Northeast Slopes Protected Areas – Source Synthesis

(A compilation of information sources, including the types and levels of information available, for Kakwa Wildland Provincial Park, Willmore Wilderness Park, Sulphur Gates Recreation Area and Rock Lake-Solomon Creek Wildland Provincial Park.)

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For:

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Table of Contents

Table of Tables

Table of Figures

Acknowledgements

I wish to thank all those people whom I contacted for further information. Their assistance and willingness to provide information was much appreciated. All the information provided was very useful and is documented in this report.

1.0 Introduction

The objectives of this project were three-fold:

1. to conduct an information and data search in order to determine the availability of information pertaining to the biophysical features of the following east slope areas, which are also referred to in this document as the study area or area of interest (See Figure 1):

    - Kakwa Wildland Provincial Park,
    - Willmore Wilderness Park,
    - Sulphur Gates Provincial Recreation Area
    - Rock Lake – Solomon Creek Wildland Provincial Park

2. to create a bibliography of all information sources located, and

3. to determine the types of data and extent (spatial distribution) of data available from these information sources.

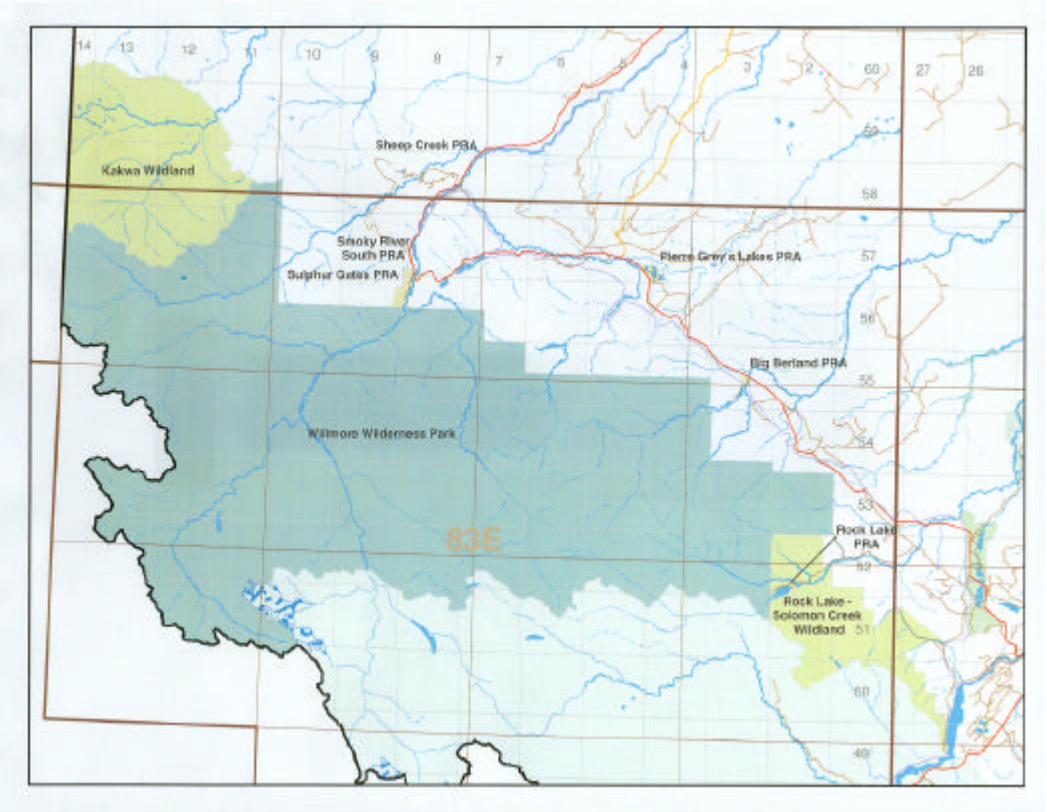

Figure 1. Map of study area discussed in this report.

2.0 Sources

2.1 Information Sources

Information was obtained through a variety of processes, including: literature searches, web site searches, database searches and communications with persons in various fields of expertise. The use of personal communication and web sites generally produced the most current information. It should be noted that some of the information mentioned in this document is related to projects, which are currently in progress and the data has not yet been officially released. These projects however, are all noted for future reference.

2.1.1Constraints

There are some constraints to the biophysical information presented in this document. Two major constraints are accessibility and accuracy. It should be noted that data or information referenced in this document has not been assessed for accuracy and in some cases availability is questionable.

Accuracy

During the course of this information search emphasis was specifically on the existence of available data. No assessment was made regarding the quality of the data. This would require more familiarity with the areas, more in depth analysis and comparison of existing data and consultation with experts. The sources and types of data are described as they are presented in the original format.

Accessibility

A number of publications listed in the bibliography have not been located during the course of this project. These are predominantly unpublished government or private agency reports. Often these reports are located in district and regional offices, many which have no existing archival system and others where the process of developing archival systems has just begun. These titles were generally obtained from the bibliographies of accessible publications which themselves were a synthesis of data provided in the unpublished reports. Therefore, information was obtained an indirect manner.

In some cases publications may have been altogether missed. The lack of internal divisional standardized collection systems inhibits accounting for all potential information available. It is hoped that by contacting personnel in the various fields that the most current information has been included here. In some instances obtaining this information took a great deal of time.

In yet other instances, there was reluctance to provide data that had not yet been formally released or presented. Most of this data should become available at some time in the near future.

2.1.2 Level and Types of Information

Scale and data collection methodology both contribute to the level and type of information.

Scale

Sources with a number of different scales or levels of information (from very general to more specific) are presented in this document. A number of the information sources listed provide very general information; however, they may still provide useful information for future reference. It should be noted that detailed information for these 4 areas is limited, but not nonexistent. Sources are generally presented in order of increasing scale or more specific detail in the document and the associated source tables.

Data Collection Methods

Collection methods are highly variable and often the type of data collected reflected the purpose of the specific study or document. This may contribute to the difficulty in direct data comparisons among sources.

An attempt was made to present the most complete reference list. The aforementioned factors were not considered and should be addressed in the data synthesis stage.

3.0 Biophysical Information

Information sources pertaining to a number of biophysical features were identified and are further described in this document, including;

- Geology,
- Water Resources (Hydrology),
- Landform (Surficial Geology),
- Soils,
- Ecology,
- Flora - Plant Communities, Species Lists, Rare Species and
- Fungi
- Fauna – Mammals, Amphibians and Reptiles, Insects, Fish, Birds, Rare Species

Included on the disk with this document is a searchable reference list. Searches can be defined by subject area and/or one of the four geographical areas. Location of reference availability has also been included for ease in the search process.

3.1 Geology

3.1.1 General Information

All geological information available is limited to small-scale maps (See Table 1). However, due to the nature and extent of most geological activity (i.e. formations, etc.) features are well defined on this scale. Many of the existent documents originate with the Geological Survey of Canada. Documented information regarding data collection procedures is often sketchy or nonexistent. Small-scale geological information is available for all four areas of interest.

Second hand information provided, pertaining to possible research by the University of Calgary in the area, was further explored. Contact was made with Jon Greggs of the Geology Department at the University of Calgary. He graciously contacted department staff regarding this matter. No one appeared to be familiar with any work that had been conducted inthis area.

Table 1. Sources of geological information.

#	Source	Scale	Area	Information Provided
G 1	Stott, D.F. 1967. The Cretaceous Smoky Group, Rocky Mountain Foothills, Alberta and British Columbia. Geological Survey of Canada Bulletin 132.	1:253,440	Kakwa	geology
G 2	Stott, D.F. 1960. Cretaceous rocks between Smoky and Pine rivers, Rocky Mountain Foothills, Alberta and British Columbia. Geological Survey of Canada Paper 60-16	1:253,440	Kakwa, Willmore	geology
G 3	Alberta Energy and Utilities Board and Alberta Geological Survey. 1999. Geological Map of Alberta.		All 4 areas	geology
G 4	Geological Survey of Canada. 1964. Geology: Mount Robson, Map 1499A.			geology
G 5	Irish, E.J.W. 1965. Geology of the Rocky Mountain Foothills, Alberta (between latitudes 53º 15' and 54º 15'. Geol. Surv. Can. Mem. 334	1:250,000	Sulphur Gates; Willmore; Rock Lake	geology
G 6	Jacques, D. and VanEck, P. 1979. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 1 - Biophysical Features. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.	1:50,000	Kakwa	Bedrock geology map, geology information from Stott 1965. GSC Bulletin 132 which appears to be similar to Stott (1967)

3.2 Water Resources (Hydrology)

Data pertaining to water resources is very limited for this area, in part due to the remoteness and the lack of a direct impact of the water movements in this area on people or industry.

3.2.1 General Information

Barnes (1977) provides some very general information pertaining to the potential for finding springs and seeps relative to the geology of the area. Information is presented on a very small scale for Kakwa Wildland Provincial Park and Willmore Wilderness Park.

According to Borneuf (1983) and Barnes (1977) a number of springs exist in the Willmore area. The most common types of springs are sulfur and calcareous tufa deposition springs.

3.2.2 Area Specific Information and Detailed Point Information

Brown (1976) documents the flow regime of Rock Creek and the location of ground water springs in the Lower Rock Creek Valley. Information pertaining to spring water analysis is also presented.

Alberta Environment's existing monitoring stations are strategically located for downstream flood monitoring purposes. With the exception of the one station which is located on the Smoky River at Hell's gap (Sulphur Mountain Recreational Area) the remaining 3 hydrometric stations are located on the Kakwa, Little Berland and Wildhay Rivers, downstream of the areas of interest and nearer to communities that may be impacted by flooding (See Figure 2). Their relatively close proximity to the areas of interest may provide some comparative information regarding watershed drainage and water flow rates. Water level information is collected at regular intervals at these stations and converted to flow values. This information is available from Alberta Environment upon request (See Table 2).

Hydrological information pertaining to lakes is very limited. Limited water level data for Rock Lake (Rock Lake-Solomon Creek Wildland Provincial Park) is available. This information is not collected on a regular basis and is available going back as far as 1968. The more recent data was collected through staff gauge surveys while the earlier data is labeled as contributed data. Mitchell and Prepas, eds. (1990) compiled available information for Rock Lake in their *Atlas of Alberta Lakes*. Information pertaining to other unnamed lakes in this area may be available indirectly as the limnological component (e.g. water quality, etc.) of fisheries studies.

See Table 3 for an expanded listing of sources pertaining to water resources.

Table 2. Personnel contacted for further water resources information.

Contact	Organization	Information
Karl Runions	Hydrology, Alberta Environment	Hydrometric data

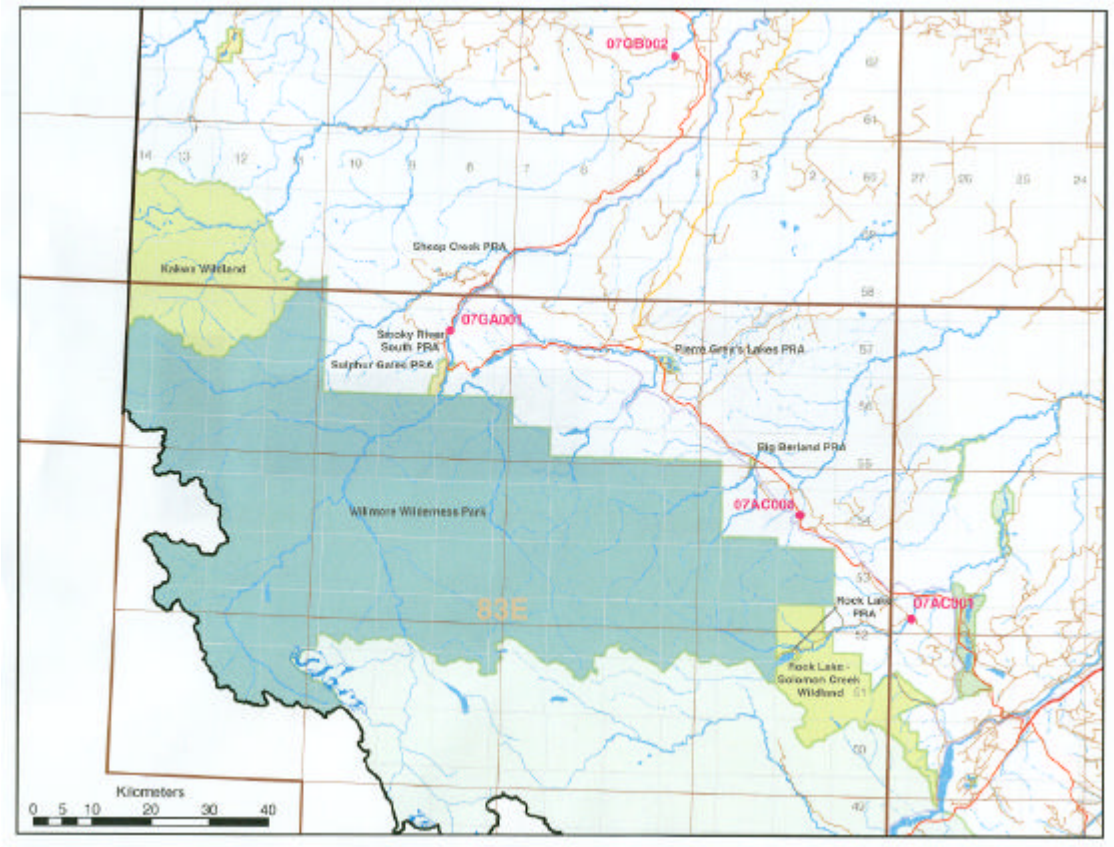

Figure 2. Location of Alberta Environment hydrometric stations relative to area of interest (Station 07GA001 – Smoky River at Hell's Gate; Station 07GB002 – Kakwa River; Station 07AC008 – Little Berland River; Station 07AC001 – Wildhay River)

Table 3. Sources of water resources information.

#	Source	Scale	Area	Information Provided
WR 1	Barnes, R. 1977. Hydrogeology of the Mount Robson-Wapiti area, Alberta (NTS maps 83E and 83L. Alberta Research Council Report 76-5.		Willmore, Kakwa	Provides general information regarding potential sites for seeps and springs and the various types, relative to the existing geology; documents a large sulfur spring beneath Kvass forestry lookout tower on the east bank of the Smoky River (T55-R10-S3); larger sulfur springs are usually found in deeper river valleys at the faulted basal contact of thick carbonate rock units; springs and seepages common in the valley bottoms, at the base of talus deposits and on the downstream borders of thick sand and gravel deposits of glacial and alluvial origin
WR 2	Borneuf, D. 1983. Springs of Alberta. Groundwater Department, Natural Resources Division, Alberta Research Council.	No scale provided	Covers all 4 areas	Indicates the presence of documented springs and documents types of springs, water quality and flow; documents springs in Willmore generally in the V to VI magnitude range, in the north several IV magnitude springs; calcareous tufa deposition prevalent at some as is hydrogen sulfide emanation at a few
WR 3	Mitchell, P. and Prepas, E.(eds). 1990. Atlas of Alberta lakes. University of Alberta Press, Edmonton.		Rock Lake	Synthesis of Alberta Environment Data and Energy, Mines and Resources Canada data for Rock Lake, information includes: lake basin characteristics, drainage basin characteristics and biological characteristics - bathymetry, drainage features, water quality etc.
WR 4	Brown, G. 1976. Vegetation-landform relationships in the lower Rock Creek valley, west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.	Map Scale - Approx. 1:21,000 map; point location information	Rock Lake-Solomon Creek; Willmore (See Figure 3)	Identifies the location of ground water springs in the Rock Creek area, flow regime of rock creek, basin description; and water analysis
WR 5	Environment Monitoring and Evaluation Branch. Hydrometric Station Data. Accessible through Environmental Assurance, Alberta Environment, 11th Floor, Oxbridge	Point data	See Figure 2	Sites of hydrometric stations in closest proximity to areas of interest. Water level information collected and converted to flow. Flow level data available.

#	Source	Scale	Area	Information Provided
	Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6.			
WR6	Environment Monitoring and Evaluation Branch. Miscellaneous Lake Levels (MLL). Accessible through Environmental Assurance, Alberta Environment, 11 th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6.	Point data	Rock Lake	Water level data available for Rock Lake. Data not collected at regular intervals

3.3 Landform (Surficial Geology)

Table 5 provides an overview of a number of landform information sources.

3.3.1 General Information

Gordan *et al.* (1997) compiled data from a number of ecological land classification projects in and around the area of interest. Surficial materials and surficial expression maps were created for the entire Yellowhead area at a scale of 1:750,000. Information presented is 'very' general.

Reimchen and Bayrock (1977) and Bayrock and Reimchen (1980) provide surficial geology for the entire area of interest and adjacent areas. These maps were prepared at a scale of 1:50,000; however, they are often presented at 1:250,000. The field sampling frequency was generally minimal in these projects due to time and access.

Standardized aerial photo interpretation procedures were utilized to create the 1:50,000 scaled Canada Land Inventory Maps. Total coverage for Willmore Wilderness Park, Sulfur Gates Recreation Area and Kakwa Wildland Provincial Park is available. Coverage for Rock Lake – Solomon Creek Wildland Provincial Park only extends to the northern portion of the park - that portion of the park covered by NTS map sheet 83 F. These maps provide information regarding parent material and surface expression.

Natural history theme coverage, available for Willmore Wilderness Park and Kakwa Wildland Provincial Park is also based on the use of aerial photo interpretation to determine surface features. Scale is generally based on that of the available air photos.

The information presented by Reimchen and Bayrock (1977) and the Canada Land Inventory maps and natural history themes provides a relatively high level of landscape detail.

The topography in this area tends to be controlled by the underlying bedrock. Colluvium dominates much of the landscape with bedrock exposed at the upper elevations in Rock Lake-Solomon Creek Wildland Provincial Park, Willmore Wilderness Park and Kakwa Wildland Provincial Park. In the Kakwa and Willmore areas the valleys located at higher elevations generally consist of Schist till, valleys at moderate elevations consist of slightly leached till, while the valleys at lower elevations consist of deeply leached till. Alluvial fans are prominent in the immediate vicinity of Rock Lake and the Wildhay River. The Kakwa area appears to be the most intensively assessed.

3.3.2 Area Specific Information

More detailed landform information is associated with studies or projects targeted to very specific geographic locations. The number of projects that have been conducted in the area of interest is very limited (See Figure 3).

Projects by Ferguson (1980), Jacques and VanEck (1979), and Hanley (1973) all rely heavily on existing data, augmented with general observations and air photo interpretation. No extensive field sampling appears to have been done. Jacques and VanEck (1979) rely on Reimchen and Bayrock (1977) for mapping information. Mapping scale for these projects ranges from 1:50,000 for Hanley(1973) and Jacques and VanEck (1979) to 1:250,000 for Ferguson (1980).

Nelson *et al.* (1988) and Archibald *et al.* (1984) relied on the use of detailed field plot data in combination with interpretation of aerial photography to map the Yellowhead North area, which encompasses Rock Lake-Solomon Creek Wildland Provincial Park, and the Deep Basin area, which, encompasses Kakwa Wildland Park, respectively. Detailed physical land classification maps (scaled at 1:50,000), including information such as parent material and surface expression, slope and aspect, texture, and soil class and drainage, were created for the Deep Basin project. The Yellowhead North project presents landform information in the form of an ecological land classification map scaled at 1:100,000. This map provides information pertaining to the parent material and various other landform parameters from an ecological perspective. Detailed sample plot information is available from both of these projects and is located in the Ecological Site Information System (ESIS) database. An ecological land classification map and associated detailed plot information for nodal areas visited (See Figure 3) will be available for Rock Lake-Solomon Creek Wildland Provincial Park upon project completion (Marshall in progress).

Nodal information is provided by Brown *et al.* (1975) for a roughly triangular shaped area from the Kakwa River north to Dead Horse Meadows (See Figure 3). Landform information is provided indirectly in the form of data pertaining to recreation development capability factors. Various polygons are identified within the project area based on a number of factors, including: slope, soil texture, soil drainage and thickness of Ah horizon. Polygon data sheets are included in the report.

Greenlee (1983) describes, in greater detail (1, 8,000), two unique areas (Kakwa Falls area and Mouse Cache Creek in the Dead Horse Meadows area) which are included in the area of the previously mentioned study in Kakwa Wildland Provincial Park (See Figure 4). The Kakwa Falls area generally consists of varying thicknesses of morainal material with glacio-fluvial sediments adjacent to the Kakwa River. The Mouse Cache Creek site consists of a large sloping bog surrounded by inclined morainal material. Field sampling was conducted; however, no point data information is available.

Brown (1976) describes the landscape of the Lower Rock Creek Valley, which includes three active stream channels; Rock Creek, Whitefish Creek and Magic Creek. Much of the area consists of alluvium and glacio-fluvial outwash.

3.3.3 Detailed Point Information

ESIS contains landform information pertaining to 130 sites or sample points in the area of interest (See Table 4 and Appendix 1).

All of the Kakwa sites are detailed and associated with an Integrated Resource Inventory of the Deep Basin Area conducted by Archibald *et al.* (1984).

Available landform data for the area of Rock Lake-Solomon Creek Wildland Provincial Park was collected as part of several projects, including:

- Yellowhead North ecological classification project
- Jasper Park ecological land classification project
- West central Alberta field guide project

Detailed information is available for 14 sites in this park, with limited information available for the remaining 7 sites. Further detailed information will be available for this area upon completion of the Rock Lake-Solomon Creek ecological land classification project (Marshall in progress).

Ten sites contain detailed landform data pertaining to Willmore Wilderness Park. These sites are associated with the:

- Deep Basin project
- Berland – Fox Creek project,
- Grande Cache biogeoclimatic project, and
- Jasper National Park ecological classification project.

Only limited information is available from the remaining sites.

Table 4. Level of landform information documented by ESIS plots.

Area	Level of Information	
	Limited	Detailed [1]
Kakwa Wildland Provincial Park		18
Willmore Wilderness Park	74	10
Rock Lake-Solomon Creek Wildland Provincial Park	7	21
Sulphur Gates Provincial Recreation Area	0	0
Marshall, E. In Progress. Ecological Land Classification of Rock Lake - Solomon Creek Wildland Provincial Park. Sustainable Resource Development, Edson	n/a	n/a

[1] detailed landform information (collection of detailed soil data)

The Willmore biogeoclimatic project data located in the Parks library also includes limited landform information pertaining to at least 3 sites, possibly more.

Significant feature reports by Timoney (1998) and Alberta Environmental Protection and Special Places Provincial Co-ordinating Committee (1998) note the significance of Hell's Gate adjacent to the Sulphur Gates Regional Recreation Area. Timoney also notes the significance of the major mountain topography and associated landforms in the Willmore and Kakwa area.

Fardoe (1980) also provides a map of major landform features in Kakwa Wildland Provincial Park (See Figure 6).

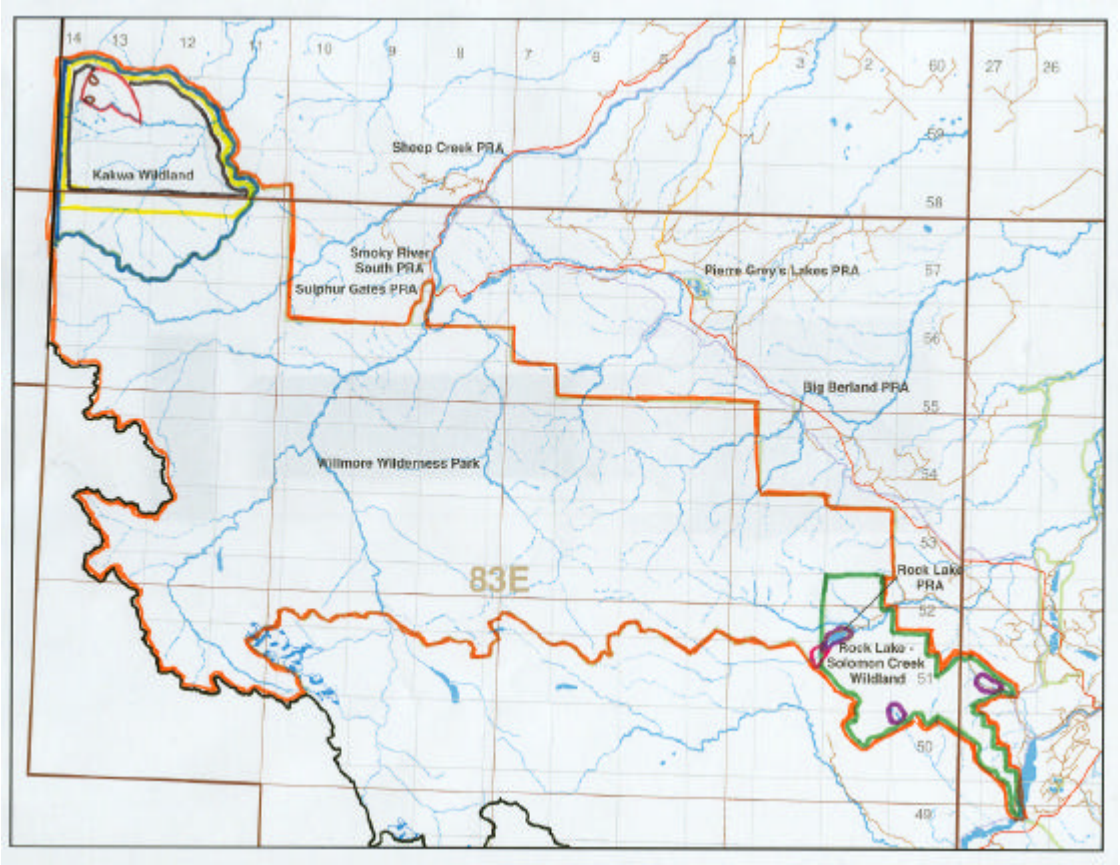

Figure 3. Map coverage of previous projects conducted in the study area. Red=Brown, Mueller and Ovenden (1973); Yellow-=Jacques and VanEck (1979); Black=Archibald *et al.* (1984); Blue=Hanley (1973); Purple=Marshall (in progress); Pink=Brown (1975); Green=Nelson *et al.* (1988); orange=Ferguson (1980), brown=Greenlee (1983).

