PRELIMINARY INVENTORY OF ENVIRONMENTALLY SIGNIFICANT AREAS WITHIN THE FOOTHILLS MODEL FOREST

Sweetgrass Consultants Ltd.
70 Deerpath Rd SE
Calgary, Alberta
T2J 6K8

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FOREWORD

This report was prepared and funded under the Ecological Reserves Sub-Program of Canada's Green Plan for a Healthy Environment. It is the first step in a process designed to improve understanding of the distribution and significance of environmentally significant areas in the Foothills Forest research area, and to suggest some directions which might be appropriate for their management and protection.

It is an overview, and a preliminary identification of sites based on various forms of existing inventory information, combined with interviews and interpretation of large-scale aerial photography. As such, it provides the basis for further and more detailed investigations which would lead to better definition and refinement of management goals, strategies and activities by the agencies responsible for resource management.

Other studies are underway by Foothills Forest which are complementary to this one, and which will provide support and improved technical information to those charged with integrated resource management decision making on the lands contained within the study area. These agencies include the Province of Alberta, the forest industry, and other forest-based industries such as the coal industry which carry out activities on the landscape.

ABSTRACT

The primary purpose of the study was to develop an Environmentally Significant Areas (ESAs) information base for the Foothills Model Forest in west-central Alberta that would be useful for future planning and management in the area. Environmental data was collected from aerial photograph interpretation; reviews of published and unpublished information in government files and reports, scientific and popular publications, and consultant reports; and interviews with knowledgeable persons. ESAs include areas that: perform a vital ecosystem function; contain rare hydrological, geological or biological features; support a diversity of habitats; encompass large and relatively undisturbed habitats for species that are intolerant of human disturbance; serve as important wildlife movement corridors; contain excellent representatives of characteristic habitats (including old-growth forest) or landscapes; are of widespread interest to the community; or have histories of scientific research. Of the 11870 sq. km that make up the Foothills Model Forest, 3599 sq. km (about 30%) have been categorized as environmentally significant in this study. Features included in areas of regional significance in the Foothills Model Forest are: key fish habitat; key areas for deer, Elk, and Moose; wetlands, including extensive patterned fens and production and staging areas for waterfowl and marsh birds; diverse or extensive areas of natural habitat; landforms, landscapes or geological features that are uncommon, rare, or the best examples in the Foothills Model Forest; and areas containing significant populations of rare or uncommon plants and animals. Features included in areas of provincial significance in the Foothills Model Forest are: relatively undisturbed and sizeable remnants of natural habitat that elsewhere in Alberta have been disturbed by various forms of development; natural habitat assemblages that are among the best examples of their type in Alberta; key areas for Woodland Caribou; extensive patterned wetlands in the Upper Foothills; and extensive Subalpine-Alpine habitat complexes in the Cardinal Divide area.

EXECUTIVE SUMMARY

Sweetgrass Consultants Ltd. was contracted by the Foothills Model Forest to undertake a preliminary study of Environmentally Significant Areas (ESAs) throughout the Foothills Model Forest in west-central Alberta. The study area is situated at the meeting place of several major natural regions -- Upper and Lower Foothills and the Montane, Subalpine and Alpine Rocky Mountains.

The primary purpose of the study was to develop an information base that would be useful for future planning and management in the area. Environmental data was collected from aerial photograph interpretation; reviews of published and unpublished information in government files and reports, scientific and popular publications, and consultant reports; and interviews with knowledgeable persons.

Standard criteria that have been applied in other ESA studies in Alberta were used for the Foothills Model Forest. These include areas that: perform a vital ecosystem function; contain rare hydrological, geological or biological features; support a diversity of habitats; encompass large and relatively undisturbed habitats for species that are intolerant of human disturbance; serve as important wildlife movement corridors; contain excellent representatives of characteristic habitats (including old-growth forest) or landscapes; are of widespread interest to the community; or have histories of scientific research. Of the 11870 sq. km that make up the Foothills Model Forest, 3599 sq. km (about 30%) have been categorized as environmentally significant in this study.

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Features included in areas of provincial significance in the Foothills Model Forest are: relatively undisturbed and sizeable remnants of natural habitat that elsewhere in Alberta have been disturbed by various forms of development; natural habitat assemblages that are among the best examples of their type in Alberta; key areas for Woodland Caribou; extensive patterned wetlands in the Upper Foothills; and extensive Subalpine-Alpine habitat complexes in the Cardinal Divide area.

Each ESA is described in a check sheet which lists the following information: site name; general location; description of features; overall level of significance (regional, provincial, national) and rationale; and references.

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1.0 INTRODUCTION

Environmentally Significant Areas (ESAs) are important, useful and often sensitive features of the landscape. They provide long-term benefits to our society by maintaining ecological processes and by providing useful products. Large portions of many of Alberta's native habitats have been converted to other uses. Surface mining, forestry, agricultural, industrial and urban developments will continue to put pressure on the native species and habitats. The identification and management of ESAs is a valuable addition to the traditional socio-economic factors that have largely determined land use planning in the past. The social and economic benefits that ESAs and other natural areas provide are major and are just beginning to be recognized (Butler 1983; Power 1985; Wallis 1983 and 1985).

A few of the functions and uses of ESAs are defined by Eagles (1984):

1. protection of gene pools for future use, including reclamation of disturbed lands, breeding of genes into commercial species or development of new commercial products such as antibiotics;

2. protection of rare or endangered species and their habitat;

3. provision of travel corridors and resting places for migratory species;

4. preservation of mature, stable climax ecosystems with their constituent complete ecological complexity;

5. providing benchmarks against which man-altered areas can be compared;

6. conservation of large blocks of habitat for species that require extensive areas for breeding and survival;

7. conservation of representative samples of different plant and animal habitats characteristic of each natural region;

8. maintenance of habitat for wildlife and plants that require undisturbed natural areas;

9. research areas for earth and life science studies;

10. sources of groundwater recharge, low stream flow supplementation, flood peak reduction and headwater protection for hydrological systems;

11. filtration and cleaning of air and water flows;

12. conservation of soil and protection from erosion;

13. protection of significant geological features;

14. identification of lands with severe development constraints such as those on floodplains, steep and unstable slopes, or permanent wetlands;

15. provision of areas for public education regarding natural features and their management;

16. maintenance of aesthetically pleasing environments; and

17. provision of commercial products such as outdoor recreation.

Sweetgrass Consultants Ltd. was contracted by the Foothills Model Forest to undertake a study of Environmentally Significant Areas throughout the Foothills Model Forest in west-central Alberta. The primary purpose of the study was to develop an information base that would be useful for planning and management in the area.

The objective of the study was to provide a preliminary inventory of environmentally significant areas of regional, provincial, national or international importance. Once the preliminary inventory is complete, follow-up work will be undertaken to more clearly delineate boundaries based on field studies. In addition each ESA with be evaluated for its relative sensitivity to various human activities and management strategies will be developed for each ESA. In some cases this may involve formal protected area designation while, in others, it will likely include some special management approaches within a multi-use resource extraction area.

The report is organized so that the user can get an overview of the major biophysical resources and future study needs as well as more detailed information on each environmentally significant area. Each of the environmentally significant areas is described in outline form so the reader can, at a glance, determine the following:

1. name of the area;

2. location;

3. major biophysical features that characterize the area;

4. level of significance (regional, provincial, national);

5. background for determining level of significance; and

6. references that will provide more scientific or detailed information should the user require it.

2.0 DATA COLLECTION METHODS

Researchers involved in the natural history portion of the study included Ray Wershler, Cliff Wallis, Cleve Wershler, and Wayne Smith. Their research backgrounds included the fields of botany, zoology, and geology.

The following methods of collecting environmental data were employed:

1. aerial photograph interpretation;

2. reviews of published and unpublished information in government files and reports, scientific and popular publications, and consultant reports; and

3. interviews with experts and other knowledgeable persons.

2.1 Aerial Photograph Interpretation

Aerial photographs of the study area were evaluated at the beginning of the project. Complete recent coverage in black and white was available at a scale of 1:40,000.

Intensively disturbed lands were identified and noted on 1:50,000 scale National Topographic Series base maps. In areas of relatively undisturbed native vegetation, more detailed evaluations of the landscape and habitat features were made. Specifically, the following types of areas were searched for:

1. areas of vegetation diversity;

2. major rock outcrops in non-mountainous areas;

3. major spring/seepage areas;

4. sand dune areas;

5. extensive riparian woodland and shrubbery;

6. areas with interesting or unusual landscape features;

7. marshes and extensive patterned wetlands;

8. stands of old-growth forest;

9. extensive open subalpine and alpine vegetation; and

10. areas with uncommon geological features such as rock glaciers.

The next step involved interpretation of bedrock geology and surficial geology maps. Major features noted included:

1. aeolian (wind-formed) deposits;

2. outwash sands and gravels;

3. bedrock outcrops in non-mountainous areas; and

4. eskers and kames.

2.2 Literature Review

Alberta Fish and Wildlife reports, information, and critical area maps from the Edson regional office were reviewed. Alberta Environmental Protection (including the Natural and Protected Areas Program) reports and files and Canadian Wildlife Service reports were also reviewed.

Numerous natural history articles, reports and books were also surveyed and relevant information was noted for incorporation into the final report.

2.3 Interviews

Interviews were conducted with Alberta Fish and Wildlife personnel (Rudy Hawryluk and Kirby Smith) in the Edson regional office and with the following local residents during the literature review session in Hinton: Maggie Ellen (Foothills Model Forest), Rick Bonar and Christy Butt (Weldwood Forest Products), Sean Curry (Weldwood Forest Products), Dan Wilson (river guide), and Jack Wright (retired forester).

2.4 ESA Boundary Delineation

All mappable information from the aerial photograph interpretation, literature review and interviews was placed on the 1:50,000 base maps.
Some principles of boundary delineation for individual ESAs follow:

- final boundaries were drawn to include known major features based on the criteria for inclusion (see section 4.1). In some cases this represented a hard edge of a heavily disturbed area, while in others it represented the approximate boundary between an area of rare natural vegetation or vegetation diversity and more monotypic and common natural vegetation types

- areas of unvegetated Alpine bedrock in the Prime Protection zone have been included in ESAs due to the difficulty in separating which portions of the unvegetated bedrock are significant

- unless there are specific known significant features on natural lands within disturbed areas, areas with a high degree of disturbance (roads, oil and gas development, pipelines, forestry) were excluded from ESAs. Some key areas designated on Alberta Fish and Wildlife maps that have been logged following their designation on key area maps have also been excluded.

3.0 OVERVIEW OF NATURAL FEATURES

The study area is situated at the meeting place of several major natural regions -- Upper and Lower Foothills and the Montane, Subalpine and Alpine Rocky Mountains. Integrated resource inventories describe the landscape, vegetation and wildlife features (Resource Information Branch 1991; Bentz, Hay and Brierley 1986; Bentz et al. 1986).

The Foothills Model Forest lies mostly in the Upper Foothills Natural Region (Achuff and Wallis 1993), while the western edge lies in the Rocky Mountains - Subalpine and Alpine Sections. A small area of Lower Foothills intrudes along the lower Wildhay, Berland and Athabasca Rivers. Rocky Mountain Montane vegetation occurs around Brûlé Lake. The following table reflects the approximate area of each Natural Region in Alberta and the area and percentage of each Natural Region within the Foothills Forest.

NATURAL REGION	AREA IN ALBERTA (SQ. KM)	AREA AND (%) IN MODEL FOREST (SQ. KM)
Lower Foothills	65505	2964 (5%)
Upper Foothills	29285	6363 (22%)
Montane Rocky Mountains	5987	134 (2%)
Subalpine Rocky Mountains	25764	1922 (7%)
Alpine Rocky Mountains	14516	486 (3%)

The area has a continental climate, characterized by large differences between summer and winter temperatures, and precipitation occurring mostly in the summer. Annual precipitation decreases and mean annual temperature increases from west to east.

Mean annual precipitation ranges from 500 to 850 mm. Precipitation totals increase and average temperatures decrease from east to west and south to north, as well as with increasing elevation. Subregions in the Foothills Model Forest are somewhat cooler in summer than the adjacent, lower elevation Boreal Forest Subregions, but are warmer in winter because of moderation by warmer Pacific air masses.

The mean May-September temperature ranges from about 6° in Alpine areas to 12°C at lower elevation Foothill sites. The frost-free period ranges from nil in portions of the Alpine to 70 days in Foothill sites.

Chinooks characterize the Montane Subregion which is intermittently snow-free in the winter.

3.1 The Physical Setting

The physical setting of the study area is described in several geological and hydrogeological reports (Green 1972; Bayrock and Reimchen 1980; Roed 1968 & 1970; Barnes 1977, 1978; Tokarsky 1977; Vogwill 1983). The landscape is complex, spanning the Front Ranges of the Rocky Mountains, the Rocky Mountain Foothills and the Interior Plains.

The Rocky Mountains are part of a major uplift that trends along the western part of Alberta forming the Continental Divide. It is separated from the Foothills primarily by structural geology, age and lithology. The Rocky Mountains are underlain primarily by upthrust and folded carbonate and quartzitic bedrock whereas the Foothills are mostly deformed sandstone and shale.

The Rocky Mountain Front Ranges comprise northwesterly trending ranges and valleys composed of a succession of overthrust sheets lying between southwesterly dipping faults. Resistant carbonate rocks of Upper Devonian and Carboniferous age form prominent ranges. Less resistant sandstones and shales of Devonian to Cretaceous age form the valleys (Roed 1968).

The Foothills Geologic Belt occupies the area east of the Rocky Mountain Front Ranges and west of the Interior Plains. Bedrock ranges in age from Jurassic to Cretaceous and includes sandstones, siltstones and shales.

With the exception of high rock mountainous terrain, most of the terrain has been modified extensively by glacial action and is dissected by major stream valleys and some glacial spillways. Ground moraine is found extensively throughout the area and is the dominant glacial deposit.

There are small lakes and ponds locally distributed throughout the Foothills Model Forest. The largest of these is Brûlé Lake along the Athabasca River. Most water bodies are relatively shallow and are partly surrounded by organic shores. Wetlands, including organic peatlands, are scattered throughout the Foothills.

Minor areas of aeolian deposits are found near Brûlé Lake and Sundance Lake.

Glacio-fluvial deposits, including outwash deposits made up of medium to coarse materials, are widespread throughout the study area. There are localized areas of esker and kame complexes and pitted outwash.

Elevations range from about 850 m (2800 feet) above sea level in the northeastern portion of the Foothills Model Forest, where the Athabasca and Berland Rivers meet, to 2750 m (9100 feet) above sea level along the western mountains adjacent Jasper National Park.

With the exception of the Brazeau and Cardinal Rivers that drain into the North Saskatchewan River, most of the drainage is into the Athabasca River via numerous streams, including the Berland, Embarras, McLeod, Pembina, and Wildhay Rivers.

3.2 Natural Subregion Descriptions

3.2.1 Lower Foothills Subregion

Surficial materials are commonly morainal; however, extensive organic deposits occur in valleys and wet depressions. Bedrock outcrops of marine shales and non-marine sandstones occur often in valleys. Fluvial and glaciofluvial deposits occur along major stream valleys.

Soils of upland forests are predominantly Luvisolics and Brunisolics, with Gleyed Luvisols and Gleysolics in more poorly drained sites. Organic soils are common in depressional sites, and Regosolics occur along stream valleys and on steeper slopes.

The forests reflect the transitional nature of the Lower Foothills Subregion in which mixed forests of white spruce, black spruce, lodgepole pine, balsam fir, aspen, paper birch, and balsam poplar occur. Lodgepole pine communities are the best indicator of the Lower Foothills lower boundary with the Boreal Forest mixedwood forests. The upper boundary to the Upper Foothills Subregion is marked by the absence of aspen, balsam poplar and birch. Lodgepole pine forests occupy extensive portions of the upland, especially following fire. On mesic sites, white spruce and aspen are frequent.

A variety of wetland vegetation occurs in the Lower Foothills, including permanent swamps, fens and lakes typical of the Foothills Natural Region. Vegetation in these habitats consists of varying mixtures of the following dominant species: tamarack, black spruce, willows, swamp birch, Labrador tea, sedges and mosses. There are extensive "patterned" fens with distinctive net-like or string patterns created by lines of trees on slightly raised areas alternating with areas of wet sedge and shrub vegetation. Black spruce dominates on wet sites with Organic and Gleysolic soils.

River valley habitats are very diverse and include newly-forming sand and gravel bars, low and tall shrub thickets, balsam poplar woodlands with a dense willow and red-osier dogwood shrub understory, white spruce and pine woodlands, abandoned channel wetlands, and Beaver ponds. The diverse valley environments support significant ungulate populations, as well as very productive breeding bird communities. The most diverse and productive stream valleys are those of the Athabasca, Berland and Wildhay Rivers.

Many of the animals that inhabit coniferous forests are wide-ranging species that are common to spruce and pine forests of the Boreal Forest, Foothills, and Rocky Mountain Natural Regions. However, for those species that have both Rocky Mountain and Boreal Forest subspecies, the Boreal Forest subspecies is characteristic of the Lower Foothills. Species of coniferous forests include Boreal Chickadee, Spruce Grouse, Ruby-crowned Kinglet, White-winged Crossbill, and Red Squirrel. The deciduous forests and deciduous-dominated mixed woods have a greater diversity of birds than coniferous stands. Typical species include Ruffed Grouse, Warbling Vireo, Black-capped Chickadee and Tennessee Warbler.

Distinctive birds in the wetland habitats include Lincoln's Sparrow, LeConte's Sparrow, Common Snipe, and Greater and Lesser Yellowlegs. A diversity of waterfowl and other marsh birds, such

as grebes and loons, nest in marshy habitats in the lakes. The Trumpeter Swan, a COSEWIC vulnerable species and an Alberta endangered species (COSEWIC 1993; Alberta Forestry, Lands and Wildlife 1991), occurs in large wetlands in the Little Sundance Creek area. Moose is a typical mammal in and around wetlands.

A number of rare plants such as the slender-leaved sundew and regionally rare or uncommon animals, including the Sandhill Crane, occur in fens.

3.2.2 Upper Foothills Subregion

The Upper Foothills Subregion occurs on strongly rolling topography along the eastern edge of the Rocky Mountains. The Subregion lies generally between the Lower Foothills and Subalpine Subregions. Bedrock outcrops of marine shales and non-marine sandstones are frequent. Morainal deposits are common over bedrock throughout much of the area, although colluvium and residuum occur on steeper terrain.

Soils of upland sites are typically Luvisolics and Brunisolics, with Gleysolics and Organics in wet sites.

Upland forests of the Upper Foothills Subregion are nearly all coniferous and dominated by white spruce, black spruce, lodgepole pine, and subalpine fir. Lodgepole pine forests occupy extensive portions of the Subregion on upland sites. The understory of upland spruce forests is very similar to that of the lodgepole pine forests, with older stands on mesic sites often having a well developed moss layer.

Common, wide-ranging bird species in forested habitats include the Gray Jay, Red-breasted Nuthatch, Golden-crowned and Ruby-crowned Kinglets, Yellow-rumped Warbler, Dark-eyed Junco, Boreal Chickadee, Black-capped Chickadee, American Robin, and Chipping Sparrow. Typical mammals include the Red Squirrel and Varying Hare, Red-backed Vole, Deer Mouse, and Elk.

Some of the most extensive remaining old-growth and mature Upper Foothills forests in Alberta occur in the study area. Older woodlands support several rare or uncommon species of plants, including the round-leaved bog orchid, and rare or uncommon animals, including the Pileated Woodpecker and Great Gray Owl. The latter species is listed as a vulnerable species in Canada (COSEWIC 1993).

Fairbarns (1991) indicates that Alberta's boreal old-growth forests have unique characteristics:

1. a high-volume conifer canopy over 18 m tall;

2. abundant conifer regeneration;

3. canopy gaps which provide for high foliage height diversity;

4. standing and fallen deadwood environments in various stages of decay which support a rich and specialized biota;

5. pit and mound microtopography created by root-throw as canopy trees fall;

6. a carpet of feather mosses along with scattered herbs and low shrubs on a deep organic mat in intact areas of the forest floor; and

7. live canopy trees with broken tops, cavities and gnarled branches.

These features are probably also characteristic of much of the old-growth in the study area in Lower Foothills, Upper Foothills and Subalpine subregions. They drive several processes that are poorly developed in younger forests and which allow the old-growth forests to be productive and support a diversity of lifeforms.

Compared with other forest types, Francis and Lumbis (1979) report that old-growth or "overmature" forests in northeastern Alberta are probably the most valuable habitats for birds but they are also the most uncommon. The minimum reclamation time for this habitat type is considered to be 150 or more years.

There is wide recognition that old-growth forests with an abundance of dead and dying trees are important to numerous cavity-nesting species (Davis et al 1983; Fischer and McClelland 1983; Juday 1988). Among the Model Forest species that may use natural cavities (not necessarily in old-growth but usually in older trees), excavate cavities or use cavities excavated in trees by other species are:

Common Merganser
Common Goldeneye
Bufflehead
American Kestrel
Barred Owl
Boreal Owl
Northern Saw-whet Owl
Northern Hawk-Owl
Yellow-bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Three-toed Woodpecker
Black-backed Woodpecker
Northern Flicker
Pileated Woodpecker
Tree Swallow
Black-capped Chickadee
Boreal Chickadee
Red-breasted Nuthatch
House Wren
Mountain Bluebird

Dead and dying snags are also used by nesting and perching Ospreys and Bald Eagles. Snags have been used as indicators of habitat quality and suitability for non-cavity nesting birds (Marzluff and Lyon 1983).

As in the Lower Foothills, there is a variety of wetland vegetation including swamps, fens and lakes. Dominant species include tamarack, black spruce, willows, and swamp birch. There are extensive patterned and non-patterned fens that represent some of the best examples in Alberta.

Seepage springs in highlands east of Coal Valley (Lovett Ridge) create very diverse vegetation complexes with extensive areas of willow and alder vegetation. These habitats are important for a number of uncommon plant and bird species. They contain a significant diversity of breeding birds and are very important for ungulates.

Animals of the Upper Foothills Subregion are similar to those of coniferous forests of the Lower Foothills and Subalpine Subregions. These include Pine Siskin, Yellow-rumped Warbler, Ruby-crowned Kinglet, White-crowned Sparrow and Varied Thrush. Elk and both Black and Grizzly Bear are also characteristic. Species diversity is generally lower here than in the Lower Foothills Subregion because of a lower vegetational diversity, including fewer deciduous forest stands. Although species diversity may be less than in the Lower Foothills, the Upper Foothills is ecologically important for a number of species, e.g. Woodland Caribou (both the woodland and mountain ecotype).

A variety of fish species occur along streams in the Upper Foothills and adjacent Subalpine and Lower Foothills, including Bull Trout, Rainbow Trout, Eastern Brook Trout, Mountain Whitefish, Burbot, Longnose Sucker, White Sucker, Spoonhead Sculpin, Longnose Dace, and Arctic Grayling (Hildebrandt 1985, 1986, 1988). Brown Trout and Northern Pike occur more locally. Productive fisheries are found on many streams including the main stems and tributaries of the Athabasca, Wildhay, Berland, Cardinal, Brazeau, and McLeod Rivers. Larger rivers provide a greater availability of pool and overwintering habitat compared with smaller, fast gradient streams (Alberta Forestry, Lands and Wildlife 1990). Arctic Grayling reach the southern limit of their Alberta distribution in the study area. The Bull Trout, thrives in portions of the study area.

3.2.3 Rocky Mountain Montane Subregion

Although much of the Rocky Mountain Montane Subregion occurs in extreme southwestern Alberta, there are disjunct occurrences northwards along major river valleys, including the Athabasca River in the study area around Brûlé Lake. This is the most northerly, extensive area of Montane habitat in Alberta. The landforms are primarily fluvial and glaciofluvial terraces and fans with smaller areas of glaciolacustrine, aeolian and morainal deposits.

Soils vary greatly with the complex topographic and climatic conditions in this Subregion and a wide range of soils is typical. Soils under grasslands are mostly Chernozemics, Brunisolics and Regosolics. Forest soils include Brunisolics and Luvisolics.

The Montane landscape is characterized by a pattern of open forests and grasslands. Characteristic tree species in the study area include white spruce, aspen and balsam poplar. Lodgepole pine is scarce due to the calcareous nature of the soils. White spruce forests occur on more mesic sites, especially along streams on fluvial terraces. Stunted balsam poplar and aspen occur characteristically in the dunes.

Montane habitats constitute some of the most important ungulate winter range in Alberta. Coniferous montane habitats are typically inhabited by Yellow-rumped Warbler, Dark-eyed Junco,

Chipping Sparrow, Red Squirrel, Blue Grouse, Mountain Chickadee, Clark's Nutcracker, Mule Deer, Elk and Columbian Ground Squirrel; however, the composition of the animal communities in the study area is not well documented.

The Long-toed Salamander occurs is a species of wet areas that is largely restricted to the Rocky Mountain Natural Region in Alberta. In the study area it occurs in the Montane at Wildhorse-Kinky Lakes and in parts of the adjacent Upper Foothills.

3.2.4 Rocky Mountain Subalpine Subregion

The Rocky Mountain Subalpine Subregion occupies a band primarily between the Upper Foothills and Alpine Subregions. Morainal materials are common, with colluvial and residual bedrock materials frequent at higher elevations. Fluvial and glaciofluvial deposits are common along stream valleys. Aeolian deposits, mostly of volcanic ash and locally derived loess, are rare.

Soils vary widely, reflecting the great diversity in parent materials and ecological conditions. Brunisolics and Luvisolics are most common and occur under a wide variety of conditions. Podzolics are largely confined to upper elevation, moist sites under spruce-fir forests. Cryosolics occur in Upper Subalpine sites in the Front Ranges from central Banff National Park to Willmore Wilderness Provincial Park. Gleysolics and Organics occur on wet sites.

The Subalpine is divided into a Lower Subalpine characterized by closed forests of lodgepole pine, Engelmann spruce and subalpine fir, and an Upper Subalpine of closed forests with spruce-fir at its lower limits and with open spruce-fir forests at treeline. At lower elevations, lodgepole pine forests cover extensive areas following fire. Engelmann spruce-subalpine fir forests typically occur on higher, moister sites that have not been as subject to fire. Older, mesic forests have a thick carpet of mosses and lichens.

Open forests in the Upper Subalpine are transitional to the treeless Alpine Subregion above. Dominant trees include Engelmann spruce and subalpine fir. High elevation grasslands occur on steep, southerly and westerly aspects in the Front Ranges. Snow avalanches also create a diverse mix of shrubby and herbaceous communities.

The animals in the Subalpine generally overlap with the Subregions above and below. Some species are common to both the Montane and Subalpine Subregions; others occur in both the Subalpine and Alpine Subregions. Species of the coniferous forests are widespread throughout the Foothills and Boreal Forest Natural Regions and include Spruce Grouse, Gray Jay, Pine Siskin, Boreal Chickadee, Marten, Snowshoe Hare, Black Bear, and Red Squirrel. Several Subalpine forest birds, including Townsend's Warbler, are largely restricted to the Rocky Mountain Natural Region. Within Alberta, a few species, such as the mountain ecotypes of the Woodland Caribou (an endangered species in Alberta) and Golden-crowned Sparrow, are more or less confined to the northern part of the Subregion.

3.2.5 Rocky Mountain Alpine Subregion

The Rocky Mountain Alpine Subregion includes all areas above treeline including vegetated areas, rockland, snowfield and glaciers. Materials are generally residual bedrock and colluvium, often on steep slopes. Periglacial features are widespread; however, extensive areas of patterned ground are quite localized. Extensive areas of unvegetated bedrock occur. Rock glaciers occur in the headwaters of the Gregg River and Whitehorse Creek.

Much of the Alpine Subregion has no soil, the amount of weathered material being too thin to qualify as a soil. Soils generally are weakly developed Regosolics and Brunisolics.

Alpine vegetation typically forms a complex, fine-scale mosaic in which microclimatic variations are reflected by marked changes in dominant species. Significant environmental factors include aspect, wind exposure, time of snow melt, soil moisture and snow depth. Deep, late-melting snowbeds are occupied by black alpine sedge communities. Moderate snowbed communities typically contain dwarf shrub heath tundra that is dominated by heathers, mountain heathers, and grouseberry. Shallow snow areas on ridgetops and other exposed sites typically contain communities dominated by white mountain avens, snow willow and moss campion, or kobresia. Diverse, colourful herb meadows occur in moist sites below melting snow banks or along streams. Highest elevation communities are composed mainly of lichens on rocks and shallow soil.

Many animals range regularly in both the Subalpine and Alpine Subregions, including Columbian Ground Squirrel, Pika, Hoary Marmot, Grizzly Bear, Mountain Goat, and Bighorn Sheep. White-tailed Ptarmigan, Rosy Finch, Horned Lark and Water Pipit are restricted to the Alpine Subregion during the nesting season.

Areas of extensive, biologically diverse Alpine habitats are localized in the Rocky Mountains of Alberta. Such areas are very important to large ungulates and large carnivores. Some of the best examples of these habitat complexes occur in the study area and in the adjoining Jasper National Park and Willmore Wilderness Provincial Park.

