poa pratensis*) was observed.

### ***Disturbed Grassland (DG)***

Grasslands that have been impacted by land clearing, seeding for cropland or pasture improvement, intensive livestock grazing, or invasions from introduced plants from adjacent properties occupy 295.2-ha or 57.1% of the study area. This habitat type is by far the most common in the study area. It occurs in several large patches throughout the study area, notably in the NW quarter of the southern section, and the two strips in the northern section north of the large ravine. Grazing by cattle occurs in disturbed grasslands throughout the study area. The heaviest recent livestock grazing appears to occur in the grassland immediately north of the large ravine. Typical plants observed in non-native grasslands were blue grass, awesless brome, wheat grass, timothy (*Phleum pratense*), thistle (*Sonchus spp.*) and rose.

### ***Wet Graminoid (WG)***

Wet depression areas occur in several isolated patches throughout much of the property. Several of these patches occur in the bottom of the large ravine, but they also occur embedded in hummocky ground moraine (Figure 1). Common plant species in these wet graminoid (WG) meadows are beaked sedge (*Carex rostrata*), water sedge (*Carex aquatilis*), and tufted hairgrass (*Deschampsia cespitosa*). Wet graminoid habitats occupy 6.2-ha (1.2%) of the property. Although no standing water was observed in these sites this fall in more moist years they can become inundated with surface water.

### ***Anthropogenic (AN)***

Buildings and non-vegetated areas occupy 12.41-ha (2.4%) of the study area. They are concentrated in SE28-25-2w5.

### ***Standing Water (W)***

Only two standing water bodies were found on the property, totalling 1.03-ha. These were both found on the southern edge of the study area. These did not support well-developed emergent zones.

## **3.3 Rare Plant Species and Communities**

Native plants are considered wildlife under the National Wildlife Policy for Canada to which all provinces, territories and the federal government are signatories. The need for consideration of rare plants in land-use decisions is becoming increasingly important as Alberta's native flora is increasingly at risk through the spread of human activities (Wallis et al. 1986). There is increasing awareness of native plants in the general public and by environmental organizations. The Alberta Native Plant Council (ANPC) was formed in the mid-1980s to educate the public and to promote the conservation of native plants as well as

their use in reclamation and restoration work. The ANPC has active rare plant conservation, reclamation, and education committees and has made presentations to hearing boards.

To meet the growing demand for more complete knowledge about an area's biodiversity, rare plant surveys have become a routine part of biophysical inventories and impact assessments. Rare plant considerations have been put before Alberta Energy and Utilities Board and National Energy Board regulatory hearings.

For this project, rare plants refer to those listed on provincial (Alberta Natural Heritage Information Center 2002) or national (COSEWIC 2002) lists. Packer and Bradley (1984) characterize rare plants for Alberta as those with five or fewer recorded collection localities and with one of the four following distribution patterns:

- widespread species that are rare throughout their range;
- peripheral species that are widespread but only small populations occur within Alberta;
- disjunct species found as localized populations at widely scattered localities. (they may occur as restricted disjunct populations throughout their range but with some restricted, disjunct populations); and
- endemic species that are considered rare because they are restricted geographically although, where they do occur, they may occur in large numbers.

The Alberta Natural Heritage Information Centre Tracking List uses the following criteria to rank species for tracking.

- S1:  $\leq 5$  occurrences in the province or only a few remaining individuals or may be imperiled because some factor of its biology makes it especially vulnerable to extirpation.
- S2: 6-20 occurrences or with many individuals in fewer occurrences; or may be susceptible to extirpation because of some factor of its biology.
- S3: 21-100 occurrences, may be rare and local throughout its provincial range, or in a restricted provincial range (may be abundant in some locations or may be vulnerable to extirpation because of some factor of its biology).
- S4: apparently secure under present conditions, typically  $>100$  occurrences but may be fewer with many large populations; may be rare in parts of its provincial range, especially peripherally.
- S5: demonstrably secure under present conditions,  $>100$  occurrences, may be rare in parts of its provincial range, especially peripherally.
- SU: status uncertain often because of low search effort or cryptic nature of the element; possibly in peril, unrankable, more information needed.