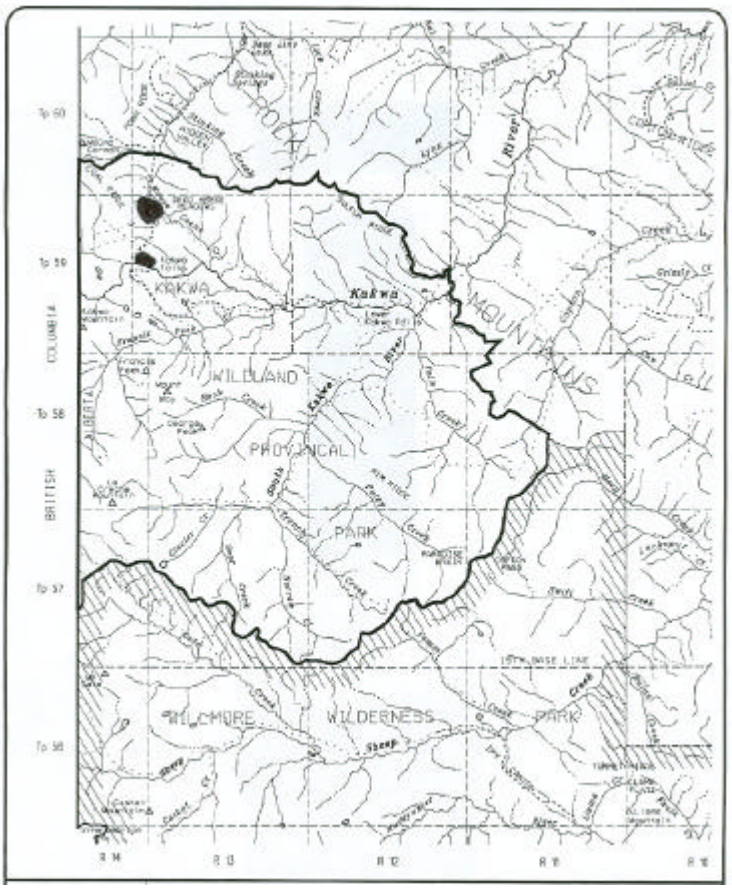

Figure 4. Location of Greenlee's soil survey (1983). Areas marked in black. The smaller area is the Kakwa Falls site and the larger area is the site along Mouse Cache Creek

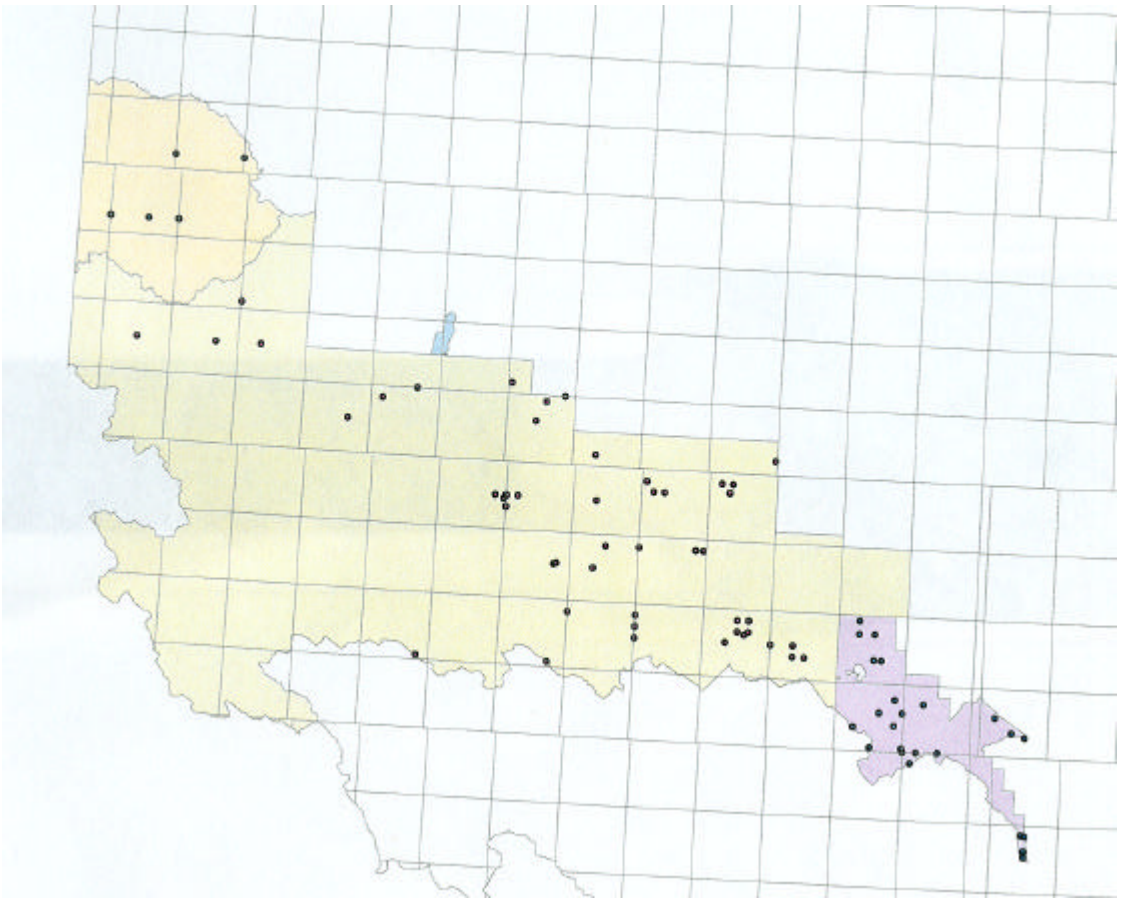

Figure 5 . Distribution of available ESIS plot data (18 plots in Kakwa WIldland Provincial Park, 84 plots in Willmore Wilderness Park, 0 plots in Sulphur Gates Provincial Recreation Area and 28 plots in Rock Lake-Solomon Creek Wildland Provincial Park. The scale makes it impossible to display each individual plot. See Appendix 1 for study identification and types of information available. It should be noted that considerable ESIS plot data is available of areas just adjacent to the study area.

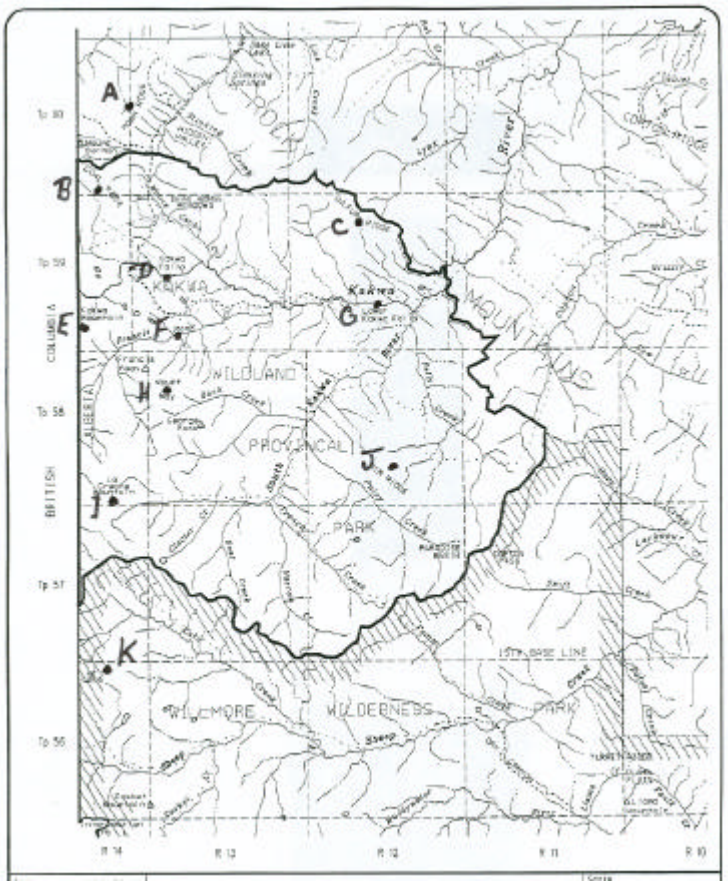

Figure 6. Major landform features in the Kakwa area defined by Fardoe (1980). Letters refer to landform features as follows: A – Horn Ridge; B – Coal Ridge; C – Sulphur Ridge; D – Upper Kakwa Falls; E – Kakwa Mountain; F – Natural Bridge; G – Lower Kakwa Falls; H – Mount May; I – La Creche Mountain; J – Rim Ridge and K – Mount Cote

Table 5. Sources of landform information**.**

#	Source	Scale	Area	Information Provided
L 1	Pettapiece, W.W. 1986. Physiographic subdivisions of Alberta. 1:500,000 map. Research Branch, Agriculture Canada, Ottawa.	1:1,500,000	All 4 areas	Kakwa - Rocky Mountain foothills; Willmore from West to east across the park – Rocky Mountains, Rocky Mountain foothills, southern Alberta uplands; Rock Lake-Solomon Creek – Rocky Mountain foothills and southern Alberta uplands; Sulphur Gates – southern Alberta uplands
L 2	Alberta Environmental Protection. 1994. Alberta Protected Areas System Analysis (1994). Report 3. Alberta Environmental Protection		Willmore	Natural History themes and associated park coverages; level I and 2 – includes special features rock glaciers and waterfalls
L 3	Alberta Environmental Protection. 1997. Kakwa Wildland Provincial Park Management Plan. Land and Forest Service and Natural Resource Service, Alberta Environmental Protection.		Kakwa	Natural history themes; level 1 and 2
L 4	Gordan, S. Bentz, J. O'Leary, D. and Clish, D. 1997. Common ecological land classification and associated attribute database for the Yellowhead ecosystem. Prepared for: Yellowhead Working Group	Map scale - 1:750,000	All 4 areas	Compilation of data from existing sources; Surface materials and Surface expression map
L 5	Bayrock, L.A. and Reimchen, T.H.F. 1980. Surficial Geology Alberta Foothills and Rocky Mountains. Prepared for Alberta Environment and Alberta Research Council.	Map scale - 1:250,000 compile from 1:50,000 maps	All 4 areas	Bedrock at upper elevations; valleys at higher elevations Schist till – generally located in the west end of Willmore; valleys at moderate elevations - slightly leached till of Cordilleran provenance-Dead Horse Meadows and along the Smoky River south of the confluence with the Jack Pine River; also some along the Jack Pine River; however Schist till of Cordilleran provenance is more prevalent here; valleys at lower elevations – deeply leached till of Cordilleran provenance; colluvium the most prominent-soil and rock creep materials overlying bedrock, relief relatively low; colluvium blankets

#	Source	Scale	Area	Information Provided
				thicker at the bases of long slopes; sand the prominent matrix texture; some small pockets of cirque tills; Rock Lake-Solomon Creek Park - coluvium dominant except for in the immediate Rock Lake vicinity and Wildhay river area where alluvial fans and aprons more prominent; some bedrock outcrops at upper elevations; Sulphur Gates – colluvium dominant
L 6	Reimchen, T.H.F. and Bayrock, L.A. 1977. Surficial geology and erosion potential Rocky Mountains and Foothills of Alberta. Prepared for Alberta Environment. Open File 1977-14.	1:50,000	All 4 areas	Helicopter traverses with spacing of about 3 miles and aerial photo interpretation
L 7	Canada Land Inventory Maps. Available through Resource Data Branch, Sustainable Resources Development, 14 th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6.	Map scale – 1: 50,000	Kakwa, Willmore, Rock Lake-Solomon Creek	Aerial photo interpreation of the landscape.
L 8	Prokopchuk, J.R. and Archibald, J.H. 1976. Land capability classification for forestry in Alberta, Canada Land Inventory. Alberta Forest Service, Energy and Natural Resources Report No. 6.	Map scale – 1: 50,000	All 4 areas	Land Capability Maps Information obtained through air photo interpretation
L 9	Andriashek, L. 1983. Surficial geology Wapiti sheet, NTS 83L. Research Council of Alberta. Open File Report 1986-23.		Kakwa	
L 10	Ferguson, N.B. 1980. Physical land classification of the Willmore-Kakwa Regional Plan study area (1:250,000). Land Classification Section, Resource Inventory and Appraisal, Alberta Energy and Natural Resources.	Map scale – 1:250,000	All 4 areas	Information general obtained from air photo interpretation

#	Source E.N.R. Report #159	Scale	Area	Information Provided
L 11	Bayrock, L.A. and Reimchen, T.H.F. 1973. Surficial geology, Willmore Wilderness Park, Alberta. Mapped and prepared for Research Council of Alberta, Edmonton, Alberta.		Willmore	
L 12	Jacques, D. and VanEck, P. 1979. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 1 - Biophysical Features. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.	1:50,000	Kakwa (See Figure 3)	Surficial materials map – map is a summary of Reimchen and Bayrock 1977
L 13	Timoney, K. 1998. Environmentally significant areas inventory of the Rocky Mountain natural region of Alberta. Prepared for: Corporate Management Service, Alberta Environmental Protection, Edmonton.	Map scale – 1:750,000	Willmore Kakwa,	Hell's gate area- sandstone/pebbly conglomerate canyons of the Smoky and Sulfur Rivers; Smoky River and tributaries- major mountain river valley and associated landforms; major mountain rivers and creeks and mountains; Periglacial features such as solifluction lobes and stone stripes, gullied shale topography, knob and kettle topography, canyons, extensive valley bottoms; major tributaries to Smoky River Valley and major mountain areas; major landscape features – Dry Canyon-Sheep Creek trail, Turret Ridge, Llama mountain, Mount Stern, Ambler Mountain and numerous creeks
L 14	Alberta Environmental Protection and Special Places Provincial Co-ordinating Committee. 1998. Special features in Alberta. Prepared for: The Special Places Provincial Co-ordinating Committee.		Sulphur Gates	Hell's Gate area – water gaps
L 15	Archibald, J.H., Ferguson, N.B., Haag, R.W., Hay, W.K. and O'Leary, D.J. 1984. An integrated resource inventory of the Deep Basin area	Map scale – 1:50,000; point plot data available – Deep Basin (See	Kakwa (See Figure 3)	Information available from physical land classification data. Data collected as per PLC manual

#	Source	Scale	Area	Information Provided
	(NTS 83L). Volume 1 - Physical land classification, forage inventory and ecological land classification. Resource Inventory and Appraisal, Resource Evaluation and Planning, Alberta Energy and Natural Resources. ENR Report #T/78	Figure 5 and Appendix 1)		
L 16	Hanley, P.T. 1973. Biophysical analysis and evaluation of capability Kakwa Falls area. Land Use Assignment Branch, Department of Lands and Forests, Special Report.	No map scale provided	Kakwa (See Figure 3)	General descriptions and ecodistrict map which provides landform information
L 17	Nelson, S.J., Hay, B. and Michalchuck. 1988. Ecological land classification of the Yellowhead North. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. Publication No. T/167.	Map scale – 1:100,000; point plot data - Yellowhead (1986) (See Appendix 1 and Figure 5)	Rock Lake-Solomon Creek (See Figure 3)	Site and landform information available
L 18	Brown, R., Mueller, J. and Ovenden, L. 1975. Kakwa Provincial Park (proposed): biophysical overview and capability of analysis of selected areas. Recreation, Parks and Wildlife, Parks Division, Alberta.	No map scale provided	Kakwa – nodal area (See Figure 3)	Information provided indirectly through recreation development capability factors and ratings (i.e. slope, texture, Ah and geological and topographical features)
L 19	Brown, G. 1976. Vegetation-landform relationships in the lower Rock Creek valley, west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.	Map Scale - Approx. 1:21,000 map; point location information representative soil profile descriptions	Rock Lake-Solomon Creek, Willmore – nodal areas (See Figure 3)	Description of geomorphology of Rock Creek valley; location of ground water springs; landform – vegetation pattern. point location information of representative soil profile descriptions
L 20	Greenlee, G.M.1983. Soil survey of designated areas in the Kakwa Falls Region and Interpretation for recreational use. Alberta Research Council.	1:8,000; no point plot data	Kakwa – nodal areas (See Figure 3 and Figure 4)	Description of nodal areas including Kakwa Falls area and Mouse Cache Creek in Dead Horse Meadows area; Kakwa Falls area generally varying thicknesses of morainal material with glacio-fluvial adjacent to Kakwa River; Mouse Cache Creek – inclined morainal material surrounding large sloping

#	Source	Scale	Area	Information Provided
				bog
L 21	Marshall, E. In Progress. Ecological land classification of Rock Lake - Solomon Creek Wildland Provincial Park. Sustainable Resource Development, Edson		Rock Lake-Solomon Creek – nodal areas (See Figure 3)	Landform information to be available upon project completion
L 22	Fardoe, B. 1980. Backcountry horse use and impact study: Kakwa Provincial Park. Prepared for Alberta Recreation and Parks, Provincial Parks Division, Resource Assessment and Management Section.	Point data (See	Kakwa	Map of major landform features
L 23	Willmore ELC plots (Willmore 1985-1988)	Point plot data (See Appendix 1 and Figure 5)	Willmore (See Figure 5)	Limited very general landform information available
L 24	Willmore BGC (1975-76) plots	Point plot data (data available on photocopied sheets in Parks library)	Willmore	Location information quite general for a number of sites. Limited very general landform information
L 25	Resource Data Branch. Ecological Site Information System (ESIS). Accessible through Alberta Sustainable Resource Development, Resource Data Branch. 14th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6. Kathleen Jacques – contact.	Point plot data (See Figure 5 and Appendix 1)	Kakwa; Willmore; Rock Lake-Solomon Creek (See Figure 5)	Field sample plot data archived from a number of sources, predominantly Ecological and Physical Land Classification Projects

3.4 Soils

Table 7 provides overviews of a number of sources containing soil information.

3.4.1 General Information

Soils information for the area of interest is very sparse. The Kakwa area appears to have had the most coverage to date.

The exploratory soil survey conducted by Lindsay, J.D., Wynnyk, A. and Odynsky, W. (1964) was on such a small scale that very little in the way of useful soil information is readily available from this source. Gordan *et al.* (1997) compiled data from existing ecological land classification projects in the Yellowhead area of Alberta and British Columbia and created a soil order/great group map at a scale of 1:750,000 for the entire area of interest.

Soil information is very general in Ferguson *et al.* (1980). This project did not have a field sampling component and relied on existing information and the use of air photo interpretation.

3.4.2 Area Specific Information

A number of projects contain a soils component, which covers a portion of the area of interest (See Figure 3).

The most detailed soil map available for the study area was developed by Twardy and Corns (1980) for the Wapiti map sheet (NTS 83L) and covers Kakwa Wildland Provincial Park. This 1:50,000 scale map provides a description of the material type, the soil group, soil unit and the associated significant and dominant soils. A figure displaying the soil sampling sites, traverse routes and helicopter observation points used in the soil survey is provided in the document; however, no point data is provided. Soils in the southwest area of Kakwa Wildland Provincial Park are of the Caw soil group with some pockets of Errington. The Caw group is associated with the upper elevations of sparsely vegetated alpine and sub-alpine areas and is represented by poorly developed Regosolic soils, while the Errington group (generally associated with steep slopes below tree line) is dominated by Brunisolic soils, with a significant component of the more developed Brunsolic Luvisols. These two groups are associated with colluvial parent material. Radiating outward from the southwest corner of the park, the Putzy group becomes predominant in morainal areas with areas of the Copton group present in areas with sedimentary bedrock. Partially developed Brunisols and Podzols dominate the Putzy group, with Luvisols and peaty Gleysols considered significant. The Putzy group is restricted to the Kakwa River valley the high upland plateau in the Kakwa area. The Copton Group is comprised primarily of Brunisols with Brunisolic Luvisols and Gleysols considered significant. This publication further describes the site conditions associated with the expected soil great group and subgroups, which occur within the area.

Both Jaques and VanEck (1979) and Hanley (1973) relied on Twardy for their soil information. Twardy provides the soil descriptions for Hanley (1973) while Jaques and VanEck (1979) rely on Twardy's Wapiti map sheet draft for their soils map.

Archibald *et al.*'s (1984) Deep Basin project also covers Kakwa Wildland Provincial Park extensively with a series of 1:50,000 physical land classification maps which provide detailed soil information including texture, soil class and soil drainage.

Nelson *et al.* (1988) present limited soils information for Rock Lake-Solomon Creek Wildland Provincial Park in the form of a 1:100,000 scaled ecological classification map.

Several nodal areas in Kakwa Wildland Provincial Park (See Figure 4) were assessed by Greenlee (1983) and mapped on a large scale (1:8,000). The Kakwa Falls area contains predominantly Brunisols while the Dead Horse Meadows area consists of a bog containing Terric Meisosols surrounded by Brunisols.

3.4.3 Detailed Point Information

Detailed soils information is not very plentiful for area with exception of sites where sampling for physical land classification projects, ecological land classification projects or targeted studies have been conducted.

ESIS contains soils information pertaining to 49 sites in the area of interest (See Table 6 and Appendix 1). All of the Kakwa sites are associated with an Integrated Resource Inventory of the Deep Basin Area conducted by Archibald *et al.* (1984). Available detailed soil data for the area of Rock Lake-Solomon Creek Wildland Provincial Park was collected as part of several projects, including:

- Yellowhead North ecological classification project
- Jasper Park ecological land classification project
- West central Alberta field guide project, and
- Rock Lake-Solomon Creek ecological land classification

Ten sites contain detailed soil data pertaining to Willmore Wilderness Park. These sites were associated with the:

- Deep Basin project,
- Berland – Fox Creek project,
- Grande Cache biogeoclimatic project, and
- Jasper National Park ecological classification project.

The number sites with limited information is not known at this time and will be better understood during data synthesis.

Both Joyce Gould and Elly Marshall are currently working on projects in the study area; the Willmore – Kakwa area and Rock Lake – Solomon Creek Wildland Provincial Park, respectively. Joyce is collecting limited soil data , including soil texture, soil colour, pH and total cations (K, Na, Ca, Mg, and total P, C and N) for the sites she documents. See Figure 11 for site locations. Elly is collecting detailed soil information for ecological land classification purposes. Further information regarding the number of sites visited and location of sites for her project will be available in the near future.

Table 6. Level of soils information documented by ESIS plots.

Area	Level of Information	
	Limited	Detailed [1]
Kakwa Wildland Provincial Park	?	18
Willmore Wilderness Park	?	10
Rock Lake-Solomon Creek Wildland Provincial Park	?	21
Sulphur Gates Provincial Recreation Area	?	0

[1] detailed soils information has been collected (collection of detailed soil data)

Table 7. Sources of soil information.

#	Source	Scale	Area	Information Provided
S 1	Lindsay, J.D., Wynnyk, A. and Odynsky, W. Exploratory soil survey of Alberta map sheets 83-L, 83-K, 83-F and 83-J. Research Council of Alberta. Preliminary Soil Survey Report 64-2.	Map scale – 1:760,320	Kakwa; Willmore; Rock Lake (area within NTS 83 F and L)	Very general, describes surficial parent material and point soil textures, but for very few areas and on a relatively small scale
S 2	Gordan, S. Bentz, J. O'Leary, D. and Clish, D. 1997. Common ecological land classification and associated attribute database for the Yellowhead ecosystem. Prepared for: Yellowhead Working Group	Map scale - 1:750,000	All 4 areas	Compilation of data from existing sources; Soil Order/ Great Group map
S 3	Ferguson, N.B. 1980. Physical land classification of the Willmore-Kakwa Regional Plan study area (1:250,000). Land Classification Section, Resource Inventory and Appraisal, Alberta Energy and Natural Resources. E.N.R. Report #159	Map scale – 1:250,000	All 4 areas	Data interpreted from existing sources and aerial photos
S 4	Jacques, D. and VanEck, P. 1979. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 1 - Biophysical Features. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.	Map scale - 1:50,000	Kakwa	Map provided for project soil sampling sites, but no individual plot information available; soil map adapted from Soil Survey Report 39. Alberta Research Council which appears to be a version of Twardy and Corns 1980
S 5	Twardy, A.G. and Corns, I.G.W. 1980. Soil survey and interpretations of the Wapiti map area, Alberta. Alberta Research Council, Alberta Institute of Pedology. Alberta Research Council Bulletin 39.	Map scale 1:50, 000; map of soil sampling sites but no information regarding individual sample plots	Kakwa	Soil groups map; includes information to parent material type and description, soil group , soil unit, dominant soils and significant soils

#	Source	Scale	Area	Information Provided
S6	Hanley, P.T. 1973. Biophysical analysis and evaluation of capability Kakwa Falls area. Land Use Assignment Branch, Department of Lands and Forests, Special Report.	No scale provided	Kakwa	Soils descriptions provided by Twardy
S7	Dumanski, J., Macyk, T.M., Veauvy, F.F. and Lindsay, J.D. 1972. Soil survey and land evaluation of the Hinton-Edson Area, Alberta. Alberta Institute of Pedology Report No. S-72-31	Map scale - 1:26,720	Rock Lake-Solomon Creek	Describes parent materials, soil associations, mapping units, dominant and significant soils
S8	Nelson, S.J., Hay, B. and Michalchuck. 1988. Ecological land classification of the Yellowhead North. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. Publication No. T/167.	Map scale – 1:100,000; Point plot information available in ESIS. (See Appendix 1 and Figure 5)	Rock Lake- Solomon Creek	Detailed soil pit information describing soils at sample plots; information utilized to create ecological land classification map
S9	Archibald, J.H., Ferguson, N.B., Haag, R.W., Hay, W.K. and O'Leary, D.J. 1984. An integrated resource inventory of the Deep Basin area (NTS 83L). Volume 1 - Physical land classification, forage inventory and ecological land classification. Resource Inventory and Appraisal, Resource Evaluation and Planning, Alberta Energy and Natural Resources. ENR Report #T/78.	Map Scale 1:50,000; Point plot data available (See Appendix 1 and Figure 5)	Kakwa	Information available on physical land classification map as per physical land classification procedures at the time of study
S10	Brown, R., Mueller, J. and Ovenden, L. 1975. Kakwa Provincial Park (proposed): biophysical overview and capability of analysis of selected areas. Recreation, Parks and Wildlife, Parks Division, Alberta	No scale provided	Kakwa	Information provided indirectly through recreation development capability factors and ratings (i.e. slope, texture, Ah and geological and topographical features)
S11	Greenlee, G.M.1983. Soil survey of designated areas in the Kakwa Falls	1:8,000	Kakwa	Description of nodal areas including Kakwa Falls area and Mouse Cache Creek in Dead Horse

#	Source	Scale	Area	Information Provided
	Region and Interpretation for recreational use. Alberta Research Council.			Meadows area; Kakwa Falls area generally Brunisols while Dead Horse Meadows area generally Terric Meisosols surrounded by Brunisols
S 12	Gould, J. and Belland, R. 2002. Reconnaissance rare plant survey of Willmore Wilderness Park, Kakwa Wildland Park and northern Jasper National Park. Preliminary findings.	Point plot data will be available upon completion of project; See Figure 10 for 13 sites completed in 1999.	Kakwa; Willmore	Limited soils information including such parameters as colour, texture, pH and total cations
S 13	Marshall, Elly. In Progress. Ecological Land Classification of Rock Lake - Solomon Creek Wildland Provincial Park. Sustainable Resource Development, Edson	Point plot information will be available upon completion of project	Rock Lake-Solomon Creek	Detailed soil information
S 14	Willmore Wilderness Plot Forms	Individual plot information See ESIS map	Willmore	Detailed soil pit information describing soils at sample plots; information was to be utilized to create ecological land classification map
S 15	Resource Data Branch. Ecological Site Information System (ESIS). Accessible through Alberta Sustainable Resource Development, Resource Data Branch. 14th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6. Kathleen Jacques – contact.	Point plot data (See Figure 5 and Appendix 1)	Kakwa; Willmore; Rock Lake-Solomon Creek	Field sample plot data archived from a number of sources, predominantly Ecological and Physical Land Classification Projects

3.5 Ecology

Table 8 provides an overview of a number of ecological sources of information.