4.0 EVALUATION OF ENVIRONMENTALLY SIGNIFICANT AREAS

Eagles (1984) stresses the need to have a standardized set of criteria for evaluating Environmentally Significant Areas (ESAs). These criteria fulfill several functions:

1. they allow a relatively systematic comparison of different sites and allow ranking schemes to be developed;

2. they help to outline the importance of sites to decision makers;

3. they stimulate research efforts towards refinement of definitions and concepts of significance;

4. they help to ensure similar approaches in other jurisdictions; and

5. they aid in the process of boundary delineation, as only those features that fulfill the criteria are included.

4.1 Criteria for Environmentally Significant Areas

Under the terms of reference, areas that had the following attributes were to be considered for this study:

1. areas that perform a vital environmental, ecological or hydrological function such as aquifer recharge;

2. areas that contain rare or unique geological or physiographic features;

3. areas that contain significant, rare or endangered plant or animal species;

4. areas that are unique habitats with limited representation in the region or are a small remnant of once large habitats that have virtually disappeared;

5. areas that contain an unusual diversity of plant and/or animal communities due to a variety of geomorphological features and microclimatic effects;

6. areas that contain large and relatively undisturbed habitats and provide sheltered habitat for species that are intolerant of human disturbance; and

7. areas that provide an important linking function and permit the movement of wildlife over considerable distances, including migration corridors and migratory stopover points.

8. areas that are excellent representatives of one or more ecosystems or landscapes that characterize a natural region;

9. areas with intrinsic appeal due to widespread community interest or the presence of highly valued features or species such as game species or sport fish; and

10. areas with lengthy histories of scientific research.

Areas of extensive vegetated Alpine have been included with the unvegetated bedrock portions of the Prime Protection zone in the final maps, even though most of the bedrock is not considered environmentally significant by our definitions. This was done because there is insufficient information to determine which portions of the unvegetated bedrock are significant. However, extensive areas of vegetated Alpine interpreted from aerial photographs were marked on the 1:50,000 scale working maps.

Size played some role in the final evaluation. Areas were not rejected on the basis of size alone; however, some areas were considered to have only local significance if they were relatively small areas and several larger areas of the same feature were available elsewhere in the region.

A considerable portion of the area has experienced some degree of disturbance (roads, oil and gas development, pipelines, forestry). Some key areas designated on Alberta Fish and Wildlife maps have been logged. Except in cases where significant patches of natural habitat remain in adjacent lands, clearcut logged areas included in Fish and Wildlife's key ungulate areas have not been shown as ESAs in this study. This distinction is made as clearcut logged lands are abundant and increasing whereas "natural" habitats are more restricted and decreasing in areal extent.

Although they have been used in other jurisdictions, aesthetic factors were not used as a primary criteria for evaluating sites in the study area. However, many of the diverse landscapes and habitat areas are aesthetically pleasing to many people and add to the value of the ESAs. All areas with regionally or provincially significant, aesthetically pleasing natural landscapes have been identified as ESAs based on other criteria.

4.2 Level of Significance

Evaluating areas in terms of their level of significance requires considerable knowledge of significant features outside the jurisdiction under study. In some cases, this is facilitated by lists of rare, threatened and endangered species (Forestry, Lands and Wildlife 1991; Argus and Pryer 1990; Fairbarns et al. 1987; Finch 1992; and Packer and Bradley 1984) or evaluations of natural ecosystem complexes or landscapes (Cottonwood Consultants 1983) that are available at provincial, national and international levels.

Species that are being considered for endangered species designation, the "red-listed species" outlined by Alberta Forestry, Lands and Wildlife (1991), that are known to occur in the study area include:

Long-toed Salamander
Woodland Caribou (already designated as endangered in Alberta)

Taiga (Yellow-cheeked) Vole
Trumpeter Swan (already designated as endangered in Alberta)

Species that are also at risk but which face less immediate threats, the "blue-listed species" outlined by Alberta Forestry, Lands and Wildlife (1991), that occur in the Foothills Model Forest include:

American White Pelican (not nesting)
Bald Eagle
Black Swift
Cooper's Hawk
Great Gray Owl
Canada Lynx
Cougar
Grizzly Bear
Mountain Goat
Osprey
River Otter
Wolverine

Other species known to occur in the Foothills Model Forest and considered uncommon or "yellow-listed" for low natural populations or habitat losses (Alberta Forestry, Lands and Wildlife 1991) include:

Wandering Garter Snake

Common Loon
American Bittern
Great Blue Heron
Green-winged Teal
Mallard
Northern Pintail
Blue-winged Teal
Northern Shoveler
Gadwall
American Wigeon
Canvasback
Lesser Scaup
Northern Goshawk
Golden Eagle
Sharp-tailed Grouse
Common Snipe
Bonaparte's Gull
Barred Owl
Boreal Owl
Northern Hawk-Owl
Pileated Woodpecker
Black-backed Woodpecker
Three-toed Woodpecker
Mountain Chickadee
Brown Creeper
Winter Wren
Clark's Nutcracker
Varied Thrush
Ovenbird

Bighorn Sheep
Columbian Ground Squirrel
Elk
Fisher
Little Brown Bat
Silver-haired Bat
Long-tailed Vole
Moose
Pika
Wolf

Not all yellow-listed species are considered to be "significant" for the purposes of this study. Some species have been listed by Alberta Fish and Wildlife to flag declines due to droughts or to indicate other management problems that may or may not apply to the study area.

COSEWIC (1993) lists as vulnerable the following species that are known to occur in the study area:

Bull Trout
Trumpeter Swan
Cooper's Hawk
Great Gray Owl
Grizzly Bear
Wolverine
Woodland Caribou

Finch (1992) describes species of concern in the Rocky Mountains of the United States. Listed species occurring in the Foothills Model Forest and that may warrant special consideration in Alberta due to sensitivity or dependence on declining habitats such as old-growth forest:

Gray Wolf
Grizzly Bear
Wolverine
Marten
Fisher
River Otter
Lynx
Rocky Mountain Bighorn Sheep
Common Loon
Trumpeter Swan
Harlequin Duck
Osprey
Bald Eagle
Northern Goshawk
Boreal Owl
Black-backed Woodpecker
Three-toed Woodpecker
Olive-sided Flycatcher

In some fields, notably geology, there have been very few studies that summarize the significance or distribution of features. In these cases, professional judgement by several researchers has been used to determine the level of significance.

The history of assigning significance levels in Alberta shows that areas are generally underrated. As more information and methods of evaluation become available, then levels of significance can be altered accordingly.

ESAs in the study area were further subdivided on the following basis:

Significance Level	Criteria
Regional	- features that are of limited distribution or are the best examples of a feature in the Foothills Model Forest
Provincial	- features that are limited in distribution at a provincial level or that are the best examples of a feature in Alberta

Areas of regional significance include:

1. key fish habitat;

2. key areas for deer, Elk, and Moose;

3. wetlands including extensive patterned fens and production and staging areas for waterfowl and marsh birds;

4. diverse or extensive areas of natural habitat;

5. landforms, landscapes or geological features that are uncommon or rare in the Foothills Model Forest;

6. landforms, landscapes or geological features that remain in a natural state and that are the best examples of their types in the Foothills Model Forest; and

7. areas containing significant populations of rare or uncommon plants and animals, e.g. Trumpeter Swan.

Areas of provincial significance include:

1. relatively undisturbed and sizeable remnants of natural habitat that elsewhere in Alberta have been disturbed by various forms of development;

2. native habitat assemblages that are among the best examples of their type in Alberta;

3. key areas for Woodland Caribou;

4. extensive patterned wetlands in the Upper Foothills; and

5. extensive Subalpine-Alpine habitat complexes in the Cardinal Divide area.

"Significant populations" of rare plants or animals generally refers to populations that are self-sustaining. Occurrences of individuals or single nest sites are not considered significant unless they are one of very few localities for the species in Alberta.

Areas of local significance are not presented on the summary maps. Most "undisturbed" lands that lie outside the boundaries of the regionally, and provincially significant ESAs could be considered locally significant sites, since they remain in native habitat and may be important in limited parts of the Foothills Model Forest. However, they do not have sufficient biophysical resources to allow consideration at the regional level.

4.3 Other Significant Areas

Areas with major physical constraints or "hazard" lands and significant cultural and historical resources have not been inventoried or discussed as part of this study.

5.0 DATA GAPS AND FUTURE RESEARCH

The purpose of this study was to identify known and potential environmentally significant areas from existing information and without field-checking. As a result, the boundaries of many areas must be considered preliminary. While, the boundaries identified in this study generally reflect areas of environmental significance, additional field data collection is required to more precisely determine boundaries for many of the ESAs.

More detailed studies should be undertaken in areas which are considered a priority either because of their high significance levels or because of planned developments. They would also be helpful in developing management strategies for each ESA.

The most conspicuously lacking information is with respect to the site specific distribution of rare plants and animals. While the critical habitats for some species such as ungulates are reasonably well documented, only patchy research has been undertaken on smaller mammals, songbirds, reptiles, amphibians, non-sport fish, invertebrates, and plants. In addition, some seasonal habitats and wildlife movement corridors, particularly for large carnivores and ungulates, are still not completely understood.

We are, however, confident that the vast majority of rare species that occur in the study area are represented in habitats that have been incorporated into Environmentally Significant Areas (ESAs) for other reasons. While minor areas of rare plant and animal habitats may still not be defined, the most significant concentrations of rare plants and animals should be accounted for by this study. The details of rare plant and animal distribution within most of the ESAs are not known. Although areas of potential habitat could be extracted from existing data, further field studies are required to accurately define the specific distribution of rare plants and animals. Considerably more work is needed to assess the significance of sites for non-vascular plants and invertebrate animals.

The significance and extent of much of the old-growth forest is still not well documented in the area. This will require general and on-going studies of the use by different wildlife species of different types of old-growth as well as site specific studies to determine the significance and extent of particular stands of old-growth.

Further research into the interactions of land uses and flow regimes in groundwater and surface water bodies (lakes and wetlands) would contribute greatly to the management of significant water bodies including large patterned wetlands.

The Foothills Model Forest's ongoing program of data acquisition and storage in a GIS will build upon the basic information provided by this study. This will include mapping land use changes. The cooperation of the Foothills Model Forest, agencies at all levels of government, landowners, researchers and naturalists will greatly enhance the type and amount of information collected. Integration with other programs and studies such as the Large Carnivore Conservation project would also be helpful.

Initial studies should be directed to refining the boundaries of certain ESAs and should also include the further identification of sites of rare, threatened or endangered plants and animals. More information is also needed on:

1. the importance of water bodies such as Fairfax, Muskiki and Mary Gregg Lakes;

2. the extent and importance of old-growth forest in the Sundance Creek and Middle Berland-Lower Pinto Creek-Lower Wildhay River areas;

3. the importance of the relatively undisturbed, extensive mixedwood habitats in the Lower Foothills area in the northeastern part of the study area;

4. the importance and connectivity of significant habitats in the Foothills Model Forest to Willmore Wilderness Provincial Park and Jasper National Park wildlife and habitats, including Whitehorse Creek and the McLeod and Cardinal River Headwaters; the Boule Range and Mumm Creek; and the Upper Wildhay River;

5. the sensitivity of significant habitats identified in point 4 to vehicle access corridors into headwaters and other areas;

6. the importance of non-ESA habitats between Hendrickson Creek and Donald Flats to Woodland Caribou;

7. areas of vegetational diversity (usually wetland or riparian habitats and immediately adjacent upland forest) identified from the aerial photograph interpretation -- some have been identified as ESAs while others have not. Specific sites include Apetowun Creek and sand dunes near the Embarras River.

8. rare plants in unique habitats such as willow-alder habitats at Coal Valley Highland (Lovett Ridge), dunes at Brûlé Lake, and calcareous springs at Ruby Lakes, Brazeau River and Thunder Lake; and

9. critical fish habitats (migration, spawning, rearing and overwintering) in unstudied or under-sampled drainages, particularly with reference to Bull Trout.

There has been some concern expressed about excluding intensively disturbed lands from evaluation in ESA studies. While areas have been excluded based on disturbance identified through the aerial photograph interpretation, other information sources (literature, interviews) were relied on to provide data on significant areas within heavily disturbed lands. As a result, some smaller sites within disturbed areas have been identified as being of environmental significance. Further field studies of disturbed areas would be required to delineate other significant features, e.g. Sharp-tailed Grouse leks in clearcuts.

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7.0 OVERVIEW OF ENVIRONMENTALLY SIGNIFICANT AREAS FOOTHILLS MODEL FOREST

Regionally Significant Sites

Site Name	Major Features	Area (sq. km)
APETOWUN CREEK	Diverse Upper Foothills Geological Features	54
ATHABASCA RANCH	Key Winter Elk Habitat	26
BEAVER CREEK	Lower Foothills Wildlife Corridor Important Fish Habitat	3
BEAVERDAM CREEK DRAINAGE	Diverse Patterned Wetland Complex Important Fish Habitat	27
BOULE RANGE	Diverse Alpine and Subalpine Key Ungulate Habitat Protected Area Buffer	289
BRAZEAU RIVER	Key Ungulate Habitat Important Fish Habitat Geological Features	46
CACHE PERCOTTE FOREST	Research/Educational Forest Lower and Upper Foothills Uncommon Wildlife Species	33
CARDINAL RIVER	Important Fish Habitat Key Ungulate Habitat Waterfall	20
EDSON RIVER	Important Fish Habitat	2
EDSON RIVER WETLAND	Key Ungulate Habitat	15
EMBARRAS RIVER DRAINAGE	Important Fish Habitat Diverse Riparian Habitat	29
EMERSON LAKES	Geological Features Diverse Sandy Habitats	8

Regionally Significant Sites (continued)

Site Name	Major Features	Area (sq. km)
ERITH RIVER DRAINAGES	Important Fish Habitat Diverse Riparian Habitat	11
FOLDING MOUNTAIN	Diverse Mountain Habitats Key Ungulate Habitat Geological Features	72
GRAVE CREEK	Diverse Lower Subalpine Habitat	50
GREGG RIVER	Important Stream Habitat	7
GREGG RIVER HEADWATERS	Key Ungulate Habitat Important Fish Habitat Diverse Mountain Habitats	99
HANLAN CREEK WETLANDS	Extensive Patterned Wetlands	8
HIGH DIVIDE RIDGE	Scenic Ridge	7
HIGHTOWER CREEK	Diverse Foothills Valley	8
JARVIS CREEK	Waterbird Habitat Diverse Foothills Valley Rare Plants and Animals Key Ungulate Habitat Breeding Bird Diversity Scenic Lookout	41
LAMBERT CREEK	Diverse Foothills Valley	14
LITTLE BERLAND -FOX DRAINAGE	Important Fish Habitat	12
LITTLE SUNDANCE WETLANDS	Trumpeter Swan Habitat	6
LOVETT RIVER HEADWATERS	Diverse Patterned Wetlands	17
LOWER BERLAND RIVER	Diverse Foothills Valley Key Ungulate Habitat Important Fish Habitat	17

Regionally Significant Sites (continued)

Site Name	Major Features	Area (sq. km)
LOWER ERITH RIVER	Diverse Riparian Habitat	6
LOWER WILLOW CREEK	Diverse Patterned Wetland	46
MACKENZIE CREEK	Diverse Valley Important Fish Habitat Key Ungulate Habitat	14
MERCOAL UPLAND	Diverse Foothills Habitats	32
MIDDLE MCLEOD RIVER	Diverse Riparian Habitats Key Ungulate Habitat Important Fish Habitat	66
MUMM CREEK	Diverse Mountain Habitats Rare Species	64
NEILSON-RUBY CREEK	Extensive Alpine Habitats	163
NOSEHILL CREEK	Key Ungulate Habitat	9
OBED HILL	Key Ungulate Habitat	22
OLDMAN CREEK	Diverse Foothills Valley Key Ungulate Habitat	17
PEMBINA RIVER	Diverse Foothills Valley Important Fish Habitat	37
PEPPERS LAKE	Waterfowl Habitat	4
PETITE-DUNN LAKES	Waterfowl Habitat Scenic Wetland Complex	2
PINE CREEK	Important Fish Habitat	3
ROBB HIGHLAND	Key Ungulate Habitat Breeding Bird Diversity	30

SUNDANCE CREEK	Key Ungulate Habitat Breeding Bird Diversity Uncommon Vegetation Type Geological Features	60
THUNDER LAKE	Geological Features	4
UPPER MCLEOD RIVER	Diverse Riparian Habitat Key Ungulate Habitat Important Fish Habitat	40
UPPER WILDHAY RIVER	Diverse Riparian Habitat Key Ungulate Habitat Scenic Lookout	60
UPPER WILLOW CREEK	Diverse Patterned Wetland	11
WEST BEAVER CREEK	Diverse Wetland -Valley Complex	13
WILDHORSE-KINKY LAKES	Productive Wetlands	1

Provincially Significant Sites

Site Name	**Major Features**	**Area (sq. km)**
ATHABASCA RIVER	Wildlife Corridor Diverse River Valley Geological Features Key Ungulate Habitat Uncommon Species	222
BERLAND RIVER -DONALD FLATS	Diverse Foothills Habitat Key Ungulate Habitat Caribou Migration Corridor	73
BERLAND RIVER -HENDRICKSON CREEK	Critical Caribou Habitat	99
BRULÉ LAKE	Unusual Montane Habitat Active Dunes Key Ungulate Habitat Rare Bird Calcareous Springs	26

Provincially Significant Sites (continued)

Site Name	Major Features	Area (sq. km)
CARDINAL RIVER HEADWATERS	Geological Features Rare Plants and Animals Diverse Mountain Habitats Rare Vegetation Type Key Ungulate Habitat	169
COAL VALLEY HIGHLAND	Diverse Foothills Habitat Key Ungulate Habitat Breeding Bird Diversity Uncommon Vegetation Type Rare Plants	155
DONALD CREEK DRAINAGE	Critical Caribou Habitat Extensive Foothills Habitats	313
LOWER PINTO CREEK	Extensive Foothills Habitats Disjunct Mountain Goat Habitat Important Fish Habitat	113
LOWER WILDHAY RIVER	Extensive Foothills Habitats Key Ungulate Habitat Important Fish Habitat Rare Birds and Mammals	230
MIDDLE BERLAND RIVER	Diverse Riparian Habitats Key Ungulate Habitat Important Fish Habitat	46
MCLEOD RIVER HEADWATERS	Geological Features Rare Plants and Animals Diverse Mountain Habitats Rare Vegetation Type Key Ungulate Habitat	89
RED CAP	Extensive Mountain Habitat Key Ungulate Habitat	148

Provincially Significant Sites (continued)

Site Name	Major Features	Area (sq. km)
SOLOMON-ICE WATER -PARADISE CREEK	Diverse Foothill Habitats Key Ungulate Habitat Rare Fish	89
UPPER PINTO CREEK	Extensive Patterned Wetland	116
WHITEHORSE CREEK	Geological Features Rare Plants and Animals Diverse Mountain Habitats Key Ungulate Habitat Important Bat Cave	89

8.0 ENVIRONMENTALLY SIGNIFICANT AREA CHECKSHEETS

Site Name: APETOWUN CREEK

Size:. 54 sq. km

Location:

- Township 53-54, Range 22-24, W5
- Apetowun Creek valley and upland to the south, including Gorge Creek

Description:

- diverse natural Upper Foothills habitat (aspen and coniferous woodlands, boreal wetlands)
- kame and fluting features
- springs

Significance: Regional

- one of several relatively undisturbed, diverse habitats in the Upper Foothills
- geological features that are localized in the region

References:

- Borneuf (1983) for springs
- Roed (1968, 1970) for surficial geology

Site Name: BEAVER CREEK

Size: 3 sq. km

Location:

- Township 57, Range 19-20, W5
- Beaver Creek valley

Description:

- Lower Foothills wildlife corridor
- deciduous and coniferous woodland
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of a handful of potentially productive wildlife corridors and Bull Trout habitats in the Lower Foothills in the region

References:

- Edson Fish and Wildlife (R. Hawryluk, personal communication), Fish and Wildlife Division (1991) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for wildlife corridor potential

Site Name: BEAVERDAM CREEK DRAINAGE

Size: 27 sq. km

Location:

- Township 47-48, Range 21-22, W5
- Beaverdam Creek valley and associated tributaries (Rainbow, Thompson, Tailor and Chief Creeks)

Description:

- Upper Foothills habitat complex
- Beaver pond complexes, calcareous ponds, patterned wetlands (including large examples), meadows, willow-dwarf birch shrubbery, and tamarack and black spruce forest
- coniferous forest on uplands
- important Moose and Elk habitat
- important fish habitat, including habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of a handful of diverse patterned wetland complexes in the Upper Foothills of the Foothills Model Forest
- one of several important fish habitats in the region

References:

- Alberta Forestry, Lands and Wildlife (1990) for Moose and Elk
- Vitt (1992) for wetlands
- Champion Forest Products (n.d.) and COSEWIC (1993) for Bull Trout

Site Name: BERLAND RIVER-DONALD FLATS

Size: 73 sq. km

Location:

- Township 56-57, Range 26, W5 - Range 3, W6
- valley of the Berland River, pasture and large tributary streams from east of Highway 40 to the mouth of "Donald Creek"

Description:

- diverse Upper Foothills valley slope complex
- extensive meadows, shrubbery, and coniferous woods
- slump blocks and springs
- key ungulate habitat
- part of the migration corridor for Woodland Caribou (woodland ecotype), an endangered species in Alberta
- year-round Elk use, including calving
- Moose habitat
- reports of Cougar (a blue-listed species in Alberta) and Grizzly Bear (a COSEWIC vulnerable species)
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Provincial

- part of a provincially significant ecosystem complex that supports Woodland Caribou

References:

- Alberta Environmental Protection (n.d.) for key ungulate habitat
- Barnes (1977) and Borneuf (1983) for springs
- Edson Fish and Wildlife (R. Hawryluk, personal communication), Fish and Wildlife Division (1991) and Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout and Woodland Caribou status
- Alberta Forestry, Lands and Wildlife (1991) for status of Woodland Caribou
- Nagy et al. (1989) for Grizzly Bear

Site Name: BERLAND RIVER-HENDRICKSON CREEK

Size: 99 sq. km

Location:

- Township 55-56, Range 3, W6
- valleys and uplands in the vicinity of the junction of Berland River and Hendrickson Creek; also includes Cabin Creek

Description:

- dry pine-lichen woodland on outwash deposits
- extensive Beaver pond complexes and diverse wet meadows
- key Upper Foothills and Subalpine habitat for Woodland Caribou (mountain ecotype), an endangered species in Alberta
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Provincial

- one of a handful of critical Woodland Caribou (mountain ecotype) habitats in Alberta

References:

- COSEWIC (1993), Fish and Wildlife Division (1991), and Edson Fish and Wildlife (R. Hawryluk, K. Smith, personal communication) for Bull Trout and Woodland ("Mountain") Caribou
- Alberta Forestry, Lands and Wildlife (1991) and Edmonds and Smith (1991) for Woodland ("Mountain") Caribou

Site Name: BOULE RANGE

Size: 289 sq. km

Location:

- Township 49-52, Range 27, W5 - Range 2, W6
- northwest of Brûlé Lake to Rock Lake
- a series of northwest to southeast trending mountain ranges: Blackcat Mountain, Brûlé Hill and Erkington Hill in eastern-most range; Boule Roche and Mt. Kephala in the Boule Range; and the western-most Boshe Range adjacent to Jasper National Park
- includes Moosehorn Lake and the following creeks: Brown, Supply, Scovil, Caywood, Oldhouse, Solomon, Westfork, Prine, Sheba and Moosehorn, as well as numerous unnamed creeks

Description:

- rugged mountains
- diverse Alpine and Subalpine vegetation
- extensive coniferous forest, grassy Alpine meadows, wet riparian meadows
- deciduous woods and shrubbery at the south end, including stands of large trees
- a buffer area between legislated protected lands to the west and multiple use areas to the east
- wildlife movement area to and from Jasper National Park and Willmore Wilderness Provincial Park
- key Elk habitat
- habitat for Bull Trout (a COSEWIC vulnerable species)
- Ogre Canyon where Black Swifts (a blue-listed species in Alberta) have been reported

Significance: Regional

- one of several representative and diverse Rocky Mountain habitat complexes in the region

References:

- Edson Fish and Wildlife (K. Smith, personal communication) for Elk
- Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- Forestry, Lands and Wildlife (1991) for Black Swift status
- aerial photograph interpretation for diverse habitats

Site Name: BRAZEAU RIVER

Size: 46 sq. km

Location:

- Township 42-45, Range 18-21, W5
- valleys of Chimney Creek, Thistle Creek and Brazeau River and adjacent uplands and wetlands

Description:

- steep corridor along lower Brazeau River with riparian floodplain
- diverse geology (gorges at Chimney and Thistle Creeks)
- esker-kame complex
- diverse wetland complexes (wet meadows, kettle ponds, springs, tufa deposits, slumps and perched wetlands)
- riparian willow and dwarf birch shrub communities
- Upper Foothills and Subalpine spruce-fir, lodgepole pine and pine-black spruce woodland
- reports of Grizzly Bear and Wolverine, both species considered by COSEWIC to be vulnerable in Canada
- key Elk habitat
- Harlequin Duck, an uncommon species
- key fish habitat, including Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of several key Elk and fish habitats in the region
- one of few esker-kame complexes in the region

References:

- Alberta Forestry, Lands and Wildlife (1990) for key fish and Elk habitat
- Fish and Wildlife Division (1991), Champion Forest Products (n.d.) for Bull Trout
- Barnes (1978), McIsaac (1983) and Borneuf (1983) for springs and tufa deposits
- Rick Bonar (personal communication) for Grizzly Bear
- COSEWIC (1993) for Bull Trout, Grizzly Bear and Wolverine status
- Bayrock and Reimchen (1980) for surficial geology

Site Name: BRULÉ LAKE

Size: 26 sq. km

Location:

- Township 49-50, Range 26-27, W5
- south end and east shore of Brûlé Lake and extensions along the Athabasca River and Highway 16

Description:

- Montane white spruce woodland as well as chokecherry-willow and stunted balsam poplar and aspen with willow-silverberry shrubbery on dunes
- extensive active and stabilized dunes in parabolic and elongate form
- calcareous springs
- spruce trees up to 400-500 years old
- reported Bald Eagle nest on the Athabasca River
- key Elk habitat
- Mule Deer habitat in dune vegetation

Significance: Provincial

- part of the most northerly area of Montane vegetation in Alberta
- a rare occurrence of active dunes in the Rocky Mountains of Alberta

References:

- Alberta Forestry, Lands and Wildlife (1990)
- Edson Fish and Wildlife (K. Smith, personal communication) for key Elk habitat
- Dan Wilson (personal communication) for Bald Eagle
- Roed (1968) for significance of dunes
- Achuff and Wallis (1993) for distribution of Montane

Site Name: CACHE PERCOTTE FOREST

Size: 33 sq. km

Location:

- Township 50-51, Range 24-25, W5
- adjacent to Hinton
- includes Happy, Hardisty and Cache Percotte Creeks, and Maxwell Lake

Description:

- a variety of Lower and some Upper Foothills woodlands including: coniferous, mixed aspen-pine and mixed aspen-white spruce
- glacial flutings
- Long-toed Salamander (a red-listed species in Alberta with a patchy, restricted distribution)
- Barred and Boreal Owls (both yellow-listed species in Alberta)
- two species of garter snakes (Red-sided and Wandering, a yellow-listed species in Alberta) have been recorded in the vicinity; at least some of the records are from the Cache Percotte Forest
- Ring-necked Duck, an uncommon species in the region
- possible location for Taiga Vole (a red-listed species in Alberta)

Significance: Regional

- one of the only research and educational forests in the region
- the only known locality for snakes in the region

References:

- Anderson (1979)
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status and management
- Smith (1993) for Taiga Vole
- Russell and Bauer (1993) for garter snakes
- Achuff et al. (1986) for Long-toed Salamander management
- Maggie Ellen (personal communication) for Cache Percotte Forest

Site Name: CARDINAL RIVER

Size: 20 sq. km

Location:

- Cardinal River valley
- Township 45, Range 18-23, W5

Description:

- narrow corridor that begins in the Subalpine and descends into the Upper Foothills
- Cardinal River Falls
- incised valley in places with steep cliffs; springs
- coniferous lodgepole pine and pine-black spruce woods
- diverse meadows with willow-dwarf birch shrubbery in upper reaches
- key Elk habitat
- key fish habitat, including Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of several key fish and wildlife habitats in the region
- one of a handful of impressive waterfalls in the Foothills Natural Region in the study area

References:

- Alberta Forestry, Lands and Wildlife (1990) for key Elk and fish habitat
- Borneuf (1983) and McIsaac (1983) for springs
- Edson Fish and Wildlife (R. Hawryluk, personal communication), Fish and Wildlife Division (1991) and COSEWIC (1993) for Bull Trout
- Jack Wright (personal communication) for Cardinal River Falls

Site Name: CARDINAL RIVER HEADWATERS

Size: 169 sq. km

Location:

- Township 44-45, Range 21-23, W5
- valleys of Toma, Russell and Nomad Creeks; headwaters of Cardinal River; Ruby Lakes; steep slopes west of Mcleod River; Front Range Mountains: Russell, Mackenzie, Prospect, Cheviot and Tripoli

Description:

- diversity of geomorphological features including tarns, waterfalls and cascades
- abundance of periglacial features including patterned ground
- extensive, diverse Alpine and Subalpine habitats, including spruce-fir and lodgepole pine woodland interspersed with large, high-elevation wetlands comprising sedge and grassy meadows and willow-dwarf birch shrubbery
- diverse meadow wetlands-spring complex (including major springs) in vicinity of Ruby Lakes; includes calcareous springs and tufa deposits
- provincially rare vegetation type -- an everlasting-boreal wormwood herb community
- nationally and provincially uncommon, rare and disjunct plant (*Rhododendron lapponicum*, *Agrostis variabilis*, *Hierochloe alpina*, *Carex misandra*, *Eriophorum callitrix*, *Salix alaxensis*, *Lesquerella arctica*, *Saxifraga flagellaris*, *Telesonix = Boykinia heucheriformis*, *Polemonium viscosum*, *Pedicularis lanata*, *Erigeron radicatus*), and invertebrate animal species
- habitat for Bull Trout (a COSEWIC vulnerable species)
- key habitat for Elk, Grizzly Bear (a COSEWIC vulnerable species), Mountain Goat (a blue-listed species in Alberta), Wolverine (a COSEWIC vulnerable species in Canada) and Fisher (a yellow-listed species in Alberta)
- part of a buffer between Jasper National Park to the west and multiple use lands to the east

Significance: Provincial, possibly National
(together with Mcleod River headwaters)

- one of the most extensive, continuous vegetated Alpine habitat complexes in the Front Ranges of the Alberta Rocky Mountains

Site Name: CARDINAL RIVER HEADWATERS (continued)

References:

- Alberta Forestry, Lands and Wildlife (1990) for Elk
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status
- COSEWIC (1993) for Bull Trout, Grizzly Bear and Wolverine status
- Alberta Ecological Survey (1977), Achuff (1984) and Komex International Ltd. (1992)
- Salt (1985 a & b) for birds and mammals
- Packer & Vitt (1974), Natural Areas Program (1983), and Mortimer (1978) for rare plants
- Argus and Pryer (1990) and Fairbarns et al. (1987) for rare plant status
- Belicek (1976), Daborn (1976), Clifford and Bergstrom (1976) and Pike (1978) for invertebrates
- Natural and Protected Areas file material
- Barnes (1978) and Borneuf (1983) for springs
- draft access management plan for the Coal Branch

Site Name: COAL VALLEY HIGHLAND

Size: 155 sq. km

Location:

- Township 47-49, Range 18-21, W5
- Lovett Ridge, east of Robb; headwaters of Erith River, including Bacon, Halpenny and Lendrum Creeks

Description:

- diverse Upper Foothills habitats including old spruce-fir, lodgepole pine and mixed pine-aspen and pine-black spruce woodlands
- extensive willow-alder on seepage springs
- wet meadows and Beaver pond complexes
- key Moose, Elk and deer habitat
- productive habitat for a diversity of breeding bird species (especially willow-alder-spring habitat)
- regionally uncommon birds - Yellow-bellied Flycatcher, Magnolia Warbler, and Bohemian Waxwing
- Barred Owls (a yellow-listed species in Alberta)
- habitat for Bull Trout (a COSEWIC vulnerable species)
- rare and uncommon plants including *Viola selkirkii, Thalictrum sparsiflorum, Sorbus scopulina* and *Oplopanax horridum*

Significance: Provincial

- the most extensive, diverse willow-alder habitats with rare species known in the Upper Foothills of Alberta

References:

- Fish and Wildlife Division (1991) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- Rick Bonar (personal communication) for Bohemian Waxwing
- Packer and Bradley (1984) for rare plants
- Cottonwood Consultants (1978) for breeding bird diversity
- aerial photograph interpretation and aerial overflights for extent of willow-alder habitats
- Achuff and Wallis (1993) for Coal Valley as special theme

Site Name: DONALD CREEK DRAINAGE

Size: 313 sq. km

Location:

- Township 55-58, Range 25, W5 - Range 1, W6
- area between the Berland River and Hightower and Pinto Creeks
- includes Smith Creek and several unnamed creeks, the largest of which is referred to as "Donald Creek" (Township 56 and 57, Range 26 and 27)

Description:

- Upper Foothills coniferous forest, including older stands, extensive marshes, wet meadows and patterned wetlands
- diverse creek habitat complexes, including slumps, Beaver ponds, tall shrubbery and wet meadows
- includes migration corridor and key winter range for Woodland Caribou, an endangered species in Alberta
- habitat for Bull Trout and Grizzly Bear, both COSEWIC vulnerable species

Significance: Provincial

- part of one of the most extensive and relatively undisturbed Upper Foothills habitat complexes in Alberta
- the most diverse and extensive Upper Foothills wetland habitat complex in Alberta
- one of a handful of critical Woodland Caribou habitats in Alberta

References:

- Vitt (1992) for wetlands
- Edson Fish and Wildlife (R. Hawryluk, personal communication), Fish and Wildlife Division (1991) for Bull Trout
- COSEWIC (1993) for Bull Trout and Woodland Caribou status
- Alberta Forestry, Lands and Wildlife (1991) for Woodland Caribou status
- Nagy et al. (1989) for Grizzly Bear
- aerial photograph interpretation for extent, quality and diversity of habitats

Site Name: EDSON RIVER

Size: 2 sq. km

Location:

- Township 54-55, Range 18-19, W5
- Edson River

Description:

- Lower Foothills stream
- diversity of fish species, including Bull Trout

Significance: Regional

- one of a handful of key fisheries in the Lower Foothills in the Foothills Model Forest

References:

- Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- Edson Fish and Wildlife (R. Hawryluk, personal communication), for fishery

Site Name: EDSON RIVER WETLAND

Size: 15 sq. km

Location:

- Township 55, Range 18, W5
- upland and unnamed creeks north of Edson River

Description:

- Lower Foothills habitat
- key Moose and deer habitat
- large, open, non-patterned wetland

Significance: Regional

- one of a handful of critical wildlife habitats identified in the Lower Foothills in the Foothills Model Forest

References:

- Alberta Government (1984) for critical wildlife habitat
- Alberta Forestry, Lands and Wildlife (1990) for Moose and deer

Site Name: EMBARRAS RIVER DRAINAGE

Size: 29 sq. km

Location:

- Township 49-51, Range 18-21, W5
- valley of Embarras River and tributaries (Baril, Mitchell, Prest and McNeill Creeks), and adjoining wetlands

Description:

- Lower Foothills streams with meander channels and oxbows
- riparian willow shrubbery as well as white spruce, lodgepole pine, black spruce and aspen woodlands; patterned wetlands, Beaver pond complexes, wet meadows, calcareous springs
- productive fishery -- Bull Trout habitat (a COSEWIC vulnerable species)

Significance: Regional

- one of a handful of productive fisheries and diverse riparian habitat complexes in the Lower Foothills of the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1990) for fish
- COSEWIC (1993), Fish and Wildlife Division (1991), and Champion Forest Products (n.d.) for Bull Trout
- aerial photograph interpretation for habitat diversity

Site Name: EMERSON LAKES

Size: 8 sq. km

Location:

- Township 54-55, Range 20-21, W5
- Emerson Lakes and connecting unnamed creeks to the south

Description:

- Lower Foothills habitats
- hoodoos, eskers, kames, and aeolian deposits
- diversity of vegetation, including sandy aspen, open water and marshy wetlands, and Beaver pond complexes
- habitat for Common Loon (yellow-listed species) and Connecticut Warbler, an uncommon species
- Wolf denning

Significance: Regional

- diverse esker complexes are very localized in the region
- one of the most diverse sandy habitat complexes in the region

References:

- Forestry, Lands and Wildlife (1991) for status of Common Loon
- nomination by Cathy Milsted, Hinton & District Chamber of Commerce, 1994, for Candidate ESA to Foothills Model Forest
- Roed (1968) for significance of eskers
- aerial photograph interpretation for habitat diversity

Site Name: ERITH RIVER DRAINAGES

Size: 11 sq. km

Location:

- Township 47-49, Range 18-19, W5
- valleys of Erith River and Landrum Creek

Description:

- narrow riparian corridors along meandering Lower Foothills streams
- coniferous lodgepole pine and black spruce woodland, swamp birch and willow shrubbery, meadows
- productive fishery -- habitat for Bull Trout (a COSEWIC vulnerable species)
- connected to critical ungulate habitat in Coal Valley Highland

Significance: Regional

- one of a handful of diverse riparian habitats and productive fish habitats in the Lower Foothills of the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1990) for fish
- Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: FOLDING MOUNTAIN

Size: 72 sq. km

Location:

- Township 48-49, Range 25-27, W5
- Folding Mountain, including Folding Mountain, Drystone Creek, and numerous unnamed creeks

Description:

- diverse Alpine and Subalpine habitats, including extensive grassy slopes, and spruce-fir and lodgepole pine woods
- excellent geological sections with contorted bedding
- key habitat for Bighorn Sheep (a yellow-listed species in Alberta)
- buffer between a legislated protected area on the west and multiple use lands on the east

Significance: Regional

- one of several representative and diverse Rocky Mountain habitat complexes in the region
- some of the best geological sections in the region

References:

- Alberta Forestry, Lands and Wildlife (1990)
- Alberta Forestry, Lands and Wildlife (1990; 1991) for Bighorn Sheep
- Spalding (1982) for geology
- aerial photograph interpretation for habitat diversity

Site Name: GRAVE CREEK

Size: 50 sq. km

Location:

- Township 45-46, Range 20-21, W5
- Grave Creek and adjacent forested uplands

Description:

- diversity of habitats -- Subalpine ridges and valleys
- upland lodgepole pine and spruce forest; black spruce bog, patterned fens (at least one of which is perched), springs
- rare plant potential
- bird diversity in willow/birch shrublands and meadows along Grave Creek
- key Elk habitat
- habitat for Bull Trout (a COSEWIC vulnerable species)
- historic value - grave of Chief Cardinal near road

Significance: Regional

- one of several diverse and productive wildlife habitat complexes in the lower Subalpine Rocky Mountain subregion of the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1990) for Elk
- Natural and Protected Areas files and McIsaac (1983)
- Borneuf (1983) for springs
- Edson Fish and Wildlife (R. Hawryluk, personal communication), for Bull Trout
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: GREGG RIVER

Size: 7 sq. km

Location:

- Township 49-50, Range 23-24, W5
- lower Gregg River valley

Description:

- Upper Foothills stream
- diverse lodgepole pine, poplar and white spruce forest with willow shrubbery
- Harlequin Duck, an uncommon bird; nesting habitat for Osprey (a blue-listed species in Alberta)
- native Rainbow Trout population (rare in Alberta)
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of several productive stream reaches in the Upper Foothills of the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1990)
- Edson Fish and Wildlife (R. Hawryluk, personal communication) and Fish and Wildlife Division (1991) for Bull Trout
- Nelson and Paetz (1992) for Rainbow Trout status
- COSEWIC (1993) for Bull Trout status
- Forestry, Lands and Wildlife (1991) for Osprey status
- aerial photograph interpretation for habitat diversity

Site Name: GREGG RIVER HEADWATERS

Size: 99 sq. km

Location:

- Township 47-48, Range 24-26, W5
- headwaters of Gregg River including Drinnan, South Drinnan, Sphinx and Berry's Creeks; unnamed tributaries of Luscar Creek; Front Range Mountains: Berry, Sphinx, Side and Drinnan; Mystery Lake

Description:

- diverse and extensive Alpine and high Subalpine habitats, including extensive grassy slopes, spruce-fir and lodgepole pine forests, wet meadows and lakes
- rock glacier
- key habitat for Bull Trout (a COSEWIC vulnerable species) including spawning in Drinnan Creek
- key habitat for Bighorn Sheep (a yellow-listed species in Alberta)
- possible wildlife movement corridor along Drinnan Creek into headwaters of the Fiddle River in Jasper National Park
- buffer between a legislated protected area on the west and mined and multiple use lands on the east

Significance: Regional

- one of several representative, diverse Rocky Mountain habitat complexes in the region
- one of several key fish and wildlife habitats in the region

References:

- Alberta Forestry, Lands and Wildlife (1990) for Bighorn Sheep and Bull Trout
- COSEWIC (1993) for Bull Trout status
- draft access management plan for the Coal Branch
- aerial photograph interpretation for habitat diversity

Site Name: HANLAN CREEK WETLANDS

Size: 8 sq. km

Location:

- Township 47-48, Range 18, W5
- three disjunct wetland complexes south of Hanlan Creek

Description:

- Lower Foothills habitats
- Beaver ponds, extensive patterned wetlands, meadows, small lakes, and small streams

Significance: Regional

- some of the most extensive patterned wetlands in the Lower Foothills portion of the Foothills Model Forest

References:

- Vitt (1992) for wetlands

Site Name: HIGH DIVIDE RIDGE

Size: 7 sq. km

Location:

- Township 49-50, Range 24-25, W5
- summit of the High Divide Ridge along the Bighorn Trail

Description:

- diverse Subalpine lodgepole pine and spruce-fir woodland and grassy meadows
- extensive views
- Grizzly Bear (a COSEWIC vulnerable species) observed in the area

Significance: Regional

- scenic Rocky Mountain habitat

References:

- highly recommended by several people interviewed
- Roed (1968) for geological/landscape significance

Site Name: HIGHTOWER CREEK

Size: 8 sq. km

Location:

- . Township 54-55, Range 27, W5; Township 54-55, Range 1, W6
- Hightower Creek (upstream of incised valley) and Wildcat Creek

Description:

- diversity of Upper Foothills habitats including: open meadows, patterned wetlands, and unpatterned wetlands
- iron springs with tufa
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of several diverse stream valley habitats in the Upper Foothills of the Foothills Model Forest

References:

- Barnes (1977) and Borneuf (1983) for springs
- Edson Fish and Wildlife (R. Hawryluk, personal communication) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: JARVIS CREEK

Size: 41 sq. km

Location:

- Township 51-53, Range 26, W5
- valley of Jarvis Creek, northwest of Hinton
- includes: William A. Switzer Provincial Park; slopes below Athabasca Lookout; Jarvis, Blue, Cache, Graveyard and Gregg Lakes; and small portions of Peppers and Winter Creeks

Description:

- Upper Foothills habitats
- extensive grassy and wet meadows, open water, sedge marshes, willow shrubbery, springs (including calcareous tufa) and boreal wetlands
- sandstone cliffs, hoodoos, eskers and classic examples of pitted outwash
- diversity of woodlands including: coniferous and mixed woodland
- provincially and nationally rare plants including: *Woodsia glabella, Haplopappus uniflorus*
- breeding bird diversity in deciduous shrubbery and mixed woods on east side of Gregg Lake
- productive waterfowl and marshbird nesting area
- nesting habitat for Osprey
- uncommon birds including: Yellow-bellied Flycatcher, Philadelphia Vireo, and Great Gray Owl (a COSEWIC vulnerable species), as well as Alberta yellow-listed species such as the Winter Wren, Black-backed Woodpecker, Barred Owl, and Pileated Woodpecker
- important Elk, Moose and deer habitat
- habitat for Wolf, Grizzly Bear (a COSEWIC vulnerable species), Moose, Cougar (a blue-listed species in Alberta), River Otter (a blue-listed species in Alberta), and Fisher (a yellow-listed species in Alberta)

Significance: Regional

- one of several diverse and productive river valley habitat complexes in the region
- one of the most diverse waterfowl and marshbird nesting areas in the region

References:

- M.V. Jones and Associates (1973)
- Roed (1968) for significance of pitted outwash at Jarvis Lake
- Borneuf (1983) for springs
- Alberta Forestry, Lands and Wildlife (1991) for status of several bird species
- Argus and Pryer (1990) and Fairbarns et al. (1987) for rare plant status
- nomination by Jeanette Brooks, Park Ranger - William A. Switzer Provincial Park, 1994, for Candidate ESA to Foothills Model Forest

Site Name: LAMBERT CREEK

Size: 14 sq. km

Location:

- Township 50-52, Range 21-22, W5
- upper Lambert Creek and associated tributaries and wetlands

Description:

- diverse Upper Foothills habitats including deciduous and coniferous valley woodlands, patterned wetlands, small boggy and marshy lakes, and springs
- steep-sided valley in places
- habitat for River Otter (a blue-listed species in Alberta)

Significance: Regional

- one of several diverse stream valley habitat complexes in the Upper Foothills of the Foothills Model Forest

References:

- Champion Forest Products (n.d.) for River Otter
- aerial photograph interpretation for habitat diversity

Site Name: LITTLE BERLAND-FOX DRAINAGE

Size: 12 sq. km

Location:

- Township 54-55, Range 2-3, W6
- valleys of Little Berland River and Fox Creek near Highway 40

Description:

- diverse Upper Foothills meadows, coniferous forest and high elevation wetlands
- possible wildlife movement corridors
- spawning habitat for Bull Trout (a COSEWIC vulnerable species)
- report of Wolverine (a COSEWIC vulnerable species)

Significance: Regional

- one of several diverse and productive stream valley habitats in the Upper Foothills of the Foothills Model Forest

References:

- Christy Butt (personal communication) for Bull Trout spawning
- Fish and Wildlife Division (1991) for Bull Trout
- COSEWIC (1993) for Bull Trout and Wolverine status
- aerial photograph interpretation for habitat diversity

Site Name: LITTLE SUNDANCE WETLANDS

Size: 6 sq. km

Location:

- Township 54, Range 19, W5
- Wetlands north and south of Little Sundance Creek

Description:

- Lower Foothills wetlands including small lakes with marshy shores and patterned wetlands
- nesting habitat for Trumpeter Swan, a COSEWIC vulnerable species in Canada and an endangered species in Alberta
- reported nesting of Great Blue Heron (a yellow-listed species in Alberta)

Significance: Regional

- nesting Trumpeter Swans and Great Blue Herons are rare in the region

References:

- Alberta Forestry, Lands and Wildlife (1990, 1991), Shandruk (1986), Poston et al. (1990), COSEWIC (1993) and Edmonds and Smith (1987) for Trumpeter Swan
- Forestry, Lands and Wildlife (1991) for bird status
- Semenchuk (1992) for Great Blue Heron

Site Name: LOVETT RIVER HEADWATERS

Size: 17 sq. km

Location:

- Township 47, Range 20-21, W5
- Lovett River headwaters and associated wetlands; Erickson Creek

Description:

- diverse Upper Foothills wetland complexes, including several extensive patterned wetlands

Significance: Regional

- one of a handful of diverse patterned wetland complexes in the Upper Foothills of the Foothills Model Forest

References:

- Vitt (1992) for wetlands

Site Name: LOWER BERLAND RIVER

Size: 17 sq. km

Location:

- Township 57-58, Range 20-22, W5
- Berland River valley from confluence with Wildhay River to the confluence with the Athabasca River

Description:

- the most incised portion of the Berland River within the region
- Lower Foothills mixed woodlands and stands of large riparian poplar
- hoodoos, steep slopes, and springs
- Beaver ponds, oxbow lakes, and marshes
- important ungulate and fish habitat

Significance: Regional

- one of a handful of diverse and productive stream valley habitats in the Lower Foothills of the Foothills Model Forest

References:

- Alberta Environmental Protection (n.d.) for fish
- Fish and Wildlife Division (1990) for ungulate habitat
- Tokarsky (1977) and Borneuf (1983) for springs
- aerial photograph interpretation for habitat diversity

Site Name: LOWER ERITH RIVER

Size: 6 sq. km

Location:

- Township 49-51, Range 18-19, W5
- valley of Erith River upstream of confluence with Raven Creek downstream to confluence with the Embarras River

Description:

- Lower Foothills streams with meander channels and oxbows
- riparian willow shrubbery as well as conifer woodlands
- wet meadows and calcareous springs

Significance: Regional

- one of a handful of diverse riparian habitat complexes in the Lower Foothills of the Foothills Model Forest

References:

- aerial photograph interpretation for habitat diversity

Site Name: LOWER PINTO CREEK

Size: 113 sq. km

Location:

- Township 55-56, Range 24-26, W5
- valley of lower Pinto Creek and adjacent upland, and the mouth of Wroe Creek

Description:

- Upper Foothills habitats
- diverse valley habitats including grassy slopes, wet meadows, low shrubbery, and deciduous and coniferous woodland
- coniferous forest uplands
- back channel swamps and oxbows, springs
- cliffs and a spectacular, 200 meter deep valley
- includes a unique population of Mountain Goats, isolated from other populations in the Rocky Mountains
- reports of Fisher (a yellow-listed species in Alberta) and Grizzly Bear (a COSEWIC vulnerable species)
- habitat for Black-backed Woodpecker (a yellow-listed species in Alberta)
- key fish habitat, including habitat for Bull Trout (a COSEWIC vulnerable species) and, formerly, Arctic Grayling spawning

Significance: Provincial

- part of one of the most extensive and relatively undisturbed Upper Foothills habitat complexes in Alberta
- the largest of a handful of Mountain Goat populations in Alberta that exist in non-mountainous terrain

References:

- Stelfox and Kerr (1962) and Penner and Jalkotzy (1982) for Mountain Goats
- Edson Fish and Wildlife (R. Hawryluk, personal communication) for key fish habitat
- Dan Wilson (personal communication) for Arctic Grayling spawning
- COSEWIC (1993) for Bull Trout status
- Semenchuk (1992) and Forestry, Lands and Wildlife (1991) for Black-backed Woodpecker
- Nagy et al (1989) for Grizzly Bear
- Achuff and Wallis (1992) for significance as a potential protected area (referenced as Lower Wildhay River region)
- aerial photograph interpretation for habitat diversity

Site Name: LOWER WILDHAY RIVER

Size: 230 sq. km

Location:

- Township 53-58, Range 23-27, W5
- lower stretches of Wildhay River valley and portions of adjacent upland, including unnamed creeks

Description:

- Lower Foothills in the northern half; Upper Foothills in southern portions
- very diverse, extensive river valley habitats, including: deciduous, mixed and coniferous woodland (with stands of old white spruce, fir and lodgepole pine)
- variety of wetlands in the valley and adjacent uplands: fens, marshes, oxbows, meadows, Beaver pond complexes and patterned wetlands
- outwash and glacial sand deposits
- habitat for the following Alberta blue-listed species: River Otter and Cougar
- key Elk, Moose and deer habitat
- habitat for the following Alberta yellow-listed species: Barred Owl, Black-backed Woodpecker, and Fisher
- key habitat for a diversity of fish species including Bull Trout (a COSEWIC vulnerable species)

Significance: Provincial

- part of one of the most extensive and relatively undisturbed Upper and Lower Foothills fish and wildlife habitat complexes in Alberta

References:

- Semenchuk (1992) for Black-backed Woodpecker
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status
- Edson Fish and Wildlife (R. Hawryluk, K. Smith, personal communication) for Bull Trout and ungulates
- Fish and Wildlife Division (1991), Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- Achuff and Wallis (1992) for significance as a potential protected area
- aerial photograph interpretation for habitat diversity

Site Name: LOWER WILLOW CREEK

Size: 46 sq. km

Location:

- Township 57-58, Range 21-22, W5
- lower stretch of unnamed tributary of Berland River (locally known as Willow Creek) and adjacent uplands

Description:

- diverse Lower Foothills habitats including deciduous, mixed and coniferous woodlands, and wetlands
- large patterned wetland -- habitat for Sandhill Crane (regionally rare)
- small lakes and Beaver ponds

Significance: Regional

- one of the most diverse patterned wetlands in the Lower Foothills of the Foothills Model Forest

References:

- Vitt (1992) for wetlands
- Semenchuk (1992) for Sandhill Crane
- aerial photograph interpretation for habitat diversity

Site Name: MACKENZIE CREEK

Size: 14 sq. km

Location:

- Township 46-47, Range 22-23, W5
- valley of Mackenzie Creek and tributaries (Little Mackenzie and Meadow Creeks)

Description:

- attractive narrow valley in the Upper Foothills and lower Subalpine
- meadows including willow and dwarf birch shrubbery
- important Bull Trout spawning stream
- key Moose and Elk habitat

Significance: Regional

- one of several diverse and productive stream valley habitats in the Foothills Model Forest
- one of several key ungulate and fish habitats in the region

References:

- Alberta Forestry, Lands and Wildlife (1990) for Bull Trout and ungulates
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: MCLEOD RIVER HEADWATERS

Size: 89 sq. km

Location:

- Township 45-46, Range 22-24, W5
- Front Range Mountains: Tripoli, Cheviot and Prospect; Miette Range; Drummond, Thornton and Prospect Creeks; small portions of Whitehorse and Cheviot Creeks; high terrain north of Cardinal River

Description:

- extensive and diverse Alpine and Subalpine habitats including meadows, spruce-fir and lodgepole pine forests, and willow-dwarf birch shrubbery
- abundant and diverse periglacial features (patterned ground)
- diversity of geomorphological features
- provincially rare vegetation type - an everlasting-boreal wormwood herb community
- nationally and provincially uncommon, rare and disjunct plant and invertebrate species
- habitat for Bull Trout and Grizzly Bear, both COSEWIC vulnerable species
- key habitat for Elk and Bighorn Sheep (a yellow-listed species in Alberta)
- diverse breeding bird habitat
- habitat for Wolf, Wolverine (a COSEWIC vulnerable species in Canada) and Fisher

Significance: Provincial, possibly National
(together with Cardinal River headwaters)

- one of the most extensive, continuous vegetated Alpine in the Front Ranges of the Alberta Rocky Mountains

References:

- Alberta Forestry, Lands and Wildlife (1990) for Elk and Bighorn Sheep
- Alberta Ecological Survey (1977), Achuff (1984) and Komex Int. Ltd. (1992)
- Salt (1985 a & b) for birds and mammals
- Argus and Pryer (1990) and Fairbarns et al. (1987) for rare plant status
- Packer and Vitt (1974), Natural Areas Program (1983), and Mortimer (1978) for rare plants
- Belicek (1976), Daborn (1976), Clifford and Bergstrom (1976) and Pike (1978) for invertebrates
- Natural and Protected Areas file material
- Fish and Wildlife Division (1991), Edson Fish and Wildlife (R. Hawryluk, personal communication) for Bull Trout
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status
- COSEWIC (1993) for Bull Trout, Grizzly Bear and Wolverine status
- draft access management plan for the Coal Branch

Site Name: MERCOAL UPLAND

Size: 32 sq. km

Location:

- Township 48-49, Range 22-23, W5
- headwaters of Mercoal Creek and unnamed tributaries of McLeod River, west of Mercoal

Description:

- diverse Upper Foothills habitat including patterned wetlands, slope fens and coniferous woodland
- numerous small streams
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Regional

- one of several diverse and productive stream valley/upland habitat complexes in the Upper Foothills of the Foothills Model Forest

References:

- Fish and Wildlife Division (1991), Champion Forest Products (n.d.) for Bull Trout
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: MIDDLE BERLAND RIVER

Size: 46 sq. km

Location:

- Township 58, Range 23-26, W5
- middle stretches of Berland River valley and a portion of adjoining upland

Description:

- very diverse Lower Foothills and, along western reaches, Upper Foothills riparian habitat, including mature spruce and poplar
- oxbows and springs
- critical ungulate habitat
- reports of River Otter (a blue-listed species in Alberta)
- patterned wetland with Sandhill Crane nesting habitat
- extensive coniferous upland forest
- important fishery
- habitat for Bull Trout (a COSEWIC vulnerable species)

Significance: Provincial

- some of the most extensive and productive riparian woodland habitat in the Upper Foothills of Alberta
- one a handful of remote, relatively undisturbed and productive riparian woodland habitats in the Lower Foothills of Alberta

References:

- Tokarsky (1977) and Borneuf (1983) for springs
- Edson Fish and Wildlife (R. Hawryluk and K. Smith, personal communication) for Bull Trout and ungulates
- Christy Butt (personal communication) for Sandhill Crane
- Alberta Environmental Protection (n.d.) for fish
- Fish and Wildlife Division (1991) Bull Trout
- COSEWIC (1993) for Bull Trout status
- Achuff and Wallis (1992) for significance as a potential protected area (referenced as Lower Wildhay River region)
- aerial photograph interpretation for habitat diversity

Site Name: MIDDLE MCLEOD RIVER

Size: 66 sq. km

Location:

- Township 50-52, Range 20-24, W5
- McLeod River valley and unnamed tributaries and wetlands; Anderson and McPherson Creeks

Description:

- diverse Upper and Lower Foothills riparian and wetland habitats
- glacial lake deposits
- diverse floodplain wetlands, including meander scrolls, springs and meadows
- excellent wetland diversity on adjacent uplands, including patterned wetlands
- extensive Beaver pond complexes on smaller creeks
- pioneering vegetation, and riparian poplar and coniferous woodlands
- key Moose and Elk habitat
- Wolf denning along McPherson Creek
- key fish habitat
- important Bull Trout spawning habitat (Anderson Creek)