Plants tracked by the Natural Heritage Information Center are those ranked S1, S2 or S3. S1 and S2 ranked species appear on the provincial tracking list, while S3 ranked species are kept on the watch-list.

The following is a list of rare plants potentially occurring on the Spy Hill Lands based on Moss (1983), the ANHIC Tracking List and habitats that occur. Plants on this list do not necessarily occur on the Spy Hill property. Rather, the known distribution and habitat affiliations of these plants suggest potential occurrence.

- Anenome quinquefolia* (Wood anemone), balsam poplar and aspen forest , S1
- Arnica parryi* (Nodding arnica), balsam poplar and aspen forest, S2
- Aster eatonii* (Eaton's aster) - moist montane woods, streambanks; S2
- Aster umbellatus* (Flat-topped white aster), balsam poplar and aspen forest , S2
- Barbarea orthoceras* (American winter cress), balsam poplar and aspen forest ,S2
- Botrychium* spp. (*ascendens*, *boreale*, *campestre*, *crenulatum*, *michiganense*, *minganense*, *simplex*, *spathulatum*) (moonworts or grape ferns) - moist depressions in grassland, S1 to S2S3
- Carex crawei* (Crawe's sedge) - calcareous meadows, S2
- Carex parryana* (Parry's sedge) - moist calcareous or alkaline seeps, S1S2
- Carex tinctoria* (Tinged sedge), balsam poplar forest, S1
- Castilleja lutescens* (stiff yellow paintbrush) - grassland, S2S3
- Cirsium scariosum*, Thistle, balsam poplar forest, SU
- Dryopteris cristata*, (Crested shield fern), S1, balsam poplar forest
- Ellisia nyctela*, (Waterpod), balsam poplar and aspen forest , S2
- Gentiana fremontii* (marsh gentian) - calcareous springs/seepage areas, S2S3
- Gratiola neglecta* (clammy hedge-hyssop), wet muddy places, S2S3
- Hieracium cynoglossoides* (woolly hawkweed), open woods and slopes, S2S3
- Onosmodium molle* (western false gromwell), gravelly banks, dry woods, S2
- Orobanche uniflora* (One-flowered Cancer root), balsam poplar and aspen forest , S2
- Phacelia linearis* (narrow-leaved scorpion-weed) - dry gravelly slopes, S2
- Potentilla finitima* (sandhills cinquefoil) - disturbances in native grassland, especially sandier sites, S1
- Ranunculus glaberrimus* (early buttercup) - grassland, S2
- Rorippa tenerrima* (slender yellow-cress) - moist open areas, generally on recently exposed mud, S1
- Sisyrinchium septentrionale* (pale blue-eyed grass) - moist meadows, S2S3
- Sphenopholis obtusata* (prairie wedge grass), moist meadows, especially at edges of flowing springs, S2
- Stellaria crispa*, (Starwort), balsam poplar and aspen forest , S2
- Townsendia exscapa* (low townsendia), dry hillsides and prairies, especially exposed valley slopes or ridge, S2

*Veronica catenata* (water speedwell) - ponds, slow-moving creeks, S2

*Viola pedatifida* (crowfoot violet) - grassland, especially sandy types, S2

Detailed rare plant surveys have not been undertaken for this assessment. Rare plant occurrence is often based on micro-site habitat conditions so we are not able to predict which of the above species will occur on the property or precisely where. Based on plant searches on other properties, the number of actual rare plants found is typically a small percentage (usually <10%) of the number that could potentially occur.

We reviewed the Alberta Natural Heritage Information Center Preliminary Plant Community Tracking List (Allen 2001) to determine the potential for occurrence of rare plant communities representative of the Foothills Parkland. Two possible rare plant communities were identified:

Wolfwillow Shrubland

Bebb's Willow/Wild Red Raspberry/Wild White Geranium

Both of these plant communities were found on the property in association with the Upland Tall Shrub (UTS) habitat type. The north facing slope of the large ravine supports the Bebb's willow community and small stands of wolfwillow occur in the SW quarter of the southern Section of the property.

### **3.4 Vegetation Composition and Structure Assessments**

Plant species richness, vegetation structure diversity and degree of human disturbance are factors that determine the inherent ecological integrity of a land area as well as its suitability for use by wildlife species (Noss and Cooperrider 1994). These factors are discussed below in the context of mapped habitat types on the subject property. Ratings are based in large part on field measurements by URSUS staff from the same or very similar habitat types in other studies within the Calgary region, most notably the Nose Hill Park biophysical inventory and analyses (Sentar 1993).