3.5.1 General Information

The natural regions and subregions map of Alberta (Alberta Environmental Protection 1998) defines the Alberta landscape on a broad scale. Natural regions represent a combination of similar vegetation, soil and landform features, while natural subregions characterize areas, which contain landscape patterns that are unique from other subregions. The study area is situated predominantly in the Rocky Mountain Natural Region, more specifically the Alpine and Sub-alpine Natural Subregions, with a small area covered by the Foothills Natural Region, more specifically the Upper Foothills Natural Subregion. Though not indicated on such a small-scale map, in actuality some localized areas of Montane may occur in the study area; particularly in low-lying areas (valleys) and just beyond the western shores of Brule Lake (personal observation).

Strong and Thompson (1995) further delineate subregions into ecodistricts, which are based on distinct physiographic or geological patterns, thereby increasing the scale and definition of the landscape.

Corns and Annas (1986) and Beckingham *et al.* (1996) utilize an integrated landscape approach to define and describe vegetation (associations, phases and facies in Corns and Annas and ecosites, phases and communities in Beckingham). Slope, aspect, topographic position and soil texture are used to directly compare vegetation and soil conditions among different climatic zones or natural subregions. Integrated data from a number of sources – Corns and Annas' (1986) field guide and ESIS data was complemented by additional field work to fill in data gaps in the development of the current *Field Guide to West – Central Alberta* by Beckingham *et al.*

3.5.2 Area Specific Information

Several projects directed at ecological land classification (elc) have been conducted in the study area. These maps generally classify the landscape to ecosection utilizing a scale of 1:100,000. The Yellowhead North elc project (Nelson *et al.* 1988) encompasses all of Rock Lake-Solomon Creek Wildland Provincial Park, while the Deep Basin integrated resource inventory (IRI) encompasses the area covered by Kakwa Wildland Provincial Park. The Willmore ecological land classification project was initiated but mapping was not completed. Gordan *et al.* (1997) compiled data from a number of projects in the Yellowhead area and created a broad ecosystem classification for the entire Yellowhead ecosystem. This generalized map is relatively small scale in large part due to the extensive area that is covered.

An ecological classification project is currently underway for Rock Lake – Solomon Creek Wildland Provincial Park (Marshall in progress). This information should be available in the near future.

3.5.3 Detailed Point Information

Detailed plot data utilized to create the elc maps for both the Yellowhead North and Deep Basin Project is available in ESIS.

Detailed plot information is also available through ESIS from the field portion of the Willmore ecological land classification project.

Data from the Rock Lake–Solomon Creek ecological land classification project, currently underway, will be available in ESIS in the near future.

Table 8. Sources of ecological information..

#	Source	Scale	Area	Information Provided
E 1	Strong, W.L. and Thompson, J.M. 1995. Ecodistricts of Alberta: summary of biophysical attributes. Prepared for: Resource Data Division, Alberta Environmental Protection, Edmonton	Map scale – 1:1,000,000	Covers all areas	Climate –landscape associations, general information of dominant species and soils
E 2	Alberta Environmental Protection. 1998. Natural regions and subregions of Alberta (map). Resource Data Division, Alberta Environmental Protection. Edmonton.	Map scale - 1:1,000,000	Covers all 4 areas	Map of natural regions and subregions
E 3	Gordan, S.. Bentz, J. O'Leary, D/ and Clish, D. 1997. Common ecological land classification and associated attribute database for the Yellowhead ecosystem. Prepared for: Yellowhead Working Group.	Map scale - 1:750,000	Covers all 4 areas	Broad ecosystem classification map and Ecosection/Ecosdistrict map; Compilation based on existing ecological land classification projects in area
E 4	Beckingham, J.D., Corns, I.G.W. and Archibald, J.H. 1996. Field guide to the ecosites of west-central Alberta. Natural Resources Canada, Canadian Forestry Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta. Special Report 9.		Covers all 4 areas	Utilize an integrated landscape approach - potential vegetation communities that may be expected on specific landscapes
E 5	Corns, I.G.W. and Annas, R.M. 1986. Field guide to forest ecosystems of west-central Alberta. Canadian Forestry Service, Northern Forestry Centre, Edmonton.		Covers all but Willmore	Utilize an integrated landscape approach - potential vegetation communities that may be expected on specific landscapes
E 6	Willoughby, M.G. and Smith, D. 1997. Range plant community types and carrying capacity for the upper foothills subregion- second		Rock Lake-Solomon Creek	Potential vegetation communities that may be expected on specific landscapes

#	Source	Scale	Area	Information Provided
	approximation. Environmental Protection, Lands and Forest Services.			
E 7	Willoughby, M.G. 1999. Range plant community types and carrying capacity for the Sub-alpine and Alpine subregions - first approximation. Environmental Protection, Land and Forest Service.		Covers all 4 areas	Potential vegetation communities that may be expected on specific landscapes
E 8	Archibald, J.H., Ferguson, N.B., Haag, R.W., Hay, W.K. and O'Leary, D.J. 1984. An integrated resource inventory of the Deep Basin area (NTS 83L). Volume 1 - Physical land classification, forage inventory and ecological land classification. Resource Inventory and Appraisal, Resource Evaluation and Planning, Alberta Energy and Natural Resources. ENR Report #T/78.	Map scale - 1:100,000	Kakwa - See (See Figure 3)	Ecosection map
E 9	Nelson, S.J., Hay, B. and Michalchuck. 1988. Ecological land classification of the Yellowhead North. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. Publication No. T/167.	Map scale – 1:100.000	Kakwa - See (See Figure 3)	Ecological Land Classification Map – provides ecosection descriptions
E 10	Marshall, E. In Progress. Ecological Land Classification of Rock Lake - Solomon Creek Wildland Provincial Park. Sustainable Resource Development, Edson.		Rock Lake-Solomon Creek	Ecological Land Classification Map

3.6 Flora (Vegetation)

Numerous vegetation studies have been done in the area over the years; however the level of detail, the data collection methodologies and the documentation of data are highly variable. Often point plot data was used to extrapolate over large areas. In many instances this point plot data is not documented. Point plot data has been maintained for a number of ecological land classifications projects conducted in the area in the ESIS database. This information is generally very detailed, and based on standardized collection procedures, which have evolved over the years (Resource Data Branch 2003b, Alberta Environmental Protection 1994c, Downing 1985, Strong and Anderson, 1980, Boyacioglu 1974).

Table 13 provides an overview of vegetation studies or general studies that have a vegetation component. The studies are listed in order of the level of detail they provide; from general to more specific. The last column provides details as to the type of information provided by the study.

Information sources are discussed based on the presence of information pertaining to vegetation communities, vascular species and bryophytes (mosses and liverworts). Information regarding rare species is also presented. Personnel contacted for further information pertaining to vegetation are listed in Table 9.

Table 9. Personnel contacted for further vegetation information.

Contact	Organization	Information
Joyce Gould	Community Development/University of Alberta	Vascular plants; Vegetation Communities; Rare plants (Willmore – Kakwa area)
Rene Belland	Devonian Botanic Garden	Bryophytes (Willmore)
Elly Marshall	Resource Information Specialist, Edson, SRD	Vegetation Communities (Rock Lake- Solomon Creek area)

3.6.1 Vegetation Communities

General Information

A number of sources are currently available that present information pertaining to potential vegetation communities that may occur in the area of interest. Field guides and documents, which have been compiled based on data collected in the vicinity of the area of interest (Halsey *et al.* 2003; Willoughby 1999; Willoughby and Smith 1997; Beckingham *et al.* 1996 and Corns and Annas 1986), are useful in determining expected or potential vegetation communities.

Other documents also map the potential for various communities, but generalize significantly and present information on a very small scale (Alberta Environmental Protection 1994a; Alberta Environmental Protection 1994b and Vitt *et al.* 1996). These documents generally provide information regarding the likely or modal vegetation within the area.

Interest in the forest sector and timber production and supply has encouraged more detailed surveying of forested land throughout the province. The forest capability maps indicate the capability to grow timber based on the existing landscape. This information is available on a fairly small scale and does not provide great detail regarding vegetation itself.

Gordan et al. compiled existing ecological land classification data to create two vegetation maps (a main canopy species map and a vegetation physiognomy map) for the entire Yellowhead area, which encompasses the area of interest.

Area Specific Information

The Alberta Vegetation Inventory (AVI) program and its predecessor the Phase 3 Forest Inventory program are forestry driven programs that present information pertaining to the forest structure across the landscape. This mapped information is based on the interpretation of 1:15,000 scale aerial photography, supplemented with some field sampling. Variables assessed include; leading species, canopy cover, height and understory. Phase 3 data is available for all areas except Willmore Wilderness Park. AVI data is available for select townships in Willmore Wilderness Park and most of Rock Lake-Solomon Creek Wildland Provincial Park (See Figure 7).

Areal coverage of a number of existing projects that include a vegetation component is displayed in Figure 3 (Note: Ferguson 1980 – does not have a vegetation component).

Hanley (1973) relies heavily on Rowe (1972) for his description of the forests in the Kakwa area.

Nelson *et al.* (1988), Archibald *et al.* (1984), Jaques and VanEck (1979) utilized field sampling in combination with air photo interpretation to determine vegetation cover in areas including Rock Lake Solomon Creek Wildland Provincial Park and Kakwa Wildland Provincial Park, respectively. Jacques and VanEcks' (1979) vegetation map is similar to an AVI map. All three of these projects included biophysical or ecological maps scaled at 1:50,000 or 1:100,000, to define the pattern of existent vegetation associations, types or communities. Detailed plot data from the 2 later studies is located in ESIS. Jaques and VanEck conducted field surveys, however, plot data is not available. It should be noted that they do include a species list in their document.

Bork (1994) combines his own field data with data collected for a Willmore Ecological Land Classification Project and Forestry Canada data to define the communities that occur within Willmore Wilderness Park. There is no spatial component or detailed plot data included in this document; however, considerable site, species and species cover information is provided with the community descriptions.

Detailed Point Information

Detailed vegetation community information is quite limited for the study area and is generally not distributed very evenly across the landscape.

Vegetation information in ESIS is very detailed and quite consistent especially as it pertains to data collected for ecological land classification projects. This is due to the use of standardized data collection procedures. See Figure 5 for distribution of ESIS plots within the study area. Table 10 provides more detail regarding the level of vegetation information available from plot information located in the ESIS database. For further information regarding ESIS data see Appendix 1. Often the communities are not directly identified or labeled based on the dominant species; however, the data does present vegetation composition at particular locations.

Table 10. Number of detailed vegetation data sites available in ESIS. For spatial representation see Figure 5.

Area	Level of Information	
	Limited[1]	Detailed
Kakwa Wildland Provincial Park	17	1
Willmore Wilderness Park	0	84
Rock Lake-Solomon Creek Wildland Provincial Park	1	27
Sulphur Gates Provincial Recreation Area	0	0

[1] information pertaining to dominant species may or may not be provided on site form

Several other projects also document detailed vegetation community information. Brown (1976) described the vegetation communities of the Lower Rock Creek Valley in significant detail and provided a species list. No specific plot data is documented in the report.

Brown *et al.* (1975) describe the communities in several polygons in a nodal area of Kakwa Wildland Provincial Park by noting the dominant species in each physiognomic layer and providing a species list for each polygon.

Lane *et al.*1998, 2000) have conducted range surveys in Willmore Wilderness Park over consecutive years at the same sites (See Figure 9). Detailed

vegetation information pertaining to these range sites has been entered into ESIS and is labeled as Rangeland Reference sites.

A backcountry horse use study by Fardoe (1980) also provides some vegetation community information. Species and cover values for four sites in Kakwa Wildland Provincial Park are provided, however, sampling parameters are not described (See Figure 8).

Joyce Gould conducted vegetation fieldwork in Willmore Wilderness Park (See Figure 10 for 1999 field sites). Vegetation community information is provided for points where rare species have been observed. This information is associated with rare plant locations and is included in the ANHIC database.

Both Joyce Gould and Elly Marshall are currently working on projects that will significantly add to the vegetation information data set for the study area. Their data should be available in the near future.

Joyce Gould is currently working on research pertaining to rare plant species and vegetation communities in the Jasper-Willmore Area as part of her PhD.Thesis (University of Alberta). She attempted to fill in some the spatial gaps that were present in the existing data during the course of her fieldwork, which extended from 2001 to 2003. See Figure 11 for locations of data collected during her graduate studies. She is currently compiling all existing suitable vegetation data for the Kakwa and Willmore areas and combining it with her own field data in order to conduct analysis which will more accurately define vegetation communities for the area. Her research also includes the collection of information pertaining rare species, which may increase the number of species and element occurrences in the Alberta Natural Heritage Information Centre (ANHIC) database. (See Gould *et al.* 2000 and Gould *et al.* 2002). All information will be entered into the ANHIC database upon completion of her research.

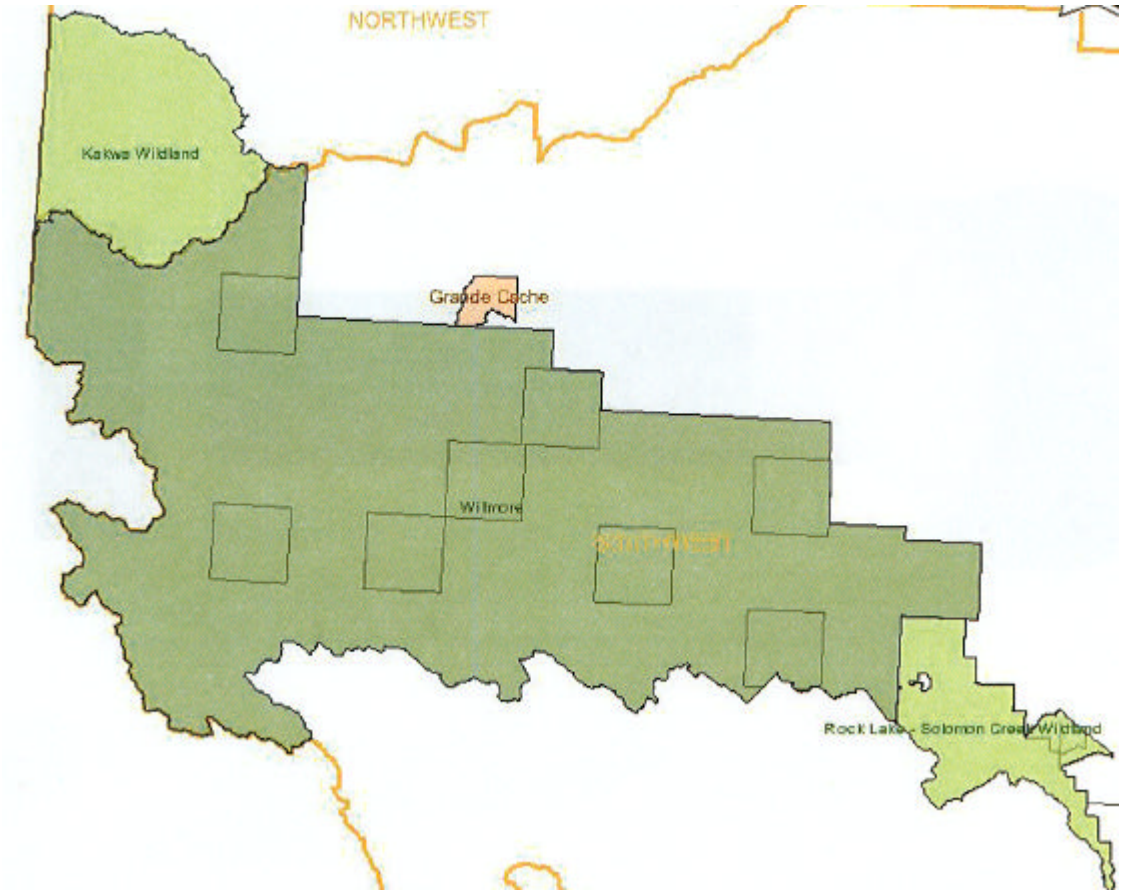

Figure 7. Alberta Vegetation Inventory (AVI) availability. Eight townships in Willmore Wilderness Park and all but a small portion in the central eastern area for Rock Lake-Solomon Creek Wildland Provincial Park. Map from Resource Data Branch, Spatial Data Browser 2003).

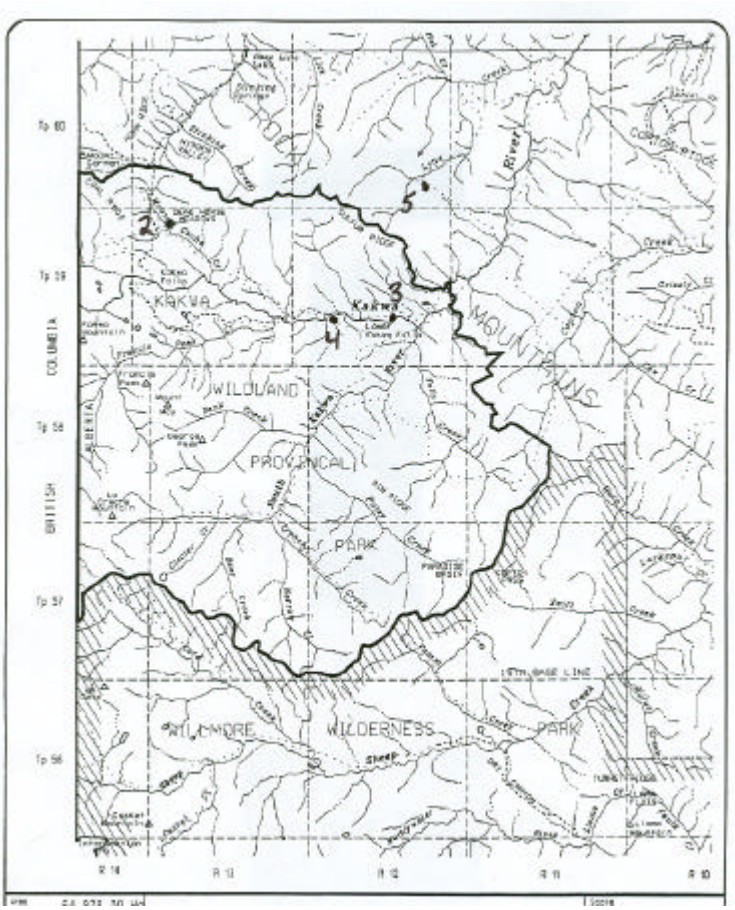

Figure 8. Vegetation plot locations in Kakwa area (Fardoe 1980). Plot numbers correspond to Fardoe's plot numbers and associated data sheets.

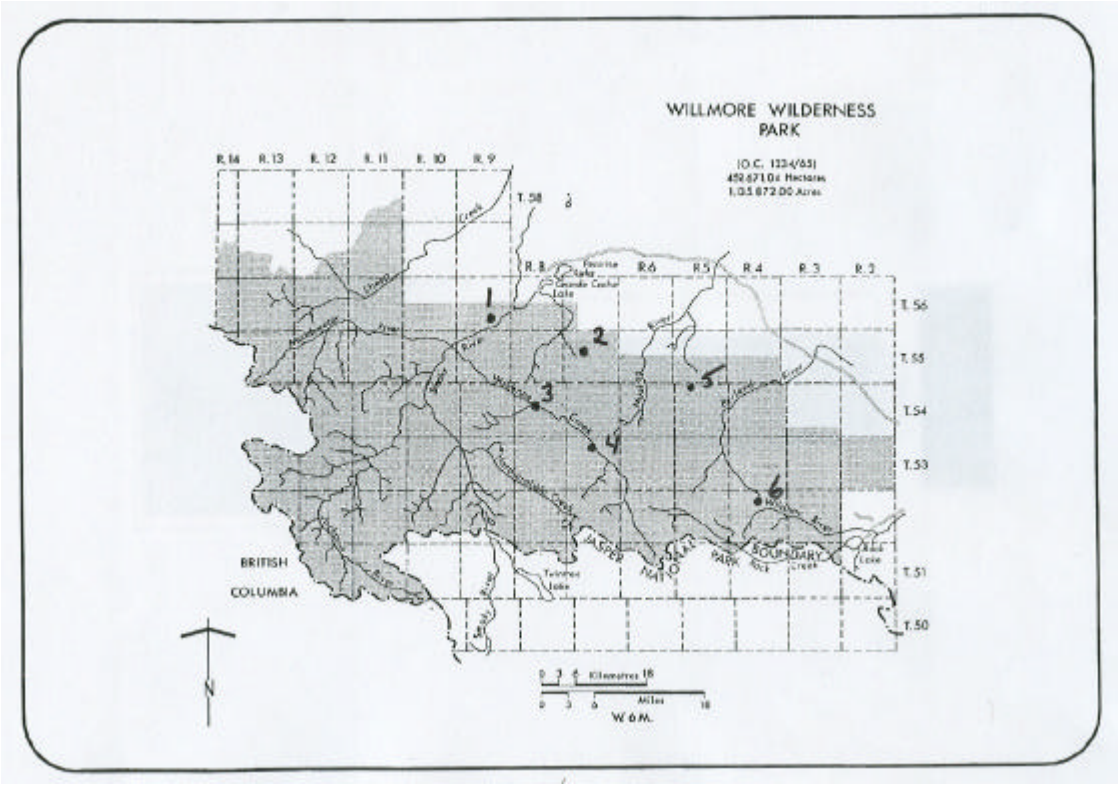

Figure 9. Plot locations for Lane and Willoughby (1998). Sites include: 1 – Hayden ridge exclosure, 2 – Sunset Creek transect, 3 – Monoghan flats transect, 4 – Sulphur-kvass exclosure, 5 – Kvass flats exclosure and 6 – Eagle's nest transect. UTM locations for plots are provided in the document.

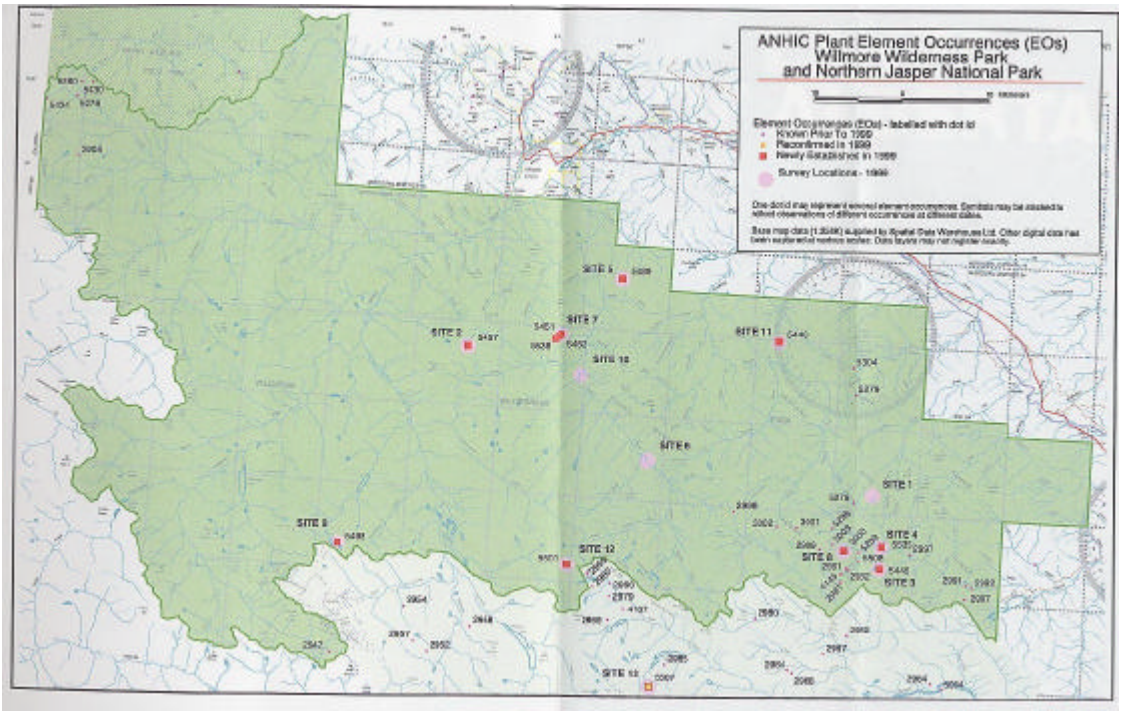

Figure 10. Vegetation plot sites in Willmore Wilderness Park (Gould *et al.* 2000). Map scanned from original document.