Significance: Regional

- one of the most diverse and productive stream valley habitat complexes in the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1990) for Bull Trout and ungulates
- COSEWIC (1993) for Bull Trout status
- Rick Bonar and Christy Butt (personal communication) for Wolf dens
- aerial photograph interpretation for habitat diversity

Site Name: NOSEHILL CREEK

Size: 9 sq. km

Location:

- Township 56-57, Range 20, W5
- Nosehill Creek valley

Description:

- Lower Foothills wildlife corridor
- key Elk habitat
- extensive Beaver pond complexes
- habitat for Winter Wren (a yellow-listed species in Alberta)

Significance: Regional

- one of a handful of productive wildlife corridors in the Lower Foothills of the Foothills Model Forest

References:

- Alberta Environmental Protection (n.d.) for Elk habitat
- Rick Bonar (personal communication), Alberta Forestry, Lands and Wildlife (1991) for Winter Wren

Site Name: OBED HILL

Size: 22 sq. km

Location:

- Township 52-53, Range 22-23, W5
- Obed Hills, south and west of Obed Lake

Description:

- Upper Foothills lodgepole pine and mixed aspen-pine woodland
- key Moose (winter) and Elk habitat (including calving)

Significance: Regional

- one of several key Moose and Elk habitats in the region

References:

- Alberta Forestry, Lands and Wildlife (1990) for ungulates

Site Name: OLDMAN CREEK

Size: 17 sq. km

Location:

- Township 55, Range 22-24, W5
- Oldman River valley

Description:

- diverse Upper Foothills stream valley habitat including meadows as well as coniferous and aspen woodland; Lower Foothills at the confluence with the Athabasca River
- slumps, oxbows
- glacial lake deposits
- historical records of Mountain Goats
- reports of Grizzly Bear (a COSEWIC vulnerable species)
- key Elk habitat
- habitat for Bull Trout (a COSEWIC vulnerable species) near the confluence with the Athabasca River

Significance: Regional

- one of several productive wildlife corridors and Bull Trout habitats in the region
- one of several key Elk habitats in the region

References:

- Fish and Wildlife Division (1991), Champion Forest Products (n.d.) for Bull Trout
- Edson Fish and Wildlife (K. Smith, personal communication) for Elk
- COSEWIC (1993) for Bull Trout status
- Roed (1968) for surficial geology

Site Name: PEMBINA RIVER

Size: 37 sq. km

Location:

- Township 45-46, Range 18-21, W5
- Pembina River valley, and Hanson and Bailey Creeks

Description:

- Upper Foothills with a diversity of stream valley habitats including meadows; old meander channels; open lodgepole pine, white spruce and pine-black spruce woodlands; willow-dwarf birch shrubbery; Beaver ponds, and springs
- limited riparian habitat development
- extensive patterned wetlands in upper Bailey Creek and small lake adjacent to Bailey Creek
- Pembina Falls
- diversity of fish species in Pembina River
- habitat for Bull Trout (a COSEWIC vulnerable species) at west end tributaries

Significance: Regional

- one of several Bull Trout streams and diverse wildlife habitat corridors in the Upper Foothills of the Foothills Model Forest

References:

- Champion Forest Products (n.d.) for Bull Trout
- Borneuf (1983) for springs
- COSEWIC (1993) for Bull Trout status
- aerial photograph interpretation for habitat diversity

Site Name: PEPPERS LAKE

Size: 4 sq. km

Location:

- Township 51, Range 26, W5
- 10 kilometers west of Hinton

Description:

- Upper Foothills lake and marsh, and associated boreal wetlands
- waterfowl breeding and staging area
- report of Bald Eagle (a yellow-listed species in Alberta)

Significance: Regional

- one of a handful of waterfowl habitats in the region

References:

- nomination by Jeanette Brooks, Park Ranger - William A. Switzer Provincial Park for Candidate ESA to Foothills Model Forest (for waterfowl breeding and staging)
- M.V. Jones & Associates (1973) for Bald Eagle
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status

Site Name: PETITE-DUNN LAKES

Size: 2 sq. km

Location:

- Township 54, Range 25-26, W5
- Petite and Dunn Lakes and associated wetlands immediately north of the confluence of the lower Wildhay River and Jarvis Creek

Description:

- Upper Foothills marsh, open water and upland mixed woods
- reports of American White Pelicans
- habitat for Common Loon (a yellow-listed species in Alberta)

Significance: Regional

- one of the more scenic wetland complexes in the region

References:

- Dan Wilson and Rick Bonar (personal communication)

Site Name: PINE CREEK

Size: 3 sq. km

Location:

- Township 57, Range 18-19, W5
- valleys of Pine Creek and unnamed tributary

Description:

- Lower Foothills habitats including mature spruce, Beaver ponds and meadows
- Bull Trout known from lower reaches, just outside Study Area
- diversity of fish species

Significance: Regional

- one of a handful of productive fish habitats in the Lower Foothills of the Foothills Model Forest

References:

- Champion Forest Products (n.d.) for Bull Trout, Fish and Wildlife Division (1991), and Edson Fish and Wildlife (R. Hawryluk, personal communication) for Bull Trout
- COSEWIC (1993) for Bull Trout status

Site Name: RED CAP

Size: 148 sq. km

Location:

- Township 45-46, Range 21-23, W5
- Nikanassin Range including Red Cap and Cadomin Mountains; upper portion of Mackenzie Creek

Description:

- extensive dry Alpine slopes
- Subalpine spruce-fir and lodgepole pine forest
- numerous creeks
- shrub fens dominated by willow and dwarf birch
- key habitat for Bighorn Sheep (a yellow-listed species in Alberta)
- part of a buffer between protected lands to the west (Jasper National Park) and multiple use lands to the east

Significance: Provincial

- part of a provincially significant extensive Alpine-Subalpine habitat complex extending to the Cardinal River Headwaters

References:

- Alberta Forestry, Lands and Wildlife (1990) for Bighorn Sheep
- aerial photograph interpretation for habitat diversity

Site Name: ROBB HIGHLAND

Size: 30 sq. km

Location:

- Township 48-49, Range 21, W5
- Lovett Ridge west of Robb, including valleys of Bryon and Jackson Creeks

Description:

- extension of Upper Foothills Coal Valley Highland but has some cut-over areas that are regenerating into deciduous trees and shrubs ("willow barrens")
- aspen, mixed and coniferous woodland as well as willow-alder habitat and spring-related vegetation
- key deer, Elk and Moose habitat
- productive for a diversity of breeding birds

Significance: Regional

- extensive and productive tall deciduous shrub communities are localized in the region
- one of several key ungulate habitats in the region

References:

- Sean Curry and Christy Butt (personal communication)
- Alberta Forestry, Lands and Wildlife (1990) for ungulates
- aerial photograph interpretation for tall shrub habitat

Site Name: SOLOMON-ICE WATER-PARADISE CREEK

Size: 89 sq. km

Location:

- Township 51-52, Range 27, W5 and Range 1, W6
- foothill ridges and valleys west of William A. Switzer Provincial Park
- includes valleys of Paradise, Solomon, Ice Water, Levi, West Fork and Jarvis Creeks, and unnamed creeks

Description:

- wide range of Upper Foothills vegetation from dense coniferous, mixed and aspen woods to tall shrub communities, grassy slopes and wet meadows
- springs
- pitted outwash deposits
- critical Elk and Moose habitats
- reports of Cougar (a blue-listed species in Alberta)
- habitat for Pygmy Whitefish, a rare species in Alberta
- part of a buffer between legislated protected areas to the west and multiple use lands to the east

Significance: Provincial

- one of the most diverse Upper Foothills habitat complexes in Alberta
- one of three known locations for Pygmy Whitefish in Alberta

References:

- Edson Fish and Wildlife (K. Smith, personal communication) for Elk
- Nelson and Paetz (1992) for Pygmy Whitefish
- aerial photograph interpretation for habitat diversity

Site Name: SUNDANCE CREEK

Size: 60 sq. km

Location:

- Township 54-55, Range 20-21, W5
- Sundance Creek valley, Sundance Lake and lower Little Sundance Creek

Description:

- diversity of Lower Foothills and Upper Foothills habitats, including moist spruce-fir woodland (including old-growth), deciduous woodland, marshy wetland, Beaver pond and springs
- springy aspen-alder-saskatoon shrubbery (productive breeding bird habitat)
- classic glacial spillway-meltwater channel features
- habitat for Bull Trout (a COSEWIC vulnerable species) native Rainbow Trout (rare in Alberta), and a significant population of Arctic Grayling
- old slumps, sandstone cliffs, hoodoos and marl deposits
- staging and production area for a variety of waterfowl
- nesting Bonaparte's Gulls, a rare species in the study area
- habitat for Winter Wren and Pileated Woodpecker (both yellow-listed species in Alberta)
- *Oplopanax horridum*, a uncommon plant in Alberta

Significance: Regional

- one of the most scenic, diverse and productive wildlife corridors in the Lower Foothills of the region
- one of a handful of important fish habitats in the Lower Foothills of the region
- shrub communities that have a restricted distribution in the Foothills Model Forest

References:

- Alberta Forestry, Lands and Wildlife (1991) for status of bird species
- Fish and Wildlife Division (1991), Champion Forest Products (n.d.) for Bull Trout
- Edson Fish and Wildlife (R. Hawryluk, personal communication) for Arctic Grayling
- COSEWIC (1993) for Bull Trout status
- Semenchuk (1991) for Bonaparte's Gull
- Nelson and Paetz (1992) for Rainbow Trout status
- Roed (1968) for geological significance
- MacDonald (1982) for marl
- highly rated by several interviewees

Site Name: THUNDER LAKE

Size: 4 sq. km

Location:

- Township 44-45, Range 19, W5
- Thunder Lake and adjacent ridge and wetland topography

Description:

- Upper Foothills lodgepole pine and pine-black spruce forest
- a complex of eskers with kettle lakes
- Thunder Lake

Significance: Regional

- esker complexes are rare in the region

References:

- Bayrock & Reimchen (1980) for surficial geology

Site Name: WEST BEAVER CREEK

Size: 13 sq. km

Location:

- Township 57-58, Range 23-24, W5
- unnamed tributary (locally known as Beaver Creek) of Berland River; includes smaller creeks and a large wetland at the upper end

Description:

- large patterned wetland in the Lower Foothills
- extensive Beaver pond complexes and riparian meadows

Significance: Regional

- one of a handful of diverse patterned wetland complexes in the Lower Foothills of the Foothills Model Forest

References:

- Vitt (1992) for wetlands

Site Name: WHITEHORSE CREEK

Size: 89 sq. km

Location:

- Township 46-47, Range 23-25, W5
- valleys of Whitehorse Creek and unnamed tributaries and Harlequin Creek (including headwaters of these streams); Nikanassin and Miette Ranges; Front Range Mountains: Gregg, Luscar and Leyland

Description:

- extensive and diverse Alpine-high Subalpine with meadows, spruce-fir and lodgepole pine forests, and willow-dwarf birch shrubbery
- provincially unique vegetated rock glacier
- patterned ground, waterfalls, and springs
- Cadomin Cave has interesting cave features and is of provincial significance: it is habitat for swarming and hibernating bats of three species
- key habitat for Bighorn Sheep (a yellow-listed species in Alberta), Elk and Mountain Goat (a blue-listed species in Alberta)
- key fish habitat, including Bull Trout (a COSEWIC vulnerable species)
- rare, uncommon and disjunct plants
- part of a buffer between Jasper National Park to the west and multiple use lands to the east

Significance: Provincial

- part of a provincially significant extensive Alpine-Subalpine habitat complex extending to the Cardinal River Headwaters and Red Cap
- one of two caves in mountain-foothill region of Alberta known to be used by hibernating bats

References:

- Salt (1985a), Alberta Energy and Natural Resources, Fish and Wildlife Division (1986) for bats
- Borneuf (1983) for springs
- Alberta Forestry, Lands and Wildlife (1990) for ungulates and fish
- Fish and Wildlife Division (1991) for Bull Trout
- COSEWIC (1993) for Bull Trout and Grizzly Bear status
- Alberta Forestry, Lands and Wildlife (1991) for wildlife status

Site Name: WILDHORSE-KINKY LAKES

Size: 1 sq. km.

Location:

- Township 49-50, Range 26, W5
- east of Brûlé Lake, including: Peach, Kinky, Wildhorse and Kia Nea Lakes, and unnamed lake north of Peach Lake

Description:

- small lakes and bulrush marsh within a cutover area
- aeolian deposits
- rare plant potential; several species of orchids are known to occur
- habitat for Long-toed Salamander (a red-listed species with a restricted, patchy distribution in Alberta)
- nesting area for waterfowl and Common Loon (a yellow-listed species in Alberta)

Significance: Regional

- productive wetlands are localized in the region

References:

- Achuff et al. (1986), Hunt (1987) and Alberta Forestry, Lands and Wildlife (1991) for Long-toed Salamander
- aerial photograph interpretation for wetland habitats

APPENDIX 1

BROWSE TABLE FROM MODFORST DBASE IV FILE
THEME REPRESENTATION IN FOOTHILLS
MODEL FOREST ESAs

APPENDIX 1: BROWSE TABLE FROM MODFORST DBASE IV FILE -- SUMMARY OF FOOTHILLS MODEL FOREST ESA FEATURES

The browse table on the next page was derived from the DBASE IV file MODFORST.DBF and indicates the location (TWP, RGE MER), Level of Significance (SIGN: R = Regional; P = Provincial), key features (KEYFEATURE), and all other features. Features represented are denoted by a Y.

The following abbreviations are used for feature headings in the browse table:

HYD -	Hydrological features such as springs, tufa
GEO -	Geological features including landforms such as glacial lake deposits, sand plains, waterfalls, and eskers
LANDSC -	Landscape features including diverse or aesthetically attractive landscapes
WETL -	Wetlands
WFOWL -	Waterfowl habitat
RIPRN -	Riparian or streamside habitats
OLDGR -	Exceptional older trees or old-growth forests
RARHAB -	Rare habitats, e.g. active sand
RARSPP -	Rare species
DIVHAB -	Diverse habitats
BIRDDIV -	Breeding bird diversity
KEYWILD -	Key or critical wildlife habitat, primarily ungulate range
KEYFISH -	Key fish habitat
CORR -	Wildlife or diverse vegetation corridor
RESRCH -	Research area
OTHER -	All other features, e.g. buffer to a protected area

SITENAME	TWP	RGE	MER	SIGN	KEYFEATURE	HYD	GEO	LANDSC	WETL	WFOWL	RIPN	OLDGR	RARHAB	RARSPP	DIVHAB	BIRDDIV	KEY WILD	KEYFISH	CORR	RESRCH	OTHER
APETOWUN CREEK	53	23	W5	R	DIVERSE UPPER FOOTH	Y	Y								Y						
ATHABASCA RANCH	51	25	W5	R	KEY ELK WINTER HAB		Y										Y				
ATHABASCA RIVER	52	24	W5	P	WILDLIFE CORRIDOR	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y		
BEAVER CREEK	57	19	W5	R	WILDLIFE CORRIDOR									Y					Y		
BEAVERDAM CREEK DRAINAGE	47	21	W5	R	DIVERSE WETLANDS				Y					Y	Y		Y	Y			
BERLAND RIVER-DONALD FLATS	55	1	W6	P	CARIBOU	Y	Y							Y	Y		Y		Y		
BERLAND RIVER-HENDRICKSON CREEK	55	3	W6	P	CARIBOU				Y				Y	Y	Y		Y				
BOULE RANGE	50	28	W5	R	DIVERSE MOUNTAINS			Y				Y		Y	Y		Y		Y		
BRAZEAU RIVER	43	20	W5	R	FISH, WILDLIFE, GEOL	Y	Y		Y		Y		Y	Y	Y		Y	Y	Y		
BRULE LAKE	49	27	W5	P	NORTHERN MONTANE	Y	Y					Y	Y	Y			Y				
CACHE PERCOTTE FOREST	50	24	W5	R	RESEARCH FOREST		Y							Y	Y					Y	Y
CARDINAL RIVER	45	21	W5	R	FISH, WILDLIFE	Y	Y	Y	Y					Y			Y	Y	Y		
CARDINAL RIVER HEADWATERS	45	24	W5	P	EXTENSIVE ALPINE	Y	Y	Y	Y				Y	Y	Y		Y	Y			Y
COAL VALLEY HIGHLAND	48	20	W5	P	EXTENSIVE WILLOW	Y			Y			Y	Y	Y	Y	Y	Y				
DONALD CREEK DRAINAGE	56	26	W5	P	CARIBOU, DIVERSITY				Y			Y		Y	Y		Y				
EDSON RIVER	55	19	W5	R	FISH HABITAT													Y			
EDSON RIVER WETLAND	55	18	W5	R	KEY UNGULATE				Y								Y				
EMBARRAS RIVER DRAINAGE	50	20	W5	R	DIVERSE RIPARIAN				Y		Y			Y	Y			Y	Y		
EMERSON LAKES	54	22	W5	R	ESKER COMPLEX		Y	Y	Y				Y	Y	Y						
ERITH RIVER DRAINAGES	48	19	W5	R	RIPARIAN, FISH						Y			Y				Y	Y		
FOLDING MOUNTAIN	48	26	W5	R	GEOLOGY, WILDLIFE		Y	Y						Y	Y		Y				Y
GRAVE CREEK	45	21	W5	R	DIVERSE SUBALPINE	Y			Y					Y	Y	Y	Y				Y
GREGG RIVER	49	24	W5	R	FISH						Y			Y	Y				Y		
GREGG RIVER HEADWATERS	47	24	W5	R	DIVERSE MOUNTAINS		Y	Y						Y	Y		Y	Y	Y		
HANLAN CREEK WETLANDS	47	18	W5	R	EXTENSIVE WETLAND				Y												
HIGH DIVIDE RIDGE	50	25	W5	R	SCENIC MOUNTAINS			Y						Y							
HIGHTOWER CREEK	54	27	W5	R	DIVERSE UPPER FOOTH	Y	Y		Y				Y	Y	Y						
JARVIS CREEK	52	26	W5	R	WETLAND, VALLEY	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y		
LAMBERT CREEK	51	21	W5	R	DIVERSE STREAM				Y		Y			Y	Y						
LITTLE BERLAND-FOX DRAINAGE	54	2	W6	R	DIVERSE STREAM				Y		Y			Y	Y			Y	Y		
LITTLE SUNDANCE WETLANDS	54	19	W5	R	TRUMPETER SWAN				Y	Y			Y	Y							
LOVETT RIVER HEADWATERS	47	20	W5	R	DIVERSE WETLANDS				Y												
LOWER BERLAND RIVER	58	20	W5	R	DIVERSE STREAM	Y	Y	Y	Y		Y	Y	Y		Y		Y	Y	Y		
LOWER ERITH RIVER	50	19	W5	R	DIVERSE STREAM	Y			Y		Y				Y				Y		
LOWER PINTO CREEK	56	25	W5	P	EXTENSIVE UPPER FOO	Y	Y	Y	Y		Y			Y	Y		Y	Y			
LOWER WILDHAY RIVER	55	25	W5	P	EXTENSIVE FOOTHILLS	Y	Y	Y	Y		Y	Y		Y	Y		Y	Y	Y		
LOWER WILLOW CREEK	57	22	W5	R	DIVERSE WETLAND				Y					Y	Y						
MACKENZIE CREEK	47	22	W5	R	DIVERSE STREAM				Y		Y			Y	Y		Y	Y			
MCLEOD RIVER HEADWATERS	46	24	W5	P	EXTENSIVE ALPINE		Y	Y					Y	Y	Y	Y	Y				
MERCOAL UPLAND	48	23	W5	R	DIVERSE STREAM				Y		Y			Y	Y						
MIDDLE BERLAND RIVER	58	24	W5	P	EXTENSIVE RIPARIAN	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y		
MIDDLE MCLEOD RIVER	51	22	W5	R	DIVERSE STREAM	Y	Y		Y		Y			Y	Y		Y	Y	Y		
MUMM CREEK	52	1	W6	R	DIVERSE MOUNTAINS			Y	Y					Y	Y		Y				Y
NEILSON-RUBY CREEK	43	21	W5	R	EXTENSIVE ALPINE		Y	Y						Y	Y		Y				
NOSEHILL CREEK	56	20	W5	R	WILDLIFE CORRIDOR				Y		Y			Y			Y		Y		
OBED HILL	52	22	W5	R	KEY MOOSE, ELK												Y				
OLDMAN CREEK	55	23	W5	R	DIVERSE STREAM		Y				Y			Y	Y		Y		Y		
PEMBINA RIVER	46	19	W5	R	DIVERSE STREAM		Y	Y	Y		Y			Y	Y			Y	Y		
PEPPERS LAKE	51	26	W5	R	WATERFOWL				Y	Y				Y							
PETITE-DUNN LAKES	54	25	W5	R	SCENIC WETLAND			Y	Y					Y							
PINE CREEK	57	18	W5	R	DIVERSE FISH						Y							Y			
RED CAP	46	22	W5	P	EXTENSIVE ALPINE			Y	Y						Y		Y				
ROBB HIGHLAND	48	21	W5	R	EXTENSIVE SHRUB				Y				Y		Y	Y	Y				
SOLOMON-ICE WATER-PARADISE CREEK	51	27	W5	P	DIVERSE UPPER FOOTH	Y	Y	Y	Y					Y	Y		Y				Y
SUNDANCE CREEK	55	20	W5	R	DIVERSE LOWER FOOT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
THUNDER LAKE	44	19	W5	R	ESKER COMPLEX		Y	Y	Y												
UPPER MCLEOD RIVER	49	23	W5	R	RESEARCH, FISH/WILDL	Y			Y		Y			Y	Y		Y	Y	Y		
UPPER PINTO CREEK	53	27	W5	P	DIVERSE WETLAND	Y			Y					Y	Y						
UPPER WILDHAY RIVER	52	2	W6	R	WILDLIFE CORRIDOR		Y	Y			Y	Y		Y	Y		Y		Y		
UPPER WILLOW CREEK	55	23	W5	R	DIVERSE WETLAND				Y						Y						
WEST BEAVER CREEK	57	24	W5	R	DIVERSE WETLAND				Y						Y						
WHITEHORSE CREEK	46	24	W5	P	EXTENSIVE ALPINE	Y	Y	Y						Y	Y		Y	Y			Y
WILDHORSE-KINKY LAKES	49	26	W5	R	WETLAND		Y		Y	Y				Y							

APPENDIX 2. DISCUSSION DRAFT, MANAGEMENT CONSIDERATIONS FOR ENVIRONMENTALLY SIGNIFICANT AREAS WITHIN THE FOOTHILLS MODEL FOREST

DISCUSSION DRAFT
MANAGEMENT CONSIDERATIONS FOR ENVIRONMENTALLY SIGNIFICANT AREAS WITHIN THE FOOTHILLS MODEL FOREST

Sweetgrass Consultants Ltd.
70 Deerpath Rd SE
Calgary, Alberta
T2J 6K8

1994

ABSTRACT

The primary purpose of the project was to develop a discussion paper regarding the management of Environmentally Significant Areas (ESAs) identified in the Foothills Model Forest in west-central Alberta. A variety of management principles and strategies for ESAs are outlined that could help to ensure the long-term maintenance of ESA features. There is also a discussion of threats to ESA features in the Foothills Model Forest as well as the provincial and federal policy context for land use zoning, biodiversity conservation and protected areas. Particular attention is paid to habitat fragmentation, old-growth forests, riparian habitats, wetlands, and high profile species such as fish, cavity-nesting birds, neotropical migrant birds, Woodland Caribou and Grizzly Bear.

EXECUTIVE SUMMARY

Sweetgrass Consultants Ltd. was contracted by the Foothills Model Forest to undertake a preliminary study of Environmentally Significant Areas (ESAs) throughout the Foothills Model Forest in west-central Alberta. The study area is situated at the meeting place of several major natural regions -- Upper and Lower Foothills and the Montane, Subalpine and Alpine Rocky Mountains.

The primary purpose of the study was to develop an information base that would be useful for future planning and management in the area. Environmental data was collected from aerial photograph interpretation; reviews of published and unpublished information in government files and reports, scientific and popular publications, and consultant reports; and interviews with knowledgeable persons.

Standard criteria that have been applied in other ESA studies in Alberta were used for the Foothills Model Forest. These include areas that: perform a vital ecosystem function; contain rare hydrological, geological or biological features; support a diversity of habitats; encompass large and relatively undisturbed habitats for species that are intolerant of human disturbance; serve as important wildlife movement corridors; contain excellent representatives of characteristic habitats (including old-growth forest) or landscapes; are of widespread interest to the community; or have histories of scientific research. Of the 11870 sq. km that make up the Foothills Model Forest, 3599 sq. km (about 30%) have been categorized as environmentally significant in this study.

Features included in areas of regional significance in the Foothills Model Forest are: key fish habitat; key areas for deer, Elk, and Moose; wetlands, including extensive patterned fens and production and staging areas for waterfowl and marsh birds; diverse or extensive areas of natural habitat; landforms, landscapes or geological features that are uncommon, rare, or the best examples in the Foothills Model Forest; and areas containing significant populations of rare or uncommon plants and animals, e.g. Trumpeter Swan.

Features included in areas of provincial significance in the Foothills Model Forest are: relatively undisturbed and sizeable remnants of natural habitat that elsewhere in Alberta have been disturbed by various forms of development; natural habitat assemblages that are among the best examples of their type in Alberta; key areas for Woodland Caribou; extensive patterned wetlands in the Upper Foothills; and extensive Subalpine-Alpine habitat complexes in the Cardinal Divide area.

Each ESA is described in a check sheet which lists the following information: site name; general location; description of features; overall level of significance (regional, provincial, national) and rationale; and references.

A variety of management principles and strategies for ESAs are outlined that could help to ensure the long-term maintenance of ESA features. There is also a discussion of threats to ESA features in the Foothills Model Forest as well as the provincial and federal policy context for land use zoning, biodiversity conservation and protected areas. Particular attention is paid to habitat fragmentation, old-growth forests, riparian habitats, wetlands, and high profile species such as fish, cavity-nesting birds, neotropical migrant birds, Woodland Caribou and Grizzly Bear.

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1.0 INTRODUCTION

Sweetgrass Consultants Ltd. was contracted by the Foothills Model Forest to undertake a preliminary inventory of Environmentally Significant Areas (ESAs) throughout the Foothills Model Forest in west-central Alberta (Sweetgrass Consultants 1994). As the next step in that study, Sweetgrass Consultants was asked to develop a draft discussion document that addresses the following:

1. the relative sensitivity of sites classed as ESAs to various forms of human activity;

2. management strategies for ESAs in general;

3. land use designations, potential resource conflicts and definition of specific management considerations for each ESA; and

4. broad research needs for each ESA.

The process of ESA identification and management is still at a preliminary stage. The intent of this document is to provide some initial thoughts on challenges facing managers of ESAs and to outline potential management approaches that would ensure long-term maintenance of ESA values in the Foothills Model Forest. This initial draft will be circulated among Foothills Model Forest "stakeholders" to further define needs and concerns related to ESAs and to help in filling in data gaps, refining boundaries, and developing specific management approaches related to individual ESAs.

This report is organized so that the user can get an overview of the management considerations for ESAs in general. In addition, each of the environmentally significant areas is described in outline form so the reader can, at a glance, determine the following:

1. name of the area;

2. land use designation/assessment of resource conflicts;

3. sensitivity to human activities;

4. management considerations; and

5. references related to management or zoning.

2.0 PRINCIPLES AND POLICIES

The appropriate management of Environmentally Significant Areas (ESAs) is one essential component of a general environmental management strategy. A mix of wise stewardship on managed lands and protecting areas through legislation is needed to achieve the long-term protection of ESAs in the study area. Most of the land is Crown-owned; however, there are small areas of privately held lands in some significant areas along the Athabasca River valley.

The various administrative agencies can provide assistance in the conservation of these sites. On Crown lands planning processes include Regional Planning and Sub-regional and Local Integrated Planning. On private lands General Municipal Plans, Area Structure Plans, Area Redevelopment Plans, Land Use Bylaws and the subdivision approval process are applicable.

Many land use practices, especially those on private rural lands, are not regulated at any level of government. Success in meeting objectives for ESAs can only be achieved through cooperative approaches with the disposition holders, landowners and user groups. Administrative agencies can provide support in these situations through information programs, acting as sources of resource information, and possibly offering incentives. Often, a disposition holder, landowner or user is willing to voluntarily modify management procedures or use of an area to avoid impacts on sensitive features when informed of their significance.

Key elements of ESA management include:

1. the integration of ESA conservation into existing administrative structures;

2. the maintenance of an environmental data base;

3. a commitment by local and regional authorities to include environmental management in all components of land use planning, development control and subdivision approval; and

4. the use of environmental education to foster public awareness.

Effective ESA management will ensure the long-term maintenance of the area's features. Intensive manipulation may be necessary in a few instances but the most frequent management activity will probably be to guard against negative impacts. The specific management approaches for each ESA should be based on the requirements and sensitivities of the area's features.

2.1 Guiding Principles

Some guiding principles for the management of ESAs have been set forth by Eagles (1984):

1. no major development should be permitted in ESAs due to detrimental impact or physical constraints.

2. certain developments may be carried out subject to environmental impact analysis and appropriate mitigation if no feasible alternatives are available.

