KAKWA PROVINCIAL PARK, BC:
DESCRIPTION AND RECREATION POTENTIAL
OF THE NEW PROVINCIAL PARK

by

Jean-Guy Bergeron

B.Sc., Laval University, 1984

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

NATURAL RESOURCES MANAGEMENT

THE UNIVERSITY OF NORTHERN BRITISH COLUMBIA

June 2001

ABSTRACT

The purpose of this project was to gain a better understanding of the Kakwa Park area and to examine the recreation potential. A literature review provided information about the geology and the human history of the area. Official BC Parks reports were an important source of information to situate Kakwa in the context of other protected areas. Personal communications with visitors and field notes were used to describe the trails and routes of the area.

Kakwa Park is at the northern end of a network of protected areas along the Canadian Rocky Mountains beginning at the U.S. border. Although its spectacular scenery is comparable to that found in the southern part of the Rockies, it has received much fewer visitors than the other Rocky Mountain parks. The main reasons have been its distance from large population centres and the lack of road access.

The complexity of its geological structures and the diversity of its rock formations, which are described in this project, have helped to forge the unique character of the area. The deep valleys carved by the passage of the glaciers and separated by high mountain ridges form natural barriers between the different management units of the park. Located along the Continental Divide and mostly buffered from surrounding resource activities, Kakwa plays a major conservation role in a regional context.

The recreation potential of the area has still to be developed. The route and trail system described in the project may contribute to a world-class destination if the area is made more accessible to the public. The two multi-day loop trips listed in the trail and route system traverse all the main natural features of the Main and Front Ranges of the Central Rockies.

This project provides insight on the important conservation role of Kakwa Park in its regional context and in the BC Parks system. The area also has all the attributes for a destination of a high quality wilderness experience.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Roger Wheate for his understanding and patience throughout my graduate project, particularly with the map making component. I would also like to acknowledge the support and guidance in the writing process of Dr. Doug Baker in the chapters on geology and the management units. My original supervisor, Dr. Alan Ewert, deserves credit for getting me started and believing I could do it.

This project is the result of a decade and more of exploration and data collection in the Kakwa area. Some parts of this paper were conceived well before I started my Graduate Study at UNBC. In the last twelve years, I spent a good part of my summer holidays visiting Kakwa. During those weeks I took away from our family vacation, I would like thank my wife Beverly and my son Jarrah for their understanding and support during all those years.

I would like also to thank BC Parks who gave me the opportunity to work as a backcountry host in the Kakwa Recreation Area. Mike Murtha of BC Parks deserves special mention for all the resources that he made available for my project. To the question Mike asked me a few years ago, "What makes Kakwa so unique?", I hope he will find some answers in this paper.

This project is dedicated to my father who always had a profound love for nature and a great respect for all living creatures

1.0 INTRODUCTION

Kakwa Park remains a relatively pristine area without commercial development in spite of its grandiose and breathtaking scenery and great potential for tourism. The beauty of its landscape may rival the southern parks of the Canadian Rockies such as Jasper and Banff National Parks. The few visitors to the area wonder why the tourist potential of the area has not been exploited (personal communication).

The name Kakwa is derived from the Cree word for "porcupine", which are abundant in the area. Kakwa was designated as a class A Provincial Park in B.C. in 1999 (appendix C). As a remote recreation area, little has been written on it in detail. Existing information is scattered, often outdated and generally inaccessible to most interested users. This project aims to help create a knowledge base for Kakwa for future and continuing research, and the basis for a general guide for the new park.

This first chapter will introduce the location, relief, watersheds, vegetation, wildlife, economic background, access from B.C. and Alberta and human history of the area. Chapter Two will situate Kakwa in the context of larger systems such as the Monkman-Kakwa area, the Canadian Rocky Mountains Parks, the Yellowstone to Yukon Conservation Corridor and the adjacent Kakwa Wildland Alberta Provincial Park. In Chapter Three, Kakwa Park will be divided in six management units using three criteria. Chapter Four will present the Geological History of Kakwa. Chapter Five will describe a potential Trail and Route System for the core area of Kakwa Park. Finally, Chapter Six will provide a summary and conclude with some recommendations.

1.1 Geographic Location

Kakwa Park is located approximately 70 kilometres north of the town of McBride, about 180 kilometres east of Prince George and about 170 kilometres from Grande Prairie, Alberta. It is adjacent to the Alberta border (Figure 1.1) and covers 1830 square kilometres of wilderness land in the province of British Columbia. The southeast corner of the park is at Intersection Mountain where the Continental Divide intersects meridian 120 which defines the Alberta border and the park east boundary North of Intersection Mountain. From Intersection Mountain, the Continental Divide crosses Kakwa Park diagonally to its northwest corner, making Kakwa the only park in the Central Rockies laying on both sides of the divide. The limits of the Central Rockies are the Crownest Pass on the south and the transitional zone located between Kakwa Lake and the Peace River (Gadd, 1995).

The main reason why the area has not yet been developed is simple: it is remote and difficult to access. If we look at the location of Kakwa Park on the B.C. map (Figure 1.1), it is far from the main highways and any large urban centres. The area is also isolated by natural and political barriers, such as the Mount Sir Alexander and Mount Dimsdale massif in the west, and the B.C.-Alberta border on the east (Figure 1.2). Access from the north and the south is limited by very steep terrain. If any development had occurred in the Kakwa Lake area it would have been from the east, as the access is easier, but the political barrier that constitutes the B.C.-Alberta border has stopped any initiative of development from Alberta.

Although most of the Kakwa Recreation Area was upgraded to a provincial park in July 1999, a 10 sq. km area is still under Recreation Area status due to the mining