#### ***Floristic Diversity***

A fundamental principle of conservation biology is to protect sites that support high levels of local "species richness" (the number of organisms present in an area) (Council on Environmental Quality 1993; Noss 1990). Ecosystems that support a high level of diversity of plant species tend to be structurally diverse and productive (Meffe and Carroll 1997). These areas in turn support a wide variety and abundance of insect and animal forms.

Habitats that support the highest plant species diversity in the Calgary region are seepage tall willow, native grasslands, and moist mixedwood, aspen and balsam poplar forests. Lowest levels of plant diversity are found in non-native grasslands, disturbed sites, low shrubland and dry tall shrubland (Sentar 1993, URSUS files). Although specific measurements of plant

species diversity are not available for the Spy Hill lands, it is likely that the same pattern of diversity exists in this area. As such, native rough fescue grasslands (NG), (ravine) upland tall shrub (UTS) and aspen (Aw) and balsam poplar (Pb) forest are likely to support the highest floristic diversity on the property.

### ***Structural Diversity***

The structural complexity of an ecological community is positively correlated with the diversity of animal life (Meffe and Carrol 1997). This is especially true for vertebrate wildlife species that require unique and variable reproductive, forage and cover opportunities or “niches” for survival and reproduction. Short (1983) explained the disproportionate importance of vertical vegetation structure in prairie and rangeland environments where such habitats area in limited supply:

*“Rangeland habitats that provide only a few layers of habitat have a limited volume of space within which wildlife species can find niches. More niches are potentially available as more layers of habitat occur in cover types, so more wildlife species potentially are supported by more structurally diverse habitats.”*

Other studies conducted in similar environments within the Calgary region have shown that habitats with highest structural diversity are aspen and balsam poplar forest and tall willow (Sentar 1993). Non-native grasslands, disturbed areas and low shrub communities support low structural diversity and lesser use by wildlife as primary habitat. In areas dominated by graminoid plant communities, the habitat types with highest structural diversity are non-grazed or lightly grazed native grasslands. These types tend to support taller grass growth and an abundance of dead vegetation material (litter) that provides structure for small mammals and ground nesting birds (Short 1986). Based on the above, habitats with the highest levels of structural diversity on the Spy Hill lands are balsam poplar forest (Pb), aspen forest (Aw), and upland tall shrub (UTS), particularly in ravine settings.

Vegetation diversity can also be reflected in terms of the positioning of different habitat types. A mix of adjacent habitat types can offer wildlife varying opportunities for foraging and reproduction (e.g. nesting). On the Spy Hill property the areas with the greatest level of habitat juxtaposition are the large ravine (especially within the SE quarter of Section 33-25-2w5), and the two willow groveland (GRV) patches in the NE quarter of Section 28-25-2w5 and in the northern half of Section 33-25-2w5.

### ***Native Habitat Integrity/Human Disturbance***

Invasion of native habitats by non-indigenous or “introduced” species of plants can result in losses of native plant species, changes in community structure and function, and alterations in the physical structure of the system (Drake *et al.* 1986). Human land use and associated interruption of native ecological processes is normally the cause of plant species invasions

(Mooney and Drake 1986). Land clearing, cattle grazing, and wind-borne invasions from cultivated fields are the primary contributors of introduced species invasions in the Spy Hill lands.

### 3.5 Local and Regional Habitat Type Rarity

The significance of habitats found on the Spy Hill lands were assessed quantitatively based on land area occurrence and rarity using two levels of landscape scale:

Local	Spy Hill property (516.7-ha)
Regional	Calgary Urban Parks Project area (25,381-ha)
	Calgary Restricted Development Area (7,653-ha)
	Nose Hill (1,128-ha)

The rarest natural habitats in the local study area context were standing water (0.2%), balsam poplar forest (0.6%), and wet graminoid (1.2%). The most abundant habitats in the local context were disturbed grassland (57.1%), native grassland (17.1%), and upland tall shrub (12.1%).