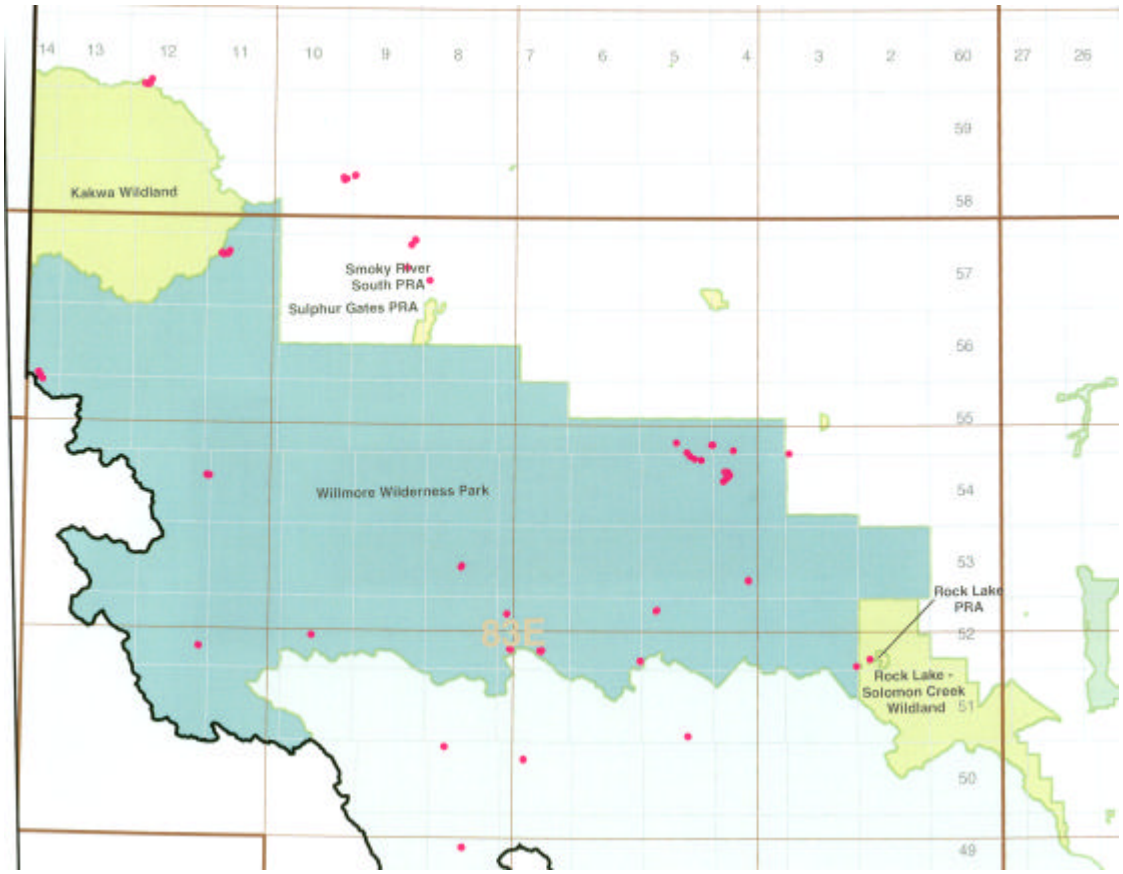

Figure 11. Locations of rare plants identified by Joyce Gould during her PhD research (2001-2003).

3.6.2 Vascular Plants

General Information

General information pertaining to the distribution of vascular species across the study area can be obtained from the general information or vegetation composition information presented in the previous section (3.6.1 Vegetation Communities). General species distribution information is also available from a number of field guides and taxonomic guides (Scotter and Flygare 1986; Kershaw *et al.* 1998; Porsild 1979; Moss 1983; etc.).

Area Specific Information

Information pertaining to species representation in the study area can be deduced from the information provided in section 3.6.1 Vegetation Communities. Relative abundance of a particular species can often be determined from the vegetation community labels (which are often named based on the dominant species) where this information is not directly provided.

Detailed Plot Information

Detailed species lists can be obtained from the site species composition information provided in ESIS. Since site and soils information are often also included for plot data in ESIS, information pertaining to species habitat preferences can be determined. Detailed site species information can also be obtained from those studies discussed in 3.6.1 Vegetation Communities – Detailed Point Information.

3.6.3 Non-Vascular Plants (Bryophytes & Lichens)

General Information

Information pertaining to the potential bryophytes that may occur in the study area can be obtained from field guides and scientific papers (Vitt *et al.* 1988). Bryophyte distribution information may also be obtained from available plant community descriptions, which generally tend to include bryophytes (particularly the more common and visually distinct species).

Area Specific Information

Rene Belland (personal communication) indicated that he was not aware of any formal bryophyte research conducted in the study area. However, he will have some bryophyte information available for the Willmore Wilderness Park early in the new year. This data was collected during some field excursions conducted with Joyce Gould, over the past several years,

Detailed Point Information

Detailed vegetation data collected often includes some of the more common mosses, therefore some detailed information pertaining to moss distribution would be included in vegetation data in ESIS and other detailed plot information for vegetation communities.

Detailed information is available pertaining to a number of rare bryophyte species documented in Kakwa Wildland Provincial Park (See 3.6.4 Rare Communities and Species).

3.6.4 Rare Communities and Species

General Information and Area Specific Information

Vegetation species and communities are identified as rare in Alberta, by the Alberta Natural Heritage Information Centre, if they are ranked as S1, S2 or S3 according to the ranking system developed by The Nature Conservancy (See Table 11). The Alberta Natural Heritage Information Centre (ANHIC) has produced a tracking list for vascular plants, mosses, liverworts and hornworts (Vujnovic and Gould 2002) and a list for plant communities (Allen 2003).

Kershaw *et al.*s'. *Rare Vascular Plants of Alberta* provides general information pertaining to the geographical location and habitat conditions in which a number of rare vascular plant species may potentially occur. Unfortunately no similar kind of document is available for mosses.

Table 11. The Nature Conservancy ranking system for rarity determination.

Rank	Definition
S1	= 5 occurrences or only a few remaining individuals
S2	6-20 occurrences or with many individuals in fewer occurrences
S3	21-100 occurrences may be rare and local throughout its range, or in a restricted range(may be abundant in some locations or may be vulnerable to extirpation because of some factor of its biology)
S4	Apparently secure under present conditions, typically >100 occurrences but may be fewer with many large populations; may be rare in parts of its range, especially peripherally
S5	Demonstratably secure under present conditions, >100 occurrences, may be rare in parts of its range, especially peripherally
SU	Status uncertain often because of low search effort or cryptic nature of element; possibly in peril, unrankable, more information needed
SH	Historically known, may be relocated in the future

Detailed Point Information

The Alberta Natural Heritage Information Centre documents rare occurrences in great detail. Table 12 provides an overview of the element occurrences (eos) located in the ANHIC database. See Figure 12, Figure 13, Figure 14 and Figure 15 for the distribution of element occurrences. Further information pertaining to these element occurrences, including; species, S-rank and general location see Appendix 2. As previously indicated in 3.6.1 Vegetation Communities Joyce Goulds current research also provides detailed information pertaining to rare species. This information will be entered into the ANHIC database upon completion of her research project. Rene Belland may possibly have some information pertaining to rare mosses in the area of interest available in the near future (Personal Communication).

Table 12. Rare vascular plant, plant communities and bryophyte element occurrence information from ANHIC database.

Location	Rare Elements					
	Plant Communities		Bryophytes		Vascular Plants	
	# of types	# of eos	# of species	# of eos	# of species	# of eos
Kakwa Wildland Provincial Park [1]	0	0	23	23	9	9
Willmore Wilderness Park [1]	2	4	11	13	46	174
Rock Lake-Solomon Creek Wildland Provincial Park [2]	0	0	7	7	0	0
Sulphur Gates Provincial Recreation Area	0	0	1	1	0	0

[1] Note the figures for these 2 parks will be revised once Joyce Gould's data for the 2000 and 2001 field seasons are entered.
[2] Note the figures for this park may change depending on Elly Marshall's data.

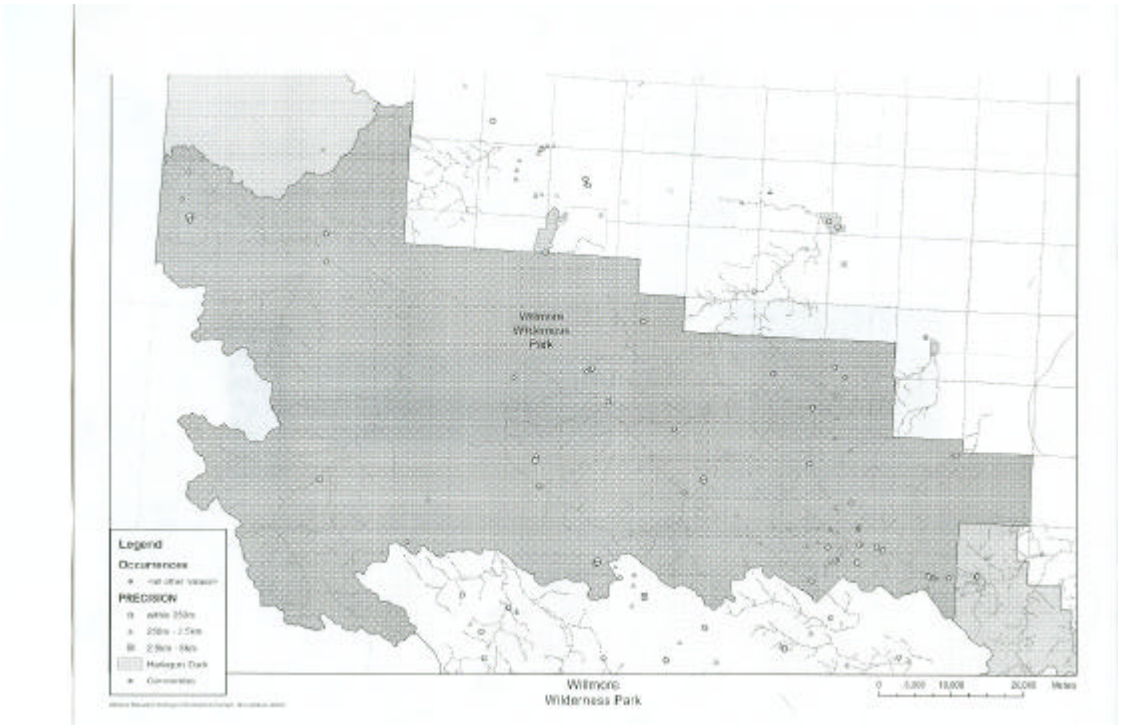

Figure 12. Distribution of available ANHIC element occurrences in Willmore Wilderness Park. Element occurrence information not available at this scale (See ANHIC database). See Appendix 2 for point location information.

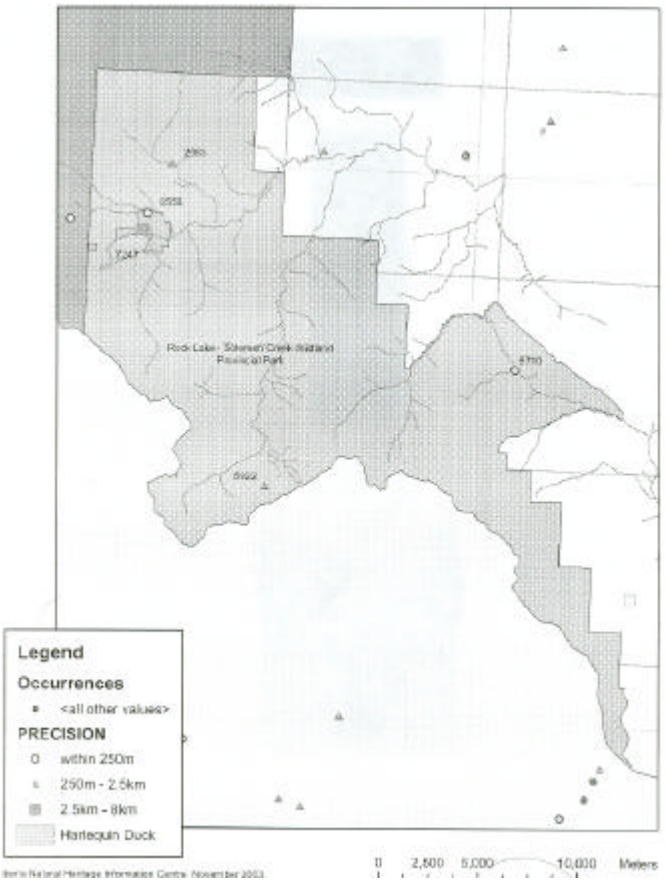

Figure 13. Distribution of available ANHIC element occurrences in Rock Lake-Solomon Creek Wildland Provincial Park. See Appendix 2 for point location information.

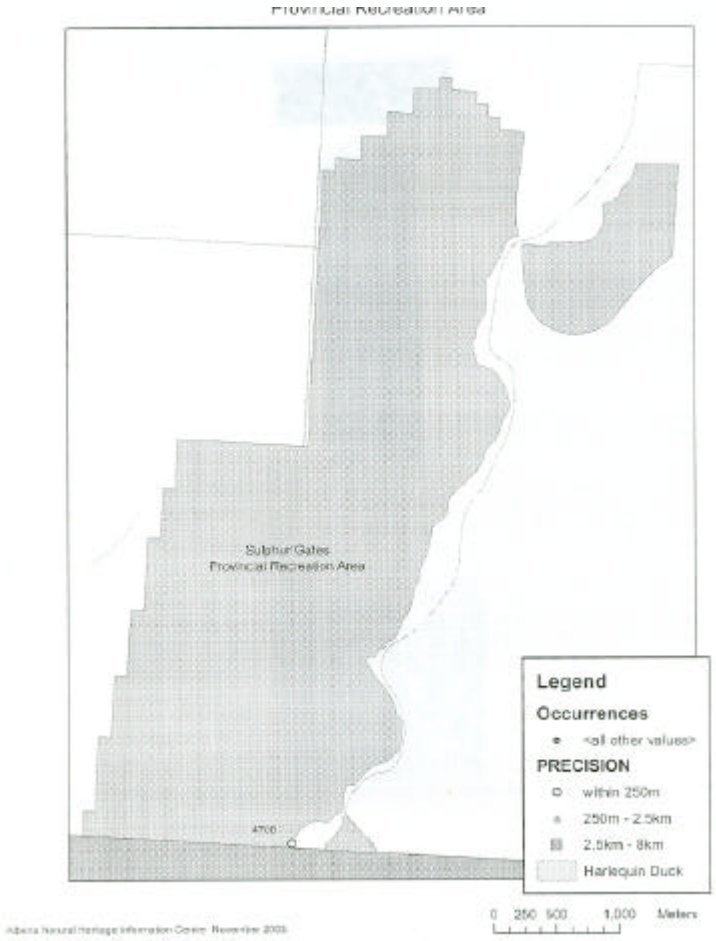

Figure 14. Distribution of available ANHIC element occurrences in Sulphur Gates Provincial Recreation Area. See Appendix 2 for point location information.

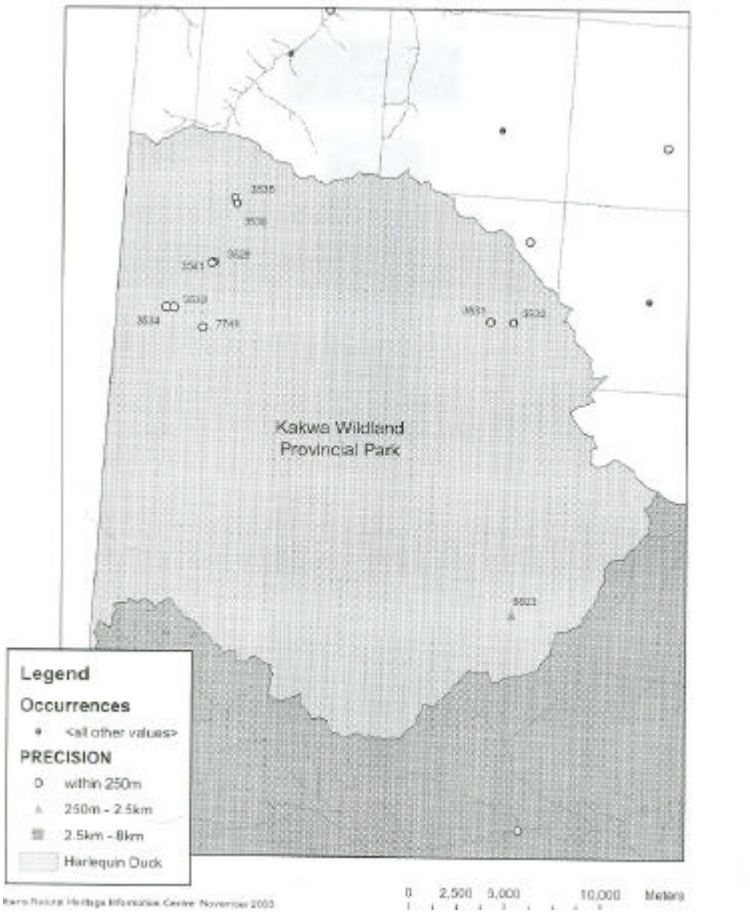

Figure 15. Distribution of available ANHIC element occurrences in Kakwa Wildland Provincial Park. See Appendix 2 for point location information

Table 13 . Sources of vegetation information for the area of interest.

#	Source	Scale	Area	Information Provided
V1	Alberta Environmental Protection. 1994. Alberta Protected Areas System Analysis (1994). Report 3. Alberta Environmental Protection.		Willmore; Kakwa	Physiognomic structure (i.e. trees, shrubs, grassland), coniferous or deciduous, riparian or upland
V2	Rowe, J.S. 1972. Forest regions of Canada. Department of Environment, Canadian Forestry Service. Pub. No. 1300.		Covers all 4 areas	Very general, leading tree species
V3	Alberta Environmental Protection. 1998. Natural regions and subregions of Alberta (map). Resource Data Division, Alberta Environmental Protection. Edmonton.	Map scale – 1:1,000,000	Covers all 4 areas	Very general; dominant species and modal understory vegetation in subregions
V4	Vitt, D.H., Halsey, L.A., Thorman, M. and Martin, T. 1996. Peatland inventory of Alberta phase I: overview of peatland resources in natural regions and subregions of the province. Peatland Resource Centre, Devonian Botanic Garden, University of Alberta, Edmonton.		Covers all 4 areas	Delineates areal coverage of peatlands by ecodistrict
V5	Halsey, L., Vitt, D., Bellman, D., Cross, S. Mehelcic, S. and Well, R. 2003. Alberta Wetland Inventory Standards, version 2.0. Prepared for Resource Data Branch, Strategic Corporate Services Division by Department of Biological Sciences, University of Alberta.			Description and identification of wetland communities
V6	Environment Canada Lands Directorate. 1976. Canada Land Inventory 1:1,000,000 Map Series Alberta- Capability for Forestry.	1,000,000	Covers all 4 areas	Field data was interpreted at 1:50,000, then generalized to 1:250,000 and 1:1,000,000 for presentation purposes. Capability classes note the capability to grow commercial timber in areas stocked

#	Source	Scale	Area	Information Provided
	Department of the Environment, Minister of Supply and Services Canada.			with the optimum number and species of tree.
V 7	Beckingham, J.D., Corns, I.G.W. and Archibald, J.H. 1996. Field guide to the ecosites of west-central Alberta. Natural Resources Canada, Canadian Forestry Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta. Special Report 9.		Covers all 4 areas	Potential vegetation communities that may be expected on specific landscapes
V 8	Corns, I.G.W. and Annas, R.M. 1986. Field guide to forest ecosystems of west-central Alberta. Canadian Forestry Service, Northern Forestry Centre, Edmonton.		Covers all areas except Willmore	Potential vegetation communities that may be expected on specific landscapes
V 9	Willoughby, M.G. and Smith, D. 1997. Range plant community types and carrying capacity for the upper foothills subregion - second approximation. Environmental Protection, Lands and Forest Services.		Rock Lake-Solomon Creek	Potential vegetation communities that may be expected on specific landscapes
V 10	Willoughby, M.G. 1999. Range plant community types and carrying capacity for the sub-alpine and alpine subregions - first approximation. Environmental Protection, Land and Forest Service.		All 4 areas	Potential vegetation communities that may be expected on specific landscapes
V 11	Gordan, S.. Bentz, J. O'Leary, D. and Clish, D. 1997. Common ecological land classification and associated attribute database for the Yellowhead ecosystem. Prepared for: Yellowhead Working Group	Map scale - 1:750,000	All 4 areas	Compilation of data from existing sources; Vegetation 1 (main canopy species) map and Vegetation physiognomy map
V 12	Archibald, J.H., Ferguson, N.B., Haag, R.W., Hay, W.K. and O'Leary,	Map scale 1:100,000 Point	Kakwa	Ecosection map

#	Source	Scale	Area	Information Provided
	D.J. 1984. An integrated resource inventory of the Deep Basin area (NTS 83L). Volume 1 - Physical land classification, forage inventory and ecological land classification. Resource Inventory and Appraisal, Resource Evaluation and Planning, Alberta Energy and Natural Resources. ENR Report #T/78.	plot data available (See Appendix 1 and Figure 5.)		
V 13	Resource Data Branch. 2003. Crown vegetation inventory. Resource Data Branch, Spatial Data Browser, Sustainable Resources Development internal website. (http://inf.env.gov.ab.ca/inf/site.html)	Map scale - 1: 15,000 to 20,000	Covers 8 townships in Willmore and most of Rock Lake – Solomon Creek (See Figure 7)	Forest structure with a minimum of landscape information. Variables include: moisture regime, crown closure, height, age and coverage of leading tree species (variables defined in Resource Information Branch 1991)
V 14	Alberta Energy and Natural Resources. Various dates. Phase 3 Forest Inventory maps.	Map scale - 1:15,000	Kakwa; Sulphur Gates; Rock Lake – Solomon Creek	Forest structure with a minimum of landscape information (variables defined in Alberta Forestry Lands and Wildlife 1988).
V 15	Hanley, P.T. 1973. Biophysical analysis and evaluation of capability Kakwa Falls area. Land Use Assignment Branch, Department of Lands and Forests, Special Report.	No map scale provided (See Figure 3)	Kakwa	Very general, utilized Rowe (1972) forest descriptions and some very general observation data, no point data
V 16	Jacques, D. and VanEck, P. 1979. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 2 - Maps. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.	Mapped from 1:20,000 aerial photography – provides map of plot locations, however specific plot information lacking	Kakwa	Map of vegetation plot locations ; vegetation map and biophysical unit (habitat type) map; provides vegetation cover type descriptions which include vegetation types based on physiognomic structure and often dominant species, height, % crown coverage and % mosaic where 2 vegetation types are interspersed; provides a species list and lists disjunct species and species on the edge of their distribution
V 17	Bork, E. 1994. Ecological range classification of Willmore Wilderness Park. Land and Forest Service, Alberta Environmental Protection,	No map	Willmore - (no plot information, utilized Willmore (1985-88) data to complete	Identification of range community types and associated site parameters; author surveyed non forested ranged types; presents community information – community, species and coverage, site

#	Source	Scale	Area	Information Provided
	Edmonton. Report No. T/282 Bork, E. 1991. Willmore Wilderness Park final report re: ecological classification and management of native ranges in Willmore Wilderness Park. Forest Land Use Branch, Alberta Forest Service, Edmonton		assessment – plot information available for Willmore (1985-88) (See Table 1 and Figure 5); also utilized CFS information	position, drainage, moisture, soils, production and suggested stocking rate
V 18	Brown, G. 1976. Vegetation-landform relationships in the lower Rock Creek valley, west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.	Map scale approx 1:21,000 (See Figure 3)	Rock Lake- Solomon Creek	Vegetation description of vegetation types, including species composition, species list
V 19	Brown, R., Mueller, J. and Ovenden, L. 1975. Kakwa Provincial Park (proposed): biophysical overview and capability of analysis of selected areas. Recreation, Parks and Wildlife, Parks Division, Alberta.	Polygon data; no map scale provided (See Figure 3)	Kakwa	Ecological unit data sheets with descriptions for specific polygons
V 20	Lane, C. 2000. Rangeland, rare plant and weed monitoring in Willmore Wilderness Park. Alberta Environment, Land and Forest Service and Natural Resource Service; Lane, C. and Willoughby, M. 1998. Rangeland monitoring in Willmore Wilderness Park. Alberta Environment, Edmonton; Alberta Sustainable Resource Development. 2003. Wilmore Wilderness Park: User survey, campsite and vegetation inventory, summer 2001 - Draft. Range Management Branch. Alberta Sustainable Resource Development	Point plot information in this document and in ESIS (See Range Reference Areas (1998) in Appendix 1and Figure 9.	Willmore	Focuses on rangeland areas. – information available includes elevation, nutrients, drainage, moisture, soil classification, parent material, description of area and major species present.
V 21	Marshall, Elly. In Progress. Ecological Land Classification of Rock Lake - Solomon Creek Wildland Provincial	Point plot data will be available in ESIS upon	Rock Lake-Solomon Creek - Plot sampling in nodal locations -	Plot location and site information not yet available, project in progress. Information that will be available follows that available on Ecological Land

#	Source	Scale	Area	Information Provided
	Park. Sustainable Resource Development, Edson.	completion of project	Rock Lake, Moosehorn Lake and Oger Canyon (See Figure 3).	Classification Forms as per Resource Data Branch (2003b) and Alberta Environmental Protection (1994c).
V 22	Nelson, S.J., Hay, B. and Michalchuck. 1988. Ecological land classification of the Yellowhead North. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. Publication No. T/167.	Map scale – 1:100,000; Point plot data in ESIS (See Yellowhead (1986) in Appendix 1)	Covers a large portion of Rock Lake-Solomon Creek	Field data is archived in ESIS and includes site, soils and vegetation parameters
V 23	Gould, J., Achuff, P. and Belland, R. 2000.Reconnaissance rare plant survey of Willmore Wilderness Park and Northern Jasper National Park 1999 - Interim Report. Included as Appendix D in Lane et al. 2000.	11 locations - Point plot data in document	Willmore (See Figure 10)	Provides community descriptions and locations for 11 sites; listing of rare plants , Rare plant data in ANHIC
V 24	Gould, J. and Belland, R. 2000. Reconnaissance rare plant survey of Willmore Wilderness Park and northern Jasper National Park, 2000. Report prepared for Foothills Model Forest.	Location information in document (See Figure 1)	Willmore	Community descriptions and listing of rare plants
V 25	Gould, J. and Belland, R. 2002. Reconnaissance rare plant survey of Willmore Wilderness Park, Kakwa Wildland Park and northern Jasper National Park. Preliminary findings.	No location information currently available	Willmore; Kakwa	Rare plant listing and site locations. More detailed information regarding vegetation will be available upon completion of PhD dissertation
V 26	Fardoe, B. 1980. Backcountry horse use and impact study: Kakwa Provincial Park. Prepared for Alberta Recreation and Parks, Provincial Parks Division, Resource Assessment and Management Section.	Point plot data (See Figure 8)	Kakwa.	Vegetation descriptions for points include species and coverage
V 27	Resource Data Branch. Ecological Site Information System (ESIS). Accessible through Alberta	Point plot data (See Figure 5 and Appendix 1)	Kakwa; Willmore; Rock Lake-Solomon Creek	Field sample plot data archived from a number of sources, predominantly Ecological and Physical Land Classification Projects

#	Source	Scale	Area	Information Provided
	Sustainable Resource Development, Resource Data Branch. 14th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta T5K 2J6. Kathleen Jacques – contact.			
V 28	Willmore (BGC plots) photocopies of field plots in Parks library	Point plot data (photocopies of field plots in Parks library)	Willmore	Loose plot forms with vegetation listing, location information sketchy.
V 29	Alberta Parks and Protected Areas. 2003. Alberta Natural Heritage Information Centre (ANHIC). Accessible through Alberta Parks and Protected Areas,	Point plot data (See Figure 12, Figure 13, Figure 14, Figure 15 and Appendix 2)	All 4 areas	Location of rare vascular and non vascular species See ANHIC maps

3.7 Fungi

No information pertaining to fungi in the area of interest could be located (See Table 14 for contact). However, some fieldwork has been conducted in adjacent areas. Formal research has been conducted in Jasper National Park and the Edmonton Mycological Society has conducted forays in William A. Switzer Provincial Park (Bill Richards personal communication).