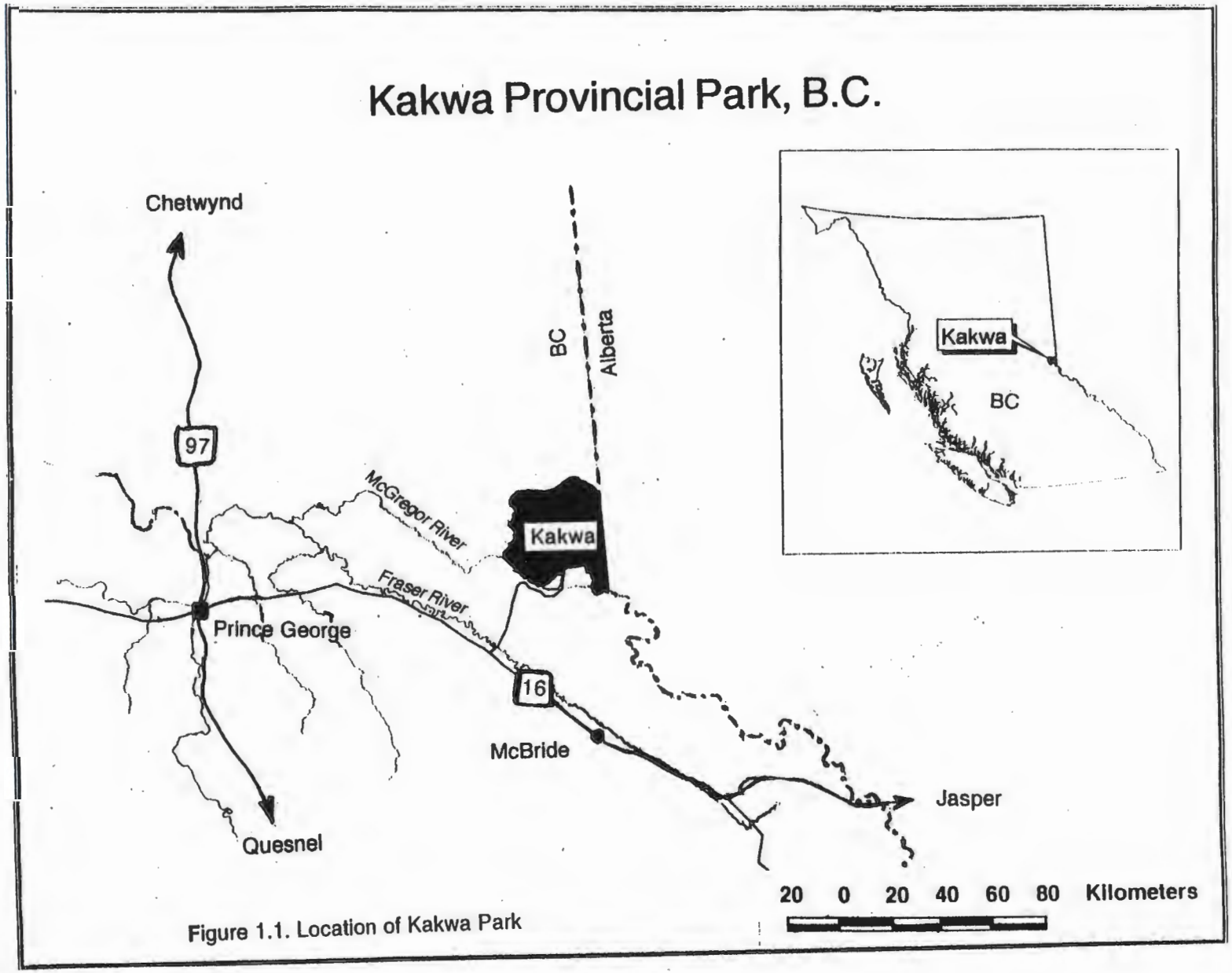

Figure 1.1. Location of Kakwa Park

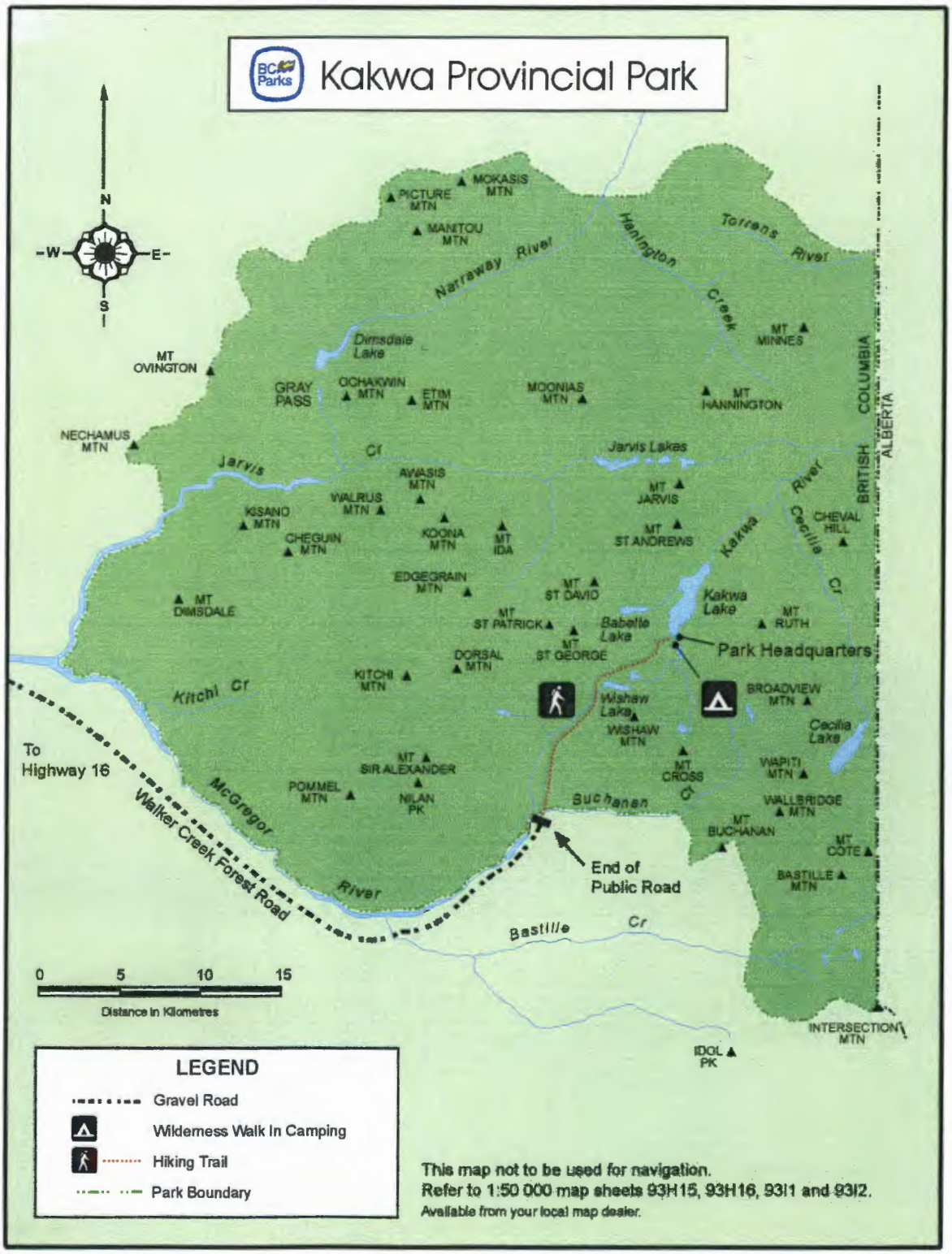

Fig 1.2 Map from BC Parks Web Site

operation at Wishaw Lake (Figure 1.3). The Kakwa Recreation Area includes the Wishaw quartzite quarry site and its transportation corridor along the McGregor River.

Figure 1.3. Mining Operation at Wishaw Lake located in Kakwa Recreation Area

1.2 Relief

Relief is extreme on the west side of the Continental Divide, with elevations ranging from 1000 metres (3000 feet) in the Jarvis Creek Valley to over 3000 metres (10,000 feet) on the highest peaks: Ida 3189 metres (10,400 feet) and Mount Sir Alexander 3270 metres (10,700 feet). Much of the terrain is very steep with cliffs on both sides of the three main valleys (Jarvis Creek, Kitchi Creek and the upper part of the McGregor River). The western part of Kakwa is covered by many glaciers, the largest one located around the summit of Mount Sir Alexander. However, on the

east side of the Continental Divide the relief is less dramatic, with the valleys becoming higher and more open. The two mountains that dominate the landscape on the east are Mount Gorman, 2366 metres (7809 feet) and Kakwa Mountain, 2282 metres (7531 feet) just outside the park boundary.

Four of the main valleys are each dominated by a large body of water (Kakwa, Jarvis Lakes, Cecilia and Dimsdale Lakes); the fifth (Sheep Creek) is characterized by large interconnected meadows. The base of the four valleys average an elevation of 1500 metres (5000 feet). As one goes east, the elevations of the mountains become lower as one approaches the limit of the Rocky Mountain Foothills. At the eastern edge of Kakwa Park, the East Jarvis Creek and the Cecilia Creek valleys intersect the Kakwa River Valley in a wide and open area called Porcupine Flats where the river meanders before dropping at the Upper Kakwa Falls in Alberta. Figure 1.4 shows a three dimensioned perspective image of Kakwa indicating the major valleys and relative relief of the area.

1.3 Watersheds

The Continental Divide crossing Kakwa Park defines its two main watersheds. On the west side of the Divide, the McGregor River and its tributaries, Jarvis Creek and Kitchi Creek, drain into the Pacific Ocean. On the east side of the Divide, the Kakwa River and the Narraway River drain to the northeast into the Arctic Ocean.

The rate of flow in the creeks west of the Divide is much faster than on the east side. Most of the creeks and rivers have their source near the Divide, and are fed by glacier streams. The water of those streams is very cold and loaded with rock flour

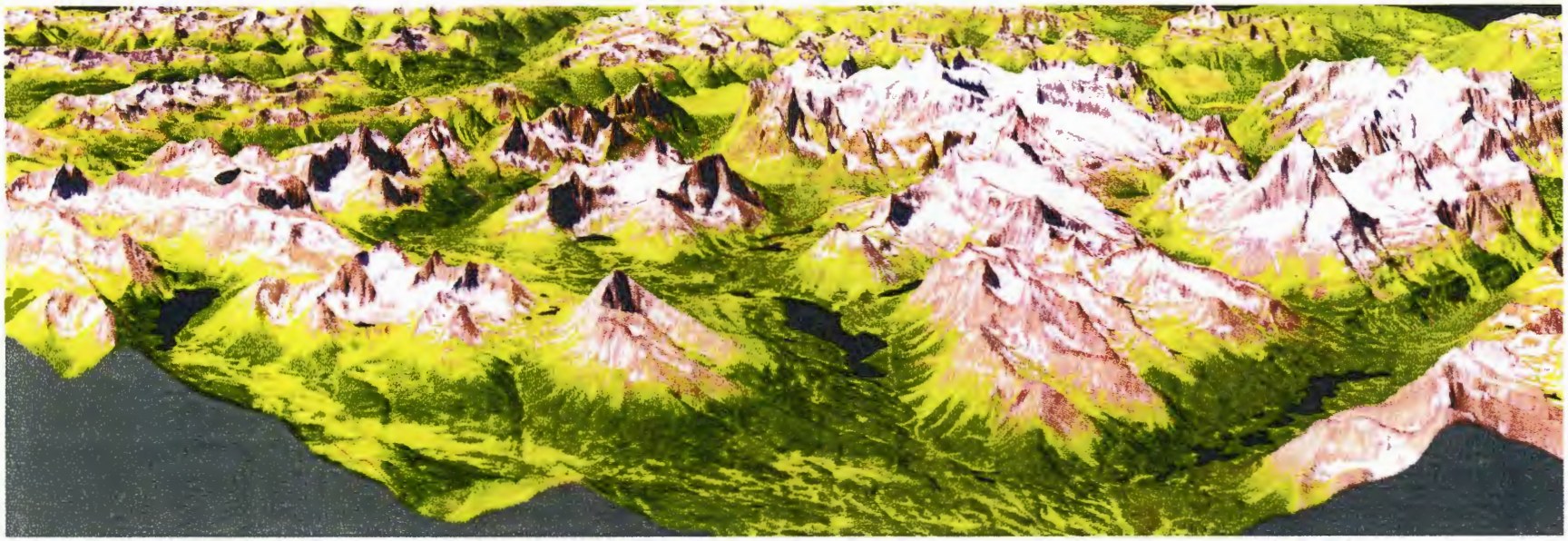

Figure 1.4. 3D perspective image of Landsat data draped over digital elevation model. View is southwest, looking from northeast of Kakwa Lake (center of image).

near their source. Buchanan Creek, which hikers have to cross when the road bridge is out, in order to reach the Kakwa Lake area from the west, is a typical example, fed by streams from the Buchanan glacier.

Many of the important lakes of the area, such as Cecilia and Dimsdale Lakes have the emerald-blue color so characteristic of glacier-fed lakes of the Canadian Rockies. A good place to compare a glacier-fed lake and another not fed by glaciers may be found on each side of Gray Pass on the Northwest corner of Kakwa Park; Dimsdale Lake, a glacier-fed lake has a deep blue color, while Barbara Lake has the dark hue of water otherwise found in lakes outside glacierised mountain ranges.