3. long-term resource protection and management (and therefore long- term economic benefits) should have priority over short-term economic gains that result in the loss of future options.

4. recognition of a site as an ESA does not imply that it will be purchased by a public agency or that it is open for public use.

5. maintaining an environmental data base is essential.

6. in-depth studies may be necessary in those areas that are subject to development threats in the near future. Proactive actions are preferable to reactive ones.

7. further precision in delineating boundaries of ESAs can be achieved by more detailed field surveys. Environmental impact assessments can provide data that are useful for detailed boundary delineation, comparison of alternatives, assessment of long-term consequences, and development of management plans.

8. buffers around an ESA may be necessary but cannot be prescribed until the proposed activity is known and its impacts assessed.

9. information dissemination is an important feature. Agencies and individuals cannot fully assist with site management if documentation is lacking. ESA maps and supporting data should be published so that all interested and involved parties, especially disposition holders, landowners and user groups, can be made aware of the features, their significance and management considerations.

10. ESAs should be recognized and provided for in official plans and not as an overriding development control over a variety of land use designations.

11. appropriate policies, plans and regulations must be adopted to ensure effective implementation and adherence to the priorities for ESAs.

12. bylaws, policies and regulations should permit innovative approaches, including management agreements with disposition holders and owners of ESAs.

Some legal considerations have also been outlined by Eagles (1984):

1. recognition must be given to the land development rights of the landowner and disposition holder relative to the ecological common property rights of the public.

2. it is necessary to shift incompatible uses out of ESAs.

3. private economic land use should be allowed while limiting negative environmental impact. This is preferable to outright activity prohibition. The amount of restriction should not be greater than necessary.

4. ESA management should be integrated with other resource management efforts such as recreation, minerals, forestry, grazing, wildlife and agriculture.

5. regulation should be applied fairly and equally to private as well as government activities.

6. local statutory plans should contain broadly-based and specific ESA policies.

7. adjacent administrative districts should be encouraged to develop similar programs to ensure consistency across jurisdictions.

2.2 Protected Areas, Wildlife, Forests and Wetlands Policies

In order to frame the recommendations regarding the management of the Foothills Model Forest ESAs, it is important to have some understanding of the policies and agreements that may influence management decisions and to be cognizant of emerging trends in the scientific and policy arenas.

Relevant federal and provincial documents include the Biodiversity Convention (United Nations Environment Program 1992), Wildlife Policy for Canada, the Special Places 2000 initiative, the interim policy for wetlands in the forested area of Alberta, recommendations of the Expert Panel on Forest Management, commitments by the Canadian Council of Forest Ministers, and the Eastern Slopes Policy.

2.2.1 UNCED and the Biodiversity Convention

In 1993, the federal Standing Committee on Environment released its report on the Conventions of the United Nations Conference on Environment and Development (UNCED), including the Biodiversity Convention (United Nations Environment Program 1992). To meet the commitments Canada made in signing the UNCED conventions, the Standing Committee's recommendations indicate that further legislative steps at the provincial and federal levels will likely be taken to ensure the protection of endangered species, habitats, ecosystems and biodiversity in Canada. The convention commits Canada to:

1. establishing a system of protected areas;

2. environmentally sound development in areas adjacent to protected areas to further protection of the protected areas; and

3. protecting ecosystems and natural habitats as well as maintaining viable populations of species in natural surroundings.

The Office of Technology Assessment (1987) recognizes the critical role that protected areas play in maintaining biodiversity and that increasingly active management will be needed to overcome the effects of human activity and gradual fragmentation of natural areas. Clearly, careful planning to preserve large tracts of intact ecosystems in areas that have not yet been degraded can prevent major problems decades from now.

A keystone of the Global Biodiversity Strategy (World Resources Institute et al. 1992) is to strengthen the role of protected areas in saving biodiversity. How viable a protected area is over the long term depends on how well it is ecologically, socially, and economically integrated into the surrounding region. Resource management on surrounding lands must be meshed with the needs of protected areas through buffer zones and corridors. The strategy outlines that protected areas can effectively contribute to biodiversity conservation only if they maintain the variety of natural habitats, including viable populations of all native species and subspecies, subject only to natural environmental changes.

2.2.2 Wildlife Ministers' Council of Canada

The Minister responsible for Alberta's wildlife adopted the Wildlife Ministers' Council of Canada's "A Wildlife Policy for Canada" in 1990. This commits Alberta to maintaining biodiversity and ecological processes. It includes broadening the definition to include any species of wild organism, plant or animal and a commitment to completing and maintaining a comprehensive system of protected areas that includes representative ecological types and gives priority to the protection of endangered or limited habitats.

2.2.3 Canadian Council of Forest Ministers

In 1992, the Canadian Council of Forest Ministers outlined its commitment to sustainable forests. This includes:

1. maintaining the integrity of forest ecosystems and sustaining a wide range of ecological processes.

2. maintaining the unique and rich array of diverse plant and animal communities through maintaining the health and diversity of the whole forest landscape, as well as designating specific areas to be protected because of their unique ecological value.

Commitments have been made that, by the year 2000, a network of protected areas will be established to represent Canada's forests, providing ecological benchmarks, protecting areas of unique biological value and ensuring wilderness experiences. The Council has also indicated it will develop working definitions of old-growth forests and formulate management strategies to ensure the continuation of old-growth as a natural heritage. Public and private forest management agencies will include specific measures to maintain biodiversity in their forest management plans.

2.2.4 The Expert Panel on Forest Management

The Expert Panel on Forest Management in Alberta (1990) outlines reasons that are commonly cited for the need to preserve old-growth ecosystems:

1. value for research into ecosystem function and change;

2. preservation of genetic material;

3. benchmark areas for comparison with managed ecosystems;

4. critical habitat for flora and fauna; and

5. social and ethical responsibility.

The Expert Panel notes that under the present policy of sustained yield management, removal of old-growth timber is given priority and protection of old-growth is only incidental to the process of setting out buffers along steep slopes, wetlands, lakes and streams, as well as in non-merchantable coniferous stands. There is no policy designed explicitly for reserving old-growth forest ecosystems in Alberta. The Expert Panel indicates that most old-growth reservations tend to be fragmented and not specifically selected to represent intact ecosystems or specific old-growth characteristics. They recommended:

1. Ecosystem components that are essential to meet specific old-growth criteria should be clearly defined, identifying those that require a preservation approach, and those that are best addressed by conservation and creative management rather than preservation.

2. Wilderness areas, ecological reserves, natural and protected areas, and parks, as well as areas designated as buffers and other reserves during management planning, should be assessed to determine their status and suitability as candidate old-growth forest ecosystems.

3. A selection and screening process should be developed to add important old-growth forest ecosystems not already represented in existing reserves.

4. The level of research activity into the structure, function, and composition of old-growth forest ecosystems should be increased, especially with respect to rare, endangered, or threatened flora and fauna.

A process of developing a Forest Conservation Strategy for Alberta has begun and old-growth concerns will be dealt with in that forum.

2.2.5 Alberta Wetland Policy

In Alberta, a draft policy on managing wetlands in the non-settled area of Alberta has been prepared (Alberta Water Resources Commission 1993). This policy is still in the discussion stage but its intents include:

1. to ensure that representative, rare, and unique peatland ecosystems are set aside.

2. to minimize the adverse effects of developments in the watersheds which impact peatlands.

2.2.6 Alberta Parks' Policies and Special Places 2000

Although it was never approved as official government policy, the Foundations for Action document was developed after considerable public input and was internally adopted as a working document to serve as a guide on policy matters (K. Morrison, personal communication). The document clearly outlined the role of Alberta Parks in conserving the Alberta's natural heritage (Alberta Recreation and Parks 1988):

1. Unique and representative physiographical, biological and ecological features of the province should be protected for the appreciation, enjoyment and education of present and future generations.

2. The ministry has a legislated mandate to preserve and protect Alberta's natural heritage, including biological and ecological resources and landscapes. Uses must be limited to activities which do not compromise the natural and historical values for which each area was established.

3. The ministry will strive for increased coordination and cooperation with other land management agencies.

4. Alberta Parks will protect the natural heritage values within its system by maintaining the landscapes and features in as natural a state as possible. Natural resources will be protected and managed to ensure the perpetuation of naturally evolving environments and the integrity of resource values.

5. Resource management must seek to avoid unnecessary alteration of the natural landscape or interference with natural processes. Where conflict occurs between conservation and facility development, the integrity of the resource features will receive priority consideration. Where incompatibility or irreversible harm or impairment would occur to in significant natural resources, resource conservation will receive priority consideration over facility development.

6. The ministry normally will not allow consumptive use of resources in areas of its system. Previously granted rights and privileges that do not conform to the present guidelines will be honored but where possible will be phased out. Commercial timber operations may be

permitted in Integrated Recreation Areas if not detrimental to the primary purpose for which the area was established.

Alberta signed the Tri-Council Ministers' statement in Aylmer, Quebec in November of 1992. This agreement and the Special Places 2000 program that is now under discussion commit Alberta to protecting a system of areas that represents the full natural diversity of Alberta's landscapes and wildlife.

2.2.7 Eastern Slopes Policy

The Eastern Slopes Policy (Alberta Government 1984) classifies the Eastern Slopes into 8 different zones and presents a table of compatible, permitted and not-permitted uses by zone. Of direct relevance to the ESAs in the Foothills Model Forest are the Prime Protection, Critical Wildlife, General Recreation, and Multiple Use zones.

The Prime Protection Zone is the most-restrictive zone in which all forms of industrial and commercial developments, logging, off-highway vehicle use, and serviced recreational use are not permitted.

The Critical Wildlife Zone is similar in intent but has more permitted uses including off-highway vehicle activity, logging, and mineral exploration and development. These activities may require special conditions and controls where necessary.

The General Recreation and Multiple Use Zones have few restrictions of note within the study area. Compared to the Multiple Use Zone, the General Recreation Zone has less compatible uses (activities generally thought to be compatible with normal guidelines and land use regulations) and more permitted uses, ones that may require special conditions and controls.

The Eastern Slopes is broken down into subregions for which subregional Integrated Resource Plans have been, or are being, prepared. In the study area these include the Coal Branch (Alberta Forestry, Lands and Wildlife 1990), Berland (Alberta Environmental Protection n.d., draft plan), and Yellowhead North (not complete).

The Coal Branch Subregional Integrated Resource Plan covers the southern half of the Foothills Model Forest while the Berland Subregional Integrated Resource Plan covers the northern third. Their intent is to achieve long-term, continuous, social and economic benefits by providing for optimal use of all available resources, while maintaining the overall integrity of the natural environment and the high aesthetic value of the area.

Relevant guidelines for the management and protection of wildlife, fish and ecological resources include:

Wildlife

1. A diversity of habitat types will be maintained to support a variety of wildlife species (including ungulates, upland game birds, non-game and furbearers).

2. A mosaic of forest cover and forage areas will be maintained to help increase ungulate populations.

3. Hunting seasons will be adjusted to meet wildlife population objectives.

4. Disturbance of wildlife populations during sensitive time periods will be minimized.

5. Disturbance of wildlife will be reduced by managing off-highway vehicle access and controlling hunting activities.

6. Late winter disturbance in critical overwintering areas designated as Zone 2, will be kept to a minimum, especially during winters with deep snow and cold temperatures.

7. Closure of new access resulting from development work will be an integral part of industrial development in important wildlife areas.

Fisheries

1. The Fish and Wildlife Division will work cooperatively with other agencies to ensure minimal aquatic impacts from industrial and agricultural developments.

2. Appropriate reservations will be applied around lakes, rivers and streams with fisheries potential to ensure their protection.

3. Angling regulations will be reviewed regularly in relation to angler use, harvest levels and the condition of fish populations, to ensure the long-term survival of naturally reproducing resident sport fish populations.

4. Stream fisheries will be managed to maintain the naturally reproducing fisheries populations.

Ecological Resources

1. Appropriate land use reservations or notations will be maintained to protect ecological resources.

2. Ecologically significant sites that are identified will be addressed through the existing referrals process.

3. Management plans will be developed for unique or ecologically significant sites that are formally recognized.

Specific guidelines have also been prepared for individual Resource Management Areas within the integrated plan. Relevant guidelines and zoning are noted in area descriptions.

It is important to note that Alberta Forestry, Lands and Wildlife (1990) states:

> *"Off-highway vehicles access is a major disturbance factor for wildlife in some areas, and is not compatible with the wildlife management intent for those areas . . . Heavy recreational off-highway vehicle use has had adverse impacts in certain areas. It can damage terrain and reduce water quality as a result of erosion, thus also affecting the fisheries resource."*

2.2.8 Emerging Trends

Lee (1993) in an address to the Canadian Institute of Forestry noted that a major new approach to improving ecosystem management from the protected areas perspective is to manage for "wildness". The major management goal will be the retention of ecological functions in a dynamic and flexible way with minimal human interference, not managing for "static vignettes" or for proprietary commercial interests.

The Alberta Water Resources Commission has begun the development of a policy for wetlands, including peatlands, in the non-settled parts of Alberta. Initial input from the public has indicated a concern about impacts of developments on wetlands and strong support for protecting wetlands in the forested regions of Alberta.

Hammond (1994) outlines an approach to landscape level planning that includes:

1. a protected landscape network of riparian ecosystems, lakes, wetlands, representative stands or ecosystem types, ecologically sensitive areas, and cross valley corridors.

2. establishment of ecologically responsible forest use zones that include cultural areas, wildlife habitats, recreation zones and harvest areas.

3. restoration plans.

Hammond also notes that old-growth forests are particularly important to include in the protected landscape.

DesGranges and Rondeau (1993b) suggest a move to more intensive management and less extensive management may be a way of meeting fibre needs at a reasonable cost while freeing up larger land bases for conservation and protected areas.

3.0 POTENTIAL THREATS TO ESAs IN THE FOOTHILLS MODEL FOREST

With ongoing human activities such as mining, oil and gas development, timber harvesting and recreational use, there are many ways in which Foothills Model Forest ESAs can be negatively impacted. These may include direct habitat loss and habitat fragmentation as well as disturbance and harassment of the wildlife due to an increasing frequency, duration and severity of human intrusion. In this regard, the heaviest impacts are most often associated with access by motorized vehicles such as automobiles, powerboats, and all-terrain vehicles; however, foot, bicycle and canoe access can have detrimental effects if not carefully planned and managed.

The Fish and Wildlife Division (1991) outlines some of the general impacts of development on wildlife:

1. direct loss of wildlife habitat (e.g. removal of isolated "islands" of forest cover for wellsites, roads, and cutblocks);

2. reduction of usable wildlife habitat as a result of displacement of wildlife from areas of ongoing land use activity (e.g. elk avoidance of meadows with roads in them);

3. seasonal disturbance of wildlife during critical periods (e.g. winter land use activities in ungulate winter range causing disturbance which can increase energy expenditure, reduce reproductive success, increase predation, and contribute to over-hunting of populations);

4. excessive loss of wildlife through hunting and poaching due to proliferation of access and vehicle access being left open in important wildlife habitat; and

5. destruction of unique or rare wildlife habitat sites (e.g. destruction of nesting sites, disruption of mineral licks).

The Fish and Wildlife Division (1991) outlines some of the general impacts of development on fisheries:

1. direct loss of fish habitat (e.g. dewatering of streams, stream channelization, or stream diversion);

2. reduction of usable fish habitat due to stream channel blockages or culverts incapable of providing upstream fish passage (i.e. undersized culverts, hanging culverts, log bundles left in streams);

3. harmful alteration of fish habitat (e.g. entry of sediments into permanent and intermittent watercourses, breakdown of developed streambanks, removal of instream and streamside vegetation);

4. entry of deleterious substances into fish-bearing waters (e.g. oil, silt, pesticides, etc.); and

5. interference with fish spawning activities or degradation of habitat/water quality during the egg incubation period (e.g. sediment from instream construction).

Coal mining has been implicated in the degradation of fisheries along several streams in the study area (Alberta Forestry, Lands and Wildlife 1990).

Bull Trout and Arctic Grayling are particularly sensitive to overexploitation by anglers. Arctic Grayling are extremely vulnerable to even moderate angling pressure and have been seriously depleted over much of their southern range. Arctic Grayling population levels usually decline rapidly once road or off-highway vehicle (OHV) access routes are developed into remote areas (Alberta Environmental Protection n.d.). The Bull Trout has suffered marked declines throughout its Alberta range; is considered vulnerable in Canada (COSEWIC 1993); and has been recommended as a threatened species in Alberta (Roberts 1987).

3.1 Wetland and Riparian Habitats and Associated Species

Wetlands and riparian habitats represent some of the most productive and sensitive landscape components in the study area. They support a greater density and species diversity of wildlife than do most other habitats and make a significant contribution to the overall diversity of the area. These habitats are also among the most vulnerable to disturbance.

A variety of human activities have been shown to cause problems for wetland birds. These range from hunting and fishing to water-based recreational activities such as powerboating. While most of the literature deals with geese and ducks, the Common Loon, Osprey and Bald Eagle are some of the most frequently mentioned non-game species that suffer from human disturbance (U.S. Fish and Wildlife Service 1987; Boyle and Samson 1983).

Human disturbance can have several impacts on the reproductive success of birds (Korschgen and Dahlgren 1992) through:

1. flushing of hens leads to exposure of eggs to heat or cold and may kill the embryos;

2. predation of eggs may increase when hens are flushed from nests;

3. predation of eggs and hens may increase at nests when humans create trails or leave markers by which predators find nests;

4. broods may be scattered, separating them from their parents, increasing their vulnerability to predation;

5. broods and adults may be killed or injured directly by recreationists;

6. pair bonds may be disrupted; and

7. clutch size may be reduced.

Continued and severe disturbance may cause birds to abandon nests or nesting grounds completely.

Power-boating is the most frequently cited factor in the disturbance of water birds. The impact is significant, resulting in diminished breeding success or local extirpation of water birds, including Common Loons (McIntyre 1975 and 1979; Titus and VanDruff 1981; Sutcliffe 1979; Ream 1980; Fish and Wildlife Division 1991; Dahlgren and Korschgen 1992; Korschgen and Dahlgren 1992; Vermeer 1973; and Mathews 1982). The disturbances are significant as they displace water birds from their feeding grounds, lower productivity by flushing nesting or brooding hens, and swamp nests in the wake left by boats.

Given the relatively exposed location of nest sites, Common Loons are one of the most vulnerable species to the effects of water-based recreational activities. The Common Loon has vanished from many parts of eastern North America because of the loss of nesting areas to recreational developments and its sensitivity to human disturbance, especially powerboating (Ream 1980; Sutcliffe 1979; Fish and Wildlife Division 1991). It has been identified as a species of special concern (McNicholl 1985) because of fish declines associated with acid rain and susceptibility to nest failure resulting from nests being swamped by the wakes created by powerboats. Common Loon declines in New York are associated with boating, camping and shoreline development, with spring and summer long weekends being particularly hazardous to Common Loon reproduction (McIntyre 1979). Even unrestricted bird-watching has been implicated in nest failure of Common Loons (Metcalf 1979). Ream (1976) indicates that the use of nesting islands by canoeists for camping appears to be the primary cause of a decrease in Common Loon productivity in the Boundary Waters Canoe Area. In the same area, Titus and VanDruff (1981) note a slight reduction in breeding success of Common Loons in high impact areas but note that the adult breeding population is not declining. Low levels of canoe use in Alaska are apparently not impacting loon production (Smith 1981). Other impacts on Common Loons include poisoning from lead fishing weights or sinkers. A single ingested pellet may kill a bird within a week (St. John 1993). Over half the loons autopsied in one area were poisoned by lead sinkers. The Environmental Defense Fund in the United States has asked for a ban on lead fishing weights in national wildlife refuges where loons are found.

Given the relatively exposed location of nest sites, Red-necked Grebes are vulnerable to the effects of water-based recreational activities. Riske (1976) notes that Red-necked Grebes are more successful nesting on ponds than lakes. Red-necked Grebe populations in Alberta have been affected by pothole drainage and land clearing as well as recreational developments and powerboating on lakes (Semenchuk 1992). Riske (1976) reports that recreational boating reduces nesting of Red-necked Grebes, noting also that large waves from boats place stress on the nests and that outboard engines leave an oily film on the water.

Great Blue Heron colonies are sensitive to human disturbance. Markham and Brechtel (1978), Short and Cooper (1985), and Taylor and Michael (1971) indicate that harassment at nesting colonies can lead to nest desertion, colony abandonment and increased mortality of young due to

predation and exposure. Werschkul et al. (1976) report more active nests in undisturbed areas compared with those being harvested for timber. Water-based recreation and highway construction have resulted in heronry abandonment (Ryder et al. 1980).

Although Ospreys can become quite tolerant of continuous disturbance from human activities (Poole 1981; French 1972; Ames and Mersereau 1964; MacCarter 1972), Garber (1972), Kahl (1972), and Dunstan (1973) document the negative impacts of disturbance by people on nesting Ospreys, including a trend towards nests being located away from lakes used by Ospreys for fishing. Swenson (1979) notes disturbance affects lakeshore nesting populations of Ospreys where there is more human activity, including boating, compared with stream nesting populations.

A number of human activities including recreational use of lakes and lakeshores have contributed to a slow, long-term decline of Bald Eagles in North America that continues to this day (Weekes 1975; Sprunt 1969; Evans 1982). Murphy (1960) indicates that one factor in Bald Eagle nest site selection in Yellowstone National Park appears to be freedom from disturbance. Heinzman (1961) reports that human presence within 150-300 m of nest sites in Florida causes Bald Eagles to take flight. Magaddino (1989) advises that people walking below the nest, boaters stopping near the nest, snowmobiling (nesting begins before snow cover is gone in some areas), blasting, shooting, tree-cutting, and operating loud equipment can disturb Bald Eagles during the nesting season. Although there is some evidence that certain populations of Bald Eagles can be habituated to continual human disturbance, Thelander (1973), Jeunemann (1973), Gerrard (1973), Ream (1980), Murphy (1965), Mathisen (1968) and Mathisen et al. (1977) document the negative impacts of human activity on nesting Bald Eagles, particularly in the nest selection and early incubation stages. This includes displacement, failure of eggs to hatch, and complete nest abandonment. Eagles gradually become more tenacious after the young have hatched and are less likely to abandon the nest during the latter part of the nesting period (Magaddino 1989).

Bergman (1973) and Lebeda and Ratti (1983) indicate that flightless, summer-moulting Canada Geese, Canvasbacks and Redheads may be displaced from portions of water bodies where there is human activity such as recreational boating and fishing. Hochbaum (1944) shows that Canvasbacks will flush easily from nests during egg-laying and early incubation, even showing avoidance to canoes that are up to .4 km from the nest. Diving ducks of the genus *Aythya* have been shown to react negatively to human effigies placed at wetlands (Boag and Lewin 1980). Hume (1976) reports that boating and shoreline use both displace Common Goldeneyes. Although shore approaches cause displacement, birds return to the water; however, repeated use by boats, especially power boats, results in complete displacement to other wetlands. Heavy sailboat activity has also resulted in almost total displacement.

Harlequin Ducks have been negatively affected by commercial rafting tours on at least one river in Jasper National Park (B. Gadd personal communication).

Hunting and fishing can also have profound effects. Cronan (1957) and Sincock (1966) show that Lesser Scaup and other diving ducks of the genus *Aythya* are more sensitive to disturbance than dabbling ducks, feeding less in areas that are heavily hunted and creating avoidance impacts during the hunting season and other times of year. Over the long-term, accumulations of lead,

particularly from lead shot but with a possible contribution from fishing weights, could result in lead poisoning in waterfowl and raptors that prey on waterfowl containing lead shot (Ontario Wildlife Working Group 1992). This has not yet been identified as a pressing problem in Alberta. However, the problem has become so severe in other jurisdictions that lead shot has been banned in areas of eastern Canada and the United States.

In a landmark study of the impacts on birds of National Wildlife Refuge management in the United States, Braun et al. (1978) show that excessive use of shallow vegetated areas of lakes and streams by wading and boating anglers can disturb feeding and nesting waterbirds. They documented damage by powerboating to include shoreline degradation, disruption of nesting and feeding waterfowl and displacement of birds. Conflicts between recreation and nesting wildlife at a wildlife refuge in Nevada led to a court action and decision that provided strong protection from incompatible recreational pressures (Bouffard 1982). After boating was allowed on the wildlife refuge, nesting success of Redheads and Canvasbacks dropped significantly (U.S. Fish and Wildlife Service 1976). At another wildlife refuge, areas that were closed to fishing experienced a marked increase in waterfowl broods and adults (Beard 1953).

In summary, the most sensitive birds associated with lakes, wetlands and riparian habitats in the Foothills Model Forest include:

Common Loon (nest sites and staging areas)
Red-necked Grebe (nest sites)
Harlequin Duck
Feeding or Brooding Concentrations of Waterfowl Species, especially diving ducks of the genus *Aythya*
Bald Eagle (nest sites)
Osprey (nest sites)

3.2 Old-growth Habitat and Forest Dependent Species

In a discussion paper for the Alberta Conservation Strategy Project, the Environment Council of Alberta (1990) provided a broad overview of the value of old-growth forests:

> *"The dynamic stability and complexity of the climax forests of this province provide critical habitat for a number of rare and highly specialized plants and animals such as Alberta's threatened caribou. The amenity value of old-growth forests is very high and they contribute much to the multiple use value of our forests. Indeed, many feel that the liquidation of old-growth stands in this province will result in a large reduction in non-timber resource values."*

3.2.1 Woodland Caribou and Grizzly Bear

Edmonds and Bloomfield (1984) note that Woodland Caribou (both mountain and woodland ecotypes) herds decreased through the 1980s due to legal and illegal harvest, collisions with

vehicles, wolf predation and extensive loss or alteration of winter habitat. Increased access associated with resource exploration and extraction is a major problem that contributes to the illegal harvest and caribou avoidance of important habitat.

Grizzly Bear are negatively affected by a variety of human intrusions. B. Horejsi (personal communication) believes that it is a fallacy to think that Grizzly Bear are increasing due to the pervasiveness of human activity. Habitat effectiveness drops off markedly within 1 km of roads (Horejsi 1990). In some areas this distance is greater. Horejsi notes that even one trip on a road every seven days severely compromises habitat effectiveness for Grizzly Bear. Road closures in the United States have proven ineffective in reducing use of roads by motorized vehicles even where there are significantly more personnel resources for enforcement available than there are in Alberta. Horejsi (1985) notes that the major problem with forestry operations is increased access. Oil and gas development increases human activity in an area over an extended period of time.

Habitat loss and degradation due to extensive clear cut logging and other industrial development will likely continue to expand rapidly over the next two decades. This is considered a serious limiting factor for both species over the long term.

3.2.2 Forest Species

There has been a growing concern in recent years about dramatic declines in populations of neotropical migrants, birds that breed in the Nearctic and migrate south into the Neotropics of Latin and South America (Hill and Hagan 1991; Hussell et al. 1992). Finch (1991) summarizes the concerns about this aggregation of bird species. Terborgh (1989) notes that several species exhibiting regional declines are associated with conifer-dominated habitats, including several old-growth dependent species.

The two primary factors that have been advanced to explain these population declines are:

1. forest fragmentation on the breeding grounds.
2. deforestation of wintering habitats.

Diamond (1988) indicates that some species that nest in the Foothills Model Forest area could lose one-quarter to more than half of their wintering habitat in the tropics by the year 2000. Species that are expected to lose more than half of their winter habitat include:

	Expected Loss of Winter Habitat
Philadelphia Vireo	83%
Orange-crowned Warbler	63%
Yellow-bellied Flycatcher	60%
Northern Oriole	52%

Species that are expected to lose between one-quarter and one-half of their winter habitat include:

Expected Loss of Winter Habitat

Magnolia Warbler	47%
Yellow-rumped Warbler	45%
Rose-breasted Grosbeak	41%
Tennessee Warbler	41%
Yellow-bellied Sapsucker	40%
Olive-sided Flycatcher	39%
American Redstart	31%
Solitary Vireo	30%
Western Wood Pewee	29%
Swainson's Thrush	26%

Although there are disagreements over the principal mechanism for the declines, there is a general consensus among researchers that a comprehensive and international program is needed to conserve viable populations of these migrants. There is good evidence that at least some of the population declines are attributable to isolation and fragmentation of breeding habitat (Ambuel and Temple 1983; Whigham 1984; Faaborg et al. 1989; Terborgh 1992). Although, the occurrence of some individual species depends more on vegetation structure and composition, there is considerable support for the idea that, compared with small forest islands, a single unfragmented large forest has a higher abundance and species richness of neotropical migrants and forest interior species, i.e. species that nest away from the forest edge (Askins et al. 1987, Blake and Karr 1984 & 1987; Martin 1992).