Table 14. Personnel contacted for further fungi information.

Contact	Organization	Information
Bill Richards	Parks and Protected Areas	Fungi

3.8 Fauna (Wildlife)

For the purposes of this report the term wildlife is used interchangeably with the term fauna and does not include plants or fungi. Wildlife data is available for much of the study area; however, it generally pertains to a limited number of species – often those associated with some form of harvesting (hunting or trapping) or more often those species, which lack a secure status (Alberta Sustainable Resource Development 2000). See Table 15 for definitions of general status categories.

Table 15. Definitions of general status categories (Alberta Sustainable Resource Development 2000).

Rank (2000)	Definition (2000)
At Risk	Any species known to be “At Risk” after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta.
May Be At Risk	Any species that “May Be At Risk” of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
Sensitive	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
Secure	A species that is not “At Risk”, May Be At Risk” or “Sensitive”.
Undetermined	Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.

Point data is not nearly as relevant for wildlife due to the mobility factor. The impact of mobility tends to increase as the size of the species increases. Landscape is a critical focus with wildlife. Factors such as suitability of the landscape as habitat (*i.e.* feeding grounds, escape areas, breeding grounds, nesting areas, etc.) is critical. Wildlife capability maps and key wildlife maps tend to generalize information pertaining to habitat and its inherent value to various species.

This fauna section has been divided into subsections based on the major classes. An attempt has been made to discuss the specific sections from more general information to more specific. Many of the studies discussed pertain to specific species or very specific locations of the landscape. See Table 18 for more information pertaining to numerous sources of wildlife information. Much of the more current and detailed information was obtained through communications with the regional biologists who specialize in the study of particular species (See Table 16).

In order to compile a literature list which documents population trends, changes in habitat use, etc. time should be spent in the district and regional fish and wildlife offices reviewing internal documents and publications. These are not available elsewhere. This would be a very time consuming process in most cases due to the general lack of any current standardized documentation system.

It appears that the Biological Species Observation Database (BSOD) is the initial stage of the documentation process for non-fish species. Currently it tends to reflect the emphasis on sensitive species and species that may be at risk. Caribou and harlequin duck observations tend to predominate. The Fisheries Management Information System (FMIS) is the corresponding data archive for fisheries data. The ANHIC database also contains some information on rare species of fauna. See Table 11 for ANHIC's ranking system.

Table 16. Personnel contacted for further wildlife information.

Contact	Organization	Wildlife - Class
Lisa Wilkinson	Species at Risk Specialist, SRD	Species at Risk
Kris Krellman	Amphibian Monitoring Program, Alberta Conservation Association	Amphibians and Reptiles
Jeff Kneteman	Hinton Area Wildlife Biologist, SRD	Wildlife
Kirby Smith	Wildlife Biologist, Edson, Fish and Wildlife, SRD	Mammals – caribou, goats
Gordan Stenhouse	Wildlife biologist, Hinton, Fish and Wildlife, SRD and Foothills Model Forest	Mammals - grizzly
Hugh Smith	Former Mammal Curator, Alberta Provincial Museum	Mammals – small mammals
Tim Schowalter	Private Consultant, Grad Student University of Regina	Mammals – small mammals
Chris Schmidt	Grad Student, University of Alberta	Insects – butterflies and moths
Greg Pohl	Entomologist, Northern Forestry Centre	Insects
Phillip Penner	Federation of Alberta Naturalists	Birds
Paul Hvenegaard	Peace River Area Fisheries Biologist, Alberta Conservation Association	Fish
George Sterling Rudy Hawryluk	Edson Area Fisheries Biologist, SRD	Fish

3.7.1 Insects

General Information

General field guides such as Acorn's *Butterflies of Alberta* and *Bugs of Alberta* provide some information regarding the species that may be expected to occur in the area of interest. However relatively little is known about the insects occurring in the study area. Greg Pohl (personal communication), an entomologist, indicated he was not aware of any entomological research conducted in this area. Chris Schmidt (personal communication), a Lepidopteran (butterflies and moths) specialist, also indicated he was not aware of any formal studies of insects conducted in the area; however, he did forward some information pertaining to personal observations of butterflies and moths in Kakwa area. Further potential contacts for information pertaining to insects and more specifically butterflies include; Norbert Kondla, Sherri Fownes, Gerald Hilchie and Jens Roland.

Area specific information

Chris Schmidt (personal communication) indicated that the knowledge of butterfly distributions within the Kakwa-Willmore region is spotty, but the likelihood of finding any additional species restricted to this area is highly unlikely. The following includes mostly the notes, which he provided.

<u>Butterflies</u>

The *Pieris marginalis tremblayi* subspecies was recently added to the provincial fauna (Schmidt et al. 2003), and its provincial distribution is restricted to the Kakwa region. It is known only from the Torrens River area, but is it is likely to occur throughout the Kakwa region and possibly also in the Willmore area.. Elsewhere, this subspecies occurs from central and northern BC northward (Guppy & Shepard 2001).

The mountain fritillary (*Boloria napaea*), an arctic-alpine species, occurs from Alaska south to Adams Lookout near Grande Cache (Bird et al. 1995), which is located in Kakwa Wildland Provincial Park. This species is identified as sensitive (Alberta Sustainable Resource Development 2000).

There are only three known localities globally for the *Erebia magdalena saxicola* subspecies, two of which include alpine rock fields in the Grande Cache region and the third near McBride, British Columbia (Hilchie 1990). This species is widely disjunct from populations of other subspecies of Magdalena alpine (*E. Magdalena)* in the west-central US.

<u>Moths</u>

Knowledge of the cordilleran moth fauna north of Jasper is almost entirely lacking; the following species are based on the few records available. Based on the relationships between butterfly and moth diversity, it should be expected that at least 10 to 20 species of moths will have a provincial distribution restricted to

the Kakwa - Willmore region. Faunal inventory work for the Kakwa-Willmore region is needed before a more complete picture is available.

Entephria kidluitata is an arctic alpine species known to occur as far south as Grande Cache (Troubridge 1997).

The southern limit of known range for *Xestia okakensis* occurs at Prospect Mountain, Cadomin. It likely also occurs throughout the Wilmore - Kakwa region (C. Schmidt, unpublished data).

Detailed Information

Fourteen rare butterfly element occurrences are documented for Willmore Wilderness Park in the ANHIC database. Seven different species are recognized (Appendix 2).

3.7.2 Fish

General Information

A number of field guides including; Paetz and Nelson (1970), provide general location information for the various species of fish that occur within the area of interest.

Area Specific Information

George Sterling and Rudy Hawryluk (personal communication) provided the following information pertaining to the distribution of fish throughout the study area with the exception of Kakwa Wildland Provincial Park.

The waters of Willmore Wilderness Park support populations of several native fish species including: bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*), Arctic grayling (*Thymallus arcticus*), longnose suckers (*Catstomus catostomus*), white suckers (*Catostomus commersoni*) and slimy sculpins (*Cottus cognatus*). Bull trout are the most common sport fish with the widest distribution, extending into the headwaters of the Smoky main stem, including the Sulphur and the Muskeg Rivers, and into the headwaters of the Berland and Wildhay Rivers, sub-basins of the Athabasca River drainage. Non-native Species include brook trout (*Salvelinus fontinalis*) and cutthroat trout (*Oncorhynchus clarki*).

All of the native species found in Willmore Wilderness Park inhabit the Smoky River adjacent to Sulphur Gates Recreation Area.

Rock Lake – Solomon Creek Wildland Provincial Park supports several fish species, including; bull trout, rainbow trout, mountain whitefish, burbot (*Lota lota*), longnose suckers, white suckers and slimy sculpins. Pygmy whitefish (*Prosopium coulteri*) have been reported in the lower reaches of Solomon Creek but are extremely rare and most likely confined to the reaches downstream from the park

boundary. Lake trout are common in Rock Lake where a very popular sport fishery exists. Northern pike (*Esox lucius*) are also common in Rock Lake.

Thera and Wildeman (2001) documented the presence of a number fish species in the Kakwa watershed, including; arctic grayling, bull trout, lake chubb (*Couesius plumbeus*), longnose dace (*Rhinichthys cataractae*), longnosed sucker, mountain whitefish, rainbow trout, redside shiner (*Richardsonius balteatus*), slimy sculpin and white sucker.

Detailed Information

A number of extensive studies have been conducted in the study area over the years. George Sterling indicated that he has conducted extensive fisheries surveys within Willmore Wilderness Park.

Extensive studies have been conducted, particularly in the Kakwa area, on bull trout, which is considered a sensitive species. These reports tend to provide detailed information pertaining to data collection procedures, survey locations and survey results (Hildebrand 1985 - Kakwa; Hildebrandt 1989 – Willmore; Brewin 1996 – Willmore and Rock Lake - Solomon Creek; Hvenegaard and Fairless 1998 – Kakwa). Post and Johnson (2002) provide an overview of bull trout populations in Alberta.

Other studies are more directed to obtaining baseline data for particular areas (Thera and Wildeman 2001 – Kakwa watershed; Watters 1975 – Solomon Creek); Aquatics Environmental Limited 1975 – Sheep Creek Drainage; Lane 1969 – Rock Lake). Many of these studies also include a limnological component.

Much of the fisheries data is documented in the Fisheries Management Information System (FMIS) housed with Alberta Fish and Wildlife. A formal request detailing the very specific nature of information must be submitted in order to obtain the data.

3.7.3 Birds

General Information

A number of field guides currently available provide general information pertaining to the distribution of avian species within the study area (McGillivray and Semenchuk 1998; Fisher and Acorn 1998; Semenchuk (ed.) 1992; etc.).

The land capability map for waterfowl provides some very general information pertaining to the suitability of the landscape for waterfowl habitat and use. The information is presented on a relatively small scale (1:250,000 and 1,000,000).

Specific Area Information

Information pertaining to avifauna within the study area is limited to a few formal research projects, which have been and are being conducted in the area.

Several levels of information are available from the database, which was compiled to create *The Atlas of the Breeding Birds of Alberta* (Semenchuk (ed.) 1992). This publication includes all bird species, which breed in or visit the province of Alberta. For data collection purposes the province was divided into nine zones. Most of the study area (that portion covered by NTS map sheet 83E and 83F) falls under the atlas zone 6. The northern half of Kakwa Wildland Provincial Park falls under atlas zone 9. A listing of species occurring in individual atlassing zones is readily available from the Federation of Alberta Naturalists. More detailed queries pertaining to the specific blocks within the study area that have been surveyed is also available, but requires more computer programming time and therefore there is a charge associated with obtaining this information. Phillip Penner is the data contact for the Alberta Federation of Naturalists. It should be noted that the number of blocks for which data was collected and that are located in the study area is limited (See Semenchuk (ed.) 1992).

Detailed Information

Harlequin Duck (*Histrionicus histrionicus*)

Kneteman and Hubbs (2000) present detailed maps of harlequin duck aerial survey results for 10 watersheds in Willmore Wilderness Park. These surveys were conducted in the spring of 1998-2000. MacCallum (2001) provides an overview map of harlequin duck breeding areas and potential breeding areas based on a review of all existing information (See Figure 16). This information is also documented in BSOD (See Table 17). Kneteman (personal communication) indicated that Harlequin ducks prefer very specific site conditions and are generally very localized within an area. Once they have located a favourable nesting site, they have a high fidelity to the location returning to the same spot year after year. Extensive information regarding locations of harlequin ducks within the study area is also available from the ANHIC database.

Barred Owl (*Strix varia*)

An observation of a barred owl (*Strix varia*) for Rock Lake is documented in BSOD (See Table 17).

Soras (*Porzana carolina*)

Soras (*Porzana carolina*) were observed in Kakwa Wildland Provincial Park (Sulphur Basin) and Willmore Wilderness Park (See Table 17).

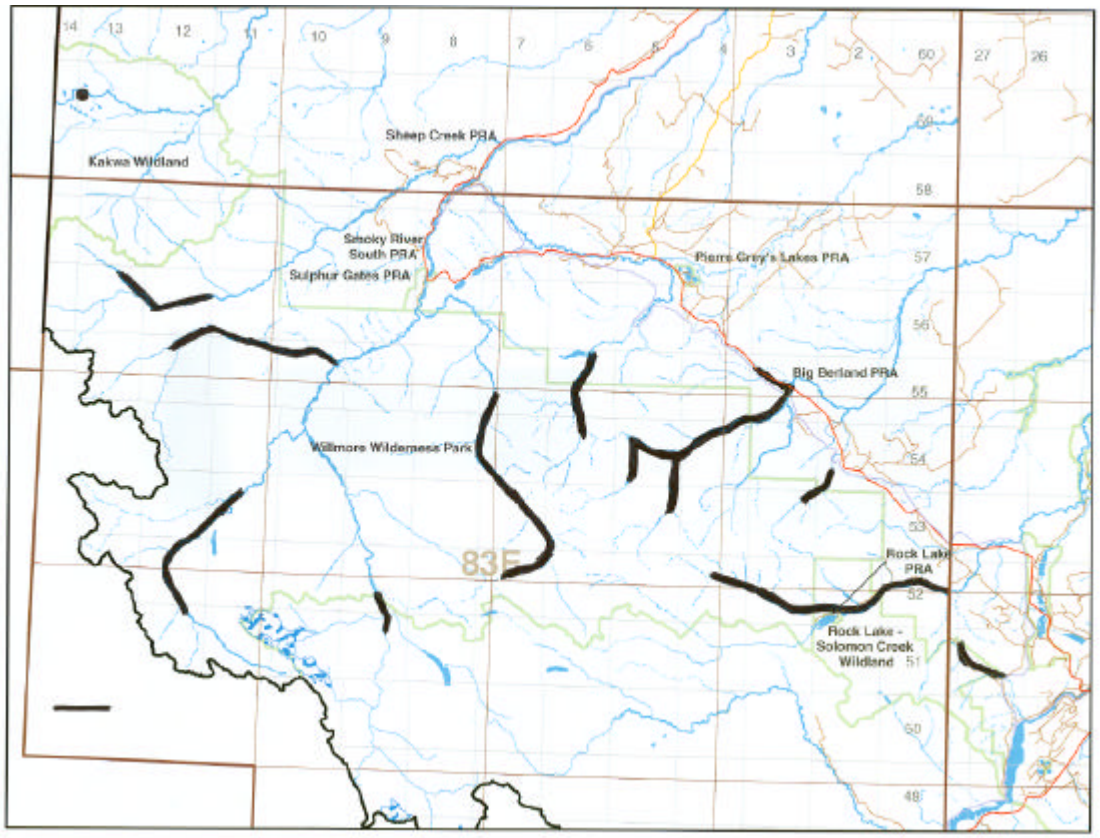

Figure 16. Harlequin duck distribution in study area (adapted from MacCallum 2001). The thickened black lines indicate harlequin duck breeding occurrences and the enlarged black dot denotes potential breeding occurrences. See MacCallum (2001) for additional comments and sources of information. Please note: there appears to be some contentious issues with this representation.

3.7.4 Mammals

A relatively large amount of research has been conducted in this study area; however, it generally associated with a few species. Much of the research appears to pertain to the larger mammals.

General Information

A number of field guides for mammals (*e.g.* Pattie and Fisher 1999) provide information pertaining to the geographical location and habitat types with which various mammals are associated

Small-scale land capability maps for ungulates utilizes a class rating system to indicate the potential for the presence of these mammals on the landscape based on habitat suitability. Maps of a 1:250,000 scale are available for the entire area. A land capability map of a similar scale is also available for furbearers (beaver, muskrat and squirrel). This map is only available for NTS map sheet 83L, which encompasses Kakwa Wildland Provincial Park/

A number of publications present maps of critical habitat areas (Alberta Fish and Wildlife Division 1981 and 1985, Olynyk 1980 – Willmore, Wingert and Markham 1974 – Kakwa, Alberta Wilderness Association 1973 – Willmore). The Alberta Fish and Wildlife key wildlife maps indicate areas of significance to various species of wildlife at a scale of approximately 1:150,000. The available maps were developed in the mid 80's, however, they should still be relevant today. Kakwa Wildland Provincial Park appears to be situated in prime grizzly (*Ursus arctos*) and caribou (*Rangifera tarandus caribou*) country with a much smaller proportion of high elevation ridges and peaks significant to mountain goats (*Oreamnos americanus*) and bighorn sheep (*Ovis canadensis*). The Wildhay River – Rock Lake Corridor in Rock Lake-Solomon Creek Wildland Provincial Park is considered significant moose and elk country with some of the upper elevation areas significant for mountain sheep. Willmore Wilderness Park supports significant habitat for a number of large mammal species. A large portion of the park provides significant habitat for sheep. The peaks and ridges within this area are also of importance to goats. Caribou and elk (*Cervus elaphus*) habitat is also relatively abundant within the park. The riparian habitat along the Smoky River in the Sulphur Gates Provincial Recreational Area is prime moose (*Alces alces*) and elk habitat. While the uplands to the west is greater importance to sheep and moose.

Smith (1993) utilized location information from museum specimens to develop distribution patterns of Alberta's mammals. His information is presented at the township level and provides some indication of the distribution patterns in the study area, although in some cases the information may be historic.

Area Specific Information

Furbearers

Butler Krebes Associates Ltd. (1979) documents the fur harvest for a number of furbearing species in the Kakwa area, including; beaver (*Castor canadensis*), ermine/weasel (*Mustela* spp.), marten (Martes americana), mink (*Mustela vision*), muskrat (*Ondatra zibethicus*), squirrel (*Tamiasciurus hudsonicus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), lynx (*Lynx canadensis*) and wolverine (*Gulo gulo*), indicating that are species were present in the area.

Wolverine (*Gulo gulo*)

More intensive studies are being initiated on the wolverine whose status currently is "may be at risk"(Peterson 1997). Some testing of methodologies to monitor wolverines has taken place in the Grande Cache area (Fisher 2003, Mowat *et al.* 2003). No studies have been conducted in the study area, but the close proximity in conjunction with past fur records would indicate that it is highly likely that it exists in the area of interest.

Black Bears (*Ursus americanus*)

Black bears may be found in the study area. A warning regarding the presence of a female bear and her cub was observed while conducting field surveys west of Brule Lake (personal observation). There is some discreptancy whether this warning was associated with a black or grizzly bear. Black bears have also been observed from the air in the Berland area located adjacent to the study area (personal observation).

Grizzly Bears (*Ursus arctos*)

As indicated on the key wildlife habitat maps grizzly bears (which are defined as may be at risk) inhabit the study area. Two grizzly bear management areas (4A and 4B) cover much of the study area. Kansas (2002) indicates the most current population estimates for these areas are 87 and 44, respectively. These are estimates for the year 2000.

Gord Stenhouse (personal communication) will have new habitat maps and resource selection function (RSF) models for grizzly bears in some of the areas of interest in the spring of 2004. These are currently being prepared. RSF models provide probability of grizzly bear occurrence maps.

Joyce Gould (personal communication) also indicated that she has seen a number of grizzlies (observations while on foot and in the air) while conducting fieldwork throughout the last five years in the Kakwa, Willmore and Rock Lake areas.

Bats (Chiroptera)

Some bat studies have been conducted in the Edson-Hinton vicinity. Only little brown bats (*Myotis lucifugus*) were caught, but Lisa Wilkinson (personal communication) suspects northern long-eared bats (*Myotis septentrionalis*), which are classified as may be at risk) are also in the vicinity. The proximity to the study area also indicates there is a high possibility that these species occur in the study area, particularly the Rock Lake area.

There is no information available on any research, within the study area, associated with small mammals. Tim Schowalter (personal communication), a private consultant, indicated that he was not aware of any research conducted in this area and suggested Hugh Smith, former Curator of Mammology at the Alberta Provincial Museum. Unfortunately contact could not be made with Hugh Smith at this time.

Detailed Information

Woodland Caribou (*Rangifera tarandus caribou*)

Woodland caribou are considered an “at risk” species and therefore have been the focus of considerable research. Three caribou herds inhabit areas of Kakwa Wildland Provincial Park and/or Willmore Wilderness Park: the Redrock/Prairie

herd, the Little Smoky herd and the A La Peche herd. A number of studies and publications have been focused on caribou in this area in the past (Brown and Hobson 1998, Edmonds and Smith 1988, Edmonds, 1988, Edmonds and Bloomfield 1984, Burgess 1970, Stelfox 1966). Dzus (2001) and Szkorupa (2001) provide overviews regarding the status of the species. Extensive and very current information is available pertaining these herds and other on the Mountain Caribou Study web site at http://www.deer.rr.ualberta.ca/research/caribou, Detailed distribution maps based on GPS data collected from collared animals are also available at this site (See Figure 17 for an example). Extensive information pertaining to caribou is also documented in BSOD. The West-Central Alberta Caribou Standing Committee also issues a publication *Research News* through the University of Alberta to update its members on current research (Available at http://www.deer.rr.ualberta.ca/research/caribou/newsletter.htm).

Wolf (*Canis lupus*)

Kuzyk (2002) conducted research pertaining to wolf distribution and movements on caribou ranges in west-central Alberta. Thirty-one wolves from eight packs were collared on two caribou ranges; the Red Rock/Prairie Creek herd range and the Little Smoky herd range. Information pertaining to the wolf-caribou interaction and the wolf-industrial activity interaction were explored.

Mountain Goat (*Oreamus americanus*)

Kneteman (2003) conducted aerial surveys of 8 mountain complexes including 12 complexes, which were located entirely or partially within Willmore Wilderness Park and one complex, which is located partially within Rock Lake – Solomon Creek Wildland Provincial Park. These surveys were conducted to obtain data on population trends, herd distribution and herd composition. Kneteman (2003) provides an overview of census data that has been collected for much of the area since 1974. Hobson (2002) conducted aerial surveys on 17 mountain complexes in 2002.

Mountain Sheep (*Ovis canadensis*)

Sheep surveys have recently been conducted in a portion of the study area. The report is currently under review and will be available in the near future (Kneteman personal communication).

Brown Lemming (*Lemmus sibiricus*)

The brown lemming's status is currently undetermined. Engley and Norton (2001) document the location a number of brown lemming carcasses that were located at Desolation Creek in Willmore Wilderness Park. This information is also documented in the ANHIC database.

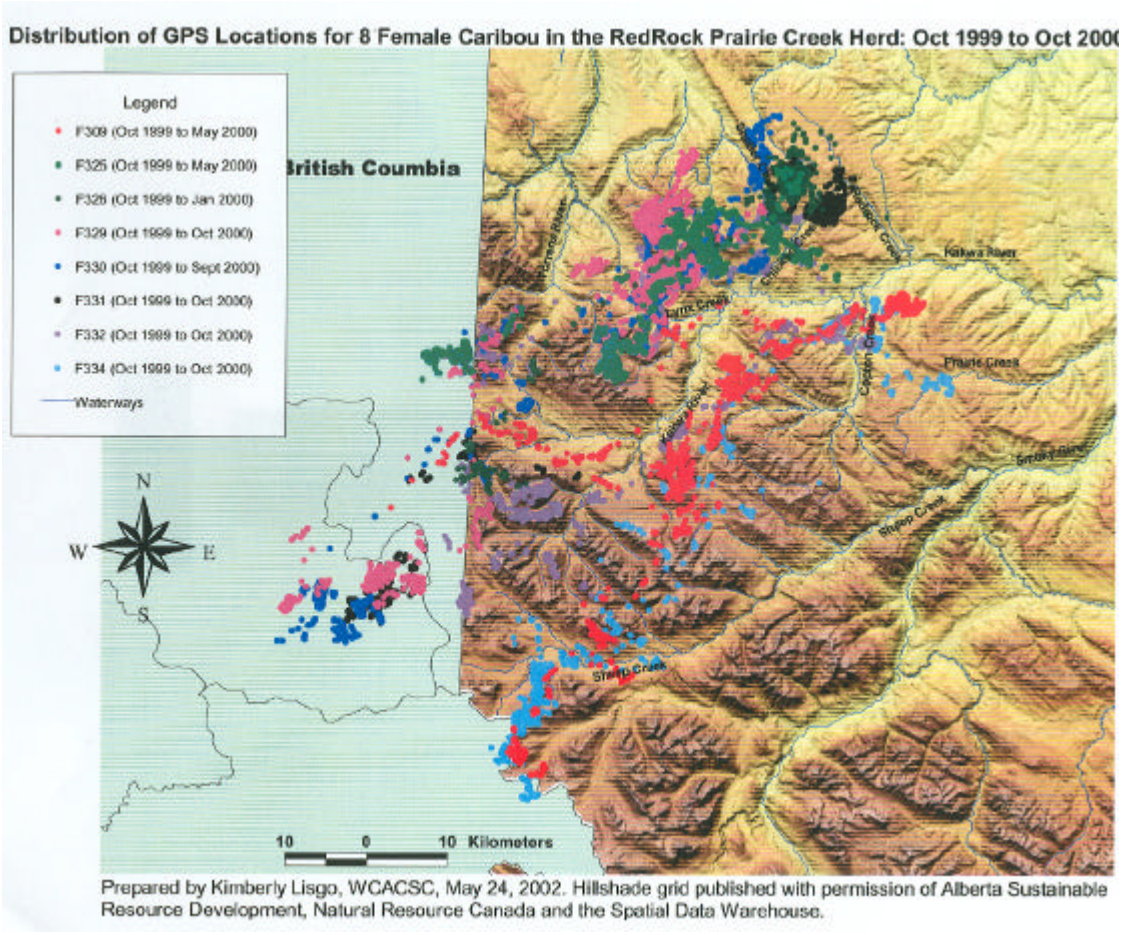

Figure 17. Example of caribou distribution maps available on the Alberta Mountain Caribou Study web site at **http://www.deer.rr.ualberta.ca/research/caribou**.

3.7.5 Amphibians and Reptiles

General Information

Field guides such as Russell and Bauer (1993) provide general location information pertaining to the distribution of amphibians and reptiles.

Area Specific Information

According to Lisa Wilkinson (personal communication) amphibian work has not extended into area of interest, but has occurred in nearby locations. Four call survey routes were conducted in the Hinton area, some in very close proximity to Rock Lake –Solomon Creek Provincial Park (Takats and Priestley 2002). Occurrences of boreal chorus frogs (*Pseudacris maculata*), wood frogs (*Rana sylvatica*) and western toads (*Bufo boreas*) were documented in the Hinton area. Lisa Wilkinson (personal communication expects the spotted frog, whose status is listed as sensitive, would be found in some of the parks.