1.4 Vegetation

About half of the surface of Kakwa Park is covered by alpine tundra, rock and ice. Sub-Boreal Forest covers most of the rest of the area, mainly Engelmann-Spruce and Subalpine Fir. The Interior Wet Belt Forest covers about 2 % of the park and is present in the lower portion of the Jarvis Creek and Kitchi Creek Valleys.The satellite image in figure 1.5 shows the vegetation cover of Kakwa Park.

Kakwa is a the northern limit of the Rocky Mountain Front Ranges and has the only representation of the Front Ranges Ecosection in British Columbia. This ecosection is characterized by alternation of limestone ridges and shale valleys running NW-SE. Cold arctic air often lies undisturbed over the mountains, bringing persistent cold temperatures that results in the Alpine Tundra zone occuring at lower elevations than in the rest of the Central Rockies.

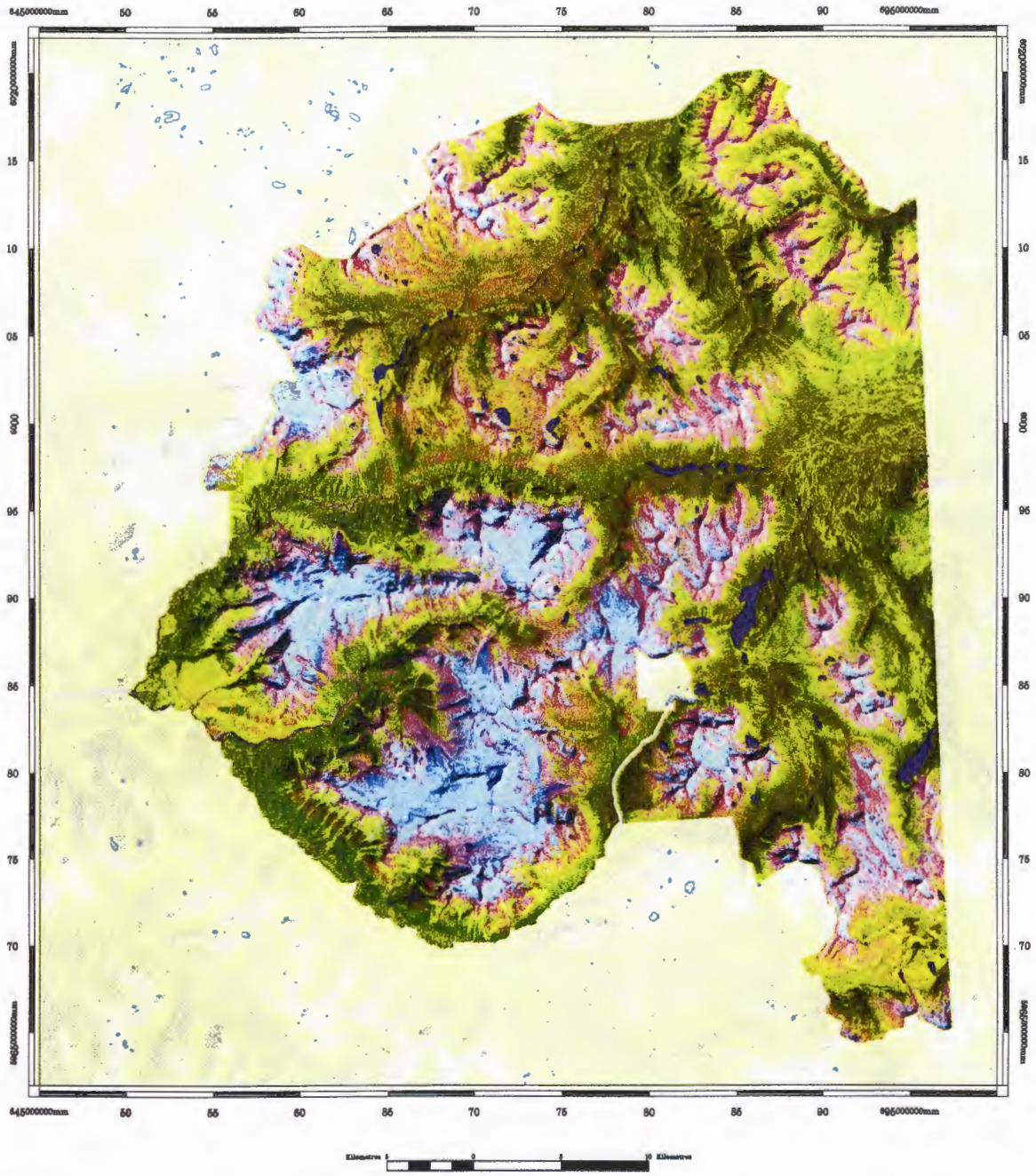

Figure 1.5: Satellite Image of Kakwa Park (Landsat Thematic Mapper, 1994)

The Sub-Boreal Forest is dominated by Engelmann Spruce and Subalpine Fir. A zone of Common Paper Birch is present at the bottom of the Jarvis Creek Valley, above the Interior Wet Belt region. Although, not common, White Bark Pine can be found along Wapumun Lake, south of Kakwa Lake. A variety of wetlands are also present in the Sub-boreal region. The two major groups of wetlands are the Fens characterized by sedge and glandular birch, and the Peat Bogs which contain cotton-grass, common Labrador tea, and different species of peat moss. Porcupine Flats adjacent to the Alberta border contains most of the wetland present in Kakwa Park. Some peat bogs are found along Kakwa River and Cecilia Creek and also along Kakwa Lake where they have been a challenging experience for all terrain vehicles (ATV) coming from Alberta for many years.

The Interior Wet Belt Region present at lower elevations is mostly represented by the Interior Western Red Cedar and the White Spruce. In the Jarvis Creek area, a zone of Western Hemlock and Red Cedar is found above the previous zone. Both the Sub-Boreal and the Interior Wet Belt Regions are influenced by westerly air flows which in turn results in relatively dry conditions on the eastern foothills on the eastern side of the divide (BC Parks , 2001).

1.5 Wildlife

There is a rich diversity of habitats found in Kakwa Park and an abundance of wildlife such as caribou, mountain sheep, mountain goats, moose, elk and grizzly bears. I should not forget to mention the nocturnal visitor who makes his presence noticed around the cabins and outhouses: the porcupine.

Mountain caribou are frequent visitors to the mountainous areas of Kakwa and adjacent areas such as Wilmore Wilderness Park and Kakwa Wildland Park. Caribou habitat in the spring, summer and fall months occurs at elevations greater than 1,800 metres in the alpine and treeline areas. During the winter, their habitat is found at elevations between 1,350 and 1,800 metres. In Kakwa Park, they migrate from the alpine in the fall to the northeast part of the park near Mount Minnes and both sides of Hannington and Torrens Creeks (Edmonds and Smith, 1991).

The grizzly bears in Kakwa Park benefit from a good habitat throughout the park partly because the area has not been significantly fragmented by human disturbance. In the summer, they move up and disperse among the alpine regions, and in the fall they move into the lower valley bottom in search of food for the winter. Grizzly bears are frequently seen in the Babette Lake area where an abundant supply of Glacier Lilies constitutes an important source of nutriments.

Mountain goats are found on very steep and cliffy terrain, usually at high elevations. In Kakwa, they may be seen in all the alpine areas of the park. Their white coat makes them particularly easy to spot on the grey cliffs of the mountainsides.

On the open alpine ridges and the basins of the northeast section of Kakwa Park is an important concentration of Rocky Mountain bighorn sheep that migrate from their winter range in Kakwa Park across the boundaries into Wilmore Wilderness Park and Kakwa Wildland Park in Alberta. Their winter range areas are near Mt. Minnes, the Torrens and Hannington Creeks. Other ungulates such as moose, elk and deer are also seen in the main valleys.

1.6 Economic Background

As with the rest of the Rockies, the Kakwa area was considered as 'wasteland' because it did not present any economic values for the early settlers. The land was too mountainous for agriculture, the exploitation of its forest was not economically viable, and in the Kakwa Park area, the mountain passes too high to be considered for a transportation corridor between Alberta and the West Coast. Although hunting and trapping in the Kakwa area have been an important economic activity for the Peace River residents, only recently have the oil and coal industries become interested in the oil and mineral reserves of the Foothills located in the eastern part of Kakwa Park.

The opening of the Quartzite quarry site at Babette Lake in the late 1970s led to the construction of a tote road along the Kakwa River from Alberta. Later, another road was added to connect to the forestry road in the McGregor Valley on the B.C. side. Although the project had a short life, the road provided motorized access to Kakwa Lake until the road was closed to motorized vehicles in 1989. Another quarry site was later developed at Wishaw Lake and is still in operation today.

1.7 Access from Alberta and B.C.

There are two main accesses to Kakwa Park, one from British Columbia at the southwest corner of the park along the McGregor River, and the other from Alberta at the northeast corner of the park along Kakwa River.