Land birds that occur in the Foothills Model Forest area for which regional declines in parts of North America or their wintering grounds have been reported over the last twenty years include (Robbins et al. 1989; Askins et al. 1990; Sauer and Droege 1992; Hussell et al. 1992; Witham and Hunter 1992):

Common Nighthawk
Northern Flicker
Yellow-bellied Sapsucker
Olive-sided Flycatcher
Yellow-bellied Flycatcher
Least Flycatcher
Hermit Thrush
Swainson's Thrush
Solitary Vireo
Red-eyed Vireo
Warbling Vireo
Philadelphia Vireo
Black-and-white Warbler
Tennessee Warbler
Mourning Warbler
Black-throated Green Warbler
Magnolia Warbler
Wilson's Warbler
Common Yellowthroat
American Redstart
Ovenbird
Northern Waterthrush
Rose-breasted Grosbeak
Northern Oriole
Western Tanager
Song Sparrow
Fox Sparrow
Swamp Sparrow
White-crowned Sparrow
White-throated Sparrow
Purple Finch

Although the overwhelming evidence of most trend lines shows a decline, results are not applicable to all regions, and several species, e.g. Common Yellowthroat, Black-throated Green Warbler and Least Flycatcher, have shown increases in some areas.

Reed (1992) prioritizes North American wood warblers and vireos for conservation using habitat specificity criteria, geographic range and local population size. Neither Terborgh (1989) nor Reed (1992) incorporates information on current population trends, nesting limitations, productivity rates, rates of habitat loss, and population responses to land use action. As such, Finch (1991) characterizes their lists as superficial and identifies the need for more comprehensive efforts to more accurately characterize vulnerable species.

Old-growth has generally not been managed as a renewable, natural ecosystem. It has almost always been "mined" by clear-cut harvesting methods. Foresters have only allowed this secondary, working forest to develop to middle-age before it is harvested again. Old-growth forests never again develop on lands managed for timber harvesting (Freedman 1993).

Old-growth dependent birds, including many neotropical migrants, are affected by habitat loss and fragmentation, largely as a result of industrial activities such as logging and energy development. These species are particularly sensitive to many of the current methods of timber harvesting because of their need for certain insect populations and, for some cavity-nesting species, nesting and roosting cavities within snags or live trees with heartrot (McLelland 1979). Wildlife Habitat Canada (1991) indicates that forestry development plans represent major threats to northern habitats in Alberta; particularly vulnerable are old-growth forests. Part of the problem is that forests become economically mature and ready to cut long before they are mature by biological definitions (Hunter 1990).

Westworth and Associates (1991b) rated old-growth habitats in northeastern Alberta as highly sensitive to most land uses, including facility-oriented recreational development, roads, utility corridors, oil and gas development and timber harvesting.

Many interior forest, neotropical migrant birds disappear from forests when habitats are fragmented into smaller patches due to the cumulative impacts of many human activities such as forest clearing, timber harvesting, and linear disturbances (e.g. seismic lines and road development). As the ratio of edge to interior habitat area increases, there can be invasion by species that are not indigenous to old-growth, leading to increased brood parasitism by Brown-headed Cowbirds and nest predation, lowering reproductive success to the point where population declines and local extinctions may occur (Whitcomb et al. 1976; Noss 1987; Greene 1988; Finch 1991; Robinson 1992; Martin 1992; Temple and Cary 1988). Norse et al. (1986) indicate that some "edge" predators may penetrate as far as 300-600 m inside the forest. With increased opening of the forestry canopy from clearcuts, roads and recreational developments, the situation may deteriorate so that undesirable countermeasures, including active control of predators and Brown-headed Cowbirds, need to be taken (Robinson et al. 1993).

Robinson et al. (1993) indicate that populations of the Brown-headed Cowbird, a brood parasite, have increased to the point where they pose a potential threat to populations of many neotropical

migrant songbirds. This population rise has been correlated with the increase in open habitats created by forest clearing and fragmentation.

Although most of the fragmentation work has been done on forests in agricultural landscapes, there is enough evidence to suggest that significant impacts on bird populations can occur over the long-term in forested landscapes as well (Hunter 1990). Analysis of long-term changes to forests in Finland showed that fragmentation was responsible for declining populations of birds, especially nonmigratory cavity-nesters (Helle 1985). There is some debate as to whether it is the physical size of the fragments or some aspect of habitat quality that is to blame for reductions in populations of some birds in the fragments. Most of the evidence indicates a problem with habitat quality in fragments. Whatever the cause, there are several North American species that have been identified by some authors as "area sensitive", with populations declining as fragments get smaller (Freemark and Collins 1992). These include:

Hairy Woodpecker
Pileated Woodpecker
Brown Creeper
Hermit Thrush
Red-eyed Vireo
Black-throated Green Warbler
Black-and-white Warbler
American Redstart
Ovenbird
Northern Waterthrush
Mourning Warbler
Rose-breasted Grosbeak

Habitat fragmentation may be the most significant problem facing bird populations in old-growth woodlands. As old-growth forest fragments become smaller and more isolated from one another, associated bird populations similarly become smaller and more isolated. This, coupled with the behavioral ecology of various species, might affect the number of populations that can interact, the size of those populations and, ultimately, the survival of the regional population (Freemark and Collins 1992).

Cumulative impacts must also be recognized. This includes interactions of man-induced and natural disturbances. For example, relatively frequent and extensive fires have combined to limit the amount of old-growth that persists in the study area. Harvesting of old-growth stands or stands that have the potential to become old-growth, given sufficient time and protection, will result in further declines or extirpation of old-growth dependent species.

Smith (1993) indicates that short harvest rotations could impact 54% of boreal forest bird species that require mature or old-growth forest. Based on studies in the Foothills Model Forest, Farr (1993) indicates that bird species that reach their maximum populations in older stands face the greatest potential declines in habitat given the current intensive management of forests. This includes the Three-toed Woodpecker, Brown Creeper, Winter Wren, Golden-crowned Kinglet, Pine Grosbeak and Red-breasted Nuthatch. Farr expresses the need to maintain populations in "good" habitats as a source for lower quality habitats. Excessive reduction in "good" habitats may result in regional extirpation for some species.

Species that have been shown to be adversely affected by logging or that find optimum habitat in forest interiors or mature and old-growth forest in parts of North America (Meslow and Wight 1975; Franzreb 1977; Titterington et al. 1979; Crawford and Titterington 1979; Temple et al. 1979; Francis and Lumbis 1979; Sanderson et al. 1980; Jerry 1984; Blake and Karr 1984; Wetmore and Booth 1986) include:

Common Goldeneye
Bufflehead
Bald Eagle
Sharp-shinned Hawk
Osprey
Ruffed Grouse
Barred Owl
Saw-whet Owl
Hairy Woodpecker
Pileated Woodpecker
Three-toed Woodpecker
Black-backed Woodpecker
Red-breasted Nuthatch
Brown Creeper
Hermit Thrush
Golden-crowned Kinglet
Ruby-crowned Kinglet
Solitary Vireo
Black-throated Green Warbler
Ovenbird
White-winged Crossbill
Western Tanager

Shook and Baldwin (1970) indicate that Three-toed Woodpeckers and Hairy Woodpeckers are more numerous in selectively cut areas of Engelmann spruce than in uncut or clear-cut areas. However, Martin (1992) notes that even single-tree selection and understory removal techniques cause a reduction in the diversity and density of potential nest sites for other species, which can cause an increase in predation or direct loss of species.

Rosenberg and Raphael (1986) show that the Pileated Woodpecker is one of the most sensitive species to forest fragmentation. Aubry and Raley (1990) indicate that Pileated Woodpeckers need structures typically found only in unmanaged forests which include large snags or broken top trees for excavating nest cavities or large snags or logs for feeding. They note that clearcutting of old-growth forests and consequent conversion to young even-aged stands may adversely affect populations of Pileated Woodpeckers.

4.0 CONSIDERATIONS FOR MANAGING DIFFERENT TYPES OF ESAs

The following sections describe the management considerations for each of the major types of features of ESAs found in the Foothills Model Forest. The major features of ESAs include significant landscapes, significant wildlife habitats, key fish habitats, other areas of biological importance, and significant geological sites. These management considerations have been modified slightly for the Foothills Model Forest from other ESA studies (Calgary Regional Planning Commission 1983; Oldman River Regional Planning Commission 1988; Red Deer Regional Planning Commission 1991). Where applicable new references are cited.

More detailed discussions of fire, grazing, off-road vehicle use and buffer zones with respect to the management of "natural areas" can be found in Bradley (1984).

4.1 Environmentally Significant Landscapes

Grouped residential developments, transportation and utilities corridors, and extraction activities such as oil and gas development and clearcut logging are not compatible with the maintenance of the character of environmentally significant landscapes. Subdivision into a number of parcels undermines ecological processes in an area; however, a properly sited individual dwelling may not greatly affect an area's overall character.

Highway commercial development, trailer parks, most commercial campgrounds, amusement attractions, and all forms of non-extractive industrial development are also considered incompatible with maintaining environmentally significant landscapes.

Smaller campgrounds and commercial land uses such as guest ranches and destination resorts that seek to conserve a large component of the natural landscape may be quite appropriate in environmentally significant landscapes provided that development and siting proceed in an environmentally responsive manner.

In some cases, buffer zones adjacent to environmentally significant landscapes may be needed to help screen these areas from adjacent residential, logging or industrial activities. Examples include the location of upland residences sufficiently far away from edges of significant valleys so that they are not visible from valley bottom positions. This will also provide the added benefit of avoiding stability problems that are encountered in several valley situations.

Recreation is often an important activity in natural landscapes. The effects on terrain, vegetation and wildlife can be significant. Some of the problems include garbage and human waste disposal, and damage caused by off-road vehicles, illegal hunting, and vandalism. While most land management and administrative agencies have limited powers in recreation management, they can help by:

1. providing forums for landowners and recreationists to discuss their concerns and cooperate in formulating solutions such as designated access sites and designated travel routes;

2. monitoring or coordinating the monitoring of recreational use in ESAs;

3. providing funds for basic facilities and improvements, such as fencing and signage, that would help maintain environmental quality in ESAs on which disposition holders and landowners are permitting public access.

4.2 Environmentally Significant Wildlife Habitats

Many of the management considerations discussed for environmentally significant landscapes would also benefit significant wildlife habitats. Alberta Fish and Wildlife maintains and updates its critical wildlife maps on a regular basis and keeps some of this information confidential. Potential changes in land use in ESAs should be discussed with Fish and Wildlife to determine any additional considerations beyond those expressed in this document.

River valley woodland and shrub habitats are extremely important for ungulates and migrating and nesting birds. Extensive clearing is not compatible with maintenance of these habitats.

Big game species such as Woodland Caribou (both mountain and woodland ecotypes), Moose, Elk, Mule Deer and White-tailed Deer are highly valued species. Protection of critical wintering ranges and protecting animals from disturbance while on those ranges are important management considerations. Certain resource activities may be compatible in one season but not in another. Movement corridors must also be protected so that there are always travel pathways from summer ranges to critical winter ranges. Csuti (1991) indicates that a minimum corridor width of 6.4 km is sufficiently wide to mitigate most edge effects. The Canadian Parks Service (1992) identified high protection level corridors as being 1 km in width.

Minta (1992) notes the exact position of an Elk movement corridor is critical and describes some general characteristics of Elk travel corridors:

1. they follow paths of least resistance, e.g. topography and habitats that have greatest visibility and fewest obstructions;

2. historic migration routes are characterized by low disturbance and escape terrain rather than forage;

3. water availability is of primary importance for extended corridors;

4. in spring, south slopes with large quantities of early-growing forage are preferred; and

5. in the absence of landscape disturbance, travel routes become highly traditional in location and season and time of use.

Woodland Caribou need particular attention due to ongoing population declines and conflicts with human activities. This should include controlling access into critical Woodland Caribou habitat, designation of sanctuaries, protection of habitat including movement corridors, and education (Edmonds 1986). Wolf control programs have also been recommended since other management measures have not proven effective.

Paquet and Hackman (1993) indicate that the Rocky Mountains are being divided into a series of disjunct segments. Continuous insularization and erosion of nature reserves in the region threatens the long term preservation of large carnivore populations in Canada and the United States. They state that habitat is being incrementally destroyed by land use practices that are incompatible with wildlife. To remedy the problem, they state that:

1. direct and indirect human-caused mortality should be controlled by dispersing transient human activities and facilities over time and space;

2. protection of undisturbed wilderness should be ensured;

3. connectivity of preserved landscapes should be enhanced through the preservation, maintenance and restoration of travel corridors;

4. conservation-related research needs to be strengthened;

5. essential ecological requirements and long term ecological processes that affect individual species must be identified; and

6. the distribution, linkages, status and specific causes of mortality for carnivores in the Rocky Mountains should be described.

4.2.1 Wetland Habitats

Significant waterfowl and marsh bird production areas are localized features of the Foothills Model Forest. Wetland conservation involves maintaining existing water regimes; operating man-influenced water-bodies with waterfowl and marsh habitats in mind; protecting wetlands from encroachment by non-compatible land uses; and protection of adjacent shoreline and upland vegetation where it still exists.

Korschgen and Dahlgren (1992) outline several management alternatives to reduce the effects of human disturbance on waterfowl that would be applicable to the Foothills Model Forest:

1. reduce the number of roads and access points to limit accessibility to habitats;

2. create inviolate or temporal sanctuaries; and

3. reduce the sources of loud noises and rapid movements of vehicles, including watercraft.

Fredrickson and Reid (1988) indicate that protection of water bird habitats from disturbance is critical. They note that even subtle disturbances in key habitat by bird-watchers and researchers during critical biological stages may be as detrimental as hunting and boating. Edwards and Bell (1987) recommend temporal restrictions on recreational activities at key wetlands to protect birds during critical stages of their life cycles.

Jessen (1981) recommends that management of waterfowl areas should emphasize the protection of feeding and resting areas from disturbance. Johnson (1964) and Morgan (1972) suggest zoning certain water areas for use by waterfowl or restricting recreational activities during seasons of waterfowl nesting and brooding. Restricting the use of boating from portions of lakes in certain seasons has proven effective in maintaining populations of wintering waterfowl (Kramer 1984). When power boat use is prohibited on critical portions of wetlands, brood sizes of Ring-necked Ducks increase (Mendall 1958). Mathews (1982) indicates that boats must be kept at least 300 m from a waterfowl area.

Plunkett (1979) outlines management programs for Common Loons in the Great Lakes and Northeastern United States that include enforcement of regulations to minimize disturbance to Common Loons and restricting human activities where they interfere with breeding. Trivelpiece et al. (1979) note that Common Loons in New York's Adirondacks avoid human disturbance by selecting secluded lakes accessible only by trail or with restricted access. More and Watton (1980) recommend protection of known nesting and brood rearing areas, restricting access during egg laying and incubation, as well as restricted use of motorized watercraft to eliminate wave disturbance to nests.

With fewer than 100 Great Blue Heron colonies in Alberta, protection of these nesting sites is critical (Fish and Wildlife Division 1991).

Alberta Forestry, Lands and Wildlife (1991) recommends that protection of specific nest sites is essential to maintaining viable Osprey populations. Kahl (1972) notes that management actions to protect nest sites in California include restrictions on human activities near nests during the breeding season. Zarn (1974) recommends limiting human activities around Osprey nest sites. More and Watton (1980) recommend that human approach to Osprey nests be restricted to no less than 150 m from active nests and that no removal of timber and snags occur in close proximity to water bodies where Ospreys nest. All large snags in the vicinity of existing nests should be considered as potential future nest sites. Human activity, including fishing, hiking and camping, should be restricted from onset of incubation to fledging of young. Although habituated to recreationists, continued disturbance and harassment by people could result in nest abandonment or overexposure of nestlings to the elements.

Protection of specific nest sites is critical to maintaining populations of Bald Eagles. Snow (1973) notes the institution of protective measures around nests in the United States, including the establishment of buffer zones in which human activities are restricted. Mathisen et al. (1977) report on successful attempts to increase the security of nesting Bald Eagles by access closures, seasonal restrictions, and rerouting of travelways. Magaddino (1989) outlines recommended management zones that are widely used to define the space and privacy required by a pair of

nesting Bald Eagles. The least sensitive zone (Zone 3) includes all potential foraging habitat within 4 km of the nest site. The most sensitive zone is the nest site (Zone 1), an area of about .4 km radius surrounding the nest. A primary use area is classed as a zone of moderate sensitivity (Zone 2) occurring in a .4 to .8 km ring around Zone 1. Low intensity activities out of sight of the nest are allowed at all times of the year in Zone 3. Use in Zone 1 is allowed only after young have left the nest. Use in Zone 2 is completely restricted until young have hatched. After hatching, there are still some restrictions in Zone 2 placed on habitat modification activities until young have left the nest.

Perhaps the most significant consideration is to allow natural water flows to enter the wetland basins and augment these where water is removed for other purposes. Drainage, in-filling and cultivation of wetlands are clearly not compatible with wetland maintenance. Moreover, adjacent shorelines and uplands are important to nesting waterfowl and certain land use activities may have to be curtailed at least on a seasonal basis if wetland productivity is to be maintained.

Conservation of diverse bird populations will require maintaining the mosaic of shrubbery, woodland and wetlands that currently exists. Bird habitats are generally enhanced by Beaver activity and protection of Beaver ponds within ESAs serves two important purposes: deep water wetlands are maintained; and diverse edge habitats are created at the water's edge, through clearing of adjacent woodlands and by supporting growth of nearby shrublands. Beaver dams in low gradient streams are also known to provide valuable pool and overwintering habitat for fish (Alberta Forestry, Lands and Wildlife 1990).

Trout and other fish should not be stocked in Long-toed Salamander breeding ponds and in other ponds within ESAs. Salamander larvae are eaten by trout stocked in ponds and lakes (Achuff et al. 1986).

4.2.2 Habitat for Old-Growth Dependent and Interior Forest Species

Westworth and Associates (1991a) suggest that the biophysical resources of protected areas be managed in a coordinated fashion since some of the important natural ecosystems in protected areas extend beyond the protected area boundary. They also note the need to incorporate the role of biological corridors and the concept of ecological diversity into management goals for entire landscapes. They recommend the development of an old-growth management strategy to ensure that the biological diversity and viable populations of old-growth dependent species are maintained.

Although coniferous forests of the study area are part of a fire-maintained system, clearcuts do not necessarily re-create bird communities or habitats that are similar to post-fire bird communities and habitats (Hutto et al 1993; DesGranges and Rondeau 1993a). Hutto et al. recommend moving from a single species management perspective to a multi-species approach, taking a landscape perspective that addresses the proportions and juxtaposition of cover types and age classes. They suggest managing the forest so that natural processes such as fire will be allowed to occur. Where timber harvesting is part of the landscape they indicate that, although

harvest does not mimic fire, the area harvested should not exceed the amount that would be naturally impacted by processes such as fire.

Cowbirds travel up to 7 km from feeding areas in open habitats to habitats where they search for host nests, often along forest borders and in secondary growth. Robinson et al. (1993) suggest that, although 3,000 ha has been suggested by some researchers as a minimum size of contiguous forest that may be necessary to retain populations of forest songbirds, 20,000-50,000 ha may be necessary in landscapes where there are high populations of cowbirds. They indicate that cowbird trapping can be effective in protecting specific endangered bird populations but that it should be seen as a last resort only to be used after attempts to protect continuous forest habitats have failed.

Pinel et al. (1991) note that Pileated Woodpecker primary habitat is old-growth mixed woodland, a habitat that is becoming increasingly scarce. Pileated Woodpeckers nest in tree cavities, preferring deciduous trees at least 38-50 cm dbh (Evans and Conner 1979; DeGraaf and Shigo 1985; More and Watton 1980). Freemark and Collins (1992) classify it as an interior forest species. The Pileated Woodpecker is an ecologically significant species that provides nesting sites for other cavity nesting wildlife. More and Watton (1980) indicate that protecting old-growth stands for Pileated Woodpeckers may be the key to retaining complete communities of cavity-nesting birds. They note that fidelity to the same nesting territory is very high in Pileated Woodpeckers -- pairs often remain in the nesting area throughout the year and return to the same breeding territory. For National Forests in the Idaho Panhandle, Jerry (1984) indicates that the minimum viable population for Pileated Woodpeckers is 500 adults or 250 pairs and that, conservatively estimated, each pair needs at least 120 ha of old- growth forest. Jerry recommends retaining 5% of the forested landscape in old-growth (including 120 ha in one largely contiguous stand) in each 4,000 ha management unit to protect viable populations of Pileated Woodpeckers.

Askins et al. (1990) recommend that extensive tracts of forest (> 1,000 ha) with the smallest proportion of edge, be preserved because they sustain a greater density and diversity of forest-dwelling neotropical migrants than small patches of forest.

Robbins (1979) recommends that unnecessary fragmentation of forests be avoided and that forests be managed in such a way that ensures that large forested blocks of all seral stages, including old-growth, are present at any given time. Pending further research, he recommends thinking in terms of at least 1,000 contiguous hectares for each forest management block. Management units that approximate a square are more effective than linear designs in preserving forest interior birds. The portions that are most beneficial to neotropical migrants are several hundred meters or more away from forest edges.

Juday (1988) recommends that old-growth management concerns be integrated into the largest protected areas such as parks. Lynch and Whigham (1984) suggest that the habitat quality factors associated with old-growth forest cannot be enhanced by interventionist management approaches except on a very long-term basis. Therefore, the most practical management implication of their data is to avoid reducing old-growth forest area and increasing isolation of the remaining patches of old-growth forest. Nyberg et al. (1987) conclude that preservation is the necessary first step to

maintaining wildlife habitat for old-growth species. For Idaho Panhandle National Forests, Jerry (1984) recommends maintaining 10% of all National Forest lands as old-growth.

National Forests are managed for a variety of purposes ranging from recreation to timber harvesting. Temple et al. (1979) state that large tracts of wildlands should be managed so as to allow natural succession and disturbance to occur, creating the variety of habitats needed to support a diverse bird population.

Greene (1988) notes that managing protected areas as part of a total landscape is now needed since many protected areas were established without any idea of what the scope of future timber harvesting activity would be. In the past, protected areas were surrounded by relatively intact forests with small areas of disturbance; consequently, outside activities had minor impacts on the protected areas. This situation has changed to the point where timber harvesting and other landscape modifying activities threaten the long-term viability of sensitive wildlife species. McLelland (1979) suggests that old-growth units should not be isolated with vast stretches of clearcuts or short rotation stands separating them. He also indicates that old-growth units should be connected with forest corridors.

Fairbarns (1991) suggests that, while some old-growth features could be reconstructed in post-harvest stands, entire old-growth communities cannot be reconstructed on harvested sites within a reasonable time scale. He also notes that some National Forests are managed to provide a minimum of 10% of the forest land base as old-growth at any given time in order to meet legislated obligations for biodiversity maintenance. Fairbarns also suggests that fragments (< 64 ha) of old-growth will be severely impoverished and that even block sizes of 9000 ha may not be sufficient to maintain the full diversity of old-growth. The effective size of fragments can, however, be increased through connecting intact corridors of old-growth.

A longer term concern is protecting an area large enough that would allow typical and frequent natural disturbances, such as fire and insect outbreaks, to occur without eliminating all old-growth and old-growth species. A particular concern about loss of old-growth would be the loss of key insect populations that may cycle through such stands but may not be present in younger age forests. Finch (1991) and Crawford and Titterington (1979) note that populations of some old-growth dependent wood warblers appear to fluctuate with outbreaks of spruce budworm and tent caterpillars.

The minimum dynamic area is the smallest area with a natural disturbance regime that contains internal recolonization sources and minimizes extinction (Noss 1987). Minimum dynamic areas must still be determined for landscapes in the Boreal Forest, Foothills and Rocky Mountains of Alberta (Fairbarns 1991). If protected areas are smaller than required, interventionist management and wildfire suppression will be necessary -- the most ecologically compatible solution is to maintain large blocks of old-growth with natural disturbance regimes (Jones 1988; Juday 1988).

Rowe (1993) suggests that the maintenance and preservation of old-growth forest ecosystems is one of the most constructive and sensible missions that forestry and professional foresters can

engage in.

The special values of old-growth forests can only be accommodated by preserving very large, landscape scale, ecological reserves in which the dynamics that allow the development of old-growth forest are allowed to occur over the long-term. This would certainly result in a substantial withdrawal from the "working forest" (Freedman 1993).

There is a general recognition of the need to protect old-growth forests (Canadian Forestry Association 1993) -- the burning question is how much and where. Champion Forest Products (n.d.) outlines in its integrated approach to forest-fish-wildlife management that species such as Woodland Caribou, Marten and Fisher which rely on old-growth coniferous forests could be seriously impacted by extensive timber harvest. Portions of the Foothills Model Forest have been recommended for immediate wilderness area designation as part of the national Endangered Spaces Campaign (Pachal 1992).

Bunnell and Kremsater (1990) suggest that the most practical approach to managing old-growth forests is to select reserves that are off-limits to harvest, then manage buffer zones of mature forest with a long rotation time between harvests around the protected cores. Protected areas should be an important component of forest management (Hunter 1993).

Ultimately, the major problem in forest management is defining the extent of habitat required to maintain various species. Although there are habitat requirements defined for birds in areas of eastern North America, data specific to Alberta and for many other wildlife species are lacking. Given the extent of the problem, the general lack of data, and the potentially devastating impact on significant species, a cautious approach to forest habitat alteration should be followed, especially for old-growth.

Large blocks of representative forest connected to other large blocks by corridors will ensure that all conservation measures that can be taken on the breeding grounds are being implemented and will ensure the conservation of forest bird diversity (Freemark and Collins 1992). Protected areas serve part of the preservation needs in forest environments and should be managed from the perspectives of biodiversity and wilderness maintenance, not for commercial timber harvesting.

Studies of the impact of fragmentation on wildlife such as the one on the Pileated Woodpecker in the Foothills Model Forest (Bonar 1994) and compilations of literature on habitat requirements (e.g. Quinlan et al. 1990) should be pursued.

4.2.3 Riparian Habitats

Hunter (1990) outlines the need for buffer strips, citing recommendations for buffers from 8-400 m wide along stream channels. He suggests that the entire floodplain should be part of the buffer and that wider strips would prevent blowdown along edges. In addition to windfirm buffers, Champion Forest Products (n.d.) also indicate the need to minimize the amount of road in riparian habitat.

Based on Hunter (1990), protection of the floodplain and adjacent buffer strips of at least 100 m width on each side of the floodplain edge are needed to ensure that a diversity of species and the riparian ecosystem processes are maintained. With the concern over edge habitats becoming ecological "traps" and subjecting the birds to increased predation and nest parasitism, the concept of such narrow buffer strips should be revisited. Cowbirds penetrate up to 600 m into forest interiors and buffer strips of a kilometre or more may be necessary to combat the detrimental effects of edge habitat.

4.3 Environmentally Significant Fish Habitats

The management of environmentally significant fish habitats is more problematical than management of other ESAs. Fish migrate extensively within the drainage system. Certain reaches may be more significant than others and land uses well outside those areas may have profound impacts on them. While direct conservation and protection of spawning habitat may be helpful in the most significant reaches, it is important to promote sound land management practices throughout the drainage basins. These are essential to the maintenance of fish migration routes and water quality and quantity. Even in areas that have no major sport or commercial fisheries, many of the recommendations for maintaining fish habitat will also improve water quality and keep the rivers suitable for a variety of other lifeforms. The following is a summary of the major observations of Longmore and Stenton (1981) with respect to fish and land use activities in the South Saskatchewan Drainage Basin -- many of these are applicable to the study area.

Water quality and quantity are affected by land clearing operations; sewage disposal, storm water runoff, stream regulation and water storage; and disruption of streambeds by channelization, diking, seismic line crossings, and construction of bridges and pipelines. Clearing of land in watersheds can remove protective vegetation from streambanks and enhance spring flooding and channel erosion.

Nutrient loading of streams and rivers because of municipal sewage and toxic residues from pulp mills can substantially affect water quality.

Impoundment structures such as weirs and dams act as barriers to fish movement, thereby reducing the viability of populations that are dependent on a variety of reaches in the drainage basin (Roberts 1988). The potential impact of any in-stream barrier requires careful consideration. Fish often migrate long distances to spawn in headwater streams. Improperly designed weirs, road crossings, or man-made channel constrictions in small tributary streams may have significant impacts on important downstream fisheries. Design of fish passage facilities into these structures can significantly reduce impacts.

Significant spawning habitats must be protected from major inputs of silt that can cause the loss of viability in developing eggs. Land use and construction practices adjacent to spawning streams should be carefully considered. Maintaining a buffer zone of natural riparian vegetation along streambanks is helpful in controlling runoff problems. Sewer outfalls and other direct input

sources of toxins or effluent should not be located in spawning streams. The deposition of material on the bed or banks of spawning streams should be prohibited.

4.4 Other Considerations for Areas of Biological Importance

Specific management guidelines should be drawn up for rare and endangered plant and animal species. Where known, these have been cited in the wildlife and fish management sections and in the area descriptions. The management and monitoring of most rare and endangered plants and animals is still in its infancy. As knowledge increases, management techniques will improve.

Large blocks of continuous habitat are generally preferable to small parcels, in that native plants and animals are better able to withstand the direct and indirect effects of adjacent land uses over the longer term (Graul 1980).

4.5 Environmentally Significant Geological Sites

All geological sites identified in this study are most significant in their undisturbed state. With the exception of intensive developments, such as OHV (off-highway vehicle) use in sand dunes and sand and gravel extraction, most current land uses are compatible with maintenance of geological features. Recreational users sometimes vandalize features but these instances are relatively limited in scope.