Kris Krellman of the amphibian monitoring program was contacted he indicated that any observations obtained through the monitoring program would be documented in BSOD.

Detailed Plot Information

Boreal or Western Toad (*Bufo boreas*)

A single of occurrence of a boreal toad observed in Sulphur Basin area (Kakwa Wildland Provincial Park is documented in BSOD (See Table 17).

Table 17. Listing of observation data and location information from BSOD database (Note: some of the information in BSOD is considered sensitive and only for department use).

Species	Wildlife Type	Location Information (more detailed location information exists in BSOD)
Kakwa Wildland Provincial Park		
Boreal Toad	Amphibian	Sulphur Basin area
Harlequin duck	Bird	Kakwa River
Sora	Bird	Sulphur Basin area
Woodland Caribou	Mammal	Numerous observations throughout Park
Rock Lake Solomon Creek Wildland Provincial Park		
Barred Owl	Bird	Rock Lake
Harlequin duck	Bird	Wildhay River
Willmore Wilderness Park		
Sora Woodland Caribou	Bird Mammal	Numerous observations throughout park
Harlequin Duck	Bird	Numerous observations throughout park: Hardscrabble Creek, Smoky River, Rock Creek, Cote Creek, Muddywater River, Fetherstonhaugh River, Sulphur River, Sheep Creek, Berland River, West Sulphur River, Wildhay River, South Berland River, Jackpine River

Table 18. Sources of wildlife related information.

#	Source	Class	Predominant Area	Information Provided
W 1	Alberta Sustainable Resource Development and the Alberta Conservation Association. Biodiversity/Species Observation Database (BSOD). Accessible through Alberta Sustainable Resource Development	Wildlife – Mammals, Birds, Amphibians	All 4 areas	Point location data provided for documented wildlife observations. Majority of the observations for harlequin duck
W 2	Alberta Mountain Caribou Study http://www.rr.ualberta.ca/research/caribou	Mammals - Caribou	Kakwa; Willmore	Maps showing movements of collared animals; overviews of current research and preliminary results
W 3	Boreal Caribou Research Program http://www.deer.rr.ualberta.ca/caribou/BCRP.htm	Mammals - Caribou	Kakwa; Willmore	
W 4	Hobson, D. 2002. Surveys of mountain goats in the Hinton/Grande Cache Wildlife Management Area: 2002 - Draft. Fisheries and Wildlife Management Division, Alberta Sustainable Resources, Hinton.	Mammals – Mountain Goats	Willmore; Rock Lake-Solomon Creek	Preliminary census report - 12 complexes located entirely or partially in Willmore and one complex in Rock Lake- Solomon Creek area (Brule vicinity) census data 1973-2002
W 5	Kneteman, J. 2003. Surveys of mountain goats in the Hinton/Grande Cache Wildlife Management Area: 2003. Fish and Wildlife Management Division, Alberta Sustainable Resources.	Mammals – Mountain Goats	Willmore; Rock Lake-Solomon Creek	Preliminary census report - 12 complexes located entirely or partially in Willmore and one complex in Rock Lake- Solomon Creek area (Brule vicinity) census data 1973-2003
W 6	Wingert, K. and Markham, B.J. 1974. Fish and Wildlife Report - Kakwa Falls Study. Land Use Assignment Committee.	Mammals - ungulates	Kakwa area	Map of critical ungulate ranges in the Kakwa Falls area
W 7	Smith, H. 1993.Alberta mammals - an atlas and guide. The Provincial Museum of Alberta, Edmonton, AB.	Mammals	All 4 areas	Identifies townships where at least one specimen of a species has been collected and the specimen is housed in a public museum. Generally implies that a species can be expected to occur where suitable

#	Source	Class	Predominant Area	Information Provided
				habitat is available within a township. Some records are quite old and terrain may have changed and suitable habitat no longer available
W 8	Kansas, J. 2002. Status of the Grizzly Bear (Ursus arctos) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division and Alberta Conservation Association. Wildlife Status Report No. 37, Edmonton, AB.	Mammals - grizzly	Foothills	Grizzly distribution in the foothills
W 9	Dzus, E. 2001. Status of the woodland caribou (Rangifera tarandus caribou). Alberta. Fisheries and Wildlife Management Division, Alberta Environment and Alberta Conservation Association, Edmonton. Wildlife Status Report No. 30.	Mammals - caribou	Willmore; Kakwa	Distribution of herds in the Kakwa and Willmore area
W 10	Engley, L. and Norton, M. 2001. Distribution of selected small mammals in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Service, Alberta Species at Risk Report No. 12. Edmonton, Alberta.	Mammals – small mammals	Willmore	Documents the finding of brown lemming carcasses
W 11	Petersen, S. 1997. Status of the wolverine (Gulo gulo) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 2, Edmonton, AB.	Mammals – small mammals	Foothills	Documents the distribution of wolverine based on fur affidavits
W 12	Szkorupa, T. 2001. 2000/2001 Progress report on caribou research in West Central Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 23, Edmonton.	Mammals	Kakwa; Willmore	Distribution of three main herds in the area of interest
W	Mowat, G., Kyle, C. and Paetkau, D.	Mammals -		Some testing conducted in the Grande Cache area

#	Source	Class	Predominant Area	Information Provided
13	2003. Testing methods for detecting wolverine. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 71, Edmonton, Alberta	wolverine		
W 14	Alberta Wilderness Association. 1973. The Willmore Wilderness Park.	Mammals - ungulates	Willmore	Map of critical winter ungulate range
W 15	Edmonds, J. and Smith, K. 1988. Monitoring the status and seasonal distribution of mountain caribou herds in west central Alberta - a progress report. Fish and Wildlife Division, Edson.	Mammals - caribou	Willmore; Kakwa	Map of primary winter range and winter observations
W 16	Edmonds, E.J. and Bloomfield, M. 1984. A study of woodland caribou in west-central Alberta 1979-1983. Fish and Wildlife Division, Alberta Energy and Natural Resources.	Mammals - caribou	Willmore; Kakwa	Caribou range maps
W 17	Olynyk. J. 1980. A wildlife management plan for Willmore Wilderness Park. Fish and Wildlife Division, Alberta Energy and Natural Resources.	Mammals	Willmore	Critical habitat maps for large mammals
W 18	Alberta Fish and Wildlife Division. 1985. Wildlife Key Area Maps 83E.	Mammals - ungulates	Rock Lake-Solomon Creek	Key wildlife area map – small scale NTS maps – scale approx. 1:150,000.
W 19	Alberta Fish and Wildlife Division. 1985. Wildlife Key Area Maps 83L	Mammals - ungulates	Kakwa; Willmore	Key wildlife area map – small scale NTS maps – scale approx. 1:150,000.
W 20	Alberta Fish and Wildlife Division. 1981. Wildlife Key Area Maps 83F	Mammals - ungulates	Willmore; Sulphur Gates; Rock Lake-Solomon Creek	Key wildlife area map – small scale NTS maps – scale approx. 1:150,000.
W 21	Environment Canada Lands Directorate. 1976. Canada land inventory map series Alberta – Land capability for wildlife – furbearers. Department of the Environment,	Mammals – furbearers (beaver, muskrat, and squirrel)	Kakwa	Land capability maps denoting habitat suitability; original interpretation generally conducted at 1:50,000 which was transferred to 1:250,000; only available for the 83L NTS map sheet

#	Source	Class	Predominant Area	Information Provided
	Minister of Supply and Services, Ottawa, Ontario.			
W 22	Environment Canada Lands Directorate. 1976. Canada land inventory map series Alberta – Land capability for wildlife – ungulates. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.	Mammals - ungulates	All 4 areas	Land capability maps; original interpretation conducted at 1:50,000 which was transferred to 1:250,000 and 1,000, 000 scale; 1:250,000 available by NTS map sheet.
W 23	Timoney, K. 1998. Environmentally significant areas inventory of the Rocky Mountain natural region of Alberta. Prepared for: Corporate Management Service, Alberta Environmental Protection, Edmonton.	Mammals - ungulates	Willmore; Kakwa.	Defines areas of caribou range as provincially significant
W 24	Kuzyk, G.W. 2002. Wolf distribution and movements on caribou ranges in west-central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.	Mammals - wolves	Kakwa; Willmore	Distribution of wolves and wolf packs; 31 wolves from 8 packs collared; traveled in 2 caribou ranges – Red Rock/Prairie Creek and Little Smoky herds
W 25	Poole, K.G. and Mowat, G. 2001. Alberta furbearer harvest data analysis. Fish and Wildlife Division, Alberta Sustainable Resource Development, Alberta Species at Risk Report No. 31. Edmonton, Alberta.	Mammals - furbearers	All 4 areas	Utilizes trapper harvest data in various analysis, including takes or distribution among Registered Fur Management Areas
W 26	Jacques, D. and VanEck, P. 1979. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 1 - Biophysical Features. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.	Wildlife	Kakwa	Habitat map, habitat information from 1975 1:20,000 black and white infrared photography, map defines rough vegetation communities
W 27	Russell, A.P. and Bauer, A.M. 1993. The amphibians and reptiles of	Amphibians and reptiles	All 4 areas	Very coarse distribution maps for Alberta, but a good starting point

#	Source	Class	Predominant Area	Information Provided
	Alberta. University of Calgary Press, Calgary and University of Alberta Press, Edmonton.			
W 28	Takats, L. and Priestley, C. 2002. Alberta amphibian call surveys - a pilot year: final report. Fish and Wildlife Division, Alberta Sustainable Resource Development, Alberta Species at Risk Report No. 53.	Amphibians	Rock Lake-Solomon Creek	Some surveys conducted in relatively close proximity to this park
W 29	Environment Canada Lands Directorate. 1981. Canada land inventory map series Alberta – Land capability for wildlife – sport fish. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.	Fish - sport fish	All 4 areas	Land capability maps; original interpretation conducted at 1:50,000 which was transferred to 1:250,000 and 1,000, 000 scale; 1:250,000 available by NTS map sheet.
W 30	Post, J.R. and Johnson, F.D. 2002. Status of the bull trout (Salvelinus confluentus) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association. Wildlife Status Report No. 39, Edmonton, Alberta.	Fish	Kakwa	Documents distribution of Bull trout in Kakwa drainage
W 31	Thera, T. and Wildeman, A. 2001. Cumulative effects of watershed disturbances on fish communities in the Kakwa and Simonette watersheds progress report. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 14, Edmonton.	Fish	Kakwa	Summary of fish species assemblages
W 32	Mackay, W.C. 2000. Status of the Pygmy Whitefish (Prosopium coulteri) in Alberta. Alberta Environment, Fisheries and Wildlife Management	Fish	Rock Lake-Solomon Creek	Documents collection location of pygmy whitefish

#	Source	Class	Predominant Area	Information Provided
	Division and Alberta Conservation Association. Wildlife Status Report No. 27, Edmonton, AB.			
W 33	Watters, D. 1975. Preliminary survey of Solomon Creek: twp. 51, rge. 27, w5.Fish and Wildlife Division, Alberta Energy and Natural Resources.	Fish; Invertebrates; Limnology	Rock Lake-Solomon Creek	Baseline data of resident fish populations and species composition, aquatic invertebrate abundance and chemical and physical parameters of stream; rainbow trout, mountain whitefish and dolly varden – rainbow trout dominant; aquatic invertebrates primarily consisted of Ephemeroptera nymphs indicating high oxygen concentrations and clean water; however presence of Dipteran larvae indicates some variability in water quality
W 34	Hildebrand, L. 1985. Bull trout population status and potential spawning habitat in the Eastern Slopes Region, Alberta. Prepared for Alberta Fish and Wildlife Division, Energy and Natural Resources	Fish; limnology	Rock Lake-Solomon Creek and Willmore	Distribution of bull trout and physical and chemical site characteristics of a number of streams are assessed; Status and potential spawning habitat of bull trout in the Berland and Wildhay drainage
W 35	Lane, C.B. 1969. The limnology and fishery management of Rock Lake, Alberta. Alberta Land and Forests, Fish and Wildlife Division, Survey Report No. 8, Edmonton.	Fish	Rock Lake	Data of resident fish populations and species composition, aquatic invertebrate abundance and chemical and physical factors of lake
W 36	Aquatic Environments Limited. 1975. Baseline studies of the biology of streams and wildlife populations in the Sheep Creek drainage, Alberta.	Fish	Willmore	Data of resident fish populations and species composition, aquatic invertebrate abundance and chemical and physical parameters of Sheep Creek and tributaries
W 37	Hvengaard, P. and Fairless, D. 1998. Biology and status of bull trout (Salvelinus confluentus) in the Kakwa River drainage, Alberta - Data summary 1995 to 1997 progress report. Fisheries Management Enhancement Project. Alberta Conservation Association, Northwest Boreal Region, Peace River, Alberta.	Fish – bull trout	Kakwa River drainage	Distribution and over wintering of bull trout in the Kakwa River drainage

#	Source	Class	Predominant Area	Information Provided
W 38	Brewin, M.K. 1996. Identification of bull trout populations in the McLeod, Wildhay, Berland, and Muskeg River systems, Alberta. Prepared for Trout Unlimited Canada, Calgary and Foothills Model Forest Program, Hinton, Alberta	Fish – bull trout	Willmore; Kakwa	Maps showing distribution and redds
W 39	Hildebrandt, D. 1989. Preliminary investigations of bull trout (Salvelinus confluentus) spawning activity in Unnamed Lake (23-55-12-6) Sept. 1986, Aug. 1987 and Sept. 1988. Fish and Wildlife Division, Forestry, Lands and Wildlife, Edmonton.	Fish	Willmore	Investigation of an unnamed lake in Willmore (23-55-12-6); bull trout; mountain whitefish – size growth curves, stomach analysis, spawning activity and food habits
W 40	Environment Canada Lands Directorate. 1974. Canada land inventory map series Alberta – Land capability for wildlife – waterfowl. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.	Birds - waterfowl	All 4 areas	Land capability maps; original interpretation conducted at 1:50,000 which was transferred to 1:250,000 and 1,000, 000 scale; 1:250,000 available by NTS map sheet.
W 41	MacCallum, B. 2001. Status of the harlequin duck (Histrionicus histrionicus) in Alberta. Fisheries and Wildlife Management Division, Alberta Sustainable Resource Development and Alberta Conservation Association. Edmonton, Alberta. Wildlife Status Report No. 36.	Birds	Northern foothills	Distribution of Harlequin Duck in the northern foothills – occurrence map
W 42	Semenchuk, G.P. (ed). 1992. The atlas of breeding birds of Alberta. Federation of Alberta Naturalists, Edmonton.	Birds	All 4 areas	- displays general map of townships which data in publication represents; however no direct specifics
W 43	Kneteman, J. and Hubbs, A. 2000. Harlequin duck monitoring in the northern east slopes of Alberta: 1998-	Birds	Willmore	Detailed maps of aerial survey data for 10 watersheds in Willmore Wilderness Park

#	Source	Class	Predominant Area	Information Provided
	2000 preliminary results. Alberta Sustainable Resource Development. Fisheries and Wildlife Management Division, Alberta Species at Risk Report No. 11, Edmonton.			
W 44	Alberta Sustainable Resource Development and the Alberta Conservation Association. Biodiversity/Species Observation Database (BSOD). Accessible through Alberta Sustainable Resource Development, Fish and Wildlife Branch. 2nd Floor, Great West Life Building, 9920-108 Street, Edmonton, Alberta T5K 2M4.	Point data for wildlife observations (See Table 17)	Willmore; Rock Lake – Solomon Creek; Kakwa	Much of the data presented in BSOD is expanded upon in the documents listed above; predominantly harlequin duck and caribou records
W 45	Alberta Sustainable Resource Development. Fisheries Management Information System (FMIS). Accessible through Alberta Sustainable Resource Development, Fish and Wildlife Division, Fisheries Management Branch. 9920-108 Street, Edmonton, Alberta T5K 2M4.			
W 46	Alberta Parks and Protected Areas. 2003. Alberta Natural Heritage Information Centre (ANHIC). Accessible through Alberta Parks and Protected Areas,	Point plot data (See Figure 12, Figure 13, Figure 15 and Appendix 2)	Willmore; Rock Lake-Solomon Creek	Predominantly harlequin duck and caribou records

4.0 Cited References and Other Sources of Potential Interest

4.1 Literature

Author?. Date?. A limnological survey of the Kakwa River in the vicinity of Kakwa Falls

Author?. Date?. Caribou habitat inventory of proposed Kakwa Provincial Park. (Terms of Ref. - 80049K01 - Vol. 2)

Acorn, J. 1993. Butterflies of Alberta. Lone Pine Publishing, Edmonton, Alberta.

Acorn, J. and Sheldon, I. 2000. Bugs of Alberta. Lone Pine Publishing, Edmonton, Alberta.

Alberta Environment and Alberta Sustainable Resource Development. 2000. The general status of Alberta wild species - 2000. Alberta Environment and Alberta Sustainable Resource Development, Edmonton, Alberta.

Alberta Environmental Protection and The Special Places Provincial Co-ordinating Committee1998. Special features in Alberta. Prepared for: The Special Places Provincial Co-ordinating Committee.

Alberta Community Development. 2001, Sulphur Gates provincial recreation area - map (1:50,000).

Alberta Community Development. 2001. Willmore Wilderness Park - revised July 2001.

Alberta Community Development and Alberta Sustainable Resource Development. 2003. Willmore Wilderness Park - map (1:125,000)

Alberta Energy and Natural Resources. Various dates. Phase 3 Forest Inventory maps.

Alberta Energy and Utilities Board and Alberta Geological Survey. 1999. Geological Map of Alberta.

Alberta Environment Conservation Authority. 1974. Land use and resource development in the eastern slopes. Interim report no. 6: Smoky River Basin Alberta. Environment Conservation Authority, Edmonton.

Alberta Environment Conservation Authority. 1973. Land use and resource development in the Eastern Slopes - Smoky River Basin (Proceedings of the Public Hearings, June-July, 1973, Part IX, Grande Cache and Grande Prairie.

Alberta Environmental Protection. 1998. Natural regions and subregions of Alberta (map). Resource Data Division, Alberta Environmental Protection. Edmonton.

Alberta Environmental Protection. 1997. Kakwa Wildland Provincial Park Management Plan. Land and Forest Service and Natural Resource Service, Alberta Environmental Protection.

Alberta Environmental Protection. 1994a. Alberta Protected Areas System Analysis (1994). Report 3. Alberta Environmental Protection.

Alberta Environmental Protection. 1994b. Natural regions, subregions and natural history themes of Alberta: a classification system for protected areas management. Report 2. Alberta Environmental Protection.

Alberta Environmental Protection. 1994c. Ecological land survey site description manual. Canadian Forest Service and Alberta Land and Forest Services, Edmonton, Alberta.

Alberta Environmental Protection. 1994d. Natural regions and subregions of Alberta, Map (1,1,000,000).

Alberta Fish and Wildlife Division. 1985. Wildlife Key Area Maps 83E.

Alberta Fish and Wildlife Division. 1985. Wildlife Key Area Maps 83L.

Alberta Fish and Wildlife Division. 1981. Wildlife Key Area Maps 83F.

Alberta Forest Service. 1980?. Willmore Wilderness Park management plan. Alberta Forest Service.

Alberta Forestry, Lands and Wildlife. 1990. Topographic Map of Willmore Wilderness Park (1: 126 720).

Alberta Forestry Lands and Wildlife. 1988. Forest cover type specifications. ENR Report No. Dept. 58. Alberta Forestry, Lands and Wildlife, Forest Service.

Alberta Forestry, Lands and Wildlife. 1986, 1987. Fish planting list. Fish and Wildlife Division, Edmonton.

Alberta Lands and Forests. 1973. The Willmore Wilderness Park task force study report. Alberta Department of Lands and Forests.

Alberta Sustainable Resource Development. 2000. The general status of Alberta Wild Species – 2000. Fish and Wildlife Service, Alberta Sustainable Resource Development.

Alberta Sustainable Resource Development. 2003. Wilmore Wilderness Park: User survey, campsite and vegetation inventory, summer 2001 - Draft. Range Management Branch. Alberta Sustainable Resource Development.

Alberta Wilderness Association. 1973. The Willmore Wilderness Park.

Allan, J.A. and Carr, J.L. 1946. Geology and coal occurrence Wapiti-Cutbank Area, Alberta. Research Council of Alberta. Report No. 48.

Allen, L. 2003. Alberta Natural Heritage Information Centre preliminary plant community tracking list. Alberta Community Development, Edmonton, Alberta.

Andriashek, L. 1983. Surficial geology Wapiti sheet, NTS 83L. Research Council of Alberta. Open File Report 1986-23..

Anonymous. 1974. The wildlife resource of the Willmore Wilderness Park area. Alberta Fish and Wildlife Division. Unpublished Report.

Aquatic Environments Limited. 1975. Baseline studies of the biology of streams and wildlife populations in the Sheep Creek drainage, Alberta.

Archibald, J.H., Ferguson, N.B., Haag, R.W., Hay, W.K. and O'Leary, D.J. 1984. An integrated resource inventory of the Deep Basin area (NTS 83L). Volume 1 - Physical land classification, forage inventory and ecological land classification. Resource Inventory and Appraisal, Resource Evaluation and Planning, Alberta Energy and Natural Resources. ENR Report #T/78.

Barnes, R. 1977. Hydrogeology of the Mount Robson-Wapiti area, Alberta (NTS maps 83E and 83L. Alberta Research Council Report 76-5.

Bayrock, L.A. and Reimchen, T.H.F. 1973. Surficial geology, Willmore Wilderness Park, Alberta. Mapped and prepared for Research Council of Alberta, Edmonton, Alberta.

Bayrock, L.A. and Reimchen, T.H.F. 1980. Surficial Geology Alberta Foothills and Rocky Mountains. Prepared for Alberta Environment and Alberta Research Council.

Beckingham, J.D., Corns, I.G.W. and Archibald, J.H. 1996. Field guide to the ecosites of west-central Alberta. Natural Resources Canada, Canadian Forestry Service, Northwest Region, Northern Forestry Centre, Edmonton, Alberta. Special Report 9.

Bibaud, A. 1978. Smoky River elk survey. Alberta Fish and Wildlife Division, Unpublished Report.

Bibaud, A. 1979. Region 4 summer goat survey (Willmore Area). Alberta Fish and Wildlife Division. Unpublished Report.

Bird, C. D., G. J. Hilchie, N. G. Kondla, E. M. Pike & Sperling, F. A. H.. 1995. Alberta Butterflies. The Provincial Museum of Alberta

Boag, T.D. and Hvenegaard, J.P. 1997. Spawning movements and habitat selection of bull trout in a small Alberta foothills stream. Pages 317-324, In: Friends of the bull trout conference proceedings (Mackay, W.C., Brewin, M.K. and Monita, M. eds.). Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary, Alberta.

Bork, E. 1994. Ecological range classification of Willmore Wilderness Park. Land and Forest Service, Alberta Environmental Protection, Edmonton. Report No. T/282.

Bork, E. 1991. Willmore Wilderness Park final report re: ecological classification and management of native ranges in Willmore Wilderness Park. Forest Land Use Branch, Alberta Forest Service, Edmonton.

Borneuf, D. 1983. Springs of Alberta. Groundwater Department, Natural Resources Division, Alberta Research Council.

Boyacioglu, E. 1974. Manual of biophysical land classification and evaluation of capability. Land Use Assignment Section, Alberta Lands and Forests, Edmonton, Alberta.

Brewin, M.K. 1994. Identification of bull trout populations in the McLeod, Wildhay, Berland, and Muskeg River systems, Alberta. Draft prepared for Trout Unlimited Canada, Calgary and Foothills Model Forest Program, Hinton, Alberta.

Brewin, M.K. 1996. Identification of bull trout populations in the McLeod, Wildhay, Berland, and Muskeg River systems, Alberta. Prepared for Trout Unlimited Canada, Calgary and Foothills Model Forest Program, Hinton, Alberta.

Brewin, P.A. and Brewin, M.K. 1997. Distribution maps for bull trout in Alberta. Pp. 209-216 in: Friends of the Bull Trout Conference Proceedings (Mackay, W.C., Brewin, M.K. and Monita, M., eds.) Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary, AB.

Brown, G. 1976. Vegetation-landform relationships in the lower Rock Creek valley, west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.

Brown, R., Mueller, J. and Ovenden, L. 1975. Kakwa Provincial Park (proposed): biophysical overview and capability of analysis of selected areas. Recreation, Parks and Wildlife, Parks Division, Alberta.

Brown, W.K. and Hobson, D.P. 1998. Caribou in west central Alberta: Information review and synthesis. Terrestrial and Aquatic Environmental Managers Ltd., Calgary, Alberta.

Burgess, T.E. 1970. Caribou in northwest Alberta. Alberta Fish and Wildlife Division. Unpublished Report.

Butler Krebes Associates Ltd. 1979. Kakwa Provincial Park - A planning study. Prepared for: Alberta Recreation and Parks, Provincial Parks Division.

Carr, H.D. and Carrothers, D.R. 1973. Status of elk in Big Game Zones 5, 6 and 7. Alberta Department of Lands and Forests, Fish and Wildlife Division.

Cherry, J.A., van Everdingen, R.O., Meneley, W.A. and Toth, J. 1972. Hydrogeology of the Rocky Mountains and interior plains. 24th International Geological Congress. Field Excursion Guidebook A26.

Cook, A.R. 1978. Aerial sheep survey of the Edson, Red Deer and Calgary regions using the revised winter range technique. Alberta Fish and Wildlife Division. Unpublished Report.

Corns, I.G.W. and Annas, R.M. 1986. Field guide to forest ecosystems of west-central Alberta. Canadian Forestry Service, Northern Forestry Centre, Edmonton, Alberta.

Currie, D.V. 1976. Hydrogeology of Tri-Creek Basin, Alberta. Alberta Research Council Bulletin 33.

DeBock, E.A. 1970. Aerial survey of Willmore Wilderness Park. November 28 - December 5, 1970. Alberta Fish and Wildlife Division. Unpublished Report.

Downing, D. 1985. Integrated resource inventory site manual. Natural Resource Information Services, Resource and Evaluation and Planning, Edmonton, Alberta.

Dumanski, J., Macyk, T.M., Veauvy, F.F. and Lindsay, J.D. 1972. Soil survey and land evaluation of the Hinton-Edson Area, Alberta. Alberta Institute of Pedology Report No. S-72-31.

Dzus, E. 2001. Status of the woodland caribou (Rangifera tarandus caribou). Alberta. Fisheries and Wildlife Management Division, Alberta Environment and Alberta Conservation Association, Edmonton. Wildlife Status Report No. 30.