On the British Columbia side, the access from Prince George and McBride is via

the Walker Creek Forestry Road, 135 kilometres east of Prince George and 70 kilometres west of McBride on Highway 16. Extensive logging in the McGregor Valley has left a road with a panoramic view of the spectacular mountains and glaciers of the western portion of Kakwa Park. The public road ends at Buchanan Creek, 85 kilometres from the highway, where a gate prevents unauthorised motorized vehicles from entering in the park. However, wash-outs along the McGregor River between Bastille Creek (Kilometre 73) and Buchanan Creek may make it impassable to two-wheel drive vehicles. The restricted-access road used by park officials and the Wishaw quarry workers continues to Kakwa Lake and Babette Lake. The road provides a good access for mountain bikers and hikers to reach Kakwa Lake. The Park Headquarters and the Kakwa Lake campsite are located 18 kilometres from Buchanan Creek. Due to recent logging activities in the Forgetmenot Valley west of Crescent Spur, the Sheep Pass area in the southern portion of the park has been made more easily accessible from the Crescent Spur area.

The deep valleys and thick vegetation on the west side of Kakwa Park have been major obstacles limiting the access to the Kakwa Lake area from B.C.. The upper McGregor River and the Jarvis and Kitchi Creeks create openings in the steep cliffs of the Mount Sir Alexander and Mount Dimsdale massif. Old horse trails are found in these three valleys and although those trails are not used anymore, the upper valley portions are still visible. After the construction of the industrial road in the upper part of the McGregor valley for mine access, the trails have been abandoned and the road has provided access to Kakwa Lake, until it was closed to the public in 1992, both for protection of the area and due to the instability of the road.

Today the majority of the visitors from British Columbia are hikers and cyclists (Figure 1.6). Few horse riders access the park via the McGregor road, mainly because of the unsuitability of the gravel road surface for horses. Before the closure of the access road, Kakwa and Babette Lakes were popular destinations for offroad vehicles. Although float planes are not used as often since the opening of the access road, they are still the easiest means of transportation to the park from Prince George or McBride.

From Alberta, the access is along Highway 666 south of Grande Prairie across the Wapiti River bridge. The road goes through Grovedale and the Two Lakes Provincial Recreation Area. Further west, Sherman Meadows, about 130 kilometres from Grande Prairie, is the end of the all-season road. The road is plowed up to this point in winter and is the starting point of the snowmobile trail to Kakwa Lake. The road continues for about 25 kilometres to a day use area upstream from Kakwa Falls, but due to the lack of road maintenance in recent years it is very rough and is only recommended for four wheel-drive vehicles and ATVs.

On the east side of Kakwa Park, the terrain in the Foothills is more gentle, valleys are wider and provide good access to the Kakwa area. However the distance from the main highway has made the trip to Kakwa Lake very long. Since 1992, after the closure of the road between Kakwa Falls and Kakwa Lake, only horse parties venture to Kakwa Park. During dry conditions, groups with horses can drive their vehicles and horse trailers to Dead Horse Meadow campsite, about two kilometres before the Falls picnic area. From Kakwa Falls, a horse trail follows an old tote road that joins the road from the B.C. side. The north end of Kakwa Lake is about 25 kilometres from Dead Horse Meadow and it is an additional 7 kilometres to the

south end of the lake. Although the trail from Alberta is flatter than along the McGregor River, the terrain is more marshy and the distances are longer.

The large majority of the visitors from Alberta are horse riders. For many years, the Kakwa area has been known by hunters from the Peace River as a prime area for sheep and goat hunting. Before the interdiction of motorized vehicles, ATVs were the main mean of access for visitors from Alberta (Figure 1.7). Because of the long and marshy trail from Dead Horse Meadows to Kakwa Lake, few hikers venture to Kakwa Park from Alberta and as far as I know no cyclist has ever ridden the trail.

Figure 1.6. A cyclist along the access road between Buchanan Creek and McGregor Pass

Figure 1.7. ATV users on the road along Kakwa Lake before the closure of the park to motorized vehicles

1.8 Human History

The Beaver and Carrier First Nations were the first people to use Kakwa, followed in the eighteenth century by the Cree, Iroquois and Metis who began to enter the area during the westewrn expansion of the fur trade. Early European explorers mentioned Indian trails crossing the Kakwa area. Those trails may have been used for trade between aboriginals of the Peace River area in Alberta and those in the Fort George area in British Columbia.

The first European explorer in the Kakwa area was Alexander MacKenzie, who in 1793 became the first european person to cross the North American continent. He crossed the Continental Divide about 50 miles west of Mount Sir Alexander, the mountain that bears his name. Almost a century later in 1875, E.W. Jarvis, surveyor for the Canadian Pacific Railway made a reconnaissance survey over the Continental Divide in the Kakwa area (Fleming, 1877). His party travelled in winter from Fort George through Jarvis Creek Valley and Jarvis Lakes to Fort Edmonton. His party was to investigate a pass from the headwaters of the Fraser River to those of the Smoky River.

In 1907, a young Englishman named Spencer H. Tuck was engaged by a lumber company to make a reconnaissance of the Rocky Mountains northward from the Yellowhead pass and went through the Wapiti Pass located north of Kakwa. It is likely that Tuck also explored the Jarvis Pass and the McGregor Pass areas in Kakwa Park and probably also the Monkman Pass area (Bowes, 1963).

Later, interest for the area between Mount Robson and Kakwa came from trappers and hunters. In 1928, a committee on Game Reserves and Trails appointed by the McBride District Board of Trade suggested that a proposed game reserve in the Sheep Pass area, south of Kakwa should be abandoned and also the trail to Sheep Pass should be improved to open the only sheep hunting country in B.C. within reasonable distance of any major transportation route (Wheeler, 1979). At that time, Bill Sweeney, a trapper from McBride was one of the early trappers at Kakwa Lake where he was spending his winters.

Early in the Twentieth Century, climber parties began to arrive to Mount Sir

Alexander or Kitchi as it was called at the time. The first alpinists to see the "Big Mountain" were Prof. J. Norman Collie and Mr. A.L. Mumm at the time of their ascent of Mt. Bess, north of Mount Robson, in 1911 (Collie, 1912). The year after, Mr. S.P. Fay of Boston had seen the peak from the headwaters of the Peace tributaries not far from Jarvis Pass (Fay, 1915). In 1914, Mary Jobe, a teacher from New York hired Curly Phillips to lead the first expedition to Mount Kitchi (Jobe, 1915). They attempted to climb the mountain but did not succeed. When she returned the next year, Curly Phillips and two other members of the party made it to within 30 metres of the summit. Fourteen years later, a party led by Andrew Gilmour, an American doctor made the first successful ascent of the peak (Waffl, 1930).

A topographical survey party arrived in the Kakwa area in 1923-1924 to delimit the boundary between the provinces of Alberta and British Columbia (Cautley, 1925). The two commissioners, R.W. Cautley for the Dominion of Canada and the province of Alberta and A.O. Wheeler for the Province of British Columbia had as a task to establish on the ground the 120th meridian from its intersection with the Continental Divide, south of Sheep Pass and the 60th parallel of latitude, which forms the north boundary of the respective provinces.

A chartered Canadian Pacific Air Barkley-Grow pontoon plane crashed in October 1945 just after take-off from Porcupine (Kakwa) Lake . The wreckage of the plane had been a major attraction for visitors until it was airlifted in 1989 and sent to the Calgary Aviation Museum where some parts of the cockpit were used to restore the Queen of Yukon . The same type of plane was used by Admiral Byrd to charter the coastline of the Antarctica continent. In 1998, a memorial plaque was placed at the

site of the crash to honour the memory of Carl Brook who died in the accident. Carl Brook was an outfitter from Saskatoon Lake near Edmonton and was regularly bringing hunting parties to Kakwa Lake (Campbell, 1981).

2.0 KAKWA IN THE CONTEXT OF LARGER ECOSYSTEMS

The scope of this chapter will focus on the importance of considering the whole ecosystem located within and outside the Kakwa Park boundaries and situate Kakwa in the context of some contiguous ecosystems in the Rocky Mountains. In his paper to the 1999 Wilderness Science Conference in Missoula, Montana, George H. Stankey notes: "The ultimate future of wilderness lies not within the boundaries of those places we define on maps with a capital "W", but in the array of economic, institutional and human systems and processes which such areas are embedded" (Stankey, 2000).

Park managers increasingly realise the importance of using an ecosystem approach to manage our wilderness. An "ecosystem approach" is based on the idea that if humans subscribe to and apply an appropriate set of values and are equipped with the required knowledge and tools, they can protect and maintain ecosystems, derive a quality existence from them and simultaneously ensure that opportunities for future generations are retained (Gray and Davidson, 2000). This integrated approach includes four components: the social, cultural, economic and ecological elements. Gray and Davidson used the term "sustainable living " instead of sustainable development which emphasizes more the relation that should exist between healthy people and healthy ecosystems. Ecosystem health is an integrated combination of ecological health, cultural health, social health and economic health. In an ecosystem approach, it is important to keep the balance between the Earth ecosystems (ecological health) and the people who live in them (cultural, economic, social health).

Political and jurisdictional boundaries may have good historical foundations, but in many cases the boundaries do not coincide with those appropriate for management of ecological processes, such as natural or anthropogenic fire, wildlife migration, and pathogenic influences. This is why it is important to consider Kakwa Park as an element of a larger ecosystem. Land-use practices adjacent to the park have an effect on the protection of the ecosystem inside the park boundaries and the wildlife that migrates outside.

In the following paragraphs, the Kakwa Park area will be situated in the context of four larger systems:

1. The Monkman-Kakwa area.
2. The Canadian Rocky Mountains parks system.
3. The Y2Y wildlife corridor from Yellowstone to Yukon.
4. The Kakwa Park and Kakwa Wildland Park area.