4.6 Site Management Plans

Ultimately, it may be desirable to develop site management plans for each ESA. The first step is to determine management objectives such as protecting ecological diversity, maintaining or enhancing populations of rare species, increasing habitat diversity, commercial product exploitation, and water level manipulation. Next, a detailed inventory and mapping of plants, animals and landforms of the ESA and adjacent lands should be carried out, and the current level and type of human impact should be documented. Based on this, management priorities for each feature (e.g. landform, process, species, habitat type) can be established including:

1. types of uses permitted;
2. level of alteration allowed or encouraged;
3. preferred amount of resource extraction;
4. methods for reducing harmful uses;
5. manipulative methods (e.g. burning, cutting, damming, grazing); and

6. protective methods (e.g. fencing, education, wardens).

Once the management priorities have been defined, then the various interested parties should cooperate in developing suitable arrangements to manage each site. Through simple techniques of encouragement, provision of information, and legal agreements (including volunteer conservancy), many management objectives can be met, provided disposition holders and landowners are sympathetic. Otherwise, some types of incentives or purchase may be necessary.

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6.0 ENVIRONMENTALLY SIGNIFICANT AREA CHECKSHEETS – LAND USE, SENSITIVITIES, MANAGEMENT CONSIDERATIONS, DATA GAPS

Site Name: APETOWUN CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- minimally disturbed landscapes to south and east; mined and extensively harvested lands to the north and west

Sensitivity:

Recreation - Low
Timber Harvesting - Moderate, no old-growth present
Motorized Vehicles - Unknown but probably low due to low populations of large carnivores and ungulates
Linear Disturbances - Low
Facility Development - Low
Mining - High

Management Considerations:

- land management should maintain the complete variety of habitats found in the area

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by aerial photograph interpretation outlining minimally disturbed, diverse valley and adjacent upland habitats
- reconnaissance survey to assess significance for a variety of wildlife, particularly breeding birds and ungulates, and for more precise boundary delineation

Site Name: ATHABASCA RANCH

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife
- motorized recreation (with seasonal limitations from September 1 to April 30) is allowed in this area
- lands to the north have been extensively harvested

Sensitivity:

Recreation - Low (summer) to high (winter)
Timber Harvesting - Moderate
Motorized Vehicles - Low (summer) to high (winter)
Linear Disturbances - Low (summer) to high (winter)
Facility Development - Low (summer) to high (winter)
Mining - High

Management Considerations:

- seasonal closures on motorized recreation should be kept in place to minimize conflicts with Elk use
- the variety of habitats found in the area should be maintained

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by Fish and Wildlife maps and Critical Wildlife Zoning
- spot surveys to assess significance of other features, particularly wetlands and breeding birds

Site Name: ATHABASCA RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- transportation corridors cross the valley
- adjacent uplands include extensively harvested areas, especially in north-central portions, as well as areas of remote uncut forest

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate
Linear Disturbances - Low (trails) to moderate (access roads), but may be high in older forests
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could act as impediments to movement of sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- the full variety of habitats should be protected

References:

- Alberta Government (1984), Alberta Environmental Protection (n.d) and Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by Critical Wildlife zoning (ungulates) and aerial photograph interpretation outlining minimally disturbed, diverse valley and adjacent upland habitats
- reconnaissance survey to more precisely define upland boundaries
- habitat delineation survey to more precisely define old-growth areas
- spot surveys for rare plants, e.g. springs and wetlands; ungulate corridors; rare animals such as Taiga Vole; and breeding bird diversity areas

Site Name: BEAVER CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands have been extensively impacted by timber harvesting and petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined primarily on basis of Bull Trout stream presence but also through aerial photograph interpretation outlining minimally disturbed valley habitats
- spot surveys to assess significance for wildlife corridor

Site Name: BEAVERDAM CREEK DRAINAGE

Land Use Designation/Assessment of Resource Conflicts:

- mostly zoned Critical Wildlife with some Multiple Use
- surrounding uplands primarily in an undisturbed state

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate
Linear Disturbances - Moderate (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- stream crossings should be constructed in a way that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning (ungulates), Vitt (1992) and also through aerial photograph interpretation outlining minimally disturbed wetland complex and adjacent upland coniferous habitats
- spot surveys to assess significance for rare plants in patterned wetlands

Site Name: BERLAND RIVER-DONALD FLATS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- there are no formal recreational developments in this area
- surrounding lands are largely in an undisturbed state, although there is some timber harvesting near the west end

Sensitivity:

Recreation - Low
Timber Harvesting - Moderate to high
Motorized Vehicles - High
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could act as impediments to movement of sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- the full variety of habitats should be protected

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning (Woodland Caribou and other ungulates), Vitt (1992) and also through aerial photograph interpretation outlining minimally disturbed wetland complex and adjacent upland coniferous habitats
- habitat delineation survey to more precisely define old-growth areas
- spot surveys to assess significance for rare plants in springs and related habitats

Site Name: BERLAND RIVER-HENDRICKSON CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use; adjacent areas have been harvested for timber
- equestrian use
- Woodland Caribou road kills along Highway 40

Sensitivity:

Recreation - Low (summer) to high (winter)
Timber Harvesting - High
Motorized Vehicles - Low (summer) to high (winter)
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- requires the highest level of protection from human disturbance

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning (Mountain Caribou) and also through aerial photograph interpretation outlining minimally disturbed upland coniferous and wet meadow habitats
- habitat delineation survey to more precisely define critical old-growth areas

Site Name: BOULE RANGE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection and Critical Wildlife
- protected lands (Jasper National Park and Willmore Wilderness Provincial Park) on west; land to the east is minimally disturbed by human activities at present

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- maintain Prime Protection status and keep motorized use to well-defined corridors at the edge of the ESA

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and also through aerial photograph interpretation outlining minimally disturbed, diverse habitats at lower elevations
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Willmore Wilderness Park and Jasper National Park wildlife and habitats
- reconnaissance survey to evaluate significance for a variety of wildlife, particularly ungulates and breeding birds, and to more precisely define lower elevation boundaries
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: BRAZEAU RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife, Multiple Use and Special Use
- minimal human activity on this and surrounding lands at the present time
- includes year round motorized recreation corridor; however, most of the area is off limits to motorized use

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (lower reaches) to high (upper reaches)
Linear Disturbances - Low (seismic lines; lower reaches) to high (access roads; upper reaches)
Facility Development - High
Mining - High

Management Considerations:

- permanent facilities and access roads reduce habitat effectiveness for Grizzly Bear
- Harlequin Ducks can be negatively impacted by river recreation during critical parts of the breeding season
- calcareous springs often contain rare plant species

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and also through aerial photograph interpretation outlining minimally disturbed, diverse habitats at lower elevations
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats
- reconnaissance survey to evaluate significance for a variety of wildlife, particularly ungulates and breeding birds, and to more precisely define lower elevation boundaries
- spot surveys to assess the significance of calcareous springs for rare plants

Site Name: BRULÉ LAKE

Land Use Designation/Assessment of Resource Conflicts:

- northern parts of the area are zoned as General Recreation and Multiple Use, while more southern portions are zoned Critical Wildlife (Alberta Forestry, Lands and Wildlife, 1990)
- General Recreation designation allows OHV use on the active dunes
- extensively harvested lands to the east and north; bordered by Brûlé Lake and Front Ranges on the west

Sensitivity:

Recreation - Low to high (Bald Eagle nesting area; critical ungulate winter range)
Timber Harvesting - High
Motorized Vehicles - High; stabilized and partially stabilized dunes are prone to erosion from vehicular use
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- requires the highest level of protection from human disturbances
- ungulates are sensitive to human activities on critical winter ranges
- portions of the unvegetated dunes, now open to motorized vehicles, should be placed off limits
- Bald Eagles are sensitive to disturbance during the nesting season

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and also through aerial photograph interpretation outlining minimally disturbed, sand dune and coniferous forest habitats
- spot surveys for rare plants in active and stabilized dunes and in springs as well as for precise nesting locations for Bald Eagles

Site Name: CACHE PERCOTTE FOREST

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - High
Linear Disturbances - High
Facility Development - Moderate to high
Mining - High

Management Considerations:

- Long-toed Salamander ponds should not be stocked with fish as salamander larvae are known to be predated by trout
- garter snakes are very vulnerable to disturbances at overwintering den sites
- snake dens should be protected from development and human disturbance

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined largely on basis of research forest boundary but also through aerial photograph interpretation outlining minimally disturbed, diverse habitats
- spot surveys for overwintering dens for garter snakes and habitats for Long-toed Salamanders

Site Name: CARDINAL RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife
- OHV and equestrian use along the Cardinal River
- surrounded by landscapes which have not been significantly altered by human activity

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low to moderate
Linear Disturbances - Low to moderate (new access roads)
Facility Development - Low to moderate
Mining - High

Management Considerations:

- stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning, waterfall, and through aerial photograph interpretation outlining minimally disturbed valley habitats
- spot surveys to further define the nature and extent of this valley as a wildlife movement corridor to adjacent ESAs

Site Name: CARDINAL RIVER HEADWATERS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection, Critical Wildlife, General Recreation (Ruby Lakes), Multiple Use
- includes part of proposed Tripoli Ridge Natural Area and recommended additions
- the area south of Cadomin receives the highest level of intensive recreation in the entire Coal Branch area
- OHV use (particularly heavy on route to Ruby Lake and in the upper Cardinal River valley headwaters) and snowmobiling
- recreational fishing at Ruby Lakes
- includes part of proposed zone 4 motorized recreational use corridor
- site of past and present research/educational activities
- surrounded by lands that have not been significantly altered by human activity

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - High
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- Alpine tundra is vulnerable to disturbance
- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and access roads reduce habitat effectiveness for Grizzly Bear
- wildlife and erosion problems associated with motorized recreational use should be monitored and, if warranted by declining wildlife or expanding erosion problems, there should be full closure of all lands to motorized use including designated access corridors

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning and access
- draft access management plan for the Coal Branch

Site Name: CARDINAL RIVER HEADWATERS (continued)

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- reconnaissance survey to evaluate significance for a variety of wildlife and to more precisely define lower elevation boundaries
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: COAL VALLEY HIGHLAND

Land Use Designation/Assessment of Resource Conflicts:

- mostly zoned Critical Wildlife, some Multiple Use
- extensively harvested areas and gas field developments to the east; mining along western edge

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact several wildlife species
- the full variety of habitats should be protected

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats, particularly those associated with slump and seepage areas such as extensive tall shrub communities
- spot surveys for rare plants and uncommon birds in willow-alder communities
- habitat delineation survey for moist spruce-fir forests and diverse habitat complexes

Site Name: DONALD CREEK DRAINAGE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- a remote area; however, there has been considerable petroleum exploration and development on lands to the east
- there are no formal recreational developments in this area

Sensitivity:

Recreation - Low (summer) to high (winter)
Timber Harvesting - High
Motorized Vehicles - Moderate (summer) to high (winter)
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact several wildlife species and reduce habitat effectiveness for Grizzly Bear
- the full variety of habitats should be protected

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning (Woodland Caribou and other ungulates), Vitt (1992) and also through aerial photograph interpretation outlining minimally disturbed wetland complex and adjacent upland coniferous habitats
- habitat delineation survey to more precisely define old-growth areas and their use by Woodland Caribou
- spot surveys to assess significance for rare plants in springs and related habitats

Site Name: EDSON RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple use
- the Edson River fishery and surrounding lands heavily impacted by extensive timber harvesting and petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Moderate to high
Facility Development - High
Mining - High

Management Considerations:

- adjacent habitats need protection from further disturbance in order to restore the fishery
- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of diverse fishery and Bull Trout stream presence
- spot surveys to further define the current significance of the area
- monitoring survey of recovery from impacts of human activities

Site Name: EDSON RIVER WETLAND

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- surrounding lands have been extensively modified by timber harvesting and petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate (summer) to high (winter)
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and access roads could negatively impact ungulates

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and also through aerial photograph interpretation outlining minimally disturbed adjacent upland habitats
- spot surveys to assess significance for breeding bird diversity

Site Name: EMBARRAS RIVER DRAINAGE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding uplands vary from extensively harvested (western sections) to moderately impacted by energy industry activities; minimally disturbed landscapes persist near the confluences with Lambert Creek and the Erith River

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - High
Mining - High

Management Considerations:

- stream crossings should be constructed in a way that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Bull Trout stream presence and through aerial photograph interpretation outlining minimally disturbed, diverse stream-related habitats
- spot surveys to assess significance for a variety of wildlife species, including birds

Site Name: EMERSON LAKES

Land Use Designation/Assessment of Resource Conflicts:

- zoned General Recreation and Multiple Use
- surrounding lands have been minimally disturbed by human activities

Sensitivity:

Recreation - Low to moderate (non-motorized boating)
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (motorized boating)
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Low (existing disturbed areas and access) to high
Mining - High

Management Considerations:

- sandy soils are prone to erosion
- Common Loons are sensitive to recreational use, particularly motorized boating, near nesting areas

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of surficial geology maps and through aerial photograph interpretation outlining minimally disturbed diverse habitats
- spot surveys to assess significance for breeding bird diversity and plants in sandy habitats and wetlands

Site Name: ERITH RIVER DRAINAGES

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- adjacent uplands have been extensively altered in many areas by timber harvesting and gas field development; some minimally disturbed landscapes near the confluence with the Embarras River

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation
- if the area is a wildlife movement corridor, permanent facilities, access roads and motorized use could have significant impacts on several wildlife species

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Bull Trout stream presence and through aerial photograph interpretation outlining minimally disturbed, diverse stream-related habitats
- spot surveys to assess significance as a wildlife movement corridor from the Coal Valley Highland along the Erith River drainages

Site Name: FOLDING MOUNTAIN

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection, Critical Wildlife
- extensively harvested lands to the north and east; remote area of Jasper National Park to the west
- Prime Protection lands are off-limits to motorized vehicles

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- Alpine tundra is vulnerable to disturbance
- ungulates are sensitive to human activities on critical winter ranges

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- reconnaissance survey to evaluate significance for a variety of wildlife and to more precisely define lower elevation boundaries

Site Name: GRAVE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- primarily zoned Critical Wildlife
- includes Grave Flats candidate Natural Area
- high density of random camping and OHV use along Grave Creek road
- trail along Grave Creek valley used by equestrians and OHVs
- surrounded by minimally disturbed landscapes

Sensitivity:

Recreation - Low
Timber Harvesting - Moderate
Motorized Vehicles - Low
Linear Disturbances - Low to moderate
Facility Development - Low (along existing disturbances) to moderate
Mining - High

Management Considerations:

- a protective notation should be maintained on the candidate Natural Area until the area is approved for protection and established

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats
- spot surveys to determine distribution of rare and uncommon plants and animals, particularly springs and wetlands

Site Name: GREGG RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands have been extensively harvested

Sensitivity:

Recreation - Low to high (during Harlequin Duck and Osprey nesting season)
Timber Harvesting - High
Motorized Vehicles - Low to high (Osprey nesting area)
Linear Disturbances - Low (seismic) to high (new access roads)
Facility Development - Low (near existing disturbances) to high
Mining - High

Management Considerations:

- Harlequin Ducks and Osprey can be negatively impacted by human activities, including river recreation, during critical parts of the breeding season

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from presence of Bull Trout and native Rainbow Trout as well as through aerial photograph interpretation outlining diverse, minimally disturbed stream-related habitats
- spot surveys to determine nature and extent of use of the area by Harlequin Ducks and Osprey

Site Name: GREGG RIVER HEADWATERS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife, Prime Protection, Multiple Use
- extensively mined land to the north and east; remote area of Jasper National Park to the west
- formalized OHV access corridor along Drinnan Creek

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- prohibitions on motorized recreational access should be maintained in all Zone 1 (Prime Protection) lands

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning
- draft access management plan for the Coal Branch

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- reconnaissance survey to evaluate significance for a variety of wildlife and to more precisely define lower elevation boundaries
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats

Site Name: HANLAN CREEK WETLANDS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounded by extensively harvested lands to the north and natural forest with moderate seismic activity to the south

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (summer)
Linear Disturbances - Low (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- developments (e.g. roads, seismic trails) can disrupt natural drainage patterns and adversely impact plant and animal habitats

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Vitt (1992) and through aerial photograph interpretation outlining minimally disturbed wetland complexes
- spot surveys to assess significance for rare and uncommon plants and animals

Site Name: HIGH DIVIDE RIDGE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- . surrounding lands have been extensively harvested

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low to moderate
Facility Development - Low
Mining - High

Management Considerations:

- remaining unharvested forest needs protection to maintain some natural landscape surrounding viewpoints

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by interviews and aerial photograph interpretation outlining minimally disturbed habitats
- reconnaissance survey to assess if the area has any significance for wildlife

Site Name: HIGHTOWER CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple use and Critical Wildlife
- lands to the north have been minimally altered by human activity; other areas have been moderately impacted by petroleum exploration

Sensitivity:

Recreation - Low
Timber Harvesting - Moderate to high
Motorized Vehicles - Low to high
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and presence of Bull Trout as well as through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- reconnaissance survey to assess significance for a variety of wildlife and to more precisely delineate boundary in the upstream portion

Site Name: JARVIS CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned General Recreation and Multiple Use
- includes William A. Switzer Provincial Park, a legislated protected area
- surrounding lands have been extensively harvested
- hang-gliding occurs at Athabasca Lookout

Sensitivity:

Recreation - Low to moderate (non-motorized boating)
Timber Harvesting - High
Motorized Vehicles - Low to high (some areas in winter; motorized boating)
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Low (existing disturbed areas and access) to high
Mining - High

Management Considerations:

- Osprey and Common Loons are sensitive to recreational use, particularly motorized boating, near nesting areas
- several bird species require mature and older stands
- ungulates are sensitive to human activities on critical winter ranges

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Wm. A. Switzer Provincial Park boundaries as well as through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats and adjacent uplands
- reconnaissance survey to more accurately locate the eastern boundary and more fully determine the extent of significant features in this area

Site Name: LAMBERT CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- extensively harvested uplands to the south; moderate to heavy petroleum exploration and development elsewhere

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low to moderate
Linear Disturbances - Low (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- reconnaissance survey to assess significance for a variety of wildlife
- spot sampling to determine significance for fish

Site Name: LITTLE BERLAND-FOX DRAINAGE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands include extensively harvested areas, especially in middle and lower reaches

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - Moderate
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation
- remaining forests adjacent streams should be protected to maintain fish habitat

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined through Bull Trout stream presence and through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- reconnaissance survey to assess significance for a variety of wildlife
- spot surveys to assess significance for wildlife corridors

Site Name: LITTLE SUNDANCE WETLANDS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- surrounding uplands have been lightly to heavily impacted by petroleum exploration and development

Sensitivity:

Recreation - Low to moderate (during Trumpeter Swan and Great Blue Heron nesting)
Timber Harvesting - High
Motorized Vehicles - Low to high (during nesting season)
Linear Disturbances - Low (seismic) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- swans and herons can be disturbed by human activity during the nesting season
- land use and recreational activities adjacent to the wetlands should be restricted during the critical nesting season

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining extent of wetlands
- spot surveys to determine the location of the Great Blue Heron colony and the extent of other waterbird use of these wetlands

Site Name: LOVETT RIVER HEADWATERS

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- mined lands to the east; lands to the west have been minimally altered by human activities

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (summer)
Linear Disturbances - Low (seismic) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- developments (e.g. roads, seismic trails) can disrupt natural drainage patterns and adversely impact plant and animal habitats

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Vitt (1992) and also through aerial photograph interpretation outlining minimally disturbed wetland complexes
- spot surveys to assess significance for rare plants in patterned wetlands and significance of streams for fish

Site Name: LOWER BERLAND RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned as General Recreation
- a remote area with little development except near the confluence with the Wildhay River
- no active timber harvesting on adjacent uplands
- no formal recreational developments in this area

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate
Linear Disturbances - Low (trails) to moderate (access roads), and may be high in older forests
Facility Development - High
Mining - High

Management Considerations:

- permanent facilities and transportation corridors could act as impediments to movement of sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- the full variety of habitats should be protected

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Fish and Wildlife maps and through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- spot surveys to assess significance for a variety of wildlife, particularly breeding bird diversity

Site Name: LOWER ERITH RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding uplands vary from extensively harvested (southern sections) to moderately impacted by petroleum exploration and development; minimally disturbed landscapes persist near the confluence with the Embarras River

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - High
Mining - High

Management Considerations:

- stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by aerial photograph interpretation outlining minimally disturbed, diverse stream-related habitats
- reconnaissance survey to assess significance for a variety of wildlife and for more precise boundary delineation

Site Name: LOWER PINTO CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- there are no formal recreational developments in this area
- part of a remote area with minimal disturbance; however, there has been extensive petroleum exploration and some timber harvesting to the northeast

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - Moderate (seismic) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- permanent facilities and transportation corridors could negatively impact sensitive wildlife species and reduce habitat effectiveness for Grizzly Bear
- the full variety of habitats should be protected
- hunting would compromise this disjunct Mountain Goat population

References:

- Alberta Government (1984) and Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining diverse valley and adjacent upland habitats
- reconnaissance survey to determine the significance for a variety of wildlife and to more precisely define boundaries

Site Name: LOWER WILDHAY RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife, General Recreation, and Multiple Use
- there is only one formal recreation site in this area
- high potential for recreational fishing
- includes a portion of the proposed Main Foothills IV Natural Area
- bordered by large areas of minimally disturbed uplands; although some areas along the eastern boundary and near the confluence with the Berland River have been extensively harvested

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - Low or Moderate (summer) to high (winter)
Linear Disturbances - Low (seismic) to high (new access roads)
Facility Development - Low (existing disturbed areas and access) to high
Mining - High

Management Considerations:

- permanent facilities and transportation corridors could act as impediments to movement of sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- several bird species require mature and older stands
- ungulates are sensitive to human activities on critical winter ranges
- the full variety of habitats should be protected

References:

- Alberta Government (1984) for and Alberta Environmental Protection (n.d.) zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining diverse valley and adjacent upland habitats
- reconnaissance survey to determine the significance for a variety of wildlife
- habitat delineation survey to determine precise locations for stands of old-growth and to more precisely define the west boundary of the area

Site Name: LOWER WILLOW CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- minimal human activity on this and immediately surrounding lands at the present time; however, there has been extensive timber harvesting and petroleum exploration and development to the west and southwest
- there are no formal recreational developments in this area

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (summer)
Linear Disturbances - Low (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- developments (e.g. roads, seismic trails) can disrupt natural drainage patterns and adversely impact plant and animal habitats

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Vitt (1992) and by aerial photograph interpretation outlining minimally disturbed, diverse wetland and adjacent upland habitats
- reconnaissance survey to assess significance for a variety of wildlife and for more precise boundary delineation
- spot surveys to determine presence of rare and uncommon plants and animals in wetlands

Site Name: MACKENZIE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- primarily zoned Critical Wildlife
- Mackenzie Creek Drainage Forest Land Use Zone -- no four-wheel drives and trucks permitted downstream from Meadow Creek and no motorized access along stream bed
- heavy OHV use along Mackenzie Creek in association with Mountain Park area use
- surrounded by lands that have little human activity in them at the present time

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - Moderate (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation
- degradation of the quality of the Mackenzie Creek fishery should continue to be avoided through the management of recreational access

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning and management considerations

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of presence of Bull Trout, Critical Wildlife zoning as well as through aerial photograph interpretation outlining diverse valley habitats
- reconnaissance survey to determine the significance for a variety of wildlife

Site Name: MCLEOD RIVER HEADWATERS

Land Use Designation/Assessment of Resource Conflicts:

- includes part of the candidate Tripoli Ridge Ecological Reserve and recommended additions
- zoned Critical Wildlife, Prime Protection
- the area south of Cadomin receives the highest level of intensive recreation in the entire Coal Branch area
- designated motorized access corridor (Drummond-Prospect)
- site of past and present research/educational activities
- surrounded by lands that have not been significantly altered by human activity
- part of a buffer between Jasper National Park to the west and multiple use lands to the east

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - High
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- Alpine tundra is vulnerable to disturbance
- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and access roads reduce habitat effectiveness for Grizzly Bear
- current prohibitions on motorized recreational access should be maintained on all Zone 1 and 2 lands
- wildlife and erosion problems associated with motorized recreational use should be monitored and, if warranted by declining wildlife or expanding erosion problems, there should be full closure of all lands to motorized use including designated access corridors

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning and access
- draft access management plan for the Coal Branch

Site Name: MCLEOD RIVER HEADWATERS (continued)

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- reconnaissance survey to evaluate significance for a variety of wildlife and to more precisely define lower elevation boundaries
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: MERCOAL UPLAND

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- adjacent uplands have been extensively harvested

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - Low (near existing disturbances) to high
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Bull Trout stream presence and through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- reconnaissance survey to assess significance for a variety of wildlife

Site Name: MIDDLE BERLAND RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned General Recreation with a small area of Critical Wildlife at the western extremity
- some timber harvesting and petroleum exploration on adjacent uplands, especially near the confluence with the Wildhay River; however, the area remains fairly remote
- no formal recreational developments in this area

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could act as impediments to movement of sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- the full variety of habitats should be protected

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Critical Wildlife zoning, Fish and Wildlife maps, and through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats and small portions of the adjacent upland
- spot surveys to assess significance for a variety of wildlife, including birds

Site Name: MIDDLE MCLEOD RIVER

Land Use Designation/Assessment of Resource Conflicts:

- primarily zoned Critical Wildlife and Multiple Use
- surrounding uplands have been extensively harvested in the upper reaches; moderate to heavy seismic activity along portions of the lower reaches

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low to high (winter)
Linear Disturbances - Low (seismic) to high (new access roads)
Facility Development - Low (near existing disturbances) to high
Mining - High

Management Considerations:

- permanent facilities and transportation corridors could negatively impact sensitive wildlife
- ungulates are sensitive to human activities on critical winter ranges
- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Critical Wildlife Zoning and through aerial photograph interpretation outlining minimally disturbed, diverse valley habitats
- spot surveys to assess significance for a variety of wildlife, including breeding bird diversity and rare plants, particularly in spring/wetland complexes

Site Name: MUMM CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection
- bordered by Willmore Wilderness Provincial Park on the west
- minimal human activity on lands to the east
- equestrian use

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- maintain Prime Protection status and keep motorized use to well-defined corridors at the edge of the ESA

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection zoning
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Willmore Wilderness Park wildlife and habitats
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: NEILSON-RUBY CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection; a de facto wildland, bordering a remote area of Jasper National Park .on the west and south
- equestrian and OHV use along Ruby Creek, including proposed OHV access corridor

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- maintain Prime Protection status and keep motorized use to well-defined corridors at the edge of the ESA

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning
- draft access management plan for the Coal Branch

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- spot surveys in potential corridors to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: NOSEHILL CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple use
- surrounding lands have been heavily impacted by timber harvesting and petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Moderate
Mining - High

Management Considerations:

- adjacent woodlands should be protected to maintain the entire range of habitats along this stream valley

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Fish and Wildlife maps (key Elk habitat)
- spot surveys to assess significance for fish and other biological features, particularly breeding bird diversity

Site Name: OBED HILL

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife
- .moderate petroleum exploration on surrounding lands

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - Moderate to high
Motorized Vehicles - Low (summer) to high (winter)
Linear Disturbances - Low (seismic) to high (new access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact sensitive wildlife species

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Critical Wildlife zoning and Fish and Wildlife maps (key Moose and Elk habitat)
- spot surveys to assess significance for other biological features, particularly breeding bird diversity

Site Name: OLDMAN CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use and Critical Wildlife
- surrounding lands have been extensively harvested

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate to high
Linear Disturbances - Moderate (seismic) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact several wildlife species and reduce habitat effectiveness for Grizzly Bear
- the full variety of habitats should be protected

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Fish and Wildlife maps (Bull Trout, key Elk habitat) and through aerial photograph interpretation outlining diverse, minimally disturbed habitats
- spot surveys to assess significance for other biological features, particularly breeding bird diversity and rare plants, especially in diverse slumping valley habitats

Site Name: PEMBINA RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounded by minimally disturbed landscapes in the upper reaches
- lower reaches flow through uplands that have been extensively harvested

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (roads)
Facility Development - High
Mining - High

Management Considerations:

- any stream crossings should be constructed in a manner that minimizes siltation
- if the area is a wildlife movement corridor, permanent facilities, access roads and motorized use could have significant impacts on several wildlife species

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from presence of Bull Trout and through aerial photograph interpretation outlining minimally disturbed, diverse stream-related habitats
- spot surveys to assess significance as a wildlife corridor and for breeding bird diversity

Site Name: PEPPERS LAKE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands have been extensively harvested

Sensitivity:

Recreation - Low to moderate (non-motorized boating)
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (motorized boating)
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Low (existing disturbed areas and access) to moderate
Mining - High

Management Considerations:

- waterfowl can be sensitive to recreational use, particularly motorized boating, near nesting areas

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of local nomination and through aerial photograph interpretation outlining undisturbed habitat
- spot surveys to further define the importance of these wetland habitats