Earle, J.E. and McKenzie, J.S. 2001. Habitat use by juvenile bull trout in mountain streams in the Copton Creek drainage, Alberta and its relation to mining activity. Pp. 121-128 in Bull Trout II Conference Proceedings (Brewin, M.K. and Monita, M., eds.), c/o Trout Unlimited Canada, Calgary, Alberta.

Edmonds, E.J. 1988. Population status, distribution and movements of woodland caribou in west central Alberta. Canadian Journal of Zoology 66:8f17-826.

Edmonds, E.J. and Bloomfield, M. 1984. A study of woodland caribou in west-central Alberta 1979-1983. Fish and Wildlife Division, Alberta Energy and Natural Resources.

Edmonds, J. and Smith, K. 1988. Monitoring the status and seasonal distribution of mountain caribou herds in west central Alberta - a progress report. Fish and Wildlife Division, Edson, Alberta.

Energy, Mines and Resources Canada. 1990. Wapiti Alberta [Geological compilation of M.E. McMechan and F.M. Dawson based on !:50,000 scale maps of the deformed belt (G.S.C. Open File Reports 1710, 2185; A-series maps in press) and surface and subsurface data from the Wapiti Coal project (G.S.C. Open File, in preparation Fall, 1990)]. Open File2313.

Engley, L. and Norton, M. 2001. Distribution of selected small mammals in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Service, Alberta Species at Risk Report No. 12. Edmonton, Alberta.

Environment Canada Lands Directorate. 1977. Canada land inventory map series Alberta – Land capability for wildlife – furbearers. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.

Environment Canada Lands Directorate. 1981. Canada land inventory map series Alberta – Land capability for wildlife – sport fish. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.

Environment Canada Lands Directorate. 1976. Canada land inventory map series Alberta – Land capability for wildlife – ungulates. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.

Environment Canada Lands Directorate. 1976. Canada Land Inventory 1:1,000,000 Map Series Alberta - Capability for forestry. Department of the Environment, Minister of Supply and Services Canada.

Environment Canada Lands Directorate. 1974. Canada land inventory map series Alberta – Land capability for wildlife – waterfowl. Department of the Environment, Minister of Supply and Services, Ottawa, Ontario.

Fardoe, B. 1980. Backcountry horse use and impact study: Kakwa Provincial Park. Prepared for Alberta Recreation and Parks, Provincial Parks Division, Resource Assessment and Management Section.

Ferguson, N.B. 1980. Physical land classification of the Willmore-Kakwa Regional Plan study area (1:250,000). Land Classification Section, Resource Inventory and Appraisal, Alberta Energy and Natural Resources. E.N.R. Report #159.

Fisher, J.T. 2003. Assessment of wolverine monitoring methodologies in Alberta 2002/2003 year end report. Alberta Research Council, Vegreville, Alberta.

Fisher, C. and Acorn, J. 1998. Birds of Alberta. Lone Pine Publishing, Edmonton, Alberta.

Geist, V. 1973. Preliminary investigations on large mammals in the areas on and surrounding No. 9 mine, Sheep Creek, on the coal leases of McIntyre-Porcupine Ltd., Grande Cache, Alberta. Typewritten report, Wildlife Heritage Ltd. and Aquatic Environments Limited.

Geological Survey of Canada. 1964. Geology: Mount Robson, Map 1499A.

Gordan, S. Bentz, J. O'Leary, D. and Clish, D. 1997. Common ecological land classification and associated attribute database for the Yellowhead ecosystem. Prepared for: Yellowhead Working Group.

Gould, J., Achuff, P. and Belland, R. 2000.Reconnaissance rare plant survey of Willmore Wilderness Park and Northern Jasper National Park 1999 - Interim Report. Included as Appendix D in Lane et al. 2000.

Gould, J. and Belland, R. 2000. Reconnaissance rare plant survey of Willmore Wilderness Park and northern Jasper National Park, 2000. Report prepared for Foothills Model Forest.

Gould, J. and Belland, R. 2002. Reconnaissance rare plant survey of Willmore Wilderness Park, Kakwa Wildland Park and northern Jasper National Park. Preliminary findings.

Green, R. and Copeland, F.L. 1972. Geological map of Alberta. Research Council of Alberta. Map 35.

Greenlee, G.M.1983. Soil survey of designated areas in the Kakwa Falls Region and Interpretation for recreational use. Alberta Research Council.

Gregoire, P., Kneteman, J. and Allen, J. 1999. Harlequin duck surveys in the central eastern slopes of Alberta; Spring 1998. Canadian Wildlife Service Technical Report Series No. 329. Canadian Wildlife Service, Prairie and Northern Region, Alberta.

Guppy, C.S. & J.H. Shepard. 2001. Butterflies of British Columbia. University of British Columbia Press, Vancouver, British Columbia.

Hall, W. and Bibaud, A. 1975a. 1974-75 region 4 sheep survey. Alberta Fish and Wildlife Division. Unpublished Report.

Hall, W. and Bibaud, A. 1975b. Winter range survey of the Smokey River valley. Alberta Fish and Wildlife Division. Unpublished Report.

Hall, W., Bibaud, A. and Cook, A. 1973a. Willmore Wilderness Park summer goat and sheep survey. Alberta Fish and Wildlife Division, Wildlife Inventory, Job Completion Report V. Project No. W-4-73, Job No. A-7 and 8.

Hall, W., Bibaud, A. and Cook, A. 1973b. Willmore Wilderness Park summer goat and sheep survey. Alberta Fish and Wildlife Division, Wildlife Inventory, Job Completion Report V. Project No. W-4-73, Job No. A-7 and 8. Unpublished Report.

Hall, W., Bibaud, A. and Cook, A. 1974 Willmore Wilderness Park summer goat and sheep survey. Alberta Fish and Wildlife Division. Unpublished Report.

Hall, W., Gunderson, G. and Cook, A. 1974. Big game zone 6 winter elk survey. Alberta Department of Lands and Forests, Fish and Wildlife Division, Wildlife Inventory, Job Completion Report XXIV.

Halsey, L., Vitt, D., Bellman, D., Cross, S. Mehelcic, S. and Well, R. 2003. Alberta Wetland Inventory Standards, version 2.0. Prepared for Resource Data Branch, Strategic Corporate Services Division by Department of Biological Sciences, University of Alberta.

Hanley, P.T. 1973. Biophysical analysis and evaluation of capability Kakwa Falls area. Land Use Assignment Branch, Department of Lands and Forests, Special Report.

Hilchie, G.J. 1990. Classification, relationships, life history and evolution of *Erebia magdalena* Strecker (Lepidoptera: Satyridae). Quaest. Entom. 26:665-693.

Hildebrand, L . 1985. Bull trout population status and potential spawning habitat in the Eastern Slopes Region, Alberta. Prepared for Alberta Fish and Wildlife Division, Energy and Natural Resources.

Hildebrandt, D. 1989. Preliminary investigations of bull trout (Salvelinus confluentus) spawning activity in Unnamed Lake (23-55-12-6) Sept. 1986, Aug. 1987 and Sept. 1988. Fish and Wildlife Division, Forestry, Lands and Wildlife, Edmonton, Alberta.

Hillman, G.R., Powell, J.M. and Rothwell, R.L. 1978. Hydrometeorology of the Hinton-Edson area, Alberta, 1972-1975. Northern Forest Research Centre, Edmonton. Information Report NOR-X-202.

Hobson, D. 2002. Surveys of mountain goats in the Hinton/Grande Cache Wildlife Management Area: 2002 - Draft. Fisheries and Wildlife Management Division, Alberta Sustainable Resources, Hinton.

Hunt, C. 1989. Lake trout management proposal for Rock Lake. Alberta Forestry Lands and Wildlife, Fish and Wildlife Division, Unpublished Report, Edson.

Hvenegaard, P.J. and Boag, T.D. 1993. Burbot collections, Smoky, Wapiti and Peace Rivers, October and November 1992. Northern River Basin Study Project Report No. 12

Hvengaard, P. and Fairless, D. 1998. Biology and status of bull trout (*Salvelinus confluentus*) in the Kakwa River drainage, Alberta - Data summary 1995 to 1997 progress report. Fisheries Management Enhancement Project. Alberta Conservation Association, Northwest Boreal Region, Peace River, Alberta.

Hydrogeological Maps 83F. Alberta Research Council Report 79-7.

Irish, E.J.W. 1954. Copton Creek, Alberta. Geological Survey of Canada. Map 1041A.

Irish, E.J.W. 1957. Grande Cache, Alberta. Geological Survey of Canada. Map 1049A.

Irish, E.J.W. 1965. Geology of the Rocky Mountain Foothills, Alberta (between latitudes 53º 15' and 54º 15'. Geol. Surv. Can. Mem. 334.

Jacques, D. and VanEck, P. 1979a. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 1 - Biophysical Features. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.

Jacques, D. and VanEck, P. 1979b. Biophysical features and recommendations for recreation development in the Kakwa Falls region, Alberta, Volume 2 - Maps. Alberta Recreation, Parks and Wildlife, Parks Division, Alberta.

Kansas, J. 2002. Status of the Grizzly Bear (*Ursus arctos*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division and Alberta Conservation Association. Wildlife Status Report No. 37, Edmonton, Alberta.

Kemp, G. 1967. Aerial survey (of east slopes of Willmore Wilderness Park). Alberta Fish and Wildlife Division. Typewritten Report.

Kerr, G.R. 1965. The ecology of mountain goats in west central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.

Kershaw, L., Gould, J., Johnson, D. and Lancaster, J. 2001. Rare vascular plants of Alberta. The University of Alberta Press and the Canadian Forest Service, Edmonton, Alberta.

Kershaw, L., MacKinnon, A., and Pojar, J. 1998. Plants of the Rocky Mountains. Lone Pine Publishing, Edmonton, Alberta.

Kneteman, J. 2003. Surveys of mountain goats in the Hinton/Grande Cache Wildlife Management Area: 2003. Fish and Wildlife Management Division, Alberta Sustainable Resources.

Kneteman, J. and Hubbs, A. 2000. Harlequin duck monitoring in the northern east slopes of Alberta: 1998-2000 preliminary results. Alberta Sustainable Resource Development. Fisheries and Wildlife Management Division, Alberta Species at Risk Report No. 11, Edmonton, Alberta.

Kocaoglu, S.S. 1990. Physical land classification methodology. Resource Inventory Section, Land Informaiton Branch, Alberta Forestry, Lands and Wildlife. Pub. No. Ref. 28.

Kuzyk, G.W. 2002. Wolf distribution and movements on caribou ranges in west-central Alberta. M.Sc. Thesis, University of Alberta, Edmonton, Alberta.

Kuzyk, G. 2001. Wolf research in west-central Alberta: a progress report for the research subcommittee of the West-Central Alberta Caribou Standing Committee. University of Alberta, Edmonton, Alberta.

Lakes of Alberta Magazine. No date. Lakes of Alberta hydrographics. Northern edition. One Stop Service Ltd.

Lane, C. 2000. Rangeland, rare plant and weed monitoring in Willmore Wilderness Park. Alberta Environment, Land and Forest Service and Natural Resource Service.

Lane, C. and Willoughby, M. 1998. Rangeland monitoring in Willmore Wilderness Park. Alberta Environment, Edmonton, Alberta.

Lane, C.B. 1969. The limnology and fishery management of Rock Lake, Alberta. Alberta Land and Forests, Fish and Wildlife Division, Survey Report No. 8, Edmonton, Alberta.

Lindsay, J.D., Wynnyk, A. and Odynsky, W. Exploratory soil survey of Alberta map sheets 83-L, 83-K, 83-F and 83-J. Research Council of Alberta. Preliminary Soil Survey Report 64-2.

Lynch, G.H. 1971. Ungulate population surveys conducted in the Edson Region. Alberta Fish and Wildlife Division. Unpublished Report.

MacCallum, B. 2001. Status of the harlequin duck (*Histrionicus histrionicus*) in Alberta. Fisheries and Wildlife Management Division, Alberta Sustainable Resource Development and Alberta Conservation Association. Edmonton, Alberta. Wildlife Status Report No. 36.

Mackay, W.C. 2000. Status of the pygmy whitefish (*Prosopium coulteri*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division and Alberta Conservation Association. Wildlife Status Report No. 27, Edmonton, Alberta.

Marshall, Elly. In Progress. Ecological land classification of Rock Lake - Solomon Creek Wildland Provincial Park. Sustainable Resource Development, Edson.

McFetridge, R.J. 1976. Grande Cache mountain goat project - progress report. Alberta Fish and Wildlife Division.

McFetridge, R.J. and Davidson, R.J. 1974. Mountain goat research in the Grande Cache area of Alberta - progress report. Alberta Fish and Wildlife Division.

McGillivray and Semenchuk, G.P. 1998. The Federation of Alberta Naturalists field guide to Alberta birds. Federation of Alberta Naturalists, Edmonton, Alberta.

McMechan, M.E. 1990. Upper Proterozoic to Middle Cambrian history of the Peace River arch: Evidence from the Rocky Mountains. Bulletin of Canadian Petroleum Geology Vol 38A, p 36-44.

Mentz, E. 1980. Rock Lake creel survey, June 1 to September 21, 1979. Alberta Energy and Natural Resources, Fish and Wildlife Division. Unpublished Report, Edmonton.

Millar, J.B. 1953. An ecological study of the moose in the Rock Lake area of Alberta. M.Sc. Thesis, University of Alberta, Edmonton.

Mitchell, P. and Prepas, E.(eds). 1990. Atlas of Alberta lakes. University of Alberta Press, Edmonton.

Moller, K. and Russell, L. 1976. Wildlife Resources in the Nose Mountain - Sherman Meadows Area. Fish and Wildlife Division, Edmonton, Alberta.

Moss, E.H. 1983. Flora of Alberta, 2nd edition. Revised by J.G. Packer. University of Toronto Press, Toronto, Ontario.

Mowat, G., Kyle, C. and Paetkau, D. 2003. Testing methods for detecting wolverine. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 71, Edmonton, Alberta.

Nash, M. Kakwa Provincial Park - Background Report. Ministry of Environment, Lands and Parks, B.C. Parks, Prince George District.

Nelson, S.J., Hay, B. and Michalchuck. 1988. Ecological land classification of the Yellowhead North. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. Publication No. T/167.

Nolan, J.W. and Sheffler, E.G. 1969. A report on the Willmore Wilderness Park aerial surveys, February 18-22, 1969. Alberta Fish and Wildlife Division. Type Written Report.

Olynyk. J. 1980. A wildlife management plan for Willmore Wilderness Park. Fish and Wildlife Division, Alberta Energy and Natural Resources.

Paetz, M.J. and Nelson, J.S. 1970. The fishes of Alberta. The Queen's Printer, Edmonton, Alberta.

Pattie, D. and Fisher, C. 1999. Mammals of Alberta. Lone Pine Publishing, Edmonton, Alberta.

Pearson, G.R. 1960. Evaluation of some Alberta Coal deposits: Part III. The Sheep Creek-Wildhay River district. Research Council of Alberta. Preliminary Report 60-1.

Pell *et al.* Kakwa recreation area geology - map. Energy and Utilities Board, AGS. BC Geological Survey Branch Open File 19.

Petersen, S. 1997. Status of the wolverine (Gulo gulo) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 2, Edmonton, Alberta.

Pettapiece, W.W. 1986. Physiographic subdivisions of Alberta. 1:500,000 map. Research Branch, Agriculture Canada, Ottawa, Ontario.

Poole, K.G. and Mowat, G. 2001. Alberta furbearer harvest data analysis. Fish and Wildlife Division, Alberta Sustainable Resource Development, Alberta Species at Risk Report No. 31. Edmonton, Alberta.

Porsild, A.E. 1979. Rocky Mountain wildflowers. National Museums of Canada, Ottawa, Ontario.

Post, J.R. and Johnson, F.D. 2002. Status of the bull trout (Salvelinus confluentus) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association. Wildlife Status Report No. 39, Edmonton, Alberta

Powell, J.M. 1977. Precipitation climatology of the eastern slopes area of Alberta. Alberta Watershed Research Program Symposium Proceedings. Fisheries and Environment Canada. Canadian Forestry Service, Northern Forest Research Centre, Edmonton. Information Report NOR-X-176.

Prokopchuk, J.R. and Archibald, J.H. 1976. Land capability classification for forestry in Alberta, Canada Land Inventory. Alberta Forest Service, Energy and Natural Resources Report No. 6.

Quaedvlieg, M. no date. Project outline: Willmore Wilderness Park Range Project (C.D. 14).

Quaedvlieg, M., Gunderson, G. and Cook, A. 1973. Willmore-McIntyre Porcupine coal lease survey--1973. Alberta Fish and Wildlife Division, Wildlife Inventory, Job Completion Report XII. Unpublished Report.

Reimchen, T.H.F. and Bayrock, L.A. 1977. Surficial geology and erosion potential Rocky Mountains and Foothills of Alberta. Prepared for Alberta Environment. Open File 1977-14.

Resource Data Branch. 2003. Crown vegetation inventory. Resource Data Branch, Spatial Data Browser, Sustainable Resources Development internal website. (http://inf.env.gov.ab.ca/inf/site.html).

Resource Data Branch. 2003b. Ecological land survey site description manual – 2nd edition. Resource Data Branch, Strategic Corporate Services Division, Alberta Sustainable Resources Development.

Ripley, T.D. 2003. Bull trout (*Salvelinus confluentus*) in the Kakwa River watershed: linking fisheries and land management using resource selection functions. Masters Thesis. University of Alberta, Edmonton.

Ripley, T.D. 1998. A stock assessment of the Kakwa River arctic grayling (*Thymallus arcticus*) population, Fall 1997. Alberta Conservation Association, Fisheries Management Division, Northwest Boreal Region.

Rowe, J.S. 1972. Forest regions of Canada. Department of Environment, Canadian Forestry Service. Pub. No. 1300.

Russell, A.P. and Bauer, A.M. 1993. The amphibians and reptiles of Alberta. University of Calgary Press, Calgary and University of Alberta Press, Edmonton, Alberta.

Sawyer, S.B. 1980. Summary of investigations into an historically interesting area of Kakwa Provincial Park. Interpretive Historical Planner.

Schmidt, B.C., D.A. Macaulay, N.G. Kondla, D. Lawrie and G. Anweiler. 2003. Additional butterfly records from Alberta, 1999-2002. Blue Jay 61:110-124.

Scotter, G.W. and Flygare, H. 1986. Wildflowers of the Canadian Rockies. Hurtig Publishers Ltd., Toronto, Ontario.

Semenchuk, G.P. (ed). 1992. The atlas of breeding birds of Alberta. Federation of Alberta Naturalists, Edmonton.

Smith, H. 1993.Alberta mammals - an atlas and guide. The Provincial Museum of Alberta, Edmonton, Alberta.

Stelfox, J.G. 1976. Range ecology of the Rocky Mountain bighorn sheep. Canadian Wildlife Service. Report No. 39.

Stelfox, J.G. 1966. Caribou abundance and distribution in northwest Alberta and the proposed 1966 season. Alberta Fish and Wildlife Division. Unpublished Report.

Stelfox, J.G. 1960. Big game survey - Muskeg River west to headwater of Sheep Creek (Athabasca Special Area). Alberta Fish and Wildlife Division. Unpublished Report.

Stott, D.F. 1967. The Cretaceous Smoky Group, Rocky Mountain Foothills, Alberta and British Columbia. Geological Survey of Canada Bulletin 132.

Stott, D.F. 1963. Stratigraphy of the Lower Cretaceous Fort St. John Group and Gething and Cadomin Formations. Foothills of Northern Alberta and British Columbia. Geological Survey of Canada Paper 62-39.

Stott, D.F. 1960. Cretaceous rocks between Smoky and Pine rivers, Rocky Mountain Foothills, Alberta and British Columbia. Geological Survey of Canada Paper 60-16.

Strong, W.L. and Thompson, J.M. 1995. Ecodistricts of Alberta: summary of biophysical attributes. Prepared for: Resource Data Division, Alberta Environmental Protection, Edmonton, Alberta.

Strong, W.L. and Anderson, H.G. 1980. Ecological land classification and evaluation reference manual. Resource Inventory and Appraisal, Alberta Energy and Natural Resources, Edmonton, Alberta.

Szkorupa, T.D. 2002. Multi-scale habitat selection by mountain caribou in west-central Alberta. Masters Thesis, University of Alberta, Edmonton, Alberta.

Szkorupa, T. 2001. 2000/2001 Progress report on caribou research in West Central Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 23, Edmonton, Alberta.

Takats, L. and Priestley, C. 2002. Alberta amphibian call surveys - a pilot year: final report. Fish and Wildlife Division, Alberta Sustainable Resource Development, Alberta Species at Risk Report No. 53.

Thera, T. and Wildeman, A. 2001. Cumulative effects of watershed disturbances on fish communities in the Kakwa and Simonette watersheds progress report. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 14, Edmonton, Alberta.

Timoney, K. 1998. Environmentally significant areas inventory of the Rocky Mountain natural region of Alberta. Prepared for: Corporate Management Service, Alberta Environmental Protection, Edmonton, Alberta.

Tokarsky, O. 1979. Geology and hydrogeology near Torrens River at Sherman Meadows.

Troubridge, J.T. 1997. Revision of the nearctic species of the genus Entephria Huebner (Lepidoptera: Geometridae, Larentiinae). Entomologica Scandinavica. 28(2): 121-139.

Twardy, A.G. and Corns, I.G.W. 1980. Soil survey and interpretations of the Wapiti map area, Alberta. Alberta Research Council, Alberta Institute of Pedology. Alberta Research Council Bulletin 39.

Vitt, D.H., Halsey, L.A., Thorman, M. and Martin, T. 1996. Peatland inventory of Alberta phase I: overview of peatland resources in natural regions and

subregions of the province. Peatland Resource Centre, Devonian Botanic Garden, University of Alberta, Edmonton, Alberta.

Vitt, D.H., Marsh, J.E. and Bovey, R.B. 1988.Mosses, lichens and ferns of northwest North America. Lone Pine Publishing, Edmonton, Alberta.

Watters, D. 1975. Preliminary survey of Solomon Creek: twp. 51, rge. 27, w5.Fish and Wildlife Division, Alberta Energy and Natural Resources.

West-Central Alberta Caribou Standing Committee. Periodical. Research News - To the Members of the West Central Alberta Caribou Standing Committee. University of Alberta.

Wingert, K. and Markham, B.J. 1974. Fish and Wildlife Report - Kakwa Falls Study. Land Use Assignment Committee.

Willoughby, M.G. 1999. Range plant community types and carrying capacity for the sub-alpine and alpine subregions - first approximation. Environmental Protection, Land and Forest Service.

Willoughby, M.G. and Smith, D. 1997. Range plant community types and carrying capacity for the upper foothills subregion- second approximation. Environmental Protection, Lands and Forest Services.

4.2 Databases and Web Sites

Alberta Parks and Protected Areas. 2003. Alberta Natural Heritage Information Centre (ANHIC). Accessible through Alberta Parks and Protected Areas, Alberta Community Development.

Alberta Sustainable Resource Development. Fisheries Management Information System (FMIS)- database. Accessible through Alberta Sustainable Resource Development, Fish and Wildlife Division, Fisheries Management Branch.

Alberta Sustainable Resource Development and the Alberta Conservation Association. Biodiversity/Species Observation Database (BSOD). Accessible through Alberta Sustainable Resource Development, Fish and Wildlife Branch.

Caribib', Caribou bibliography with 3000+ records.

Environment Monitoring and Evaluation Branch. Hydrometric Station Data. Accessible through Environmental Assurance, Alberta Environment. Contact

Environment Monitoring and Evaluation Branch. Miscellaneous Lake Levels (MLL). Accessible through Environmental Assurance, Alberta Environment.

GPS Collar Database. Digital format (Excel), differentially corrected and updated at the University of Alberta, Dept. of Renewable Resources.

Mountain Caribou Study web site at http://www.deer.rr.ualberta.ca/research/caribou

Resource Data Branch. Ecological Site Information System (ESIS) - database. Accessible through Alberta Sustainable Resource Development, Resource Data Branch.

Resource Data Branch. Crown vegetation inventory (Alberta Vegetation Inventory AVI). Resource Data Branch, Spatial Data Browser, Sustainable Resources Development internal website. (http://inf.env.gov.ab.ca/inf/site.html)

VHF database for caribou in west-central Alberta. Digital format (Excel), revised and continuously updated at the University of Alberta, Dept. of Renewable Resources.

Appendix 1

Information available in ESIS database. Much of the data stored in ESIS has been collected according to standardized methods, which have evolved over a number of years (Resource Data Branch 2003b, Alberta Environmental Protection 1994c, Kocaoglu 1990, Strong and Anderson 1980, Boyacioglu 1974).