Although the Kakwa Wildland Park area is considered in the three other systems, it is important to discuss the more intimate links existing between Kakwa Park and Kakwa Wildland Park in Alberta (the similarity of their names suggests that a close relationship exists between the two areas).

2.1 The Monkman-Kakwa Area

The Monkman-Kakwa area has been the subject of a 1971 joint project of the Regional District of Peace River-Liard, Fraser-Fort George and Peace River Regional Planning Commission (Alberta) to discuss the proposal for establishing a recreation and conservation area in the Monkman-Kakwa Lake Area. At the time of the proposal the B.C. Parks system had only two parks north of Bowron Lake Park, the Stony Mountain and Muncho Lake Parks (Figure 2.1). At the time, there was a

need to create a system of recreation and conservation areas in the Prince George and Peace River District, and to also include some multiple use status areas which may accommodate the mineral claims already present in those areas. The Monkman-Kakwa area was chosen for its outstanding scenery and also the need to protect the sources of the important headwaters of the Arctic and Pacific River system. The proposed study area was still relatively remote, only used locally by guides and their clients, by the local population, by loggers and by oil and gas exploration crews who explored the area after 1962. In 1970, coal mining interests claimed huge areas for exploration purposes (Alberta Environment Protection, 1997).

The proposed area is located in the Rocky Mountains stretching northwest from the Kakwa Lake area (which joins the Wilmore Wilderness Park) for approximately 140 kilometres in the northwesterly direction including the area of the present Monkman Park (Figures 2.2 and 2.3). The aerial distance of proposed Monkman-Kakwa area from Prince George, Grande Prairie and Dawson Creek is approximately 90 miles (140 kilometres) for the three towns. Looking at the importance of the areas covered by the coal, gas and oil leases, it is not surprising that the project never materialised. The Foothills portion of the proposed study area contains very valuable resources that still have not been exploited; the coal exploration reservation of the proposed area covers most of the Alberta portion (Figure 2.4).

2.2 The Canadian Rocky Mountain Park System

In this second large system, Kakwa is situated in the context of the Canadian Rocky Mountain Park System. Kakwa Park is the northernmost part of a continuous,

northwest-trending belt of parks that includes Kakwa Wildland and Willmore Wilderness Provincial Parks, Jasper and Banff National Parks in Alberta, Mount Robson and Mount Assiniboine Provincial Parks and Yoho National Park in British Columbia (Figure 2.5).

At the heart of Kakwa Park stand the two most northerly peaks of the Rocky Mountains higher than 10,000 feet (Mount Sir Alexander and Mount Ida). The same types of rock that shape the spectacular mountains of the Jasper and Banff areas are also present in the Kakwa Park area and have produced the same scenic landscape. The limestone of the Devonian Palliser Formation, so largely distributed in the eastern part of Jasper, is present on the cliffs of Mount Andrew and Mount Hannington in the Jarvis Lake area. The same Cambrian quartzite formations forming the peaks of the mountains along the Jasper-Banff Icefield Highway are found in the Mount Sir Alexander area. That the three physiographic divisions of the Canadian Rockies (the Main ranges, the Front Ranges and the Foothills) are contained in such a small area makes Kakwa an ideal place to study the geology of the Canadian Rockies. More details on the rock formations of Kakwa Park area are presented in the geology section of the project.

In the document "Provincial Parks & Wilderness for the 90s" (B.C. Parks, 1990), proposed study areas near Kakwa Park were to be evaluated for possible wilderness designation areas (Figure 2.6). The first study area was called Boundary Area and is located along the Continental Divide, south of Kakwa Park and adjacent to Willmore Wilderness Park in Alberta. The area would have been designated a Wilderness Area while the Horsey Creek Area south of Boundary was considered for Class A park status. Both areas would have expanded the Canadian

Rocky Mountains parks on the B.C. side of the Divide. The areas were rejected because the Robson Valley District had already reached the limit of its percentage of allowed protected areas with the Mount Robson addition. North of Kakwa Park, the Kakwa Addition, Monkman Additions and the Belcourt Area were considered for wilderness designation. This would have joined Kakwa Park and Monkman Park, and permitted a migration corridor between the two parks. Today, the Kakwa Addition and the Monkman South Additions have been added to the park system.

2.3 The Y2Y: Yellowstone to Yukon Corridor

On a larger scale, Kakwa is also part of the vast conservation initiative project known as the Yellowstone to Yukon -Y2Y- corridor, which covers nearly 1.2 million square kilometres of the Rocky Mountains from Wyoming's Yellowstone National Park to the Mackenzie Mountains in Yukon Territory (Figure 2.7). The project was outlined in 1993 by Harvey Locke, a Calgary lawyer now living in Boston. His idea was to protect the Rockies ecosystem by linking already-existing national and provincial parks and wilderness areas in the mountainous West with protected corridors of land. Those corridors between protected areas would allow the free movement of wildlife between protected areas. Through the Y2Y project concept, conservationists are seeking to protect, maintain and restore ecological integrity, promote landscape connectivity, preserve wilderness and its attendant value. To achieve this they seek careful management of resource industry activities in the corridor.

Kakwa Park is located at the north end of this belt of parks located in the central region of the Canadian Rockies and the area is one of the last pristine wilderness

areas of the Canadian Central Rockies. The Mount Sir Alexander and Mount Ida massif represent the northernmost of the Rocky Mountain high peaks.

2.4 The Wildland Kakwa Park (Alberta) - Kakwa Park (B.C) Area

The last system to be considered is the area covered by Kakwa Park in British Columbia and the adjacent Kakwa Wildland Park in Alberta, and particularly the eastern part of Kakwa Park which is located east of the Continental Divide. This portion of Kakwa Park lies in the Arctic watershed and is the headwater of the Kakwa River which flows through Kakwa Wildland Park (Figures 2.8 and 2.9). Within this park the river plunges 30 metres over Kakwa Falls, rushes through a 4 kilometre canyon and further downstream, drops over the Lower Kakwa Falls. The upper falls, accessible via a 1.2 km walking trail, is the main attraction of the park.

Kakwa Wildland Park provides a buffer zone between Kakwa Park in British Columbia and the area of oil and gas exploration and forest exploitation of the Alberta Foothills, located to the east. The lack of motorized access within Kakwa Wildland Park makes Kakwa Park even more isolated from the urban centres of northern Alberta. Both parks share the same historical background, since the first users of Kakwa Park were local people from the Grande Prairie area. Even today, horse parties from Alberta travel through both parks and consider Kakwa Park and Kakwa Wildland Park as a whole, Kakwa Lake being the highlight of their trip.

Kakwa Wildland Provincial Park was created in 1996 as part of the Special Places program of the Alberta Environmental Protection (Land and Forest Service and Natural Resources Service). Appendix A lists the different types of protected areas

designated in Alberta. The new park is about 640 km^2 in size, which is far from the 1,277 km^2 Wild Kakwa area proposed in 1973 by the Wild Kakwa Society, or the Wild Kakwa Wildland Recreation Area (Alberta Forest Service) created in 1987. The Ministry of Environmental Protection of Alberta decided not to include the whole of the Wild Kakwa Wildland Recreation Area in spite of the fact that the excluded land was already withdrawn from the Grande Prairie Forest Timber Management Area in 1976. A portion of the northern land excluded from the previous Wild Kakwa Wildland Recreation Area is adjacent to Kakwa Provincial Park in British Columbia and covers the Mount Torrens area up to the Narraway River, including the Coal Ridge and Horn Ridge. Two management zones exist in the park, the Wildland Zone which covers all of the park except the Natural Environment Zone, which includes the corridors access to Kakwa Falls and the B.C. border (Figure 2.9). The main objectives of the Wildland Zone are to maintain wildlife populations and to provide opportunity for unstructured exploration. The objectives of the Natural Environment Zone are to provide opportunities for off-highway vehicles use in the park and maintain backcountry camping opportunities at Dead Horse Meadows and day use facilities at Kakwa Falls.

The Horn Ridge and the Torrens Mountain areas are particularly important since they are part of the northern range of the Bighorn sheep and the migratory route of the caribou. Horn Ridge has been the scene of considerable coal exploration activity with a large network of roads giving access to the alpine area of the ridge. Those roads are still used by ATV and off-highway vehicles but they are located in the winter migration corridor of the caribou herd migrating to the Red Creek area, North of Kakwa River. In their 1979-1983 study of the mountain and woodland caribou, (Edmonds and Bloomfield, 1984) had recommended that the roads to

Horn Ridge should be deactivated to limit human impact on the caribou.

Except for the road corridor from the northern boundary of the park to Kakwa Falls and the river corridor from Kakwa Falls to the B.C. border, Kakwa Wildland doesn't receive many visitors other than groups on horses. The majority of these groups visit the Sulphur Ridge area at the northern limit of the park and the access trail to the B.C. border (personal observation). In the rest of park, the network of trails and seismic lines are not maintained and are often very confusing (Figure 2.10) . Trails marked on the maps are difficult to follow on the ground and some trails simply don't exist anymore. The Mount May area is visited by sheep hunters who access the area via the Francis Peak Creek trail.

On both sides of the provincial boundary, forestry, oil exploration and mining are putting pressure on governments to develop the areas adjacent to Kakwa Park. In Alberta, the area northeast of the park boundary have received a lot of pressure in recent years from oil exploration and forestry companies. Road access has been improved in the area, making Kakwa Falls and the Narraway River areas more accessible for visitors. In the summer of 2000, seismic crews were very active at the Alberta border. A seismic survey was under way between the Kakwa area and Grande Cache area (personal observation).