Site Name: PETITE-DUNN LAKES

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- extensively harvested uplands surround this site; however, there is some undisturbed forest on immediately adjacent uplands and in the Wildhay River valley

Sensitivity:

Recreation - Low to moderate (non-motorized boating)
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (motorized boating)
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Low (existing disturbed areas and access) to moderate
Mining - High

Management Considerations:

- Common Loons are sensitive to recreational use, particularly motorized boating, near nesting areas

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of interviews and through aerial photograph interpretation outlining undisturbed upland and wetland habitat
- spot surveys to further define the importance of these wetland habitats

Site Name: PINE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands have been heavily impacted by petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low
Linear Disturbances - Low (seismic) to moderate (new access roads)
Facility Development - Moderate
Mining - High

Management Considerations:

- adjacent woodlands should be protected to maintain the entire range of habitats along this stream valley

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by presence of diversity of fish species
- reconnaissance survey to assess significance for a variety of wildlife and for more precise boundary delineation
- spot surveys for fish, especially to determine presence of Bull Trout

Site Name: RED CAP

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection, Critical Wildlife
- Mackenzie Creek Drainage Forest Land Use Zone -- no four-wheel drives and trucks permitted downstream from Meadow Creek and no motorized access along stream bed
- heavy OHV use along Mackenzie Creek and adjacent Grave Flats road in association with Mountain Park area use
- with the exception of some mining along the north and west, the area is surrounded mostly by landscapes that have been minimally disturbed by human activity

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - High
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- Alpine tundra is vulnerable to disturbance
- ungulates are sensitive to human activities on critical winter ranges
- current prohibitions on motorized recreational access should be maintained on all Zone 1 and 2 lands
- wildlife and erosion problems associated with motorized recreational use should be monitored and, if warranted by declining wildlife or expanding erosion problems, there should be full closure of all lands to motorized use including designated access corridors

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- spot surveys in potential corridors to determine the importance and connectivity between significant habitats in the Foothills Model Forest and beyond
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: ROBB HIGHLAND

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife
- surrounding lands vary from extensively harvested to minimally disturbed

Sensitivity:

Recreation - Low
Timber Harvesting - Moderate
Motorized Vehicles - Moderate to high (winter)
Linear Disturbances - Moderate (seismic lines) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact several wildlife species
- the full variety of habitats should be maintained

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats, particularly those associated with spring/seepage areas such as extensive tall shrub communities
- spot surveys for rare plants and uncommon birds in willow-alder communities

Site Name: SOLOMON-ICE WATER-PARADISE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Prime Protection, Critical Wildlife and Multiple Use
- includes candidate Solomon Creek Natural Area
- lands to the east have been extensively harvested; lands to the west are minimally disturbed by human activities at the present time

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low to moderate
Linear Disturbances - Low (seismic lines) to high (new access roads)
Facility Development - Moderate to high
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact several wildlife species
- the full variety of habitats should be protected

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of Prime Protection and Critical Wildlife zoning and through aerial photograph interpretation outlining diverse, minimally disturbed habitats at lower elevations
- spot surveys of tall shrub and spring habitats for rare plant potential and breeding bird diversity

Site Name: SUNDANCE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned General Recreation and Multiple Use
- possible conflict with equestrian use
- although some of the surrounding lands have been extensively harvested or moderately impacted by petroleum exploration and development, there are still significant portions that have been minimally disturbed by human activities

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate
Linear Disturbances - Low (trails) to high (access roads)
Facility Development - High
Mining - High
Other - Low to moderate for equestrian use

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact sensitive wildlife species and should be kept out of the valley and immediately adjacent upland
- the full variety of habitats should be protected

References:

- Alberta Government (1984) and Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined by interviews, presence of Bull Trout and native Rainbow Trout, and aerial photograph interpretation outlining minimally disturbed, diverse valley and adjacent upland habitats
- habitat delineation survey to determine the full extent of significant stands of old-growth and to more precisely define the southern boundary of the area

Site Name: THUNDER LAKE

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- high density of random camping and OHV use along Grave Flats road
- surrounded by landscapes that have been minimally altered by human activities

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Moderate
Linear Disturbances - Low (seismic lines) to high (access roads)
Facility Development - Low (existing disturbed areas and access) to high
Mining - High

Management Considerations:

- sandy, gravelly terrain is prone to erosion

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from surficial geology maps and by aerial photograph interpretation outlining esker-wetland complex
- reconnaissance survey to assess significance for a variety of wildlife
- spot surveys for rare plants in open habitats

Site Name: UPPER MCLEOD RIVER

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Multiple Use
- extensively harvested area in Tri-Creek Basin; minimally disturbed uplands in other areas
- a relatively high level of canoeing, especially between Steeper and the McLeod River campground

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (summer) to high (winter)
Linear Disturbances - Low (seismic lines) to high (new access roads)
Facility Development - Low (existing disturbed areas and access) to high
Mining - High

Management Considerations:

- ungulates are sensitive to human activities on critical winter ranges
- permanent facilities and transportation corridors could negatively impact sensitive wildlife species
- Harlequin Ducks can be negatively impacted by river recreation during critical parts of the breeding season

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined through Critical Wildlife zoning as well as Bull Trout and native Rainbow Trout presence
- reconnaissance survey to assess significance for a variety of wildlife
- spot surveys to assess use by Harlequin Ducks

Site Name: UPPER PINTO CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- surrounding lands have been extensively harvested or impacted by petroleum exploration and development

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (summer)
Linear Disturbances - Low (seismic) to high (access roads)
Facility Development - High
Mining - High

Management Considerations:

- developments (e.g. roads, seismic trails) can disrupt natural drainage patterns and adversely impact plant and animal habitats
- any stream crossings should be constructed in a manner that minimizes siltation

References:

- Alberta Government (1984) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Vitt (1992), presence of Bull Trout and by aerial photograph interpretation outlining minimally disturbed, diverse wetland and adjacent upland habitats
- reconnaissance survey to assess significance for a variety of wildlife and for more precise boundary delineation
- spot surveys to determine presence of rare and uncommon plants and animals in wetlands, as well as the significance of the area for ungulates

Site Name: WEST BEAVER CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Multiple Use
- remote area; little human disturbance on immediately adjacent uplands at the present time

Sensitivity:

Recreation - Low
Timber Harvesting - High
Motorized Vehicles - Low (winter) to high (summer)
Linear Disturbances - Low (seismic) to high (roads)
Facility Development - High
Mining - High

Management Considerations:

- developments (e.g. roads, seismic trails) can disrupt natural drainage patterns and adversely impact plant and animal habitats

References:

- Alberta Environmental Protection (n.d.) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined from Vitt (1992) and by aerial photograph interpretation outlining minimally disturbed, diverse wetlands
- reconnaissance survey to assess significance for a variety of wildlife and for more precise boundary delineation
- spot surveys to determine presence of rare and uncommon plants and animals in wetlands

Site Name: WHITEHORSE CREEK

Land Use Designation/Assessment of Resource Conflicts:

- zoned Critical Wildlife and Prime Protection
- includes a recommended addition to Tripoli Ridge Natural Area and the candidate Cadomin Cave Natural Area
- high level of equestrian, OHV and hiking use in the Whitehorse Creek valley, as well as snowmobile use in winter; proposed no motorized use zone
- borders a remote area of Jasper National Park on the west
- mining activity to the east and north

Sensitivity:

Recreation - Low to moderate
Timber Harvesting - High
Motorized Vehicles - High
Linear Disturbances - High
Facility Development - High
Mining - High

Management Considerations:

- Alpine tundra is vulnerable to disturbance
- ungulates are sensitive to human activities on critical winter ranges
- prohibitions on motorized recreation use should be implemented on all Zone 1 and 2 areas in the Whitehorse Creek basin
- public access to Cadomin Cave should be restricted during bat swarming and hibernation periods from August 10 to April 30

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined through Prime Protection and Critical Wildlife zoning as well as Bull Trout presence; also aerial photograph interpretation outlining minimally disturbed habitats at lower elevations
- studies to determine the importance and connectivity of significant habitats in the Foothills Model Forest to Jasper National Park wildlife and habitats
- land use studies to determine the impacts of vehicle access corridors into headwater habitats

Site Name: WILDHORSE-KINKY LAKES

Land Use Designation/Assessment of Resource Conflicts:

- zoned General Recreation
- heavy OHV use in vicinity
- surrounding lands have been extensively harvested

Sensitivity:

Recreation - Low to moderate (non-motorized boating)
Timber Harvesting - Low to moderate
Motorized Vehicles - Low (winter) to high (motorized boating)
Linear Disturbances - Low
Facility Development - Low
Mining - High

Management Considerations:

- sandy soils are prone to erosion
- Common Loons are sensitive to recreational use, particularly motorized boating, near nesting areas
- Long-toed Salamander ponds should not be stocked with fish as salamander larvae are know to be predated by trout

References:

- Alberta Forestry, Lands and Wildlife (1990) for zoning

Boundary Delineation/Recommendations for Additional Data Collection:

- boundaries determined on basis of interviews and through aerial photograph interpretation outlining undisturbed upland and wetland habitat
- spot surveys of wetlands and sandy habitats for rare plants

APPENDIX 1. SURVEY TYPE DEFINITIONS

The following survey types are referred to in Section 6.0:

Habitat Delineation Survey -- more detailed than a reconnaissance survey; field checking of portions of ESAs to determine the presence/absence of particular habitat features, e.g. old-growth stands identified from stand age classes, interviews and aerial photograph interpretation. This will be used primarily in potential high conflict areas where very precise boundary information is required, often in sites where there is pre-existing field information.

Land Use Studies -- nature, extent and severity of the impacts of conflicting land uses in a particular ESA, e.g. OHV access into wildland areas

Monitoring Survey -- surveys encompassing a wide range of sampling intensity depending on the specific nature of the problem. Some examples would be examining the recovery of fish stocks or determining the impact on fish stocks in prime fisheries that have been subject to extensive disturbance on adjacent lands.

Reconnaissance Survey -- generally would include an aerial overflight and a brief (approx. one day) site visit. This would be used primarily to confirm the aerial photograph interpretation, to achieve a high comfort level with boundary delineation and to get a general feel for its wildlife and other values where there is little existing field data.

Spot Survey -- brief field visit directed at gathering specific types of biological information, e.g. fish spot surveys to evaluate diversity and presence of species of concern; rare species spot survey to determine nesting sites; breeding bird spot surveys in potential bird diversity areas; and spot sampling of mammal sign (e.g. pellets and browse) in representative habitats in potential wildlife corridors.

APPENDIX 1: BROWSE TABLE FROM MODFORST DBASE IV FILE – THEME REPRESENTATION IN FOOTHILLS MODEL FOREST ESAs

The browse table on the next page was derived from the DBASE IV file MODFORST.DBF and indicates which themes are represented in each of the Foothills Model Forest ESAs. For the Upper and Lower Foothills, the approximate area occupied by a theme in each ESA is given in square kilometres. For the Montane, Subalpine and Alpine, a Y indicates that the theme is represented in the ESA. The following abbreviations are used for the theme headings in the browse table:

Lower Foothills (Area Given in Square Kilometres)

LWALL -	Valley/Ridge - Ridge/Valley Wall
LSTRM -	Valley/Ridge - Floor/Stream
LMIN -	Wetland - Mineral
LORG -	Wetland - Organic
LLAKE -	Wetland - Lake

Upper Foothills (Area Given in Square Kilometres)

UWALL -	Valley/Ridge - Ridge/Valley Wall
USTRM -	Valley/Ridge - Floor/Stream
UMIN -	Wetland - Mineral
UORG -	Wetland - Organic
ULAKE -	Wetland - Lake

Montane (Y = Theme Represented)

MSTRM -	Valley/Ridge - Floor/Stream
MWALL -	Valley/Ridge - Ridge/Valley Wall
MMIN -	Wetland - Mineral
MLAKE -	Wetland - Lake

Subalpine (Y = Theme Represented)

SSTRM -	Valley/Ridge - Floor/Stream
SWALL -	Valley/Ridge - Ridge/Valley Wall
SMIN -	Wetland - Mineral
SORG -	Wetland - Organic
SLAKE -	Wetland - Lake

Alpine (Y = Theme Represented)

ASTRM -	Valley/Ridge - Floor/Stream
AWALL -	Valley/Ridge - Ridge/Valley Wall
AGLAC -	Glacier/Snowfield
AMIN -	Wetland - Mineral
ALAKE -	Wetland - Lake

Special (Y = Theme Represented)

SPEC - Special

SITENAME	LWALL	LSTRM	LMIN	LORG	LLAKE	UWALL	USTRM	UMIN	UORG	ULAKE	MSTRM	MWALL	MMIN	MLAKE	SSTRM	SWALL	SMIN	SORG	SLAKE	ASTRM	AWALL	AGLAC	AMIN	ALAKE	SPEC
APETOWUN CREEK						38.1	12	0.5	3																
ATHABASCA RANCH	5	20.8	0.4		0.2																				
ATHABASCA RIVER	49	158.1	14	7																					Y
BEAVER CREEK		2.9	2																						
BEAVERDAM CREEK DRAINAGE						4	18.6	4	4																
BERLAND RIVER-DONALD FLATS						0	71	12																	Y
BERLAND RIVER-HENDRICKSON CREEK						3	17	2																	Y
BOULE RANGE															Y	Y	Y	Y	Y	Y	Y		Y		
BRAZEAU RIVER															Y	Y	Y	Y							Y
BRULE LAKE											Y	Y	Y	Y											Y
CACHE PERCOTTE FOREST	21	0.8	0.2	0.2		10.7	0.2	0.2																	
CARDINAL RIVER							5								Y		Y								Y
CARDINAL RIVER HEADWATERS															Y	Y	Y	Y		Y	Y		Y	Y	Y
COAL VALLEY HIGHLAND						149	6	6	0.5																Y
DONALD CREEK DRAINAGE						140	150	5	25																Y
EDSON RIVER		1.9	1.9																						
EDSON RIVER WETLAND		10.5	1	4.5																					
EMBARRAS RIVER DRAINAGE		26.3	15	3																					
EMERSON LAKES		6.5	1.5	0.2	0.8																				
ERITH RIVER DRAINAGES		11.2	4																						
FOLDING MOUNTAIN															Y	Y	Y			Y	Y				
GRAVE CREEK															Y	Y	Y	Y							
GREGG RIVER							6.8	1.5																	
GREGG RIVER HEADWATERS															Y	Y	Y	Y	Y	Y	Y				
HANLAN CREEK WETLANDS		1.5	1	6.9																					
HIGH DIVIDE RIDGE																Y									
HIGHTOWER CREEK							6.9	4	1																
JARVIS CREEK						3	33	9	1.5	3.5															
LAMBERT CREEK						1.5	9.1	2	4	0.5															
LITTLE BERLAND-FOX DRAINAGE							5.2	3.5	2																
LITTLE SUNDANCE WETLANDS		1	2.8	1	2.5																				
LOVETT RIVER HEADWATERS						3	6.3	3	8																
LOWER BERLAND RIVER	2	15	1																						
LOWER ERITH RIVER		6.3	1																						
LOWER PINTO CREEK						83.3	30	6																	
LOWER WILDHAY RIVER	20	75	6	2		30	97	9	3																
LOWER WILLOW CREEK		20	7.6	22	0.5																				
MACKENZIE CREEK						0	4	1	0						Y		Y	Y							
MCLEOD RIVER HEADWATERS															Y	Y	Y	Y		Y	Y		Y		Y
MERCOAL UPLAND						26.9	2	0.5	3																
MIDDLE BERLAND RIVER	2	24.3	4	6		1	9	2	1																
MIDDLE MCLEOD RIVER		48.9	12	1			14.5	3	1.5	0															
MUMM CREEK															Y	Y	Y	Y		Y	Y		Y		
NEILSON-RUBY CREEK															Y	Y	Y	Y		Y	Y		Y	Y	
NOSEHILL CREEK	0.5	7.6	4.5	0.5																					
OBED HILL						22	0.2	0.2																	
OLDMAN CREEK	4	3	1			0.5	8.5	4.5																	
PEMBINA RIVER						2	32.8	7	2																
PEPPERS LAKE							0.5	0.5	1.6	1.6															
PETITE-DUNN LAKES							1.2	0.2	0.2	0.4															
PINE CREEK		2.4	1.5	0.2																					
RED CAP															Y	Y	Y			Y	Y		Y		
ROBB HIGHLAND						27	2.7	0.5																	
SOLOMON-ICE WATER-PARADISE CREEK						81	8	3																	
SUNDANCE CREEK	46	5.3	1.5	0.5	2																				Y
THUNDER LAKE							3.8	0		0.2															
UPPER MCLEOD RIVER						1	38.6	8	0.5																
UPPER PINTO CREEK						40	45.8	12	30																
UPPER WILDHAY RIVER							41.5	8							Y	Y	Y	Y	Y						
UPPER WILLOW CREEK		3	2	8.4																					
WEST BEAVER CREEK		5.5	3.5	6																					
WHITEHORSE CREEK															Y	Y	Y	Y		Y	Y		Y		Y
WILDHORSE-KINKY LAKES												Y	Y	Y											

APPENDIX 2: BROWSE TABLE FROM MODFORST DBASE IV FILE -- SENSITIVITY OF FOOTHILLS MODEL FOREST ESAs TO LAND USES

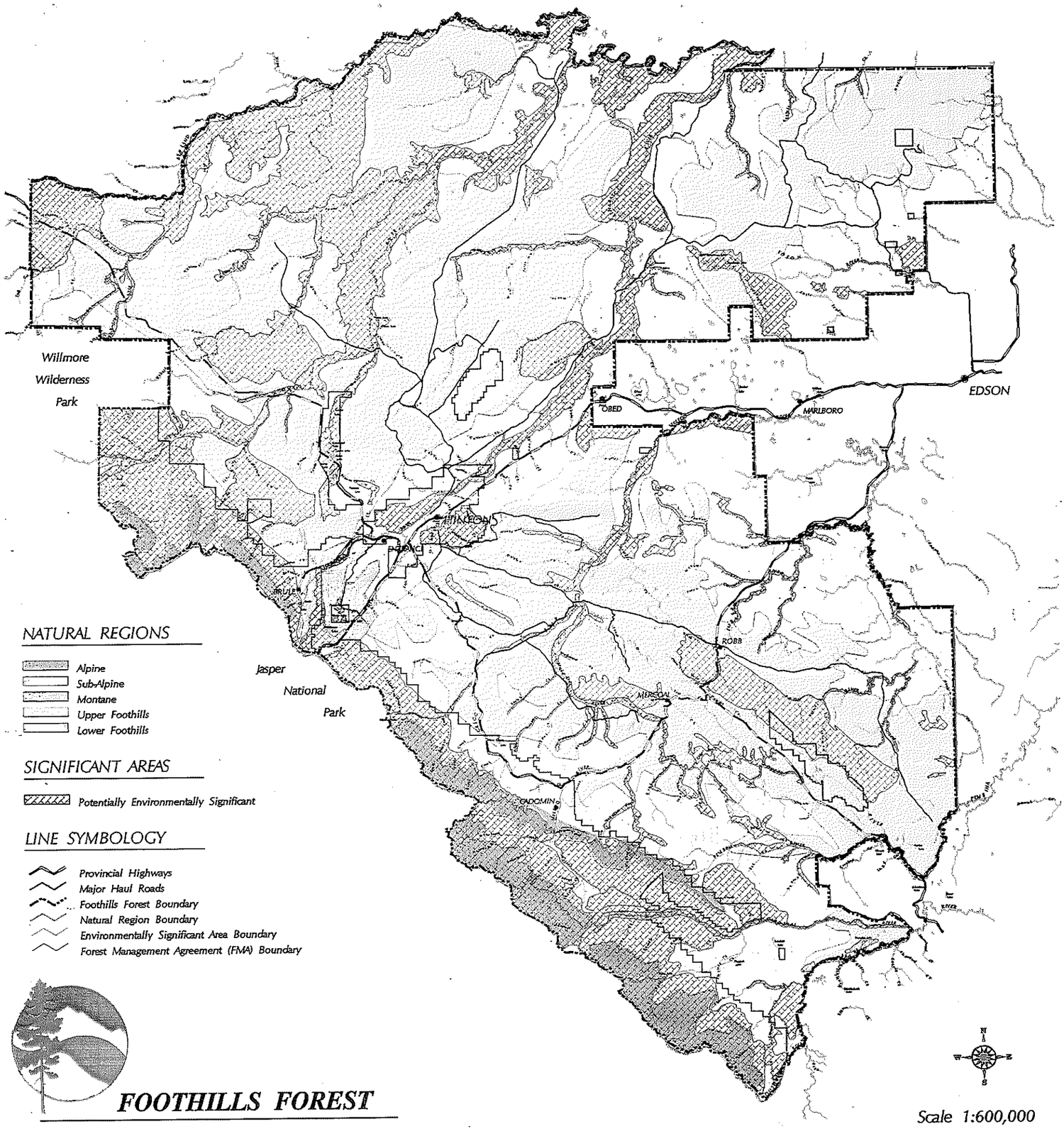
The browse table on the next page was derived from the DBASE IV file MODFORST.DBF and indicates the relative sensitivity (L - Low; M - Moderate; H - High) of each Foothills Model Forest ESA to various land uses. The most up-to-date Eastern Slopes zoning for each ESA is also provided under the heading ZONING (MU - Multiple Use; GR - General Recreation; SU - Special Use; CW - Critical Wildlife; PP - Prime Protection). The area (AREA) of each ESA is shown in sq. km.

The following abbreviations are used for the land use headings in the browse table:

RECREAT1 -	Recreation (least sensitive portions or lowest impact activities/season)
RECREAT 2 -	Recreation (most sensitive portions or highest impact activities/season)
TIMBERHARV -	Timber Harvesting
MOTORVEH1 -	Motorized Vehicle Use (low end of range, e.g. critical winter range in summer; bird of prey nesting areas, waterfowl habitats or wetlands in winter)
MOTORVEH2 -	Motorized Vehicle Use (high end of range, e.g. critical winter range in winter; bird of prey nesting areas, waterfowl habitats or wetlands in summer)
LINEARDEV1 -	Linear Developments (smaller types, e.g. trails, seismic lines; or lowest impact season)
LINEARDEV2 -	Linear Developments (larger types, e.g. roads; or highest impact season)
FACILITYDEV1 -	Facility Developments (lowest impact activities/season or least sensitive portions, e.g. existing disturbance)
FACILITYDEV2 -	Facility Developments (highest impact activities/season or most sensitive portions)
MINING -	Mining

SITENAME	AREA	ZONING	RECREAT1	RECREAT2	TIMBERHARV	MOTORVEH1	MOTORVEH2	LINEARDEV1	LINEARDEV2	FACILITYDEV1	FACILITYDEV2	MINING
APETOWUN CREEK	54	MU	L	L	M	L	L	L	L	L	L	H
ATHABASCA RANCH	26	CW	L	H	M	L	H	L	H	L	H	H
ATHABASCA RIVER	222	CW,MU	L	L	H	M	M	L	M	H	H	H
BEAVER CREEK	3	MU	L	L	H	L	L	L	M	H	H	H
BEAVERDAM CREEK DRAINAGE	27	CW,MU	L	L	H	M	M	M	H	H	H	H
BERLAND RIVER-DONALD FLATS		CU,MU	L	L	H	H	H	M	H	H	H	H
BERLAND RIVER-HENDRICKSON CREEK	99	CW,MU	L	H	H	L	H	H	H	H	H	H
BOULE RANGE	289	PP,CW	L	L	H	H	H	H	H	H	H	H
BRAZEAU RIVER	46	CW,MU,SU	L	L	H	L	H	L	H	H	H	H
BRULE LAKE	26	GR,MU,CW	L	H	H	H	H	H	H	H	H	H
CACHE PERCOTTE FOREST	33	MU	L	L	H	H	H	H	H	M	H	H
CARDINAL RIVER	20	CW	L	L	H	L	M	L	M	L	M	H
CARDINAL RIVER HEADWATERS	169	CW,GR,MU	L	M	H	H	H	H	H	H	H	H
COAL VALLEY HIGHLAND	155	CW,MU	L	L	H	M	H	M	H	H	H	H
DONALD CREEK DRAINAGE	313	CW,MU	L	H	H	M	H	H	H	H	H	H
EDSON RIVER	2	MU	L	L	H	L	L	M	H	H	H	H
EDSON RIVER WETLAND	15	CW,MU	L	L	H	M	H	M	H	H	H	H
EMBARRAS RIVER DRAINAGE	29	MU	L	L	H	L	L	L	M	H	H	H
EMERSON LAKES	8	GR,MU	L	M	H	L	H	L	M	L	H	H
ERITH RIVER DRAINAGES	11	MU	L	L	H	L	L	L	M	H	H	H
FOLDING MOUNTAIN	72	PP,CW	L	L	H	M	H	H	H	H	H	H
GRAVE CREEK	50	CW	L	L	M	L	L	L	M	L	M	H
GREGG RIVER	7	MU	L	H	H	L	H	L	H	L	H	H
GREGG RIVER HEADWATERS	99	CW,PP,MU	L	L	H	M	H	H	H	H	H	H
HANLAN CREEK WETLANDS	8	MU	L	L	H	L	H	L	H	H	H	H
HIGH DIVIDE RIDGE	7	MU	L	L	H	L	L	L	M	L	L	H
HIGHTOWER CREEK	8	MU,CW	L	L	H	L	H	M	H	H	H	H
JARVIS CREEK	41	GR,MU	L	M	H	L	H	L	M	L	H	H
LAMBERT CREEK	14	MU	L	L	H	L	M	L	H	H	H	H
LITTLE BERLAND-FOX DRAINAGE	12	MU	L	L	H	L	L	L	M	M	M	H
LITTLE SUNDANCE WETLANDS	6	CW,MU	L	M	H	L	H	L	H	H	H	H
LOVETT RIVER HEADWATERS	17	MU	L	L	H	L	H	L	H	H	H	H
LOWER BERLAND RIVER	17	GR	L	L	H	M	M	L	M	H	H	H
LOWER ERITH RIVER	6	MU	L	L	H	L	L	L	M	H	H	H
LOWER PINTO CREEK	113	CW,MU	L	M	H	M	H	M	H	H	H	H
LOWER WILDHAY RIVER	230	CW,GR,MU	L	M	H	L	H	L	H	L	H	H
LOWER WILLOW CREEK	46	MU	L	L	H	L	H	L	H	H	H	H
MACKENZIE CREEK	14	CW	L	L	H	M	H	M	H	H	H	H
MCLEOD RIVER HEADWATERS	89	CW,PP	L	M	H	H	H	H	H	H	H	H
MERCOAL UPLAND	32	MU	L	L	H	L	L	L	M	L	H	H
MIDDLE BERLAND RIVER	46	GR,CW	L	L	H	M	H	M	H	H	H	H
MIDDLE MCLEOD RIVER	66	CW,MU	L	L	H	L	H	L	H	L	H	H
MUMM CREEK	64	PP	L	L	H	M	H	H	H	H	H	H
NEILSON-RUBY CREEK	163	PP	L	L	H	M	H	H	H	H	H	H
NOSEHILL CREEK	9	MU	L	L	H	L	L	L	M	M	M	H
OBED HILL	22	CW	L	M	H	L	H	L	H	H	H	H
OLDMAN CREEK	17	MU,CW	L	L	H	M	H	M	H	H	H	H
PEMBINA RIVER	37	MU	L	L	H	L	L	L	M	H	H	H
PEPPERS LAKE	4	MU	L	M	H	L	H	L	M	L	M	H
PETITE-DUNN LAKES	2	MU	L	M	H	L	H	L	M	L	M	H
PINE CREEK	3	MU	L	L	H	L	L	L	M	M	M	H
RED CAP	148	PP,CW	L	M	H	H	H	H	H	H	H	H
ROBB HIGHLAND	30	CW	L	L	M	M	H	M	H	H	H	H
SOLOMON-ICE WATER-PARADISE CREEK	89	PP,CW,MU	L	L	H	L	M	L	H	M	H	H
SUNDANCE CREEK	60	GR,MU	L	L	H	M	M	L	H	H	H	H
THUNDER LAKE	4	MU	L	L	H	M	M	L	H	L	H	H
UPPER MCLEOD RIVER	40	CW,MU	L	L	H	L	H	L	H	L	H	H
UPPER PINTO CREEK	116	MU	L	L	H	L	H	L	H	H	H	H
UPPER WILDHAY RIVER	60	GR,CW	L	L	H	M	H	L	H	L	H	H
UPPER WILLOW CREEK	11	MU	L	L	H	L	H	L	H	H	H	H
WEST BEAVER CREEK	13	MU	L	L	H	L	H	L	H	H	H	H
WHITEHORSE CREEK	89	CW,PP	L	M	H	H	H	H	H	H	H	H
WILDHORSE-KINKY LAKES	1	GR	L	M	M	L	H	L	L	L	L	H

PRELIMINARY INVENTORY OF POTENTIAL ENVIRONMENTALLY SIGNIFICANT AREAS WITHIN FOOTHILLS FOREST



FOOTHILLS FOREST

Scale 1:600,000