Other Plot # 'ESIS info'	Plot Number	Study (survey year)	Available Information		
			Site	Soils	Veg
Kakwa Wildland Provincial Park – 18 plots					
31GP4583	9	Deep Basin (1982)	·	·	
31GP7474	33	Deep Basin (1982)	·	·	
31GP7477	36	Deep Basin (1982)	·	·	
31GP7478	37	Deep Basin (1982)	·	·	
31GP7480	39	Deep Basin (1982)	·	·	
31GP7481	40	Deep Basin (1982)	·	·	
31GP7499	58	Deep Basin (1982)	·	·	
31GP7500	59	Deep Basin (1982)	·	·	
31GP8625	120	Deep Basin (1982)	·	·	
31GP8628	123	Deep Basin (1982)	·	·	
31GP8629	124	Deep Basin (1982)	·	·	
31GP8633	128	Deep Basin (1982)	·	·	
31GP8637	132	Deep Basin (1982)	·	·	
31GP8638	133	Deep Basin (1982)	·	·	
31GP7479	38	Deep Basin (1982)	·	·	
31GP7498	57	Deep Basin (1982)	·	·	
31GP8627	122	Deep Basin (1982)	·	·	
34GP3124	37	Deep Basin (1985)	·	·	·
Rock Lake-Solomon Creek Wildland Provincial Park – 28 plots					
34PS1601	597	Permanent sample plot (1994)	·	·	·
37YH1141	139	Yellowhead (1986)	·	·	·
37YH1147	145	Yellowhead (1986)	·	·	·
37YH1230	228	Yellowhead (1986)	·	·	·
37YH1232	230	Yellowhead (1986)	·	·	·
37YH1233	231	Yellowhead (1986)	·	·	·
37YH1236	234	Yellowhead (1986)	·	·	·
37YH1237	235	Yellowhead (1986)	·	·	·
37YH1231	229	Yellowhead (1986)	·	·	·
37YH1235	233	Yellowhead (1986)	·	·	·
37YH1136	135	Yellowhead (1986)	·	·	·
37YH1184	182	Yellowhead (1986)	·	·	·
37YH1234	232	Yellowhead (1986)	·	·	·
SVHTP03	3	Solomon Valley HTP (1998)	·	?	?
VINSN07	7	Tom Vinson Grazing Lease (1998)	·		·
VINSN08	8	Tom Vinson Grazing Lease (1998)	·		·
MH1'85	22	Willmore 85 & 88 (1985)	·		·
MH2'85	23	Willmore 85 & 88 (1985)	·		·
MC1'87	24	Willmore 85 & 88 (1987)	·		·

Other Plot # 'ESIS info'	Plot Number	Study (survey year)	Available Information		
			Site	Soils	Veg
MH1'87	25	Willmore 85 & 88 (1988)	·		·
94JD9010	9010	Jasper Park 76-79 (1979)	·	·	·
94JE9018	9018	Jasper Park 76-79 (1979)	·	·	·
94JE9001	9001	Jasper Park 76-79 (1979)	·	·	·
94LC9005	9005	Jasper Park 76-79 (1979)	·	·	·
94SJ9002	9002	Jasper Park 76-79 (1979)	·	·	·
94SJ9014	9014	Jasper Park 76-79 (1979)	·	·	·
95WCA02	26	West central Alberta (1995)	·	·	·
95WCA02	27	West central Alberta (1995)	·	·	·
Willmore Wilderness Park – 84 plots					
34GP0108	45	Deep Basin (1985)	·	·	·
34GP0109	46	Deep Basin (1985)	·	·	·
34GP0114	51	Deep Basin (1985)	·	·	·
34GP0115	52	Deep Basin (1985)	·	·	·
34GP0125	61	Deep Basin (1985)	·	·	·
34GP0116	53	Deep Basin (1985)	·	·	·
37BF1021	140	Berland – Fox Creek (1983)	·	·	·
67GC3915	4	Grande Cache BGC (1979)	·	·	·
SN1'85	3	Aspen Cutblock (1985)	·		·
SUNSET	99	Rangeland Reference Areas (1998)	·		·
MONAGH	100	Rangeland Reference Areas (1998)	·		·
SULPI98	101	Rangeland Reference Areas (1998)	·		·
SUKPO98	102	Rangeland Reference Areas (1998)	·		·
HAYO98	106	Rangeland Reference Areas (1998)	·		·
EAGNES	98	Rangeland Reference Areas (1998)	·		·
HAYI98	105	Rangeland Reference Areas (1998)	·		·
WR1'88	1	Willmore (1985-88)	·		·
WR2'88	2	Willmore (1985-88)	·		·
IT1'88	3	Willmore (1985-88)	·		·
TC1'88	4	Willmore (1985-88)	·		·
TC2'88	5	Willmore (1985-88)	·		·
TC3'88	6	Willmore (1985-88)	·		·
SR1'84	9	Willmore (1985-88)	·		·
SR2'84	10	Willmore (1985-88)	·		·
SR3'84	11	Willmore (1985-88)	·		·
WH1'84	12	Willmore (1985-88)	·		·
WH2'84	13	Willmore (1985-88)	·		·
WH3'84	14	Willmore (1985-88)	·		·
WH4'84	15	Willmore (1985-88)	·		·
CC1'84	16	Willmore (1985-88)	·		·
CC2'84	17	Willmore (1985-88)	·		·
EN1'88	18	Willmore (1985-88)	·		·
EN2'88	19	Willmore (1985-88)	·		·
EN4'88	21	Willmore (1985-88)	·		·
SWS1'84	27	Willmore (1985-88)	·		·
MO1'84	28	Willmore (1985-88)	·		·
MO2'84	29	Willmore (1985-88)	·		·
LP1'85	30	Willmore (1985-88)	·		·

Other Plot # 'ESIS info'	Plot Number	Study (survey year)	Available Information		
			Site	Soils	Veg
WALT1	31	Willmore (1985-88)	·		·
WALT2	32	Willmore (1985-88)	·		·
MUSK1	33	Willmore (1985-88)	·		·
MUSK2	34	Willmore (1985-88)	·		·
PERSIM1	36	Willmore (1985-88)	·		·
PERSIM2	37	Willmore (1985-88)	·		·
PT3'85	38	Willmore (1985-88)	·		·
SNOWCR2	40	Willmore (1985-88)	·		·
SBERLA1	42	Willmore (1985-88)	·		·
SBERLA2	43	Willmore (1985-88)	·		·
NBERLA1	44	Willmore (1985-88)	·		·
NBERLA3	46	Willmore (1985-88)	·		·
SUNCRK1	47	Willmore (1985-88)	·		·
SUNCRK2	48	Willmore (1985-88)	·		·
SUNCRK3	49	Willmore (1985-88)	·		·
SUNCRK4	50	Willmore (1985-88)	·		·
SUNCRK5	51	Willmore (1985-88)	·		·
ADAMCR3	52	Willmore (1985-88)	·		·
ADAMCR2	53	Willmore (1985-88)	·		·
ADAMCR4	54	Willmore (1985-88)	·		·
SK2'84	58	Willmore (1985-88)	·		·
SK3'84	59	Willmore (1985-88)	·		·
SK4'84	60	Willmore (1985-88)	·		·
SK6'84	62	Willmore (1985-88)	·		·
SK7'84	63	Willmore (1985-88)	·		·
SK8'84	64	Willmore (1985-88)	·		·
SK9'84	65	Willmore (1985-88)	·		·
SK1'85	66	Willmore (1985-88)	·		·
LA1'85	70	Willmore (1985-88)	·		·
SM1'85	71	Willmore (1985-88)	·		·
MW1'85	72	Willmore (1985-88)	·		·
COR1'85	73	Willmore (1985-88)	·		·
NDC1'84	74	Willmore (1985-88)	·		·
SC1'84	75	Willmore (1985-88)	·		·
NDC2'84	76	Willmore (1985-88)	·		·
COC1'85	80	Willmore (1985-88)	·		·
SUNCRK6	84	Willmore (1985-88)	·		·
EN3'88	20	Willmore (1985-88)	·		·
HORSE1	35	Willmore (1985-88)	·		·
SNOWCR1	39	Willmore (1985-88)	·		·
SNOWCR3	41	Willmore (1985-88)	·		·
NBERLA2	45	Willmore (1985-88)	·		·
SK1'84	57	Willmore (1985-88)	·		·
SK5'84	61	Willmore (1985-88)	·		·
94LC9163	9163	Jasper Park (1976-79)	·	·	·
94PA9091	9091	Jasper Park (1976-79)	·	·	·

Appendix 2

ANHIC element occurrences within the study area.

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
Kakwa Wildland Provincial Park (See				
3529	Athalamia hyalina	Liverwort	S2	Kakwa Falls
3529	Scapania irrigua	Liverwort	S2	Kakwa Falls
3529	Blindia acuta (sharp-pointed weissia)	Moss	S2	Kakwa Falls
3529	Brachythecium nelsonii	Moss	S2	Kakwa Falls
3529	Bryum knowltonii	Moss	S1	Kakwa Falls
3529	Campylium polygonum	Moss	S3	Kakwa Falls
3529	Cynodontium tenellum	Moss	S2S3	Kakwa Falls
3529	Dichelyma falcatum	Moss	S1	Kakwa Falls
3529	Didymon johansenii	Moss	S2	Kakwa Falls
3529	Didymon subandreaeoides	Moss	S2	Kakwa Falls
3529	Drepanocladus crassicostatus	Moss	S2	Kakwa Falls
3529	Mnium ambiguum	Moss	S1S2	Kakwa Falls
3529	Myurella tenerrima	Moss	S2	Kakwa Falls
3529	Orthothecium intricatum	Moss	S1	Kakwa Falls
3529	Orthothecium strictum	Moss	S1	Kakwa Falls
3529	Orthotrichum pallens	Moss	S2	Kakwa Falls
3529	Philonotis marchia	Moss	S1	Kakwa Falls
3529	Scouleria aquatica	Moss	S2	Kakwa Falls
3529	Seligeria campylopoda	Moss	S2	Kakwa Falls
3529	Seligeria donnia (Donian beardless moss)	Moss	S2	Kakwa Falls
3529	Seligeria subimmersa	Moss	S1	Kakwa Falls
3529	Timmia norvegica	Moss	S2	Kakwa Falls
3529	Anomobryum filiforme	Moss	S1	Kakwa Falls
3541	Arnica amplexicaulis (stem-clasping arnica)	Vascular	S2	Kakwa Falls
3533	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Kakwa Falls
3534	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Upper Kakwa Falls
3532	Salix raupii (Raup's willow)	Vascular	S1	Lower Kakwa Falls
7748	Thuja plicata (western red cedar)	Vascular	S1S2	North of Francis Peak
3538	Carex arcta (narrow sedge)	Vascular	S1	Dead Horse Meadows
5923	Carex heleonastes (Hudson Bay sedge)	Vascular	S2	Putzy Creek
3531	Agrostis exarata (spike red top)	Vascular	S2	Lower Kakwa Falls
3535	Trisetum wolfii (awnless trisetum)	Vascular	S1	Dead Horse Meadows
Sulphur Gates Provincial Recreation Area				
4700	Homalothecium pinnatifidum	Moss	S2?	Mount Stearn
Rock Lake-Solomon Creek Wildland Provincial Park				
2983	Amblyodon dealbatus	Liverwort	S2	Mumm Creek
2983	Cynodontium strumiferum	Moss	S2S3	Mumm Creek

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
2983	Didymodon johansenii	Moss	S2	Mumm Creek
2983	Orthothecium strictum	Moss	S1	Mumm Creek
2983	Schistidium tenerum (thread bloom moss)	Moss	S1	Mumm Creek
2983	Coscinodon calyptratus (sieve-toothed big calyptra moss)	Moss	S2	Mumm Creek
2983	Bryocaulon divergens	Moss	S1	Moosehorn Lake
5710	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Solomon Creek
Willmore Wilderness Park				
5693	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Muskeg River
5697	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Sulphur River
5699	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Berland River
5700	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Little Berland River
5702	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Smoky River
5707	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Rock Creek
5709	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Wildhay River
5777	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Jackpine River
5779	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Muddywater River
5780	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Sheep Creek
6873	Histrionicus histrionicus (Harlequin duck)	Bird	S3B	Hardscrabble Creek
3004	Lemmus sibiricus (Brown Lemming)	Mammal	S1	Desolation Creek
7396	Rangifera tarandus pop 1 (Woodland caribou – mountain ecotype)	Mammals	S1	Pope Crest
7948	Festuca altaica-Leymus innovatus community (northern rough fescue-hairy wild rye community)	Vegetation Community		Thorean Creek
7949	Festuca altaica-Leymus innovatus community (northern rough fescue-hairy wild rye community)	Vegetation Community		Thorean Creek
7950	Festuca altaica-Deschampsia caespitosa community (northern rough rough fescue-tufted harigrass community)	Vegetation Community		Wildhay River
7951	Festuca altaica-Deschampsia caespitosa community (northern rough fescue-tufted hairgrass community)	Vegetation Community		Thorean Creek
7048	Lycaena phlaeas (little copper)	Butterfly	S2	Adams Lookout, near summit
5304	Lycaena phlaeas (little copper)	Butterfly	S2	Adams Creek
7137	Lycaena phlaeas (little copper)	Butterfly	S2	below Adams Lookout
7137	Lycaena cupreus henryae (Henry's copper)	Butterfly	S2	below Adams Lookout
7048	Boloria napaea (Napaea fritillary)	Butterfly	S2	Adams Lookout, near summit
7228	Boloria napaea (Napaea fritillary)	Butterfly	S2	Planet Creek
7229	Boloria napaea (Napaea fritillary)	Butterfly	S2	Berland River between Hoff and Berland Ranges
7229	Boloria improba (dingy arctic fritillary)	Butterfly	S2	Berland River between Hoff and Berland Ranges
7048	Boloria improba (dingy arctic fritillary)	Butterfly	S2	Adams lookout, near

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
				summit
7137	Boloria epithore (Pacific fritillary)	Butterfly	S2	below Adams Lookout
7048	Boloria astarte (astarte fritillary)	Butterfly	S2	Adams Lookout
7229	Boloria astarte (astarte fritillary)	Butterfly	S2	Berland River between Hoff and Berland Ranges
7137	Boloria astarte (astarte fritillary)	Butterfly	S2	below Adams Lookout
7048	Erebia Magdalena (Magdalena alpine)	Butterfly	S1	Adams Lookout, near summit
2991	Barbilophozia kunzeana	Liverwort	S2	Along Wildhay River
8287	Barbilophozia kunzeana	Liverwort	S2	West of rock lake
8287	Barbilophozia quadriloba	Liverwort	S2	West of Rock Lake
2491	Barbilophozia quadriloba	Liverwort	S2	2.9 miles west of gate to Rock Lake Park
8287	Cephalozia pleniceps	Liverwort	S2S3	West of Rock Lake
8287	Cephalozia rubella	Liverwort	S?	West of Rock Lake
2991	Chiloscyphus pallescens	Liverwort	S1	2.9 miles west of gate to park at Rock Lake
2991	Chiloscyphus polyanthes	Liverwort	S1	2.9 miles west of gate to park at Rock Lake
2991	Scapania glaucocephala	Liverwort	S1	2.9 miles west of gate to park at Rock Lake
8287	Tritomaria scitula	Liverwort	S2S3	West of Rock Lake
2997	Amblyodon dealbatus	Moss	S2	Along Wildhay River west of Rock Lake
2991	Bryum algovicum	Moss	S2	Along Wildhay River west of Rock Lake
2992	Bryobrittonia longipes	Moss	S3	Along Wildhay River west of Rock Lake
2982	Dactylina beringica	Lichen	S2S3	Eagles Nest Pass
2982	Bryoria trichodes (old man's beard)	Lichen	SU	Eagles Nest Pass
5280	Osmorhiza purpurea (purple sweet cicely)	Vascular	S2	Cote Creek
3000	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Eagles Nest cabin
5451	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Sulphur River
5457	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Childear Mountain
5498	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Resthaven
5501	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Azure Lake
5508	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Eagles Nest Pass
5515	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Bury Ridge
6452	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Jack-knife Pass
6536	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Hardscrabble Pass

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
6559	Antennaria monocephala (one-headed everlasting)	Vascular	S2	North Azure Lake
6562	Antennaria monocephala (one-headed everlasting)	Vascular	S2	Mount Cote
5515	Artemesia furcata var. furcata (forked wormwood)	Vascular	S1	Bury Ridge
5280	Erigeron flagellaris (creeping fleabane)	Vascular	S1	Cote Creek
5445	Erigeron trifidus (trifid-leaved fleabane)	Vascular	S1S2	Eagles Nest Creek
5451	Erigeron trifidus (trifid-leaved fleabane)	Vascular	S1S2	Sulphur River
5508	Erigeron trifidus (trifid-leaved fleabane)	Vascular	S1S2	Eagles Nest Pass
5515	Erigeron trifidus (trifid-leaved fleabane)	Vascular	S1S2	Bury Ridge
6452	Erigeron trifidus (trifid-leaved fleabane)	Vascular	S1S2	Jack-knife Pass
2998	Arabis lemmonii (Lemon's rock cress)	Vascular	S2	Summit cabin
3001	Braya purpurescens (alpine braya)	Vascular	S1S2	Persimmon Range
5445	Braya purpurescens (alpine braya)	Vascular	S1S2	Eagles Nest Creek
6536	Cardamine bellidifolia (alpine bitter cress)	Vascular	S2	Hardscrabble Pass
6556	Cardamine bellidifolia (alpine bitter cress)	Vascular	S2	Hardscrabble Pass
5280	Cardamine oligosperma var. kamtschatica (mountain cress)	Vascular	S2	Cote Creek
6556	Cardamine oligosperma var. kamtschatica (mountain cress)	Vascular	S2	Hardscrabble Creek
6559	Cardamine oligosperma var. kamtschatica (mountain cress)	Vascular	S2	North Azure Lake
6552	Cardamine oligosperma var. kamtschatica (mountain cress)	Vascular	S2	Mount Cote
8192	Cardamine oligosperma var. kamtschatica (mountain cress)	Vascular	S2	Mount Cote
6452	Draba longipes (whitlow-grass)	Vascular	S1S2	Jack-knife Pass
3005	Draba longipes (whitlow-grass)	Vascular	S1S2	Mount Cote
2961	Draba longipes (whitlow-grass)	Vascular	S1S2	Eagles Nest Pass
5445	Draba porsildii (Porsild's whitlow-grass)	Vascular	S2	Eagles Nest Pass
5452	Draba porsildii (Porsild's whitlow-grass)	Vascular	S2	Sulphur River
5457	Draba porsildii (Porsild's whitlow-grass)	Vascular	S2	Childear Mountain
5508	Draba porsildii (Porsild's whitlow-grass)	Vascular	S2	Eagles Nest Pass
5446	Campanula uniflora (alpine harebell)	Vascular	S2	Sunset Creek
5451	Campanula uniflora (alpine harebell)	Vascular	S2	Sulphur River
5457	Campanula uniflora (alpine harebell)	Vascular	S2	Childear Mountain
5508	Campanula uniflora (alpine harebell)	Vascular	S2	Eagles Nest Pass
5298	Campanula uniflora (alpine harebell)	Vascular	S2	Upper Wildhay Drainage
2981	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Eagles Nest Pass
3001	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Persimmon Range
5508	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Eagles Nest Pass
5515	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Bury Ridge
5538	Minuartia elegans (purple alpine	Vascular	S1	Sulphur River

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
	sandwort)			
5445	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Eagles Nest Creek
6452	Minuartia elegans (purple alpine sandwort)	Vascular	S1	Jack-knife Pass
5515	Silene involucrate (alpine bladder catchfly)	Vascular	S1S2	Bury Ridge
5276	Vaccinium uliginosum (bog bilberry)	Vascular	S2	Cote Creek
5446	Oxytropis campestris var. davisii	Vascular	S2?	Sunset Creek
5447	Oxytropis campestris var. davisii	Vascular	S2?	Childear Mountain
5515	Oxytropis campestris var. davisii	Vascular	S2?	Bury Ridge
6555	Oxytropis campestris var. davisii	Vascular	S2?	Rocky Pass
2947	Ribes laxiflorum (mountain currant)	Vascular	S2	Jackpine Pass
5304	Ribes laxiflorum (mountain currant)	Vascular	S2	Adams Creek
5280	Epilobium lactiflorum (willowherb)	Vascular	S2	Cote Creek
5445	Papaver radicatum ssp. Kluanensis (alpine poppy)	Vascular	S2	Eagles Nest Creek
5538	Papaver radicatum ssp. Kluanensis (alpine poppy)	Vascular	S2	Sulphur River
5275	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Wildhay River
5279	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Hoff Range
5276	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Cote Creek
5280	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Cote Creek
5298	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Upper Wildhay Drainage
5445	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Eagles Nest Creek
5451	Pyrola grandiflora (arctic wintergreen)	Vascular	S2	Sulphur River
5304	Aquilegia Formosa (sitka columbine)	Vascular	S2	Adams Creek
2947	Aquilegia Formosa (sitka columbine)	Vascular	S2	Jackpine Pass
2961	Ranunculus nivalis (snow buttercup)	Vascular	S1	Eagles Nest Pass
3002	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Persimmon Range
5276	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Cote Creek
5280	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Cote Creek
5430	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Cote Creek
6452	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Jack-knife Pass
6555	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Rocky Pass
6562	Ranunculus occidentalis var. brevistylus (western buttercup)	Vascular	S2	Mount Cote
5445	Salix alaxensis var. alaxensis (Alaska willow)	Vascular	S2	Eagles Nest Creek
5276	Salix commutata (changeable willow)	Vascular	S2	Cote Creek
5289	Salix commutata (changeable willow)	Vascular	S2	Eagles Nest Creek
5280	Salix commutata (changeable willow)	Vascular	S2	Cote Creek

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
5430	Salix commutata (changeable willow)	Vascular	S2	Cote Creek
5430	Saxifraga ferruginea (saxifrage)	Vascular	S2	Cote Creek
5498	Saxifraga ferruginea (saxifrage)	Vascular	S2	Resthaven
6556	Saxifraga ferruginea (saxifrage)	Vascular	S2	Hardscrabble Pass
3003	Saxifraga flagellaris spp. Setigera (spiderplant)	Vascular	S2	Eagles Nest Cabin
5275	Saxifraga flagellaris spp. Setigera (spiderplant)	Vascular	S2	Wildhay River
2961	Saxifraga flagellaris spp. Setigera (spiderplant)	Vascular	S2	Eagles Nest Pass
5446	Saxifraga flagellaris spp. Setigera (spiderplant)	Vascular	S2	Sunset Creek
5515	Saxifraga flagellaris spp. Setigera (spiderplant)	Vascular	S2	Bury Ridge
3005	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Mount Cote
2981	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Eagles Nest Pass
5501	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Azure Lake
5538	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Sulphur River
6452	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Jack-knife Pass
6562	Saxifraga nelsoniana ssp. Porsildiana (Nelson's saxifrage)	Vascular	S2	Mount Cote
3001	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Persimmon Range
5446	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Sunset Creek
5452	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Sulphur River
5457	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Childear Mountain
5508	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Eagles Nest Pass
5501	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	Azure Lake
6559	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	North Azure Lake
6557	Saxifraga nivalis (alpine saxifrage)	Vascular	S2	North Azure Lake
5280	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Cote Creek
2961	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Eagles Nest Pass
5434	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Cote Creek
5445	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Eagles Nest Creek
5451	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Sulphur River
5457	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Childear Mountain
5489	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Hayden Ridge
6452	Pedicularis capitata (large-flowered	Vascular	S2	Jack-knife Pass

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
	lousewort)			
6536	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Hardscrabble Pass
6555	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Rocky Pass
6562	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Mount Cote
6561	Pedicularis capitata (large-flowered lousewort)	Vascular	S2	Mount Cote
5445	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Eagles Nest Creek
5446	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Sunset Creek
5489	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Hayden Ridge
5515	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Bury Ridge
2961	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Eagles Nest Pass
6452	Pedicularis flamnea (flame-colored lousewort)	Vascular	S2	Jack-knife Pass
3001	Pedicularis lanata (woolly lousewort)	Vascular	S2	Persimmon Range
6452	Pedicularis lanata (woolly lousewort)	Vascular	S2	Jack-knife Pass
5275	Pedicularis lanata (woolly lousewort)	Vascular	S2	Wildhay River
5279	Pedicularis lanata (woolly lousewort)	Vascular	S2	Hoff Range
2961	Pedicularis lanata (woolly lousewort)	Vascular	S2	Eagles Nest Pass
5298	Pedicularis lanata (woolly lousewort)	Vascular	S2	Upper Wildhay Drainage
5446	Pedicularis lanata (woolly lousewort)	Vascular	S2	Sunset Creek
5457	Pedicularis lanata (woolly lousewort)	Vascular	S2	Childear Mountain
5489	Pedicularis lanata (woolly lousewort)	Vascular	S2	Hayden Ridge
5508	Pedicularis lanata (woolly lousewort)	Vascular	S2	Eagles Nest Pass
5515	Pedicularis lanata (woolly lousewort)	Vascular	S2	Bury Ridge
5445	Pedicularis lanata (woolly lousewort)	Vascular	S2	Eagles Nest Creek
6555	Pedicularis lanata (woolly lousewort)	Vascular	S2	Rocky Pass
5434	Pedicularis longsdorfii spp. Arctica (arctic lousewort)	Vascular	S2	Cote Creek
5515	Pedicularis oederi	Vascular	S1	Bury Ridge
6556	Carex lachenalii (two-parted sedge)	Vascular	S2	Hardscrabble Pass
6562	Carex lachenalii (two-parted sedge)	Vascular	S2	Mount Cote
5501	Carex glacialis (glacier sedge)	Vascular	S2	Azure Lake
5276	Carex heleonastes (Hudson Bay sedge)	Vascular	S2	Cote Creek
5515	Carex incurviformis var. incurviformis (seaside sedge)	Vascular	S2	Bury Ridge
4145	Carex petricosa (stone sedge)	Vascular	S2S3	Eagles Nest Pass
2982	Carex petricosa (stone sedge)	Vascular	S2S3	Eagles Nest Pass
5279	Carex petricosa (stone sedge)	Vascular	S2S3	Hoff Range
2999	Eriophorum callitrix (beautiful cotton grass)	Vascular	S2	Persimmon Range

Dot ID (on ANHIC maps)	Species	Biophysical Feature	S-Rank	General Location Information (more detailed location information exists in ANHIC database)
2987	Festuca altaica (northern rough fescue)	Vascular	S2	Rock Lake Ranger Station
5275	Festuca altaica (northern rough fescue)	Vascular	S2	Wildhay River
5289	Festuca altaica (northern rough fescue)	Vascular	S2	Eagles Nest Creek
2961	Festuca altaica (northern rough fescue)	Vascular	S2	Eagles Nest Pass
5298	Festuca altaica (northern rough fescue)	Vascular	S2	Upper Wildhay Drainage
5304	Festuca altaica (northern rough fescue)	Vascular	S2	Adams Creek
5279	Festuca altaica (northern rough fescue)	Vascular	S2	Hoff Range
5446	Festuca altaica (northern rough fescue)	Vascular	S2	Sunset Creek
5489	Festuca altaica (northern rough fescue)	Vascular	S2	Hayden Ridge
5508	Festuca altaica (northern rough fescue)	Vascular	S2	Eagles Nest Pass
5515	Festuca altaica (northern rough fescue)	Vascular	S2	Bury Ridge
5535	Festuca altaica (northern rough fescue)	Vascular	S2	Wildhay River
5445	Festuca altaica (northern rough fescue)	Vascular	S2	Eagles Nest Creek
6452	Festuca altaica (northern rough fescue)	Vascular	S2	Jack-knife Pass
6555	Festuca altaica (northern rough fescue)	Vascular	S2	Rocky Pass
5430	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Cote Creek
5489	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Hayden Ridge
5498	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Resthaven
5501	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Azure Lake
5515	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Bury Ridge
6536	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	Hardscrabble Pass
6557	Anthoxanthum monticola (alpine sweet grass)	Vascular	S2	North Azure Lake
2982	Cryptogramma stelleri (Steller's rock brake)	Vascular	S2	Eagles Nest Pass
5501	Huperzia haleakalae	Vascular	S2	Azure Lake
6556	Huperzia haleakalae	Vascular	S2	Hardscrabble Pass
2991	Botrychium minganense (mingan grape fern)	Vascular	S2S3	Northwest of Rock Lake
6582	Botrychium minganense (mingan grape fern)	Vascular	S2S3	Jackpine Pass
6589	Botrychium minganense (mingan grape fern)	Vascular	S2S3	Sulphur Creek
2992	Botrychium ascendens (ascending grape fern)	Vascular	S1	Wildhay River west of Rock Lake