In British Columbia, the Wishaw Lake quartzite quarry and its access road located in the core of Kakwa Park retain a recreational area status. The area lies inside the corridor used by grizzly bears travelling to and from the McGregor Valley. Although the exploitation of the quarry has an uncertain future, its access road in the McGregor Valley and into the park will remain an important issue in regard to the

preservation of the Kakwa Park area.

In this chapter, Kakwa has been examined in relation to more extensive ecosystems: the Monkman-Kakwa Area, the Rocky Mountain Park System, the Y2Y and the Kakwa Wildland Park Area.

Provincial Parks of British Columbia in 1970

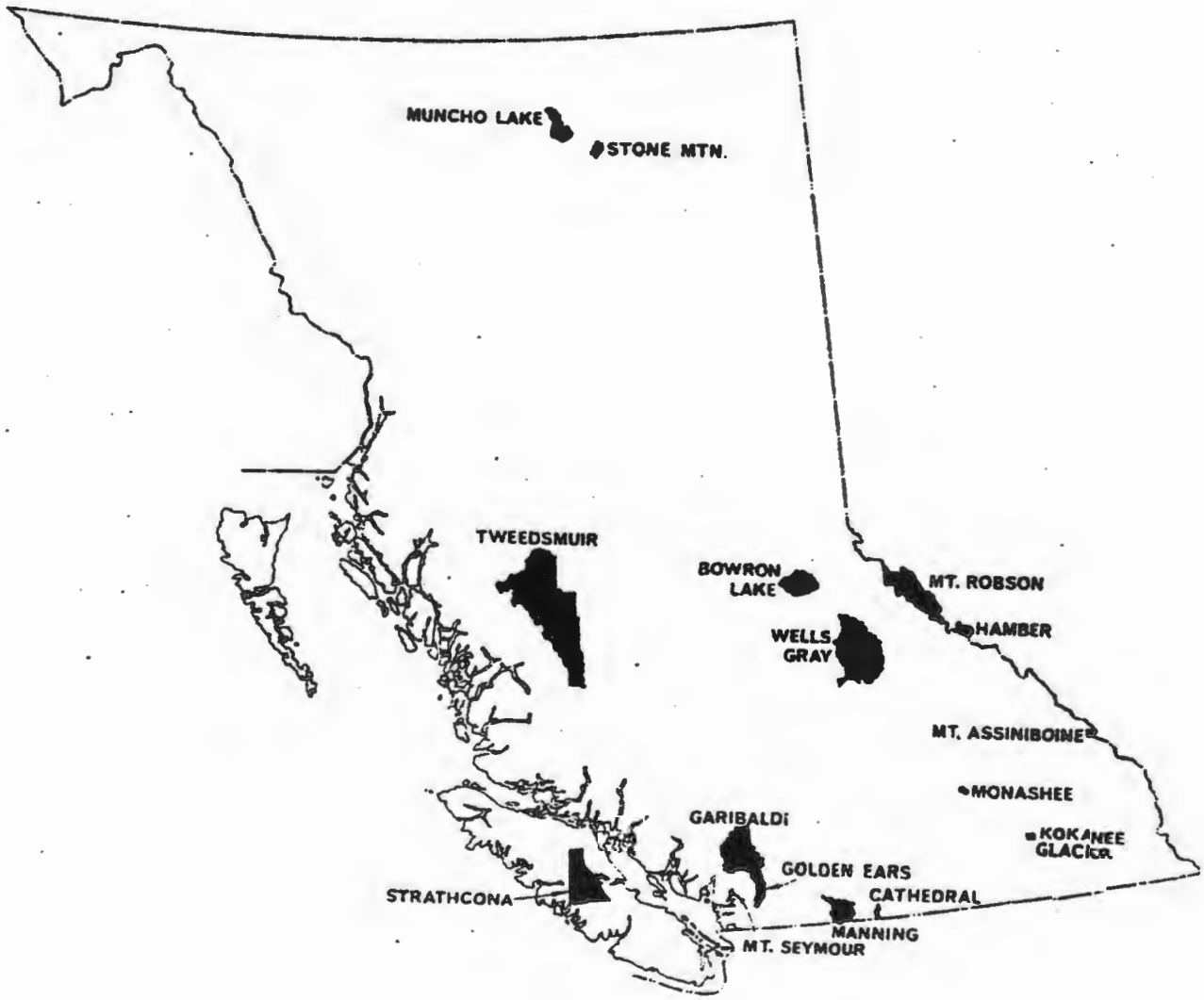

Figure 2.1. Location of the Provincial Parks in 1970. Only 2 parks were located in the northern part of British Columbia