In the context of the Calgary region, the least common habitats found within the Spy Hill property are wet graminoid and upland tall shrub in ravines. The wet graminoid habitat was termed “poorly-drained graminoid” by GAIA (1993). This type occupies 52-ha or 0.2% of the Calgary Urban Parks area. Strong and Kansas (1984) mapped two wet graminoid plant associations in the former Calgary Restricted Development Area (RDA). These were Hairgrass-sedge which occupied 16.3-ha (0.2%) and the sedge community type which occupied 12.7-ha (0.2%). The Calgary UPP reported only 1 ha of willow shrubland on ravine landforms (GAIA 1993). Sentar (1993) reported another 21.4-ha of this habitat type on Nose Hill Park. Strong and Kansas (1984) classified and mapped 45.8-ha of willow shrubland on ravine landforms in the Calgary RDA where it occurred primarily in association with groundwater seepage. Review of a 1:50,000 scale air photo (September 1999) of NW Calgary surrounding the Spy Hill lands indicates that tall willow vegetation in ravines is an uncommon to rare habitat type in this region.

The most abundant habitats in a regional context are native grassland and disturbed grassland. Strong and Kansas (1984) mapped 1,747-ha (22.8%) of rough fescue grassland (NG) in the Calgary RDA. GAIA (1993) mapped 2,879-ha (11.3%) of native grassland in the Calgary Urban Parks Project study area. Sentar (1993) mapped 421-ha of rough fescue grassland on Nose Hill Park.

### **3.6 Wildlife Species Occurrence and Status**

Based on habitat requirements and known distributional ranges we estimate that 26 vertebrate species at risk as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002) and Alberta Environmental Protection (AEP 2001) have potential to occur as summer, winter or year-round residents, migrants or transients on the Spy Hill lands. These species are listed in Table 3 and include 17 birds, 5 mammals, and 4 amphibians and reptiles.

### **3.7 Wildlife Habitat Suitability Ratings**

The suitability of mapped habitat types in the Spy Hill lands was rated with reference to appropriate literature, first-hand knowledge of habitats gained from the site visits, and the authors' knowledge for each vertebrate species. The assigned ratings are conservative and in some cases may overrate the importance of the habitat type to the species in question. High-very high suitability habitat was rated for fifteen of these species on the Spy Hill lands (Table 5).

### **3.8 Habitat Type Significance Assessment**

Table 4 summarizes ratings of significance of mapped habitat types on the Spy Hill property for seven ecological factors. These ratings place into local and regional perspective the relative and overall significance of the habitat types found on the property. Overall, the most highly rated habitats were willow groveland (GRV), upland tall shrub (UTS), and balsam poplar forest (Pb). Lowest rated habitats were disturbed grassland (DG) and anthropogenic (AN).

Willow groveland and upland tall shrub were rated as highly significant for six and five of seven criteria respectively. Balsam poplar forest was rated as high for four criteria. The regional rarity of these habitats combined with their productivity for wildlife and plants make them the most ecologically important habitats on the Spy Hill property. Native grassland was the highest rated habitat solely from a species at risk perspective.

### **3.9 Fragmentation**

Habitat fragmentation occurs in two principal ways:

- reduction of the total amount of a habitat type in a landscape; and
- apportionment of the remaining habitat into smaller more isolated habitats (Meffe et al. 1997).

Human settlement in urban areas routinely results in a patchwork of small isolated natural areas within a matrix of developed land (Adams and Dove 1989). This is currently the case in

the Calgary urban area. Small insular populations are more susceptible than larger populations to stochastic (chance) events like fire or disease and have reduced genetic resources.

Given its suburban/country residential character the effects of fragmentation have already occurred to a great extent in, and especially around, the Spy Hill lands. Many sensitive species have already been significantly affected by existing levels of human use (e.g. Sharp-tailed Grouse). However in the context of remaining native lands within The City of Calgary the Spy Hill lands support relatively large patches of native vegetation, particularly the willow groveland and ravine habitats.

### **3.10 Wildlife Movement Routes**

Wildlife corridors can be defined as "linear landscape features that facilitate the biologically effective transport of animals between larger patches of habitat to accommodate daily, seasonal and dispersal movements" (Paquet et al. 1994.). Protection of routes wildlife use is important in order to provide safe travel opportunities between important habitats and to facilitate dispersal and population exchanges.