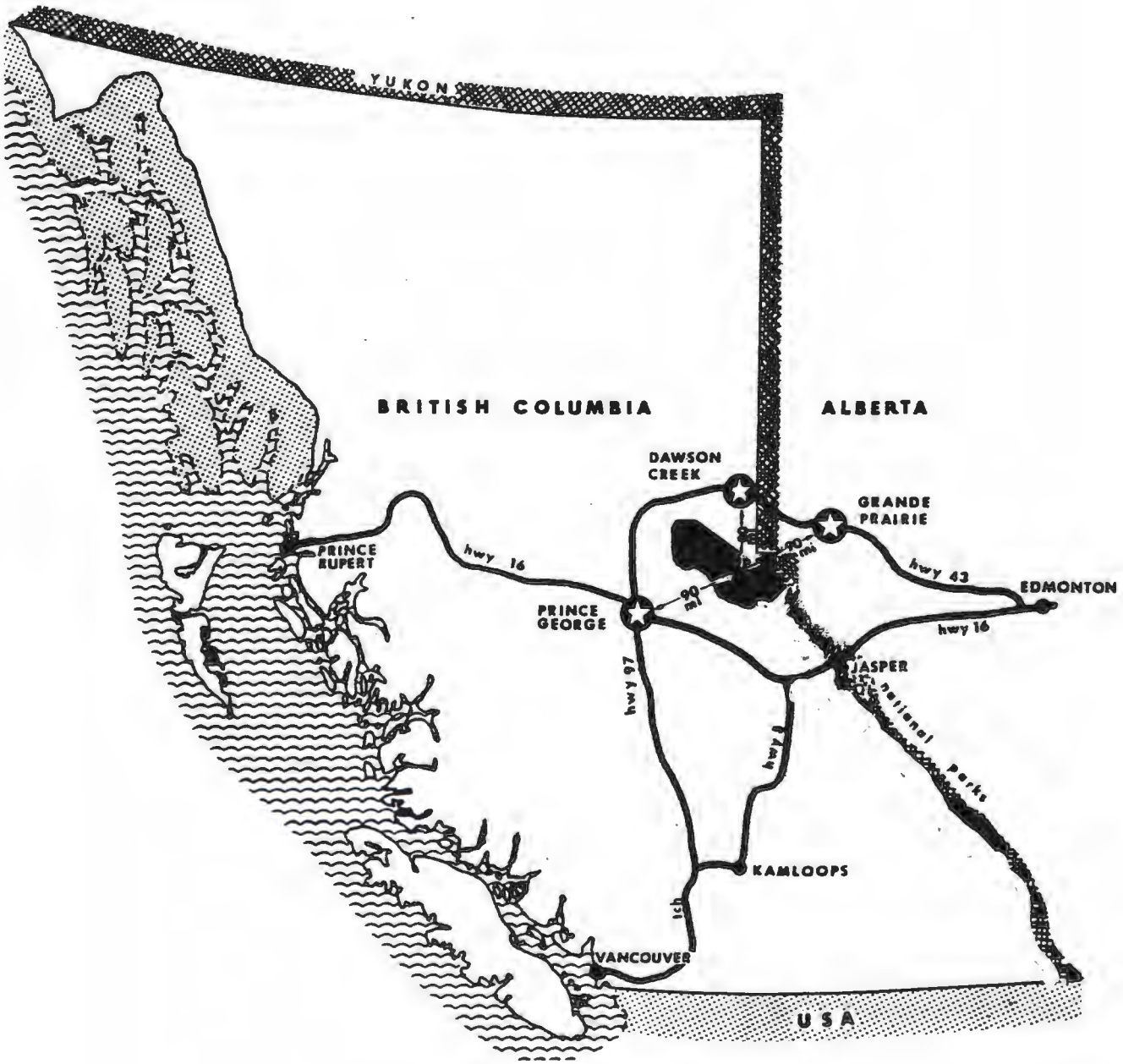

Figure 2.2. Map showing the location of the Monkman-Kakwa Study Area

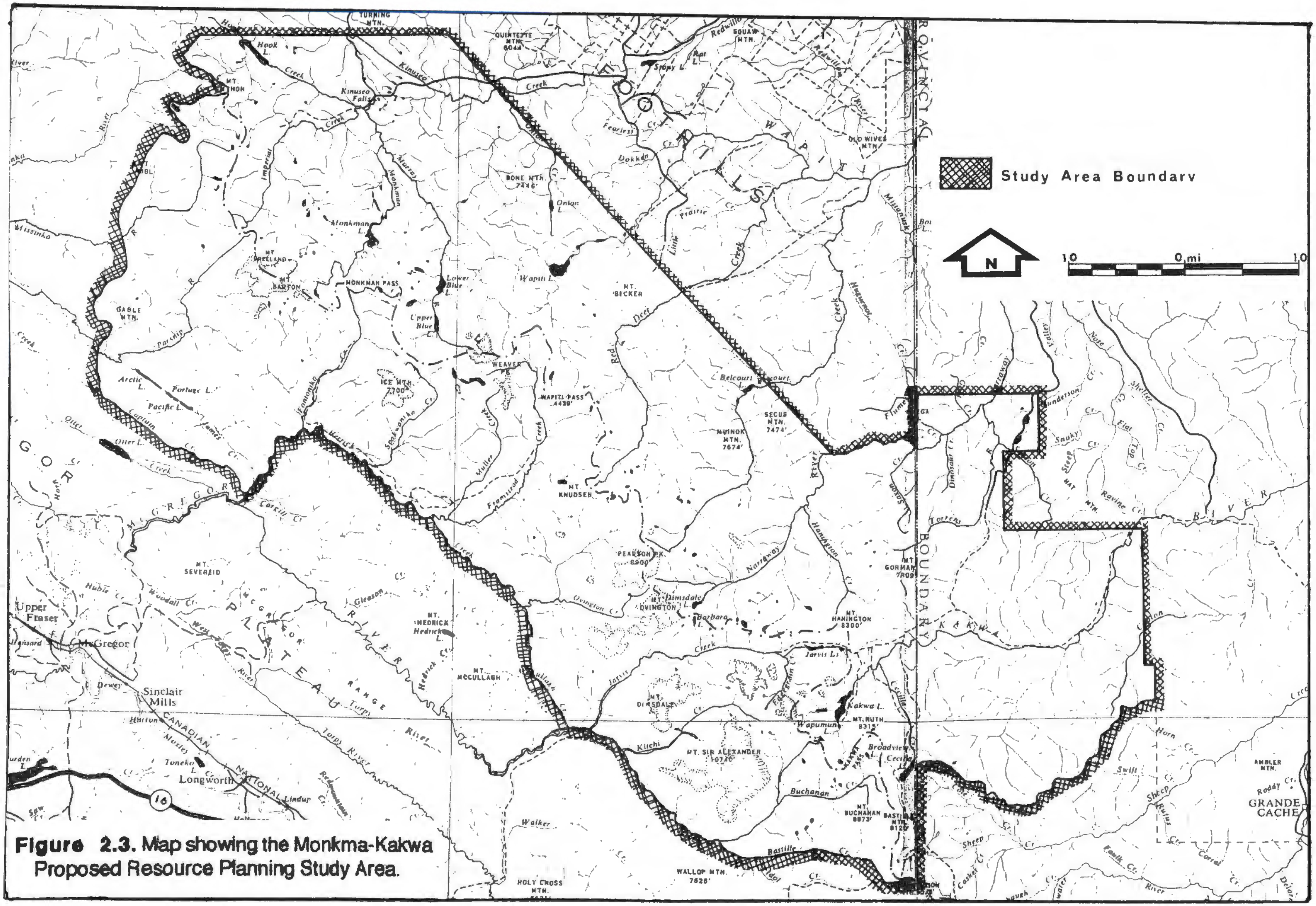

Figure 2.3. Map showing the Monkma-Kakwa Proposed Resource Planning Study Area.

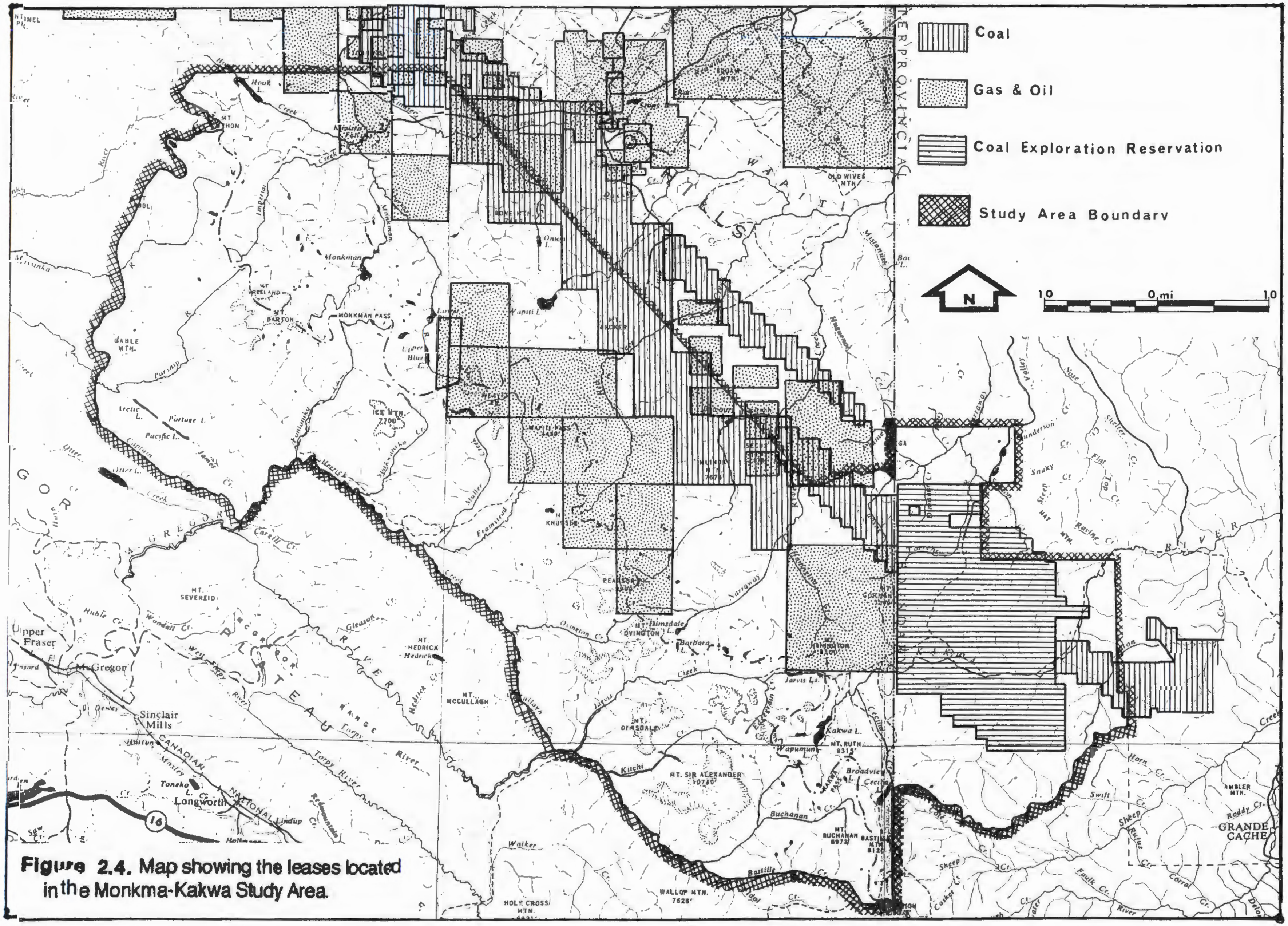

Figure 2.4. Map showing the leases located in the Monkma-Kakwa Study Area.