Movement of wildlife between isolated habitat patches is an important factor that can serve to temper the effects of habitat fragmentation especially in highly developed urban areas. Removal of existing strips of habitat that connect natural areas or larger patches of suitable habitat can lead to isolation and eventual depletion of local populations of sensitive wildlife species.

The presence of extensive suburban/country residential development, industrial development and roads in the local area impairs the value of the Spy Hill lands as part of a regional movement corridor. However forest and shrub habitat types on the property provide sufficient security cover to contribute to local movement. Thus the property likely is important to local movement of wildlife but is not significant regionally.

#### 4.0 SUMMARY AND CONCLUSIONS

- Over half (59.5%) of the Spy Hill property has been significantly disturbed by human settlement and land clearing.
- The remaining native component of the property occurs in relatively large contiguous patches that have a high level of native ecological integrity.
- The large ravine that transects the northern section of the property is a regionally significant ecological feature that is uncommon in the Calgary area.
- The two most significant habitats on the property are tall willow maintained by low volume groundwater on the north slopes of the large ravine; and the willow-fescue groveland that occurs in two relatively large patches in the eastern and northern portion of the property.
- The Bebb's Willow-Wild Red Raspberry-White Geranium community on the north slope of the large ravine is identified by the Alberta Natural Heritage Information Centre as a regionally rare plant community, and has been reported as rare in regional ecological inventories.
- The adjacency of a large tract of willow groveland south of the ravine adds to the ecological integrity of the ravine system.
- Fifteen of twenty-six species at risk with potential to occur on the property have habitat rated as high-very highly suitable with Native Grassland the most important habitat from this perspective.
- The Spy Hill lands and surrounding area has already been degraded due to fragmentation and the property's importance to wildlife movement is limited to the local scale.

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## TABLES

**Table 1. At Risk Definitions (AEP 2000: 2001; COSEWIC 2002)**

***Alberta Environmental Protection (AEP)***

**At Risk** – any species known to be “At Risk” after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta

**May Be At Risk** – any species that “May Be At Risk” of extirpation or extinction, and is therefore a candidate for detailed risk assessment.

**Sensitive** – any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

**Endangered** – a species facing imminent extirpation or extinction.

**Threatened** – a species likely to become endangered if limiting factors are not reversed.

**Special Concern** – a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

**Data Deficient** – a species for which there is insufficient scientific information to support status designation.

***Committee on the Status of Endangered Wildlife in Canada (COSEWIC)***

**Endangered** - a species facing imminent extirpation or extinction.

**Threatened** - a species likely to become endangered if limiting factors are not reversed.

**Special Concern** - a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

**Not at Risk** - a species that has been evaluated and found to be not at risk.

**Indeterminate** - a species for which there is insufficient scientific information to support status designation.

**Table 2. Areas of habitat types on the Spyhill lands**

Vegetation Cover Type		Supply	
		Ha	% of total
<b>AN</b>	<b>Anthropogenic</b>	12.4	2.4%
<b>Aw</b>	<b>Aspen Forest</b>	18.3	3.5%
<b>DG</b>	<b>Disturbed Grassland</b>	295.2	57.1%
<b>GRV</b>	<b>Willow Groveland</b>	90.2	17.5%
<b>LS</b>	<b>Low Shrub</b>	20.7	4.0%
<b>NG</b>	<b>Native Grassland</b>	34.1	6.6%
<b>Pb</b>	<b>Balsam Poplar</b>	3.2	0.6%
<b>UTS</b>	<b>Upland Tall Shrub</b>	35.4	6.9%
<b>W</b>	<b>Water</b>	1.0	0.2%
<b>WG</b>	<b>Wet Graminoid</b>	6.3	1.2%

**Table 3. Vertebrate species at risk with potential to occur on Spy Hill lands**

Common Name	Scientific Name	Status	Abund	At Risk Designation	
				Alberta	COSEWIC
Pied-billed Grebe	<i>Podilymbus podiceps</i>	S	S	Sensitive	
Horned Grebe	<i>Podiceps auritus</i>	S	S	Sensitive	
Great Blue Heron	<i>Ardea herodias</i>	S	S	Sensitive	
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	S	S	Sensitive	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	W	S	Sensitive	Not at Risk
Northern Goshawk	<i>Accipiter gentilis</i>	R	S	Sensitive	Not at Risk
Swainson's Hawk	<i>Buteo swainsoni</i>	S	U	Sensitive	
Golden Eagle	<i>Aquila chrysaetos</i>	W	S	Sensitive	Not at Risk
Prairie Falcon	<i>Falco mexicanus</i>	S	S	Sensitive	Not at Risk
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	R	S	Sensitive	
Upland Sandpiper	<i>Bartramia longicauda</i>	S	S	Sensitive	
Short-eared Owl	<i>Asio flammeus</i>	S	S	May Be At Risk	Special Concern
Common Nighthawk	<i>Chordeiles minor</i>	S	U	Sensitive	
Pileated Woodpecker	<i>Dryocopus pileatus</i>	R	S	Sensitive	
Sprague's Pipit	<i>Anthus spragueii</i>	S	U	Sensitive	Threatened
Western Tanager	<i>Piranga ludoviciana</i>	S	S	Sensitive	
Baird's Sparrow	<i>Ammodramus bairdii</i>	S	S	Sensitive	Not at Risk

**Table 3. Vertebrate species at risk with potential to occur on Spy Hill lands**

Common Name	Scientific Name	Status	Abund	At Risk Designation	
				Alberta	COSEWIC
Long-tailed Weasel	<i>Mustela frenata</i>	R	U	May Be At Risk	Not at Risk
American Badger	<i>Taxidea taxus</i>	R	U	Sensitive	Not at Risk
Lynx	<i>Felis concolor</i>	T	R	Sensitive	
Cougar	<i>Lynx canadensis</i>	T	R	Sensitive	
Bobcat	<i>Lynx rufus</i>	R	S	Sensitive	
Western Toad	<i>Bufo boreas</i>	R	S	Sensitive	
Northern Leopard Frog	<i>Rana pipiens</i>	R	R	At Risk Threatened	Special Concern
Wandering Garter Snake	<i>Thamnophis elegans</i>	R	U	Sensitive	
Red-sided Garter Snake	<i>Thamnophis sirtalis</i>	R	U	Sensitive	

**Table 4. Significance of habitat types on the Spy Hill lands**

Criteria	Habitat Significance*									
	AN	Aw	DG	GRV	LS	NG	Pb	UTS	W	WG
Floristic Diversity	L	H	L	H	M	H	H	H	L	M
Native Habitat Integrity	L	M	L	H	M	H	M	H	L	M
Structural Diversity	L	H	L	H	M	L	H	H	L	L
Local Rarity	M	M	L	H	M	L	H	L	H	H
Regional Rarity	L	M	L	H	H	L	M	H	H	H
Wildlife Habitat Suitability (based on species at risk)	L	L	L	L	L	H	M	L	M	M
Rare Plant Potential	L	L	L	H	M	M	H	H	L	H

\* L - low  
M - moderate  
H - high



**Table 5. Species at risk high-very high suitability habitat supply**

<b>Species</b>	<b>Supply (ha)</b>
Northern Goshawk	21.5
Swainson's Hawk	419.5
Prairie Falcon	34.1
Sharp-tailed Grouse	145
Upland Sandpiper	34.1
Short-eared Owl	61.1
Pileated Woodpecker	21.5
Sprague's Pipit	34.1
Baird's Sparrow	34.1
Long-tailed Weasel	186.7
American Badger	329.3
Western Toad	10.5
Northern Leopard Frog	7.3
Wandering Garter Snake	10.5
Red-sided Garter Snake	10.5

## **APPENDIX 1**

### Species at Risk Habitat Suitability Ratings

Habitat	AN	Aw	DG	GRV	LS	NG	Pb	UTS	W	WG
Pied-billed Grebe	0	0	0	0	0	0	0	0	2	0
Horned Grebe	0	0	0	0	0	0	0	0	2	0
Great Blue Heron	0	0	0	0	0	0	0	0	2	2
Black-crowned Night-Heron	0	0	0	0	0	0	0	0	2	1
Bald Eagle	0	0	2	0	0	0	0	0	0	0
Northern Goshawk	0	3	2	2	1	2	3	2	0	0
Swainson's Hawk	0	2	3	3	2	3	1	2	0	2
Golden Eagle	0	0	0	0	0	0	0	0	0	0
Prairie Falcon	0	0	2	0	1	3	0	0	0	2
Sharp-tailed Grouse	0	2	2	3	3	3	2	2	0	2
Upland Sandpiper	0	0	1	1	2	3	0	0	0	2
Short-eared Owl	0	1	2	2	3	3	1	1	0	3
Common Nighthawk	0	0	0	0	0	0	0	0	0	0
Pileated Woodpecker	0	3	0	2	0	0	3	2	0	0
Sprague's Pipit	0	0	2	0	0	3	0	0	0	2
Western Tanager	0	2	0	1	0	0	2	1	0	0
Baird's Sparrow	0	0	2	0	1	3	0	0	0	2

### Species at Risk Habitat Suitability Ratings

Habitat	AN	Aw	DG	GRV	LS	NG	Pb	UTS	W	WG
Long-tailed Weasel	0	2	2	3	3	3	2	3	2	3
American Badger	0	1	3	2	2	4	1	2	1	2
Lynx	0	1	1	2	1	1	1	2	1	1
Cougar	0	1	1	2	1	1	1	2	1	1
Bobcat	0	2	1	2	2	2	2	2	2	1
Western Toad	0	2	1	1	0	0	3	1	3	3
Northern Leopard Frog	0	0	0	0	0	0	0	0	3	3
Wandering Garter Snake	0	2	2	2	2	2	3	2	3	3
Red-sided Garter Snake	0	2	2	2	2	2	3	2	3	3

**Note: See section 2.9 for ratings definitions**

## **APPENDIX 2**



Disturbed grassland (DG) of smooth brome and Canada Thistle in the SW quarter of Section 33-25-2w5



Very heavily grazed non-native (disturbed) grassland (DG) in the NW quarter of Section 28-25-2w5



North-facing slopes of morainal knoll with upland tall shrub (UTS) community (left) and aspen forest (right) – SW quarter of Section 28-25-2w5



Ungrazed rough fescue grassland (NG) on morainal knoll (foreground) with water reservoir construction (background) – SW quarter of Section 28-25-2w5



Disturbed brome-thistle grassland (DG) in SW quarter of Section 28-25-2w5



Close-up of sedge-hairgrass wet graminoid (WG) habitat in the SW quarter Section 28-25-2w5





Wolfwillow-Bluegrass-Fescue upland tall shrub habitat (UTS) immediately south of the moraine knoll  
– SW quarter Section 28-25-2w5



Wet graminoid (hairgrass) habitat (WG) surrounded by disturbed brome-thistle grassland on the  
southern border of NE quarter Section 28-25-2w5



Aspen-Gooseberry-Buckbrush stand (Aw) that has been damaged by livestock grazing – NE quarter Section 28-25-2w5



Ungrazed Aspen-Gooseberry-Buckbrush stand (Aw) in NE quarter Section 28-25-2w5



Willow groveland (GRV) habtiat type – NE quarter Section 28-25-2w5



Panoramic view of large ravine in SE quarter Section 33-25-2w5 from the east



Large wet graminoid (WG) meadow (foreground) and Bebb's Willow-Wild Red Raspberry-White Geranium upland tall shrub habitat (UTS) in background on ravine slope – SW quarter Section 33-25-2w5



Close-up of Bebb's willow community shown in Photo #3 - SW quarter Section 33-25-2w5



South-facing ravine slope with native grassland (needle grass-junegrass-rough fescue) – SE quarter Section 33-25-2w5



Panoramic view of middle portion of large ravine looking east - - SE quarter Section 33-25-2w5



Very tall seepage willow (UTS) community in lower slope of large ravine - SE quarter Section 33-25-2w5



Eastern extent of large ravine with Lafarge Spy Hill gravel operation in background - SE quarter Section 33-25-2w5



Upland plateau with extensive cattle grazing and disturbed grassland (DG) - SE quarter Section 33-25-2w5



Secondary ravine with upland tall shrub (UTS) in SE quarter Section 33-25-2w5



Annual cropland (DG) in the NW quarter Section 33-25-2w5