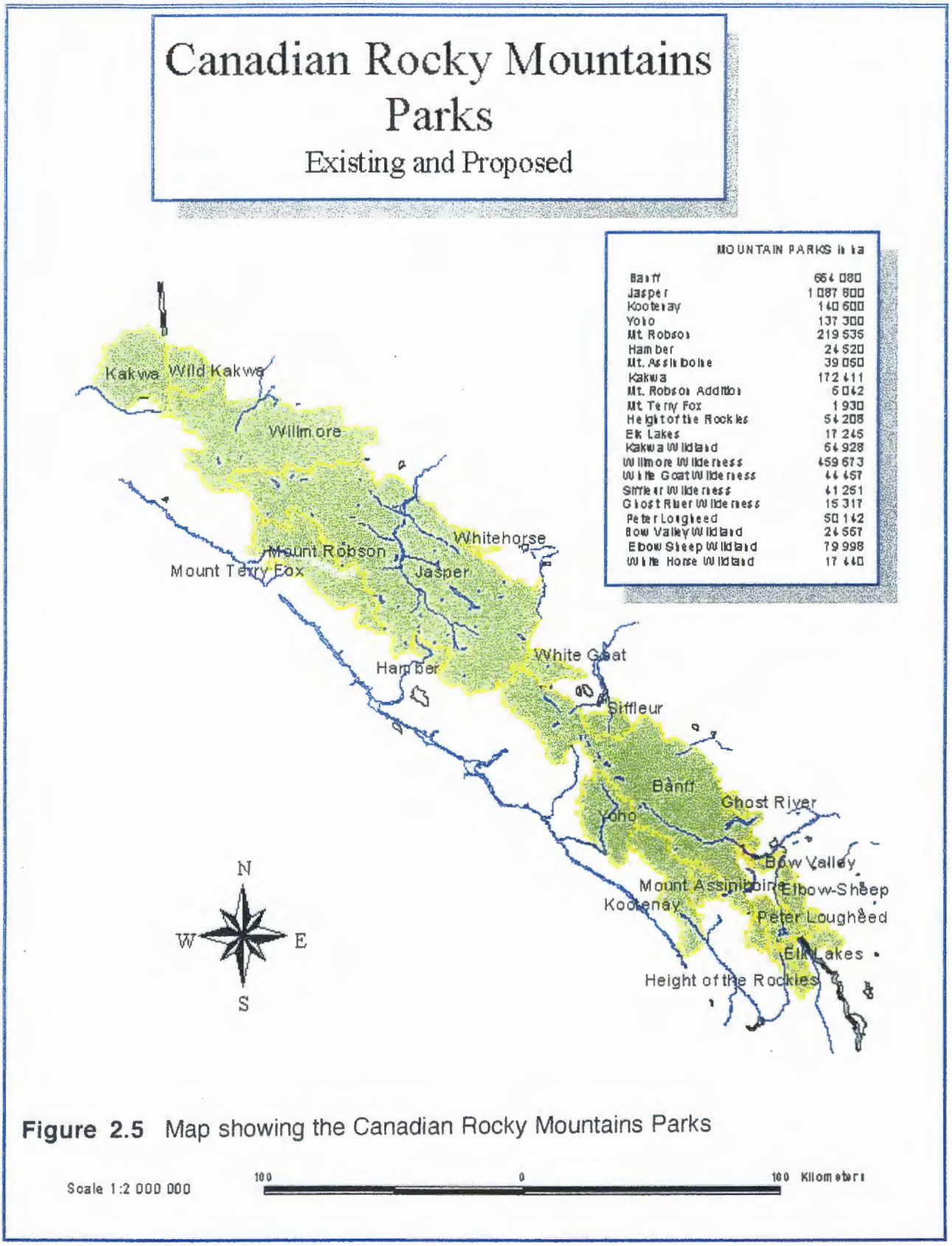

Figure 2.5 Map showing the Canadian Rocky Mountains Parks

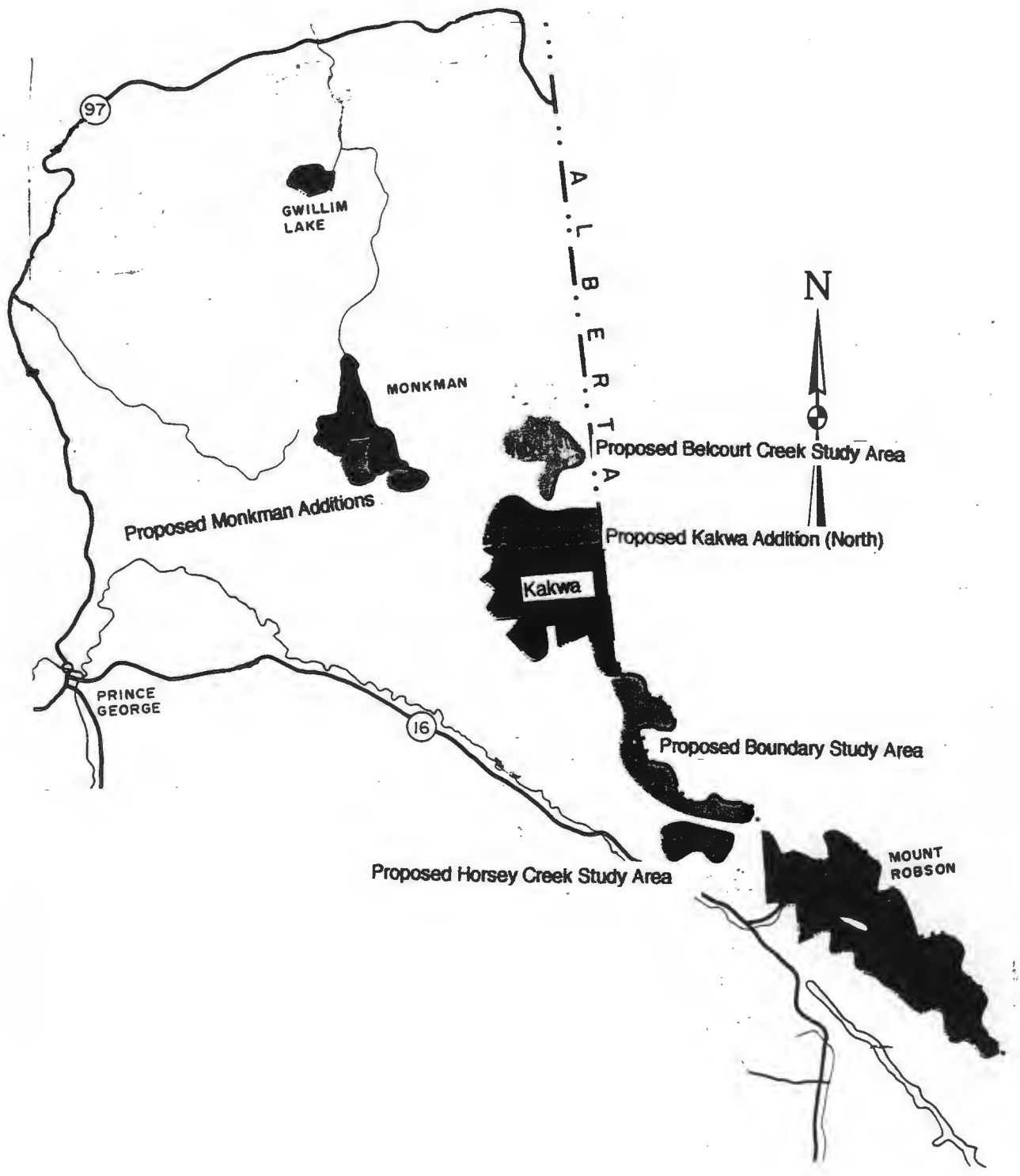

Figure 2.6. Map of the existing and proposed protected areas of British Columbia located in the Central Rockies. The information from the document "Parks & Wilderness for the 90s"

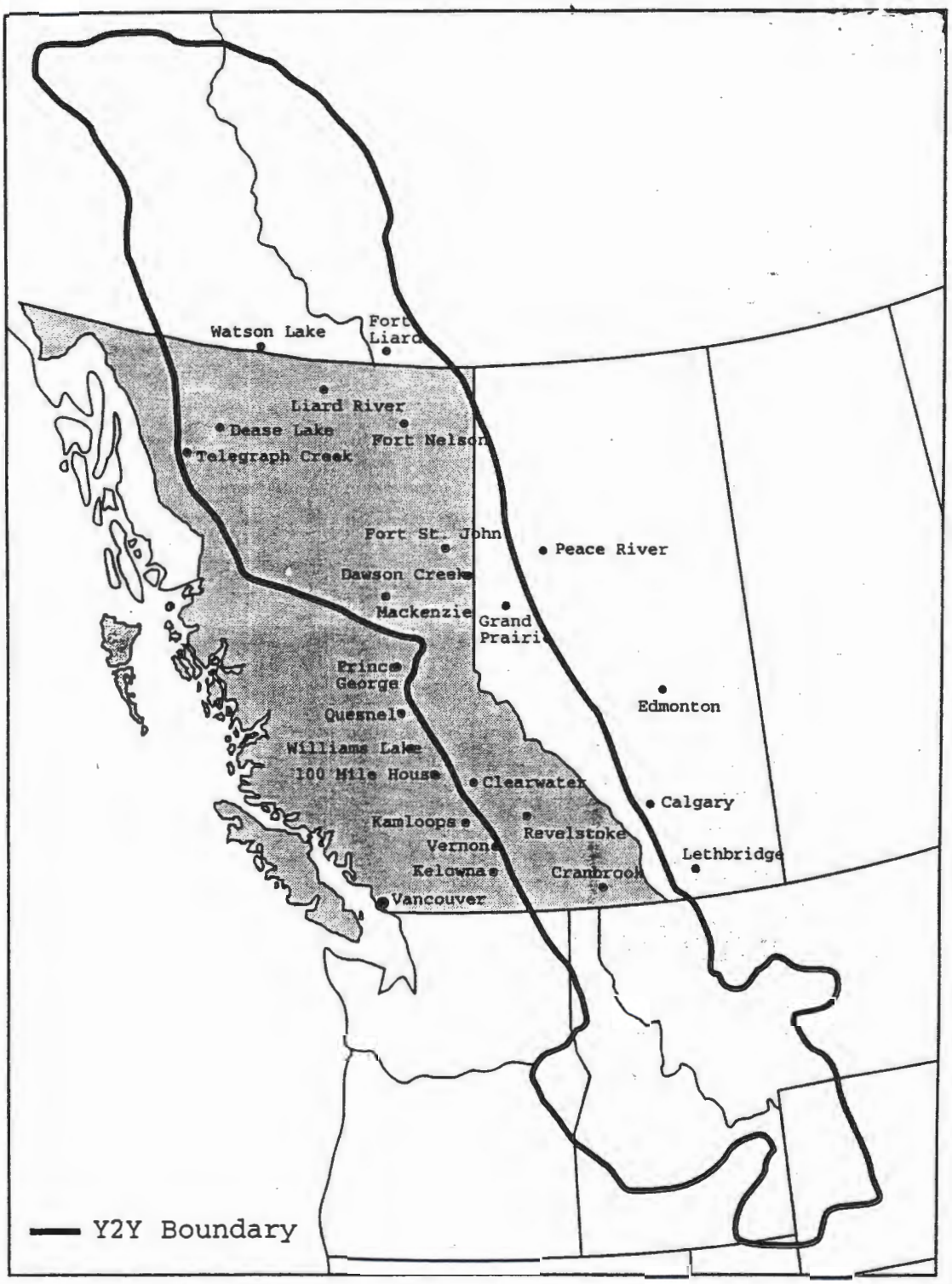

Figure 2.7 Map of the proposed Wildlife Corridor Y2Y Yellowstone to Yukon. The area coverts 1.2 million square kilometres along the spine of the Rockies from the Greater Yellowstone Ecosystem in the south to the MacKenzie Mountains in the north.

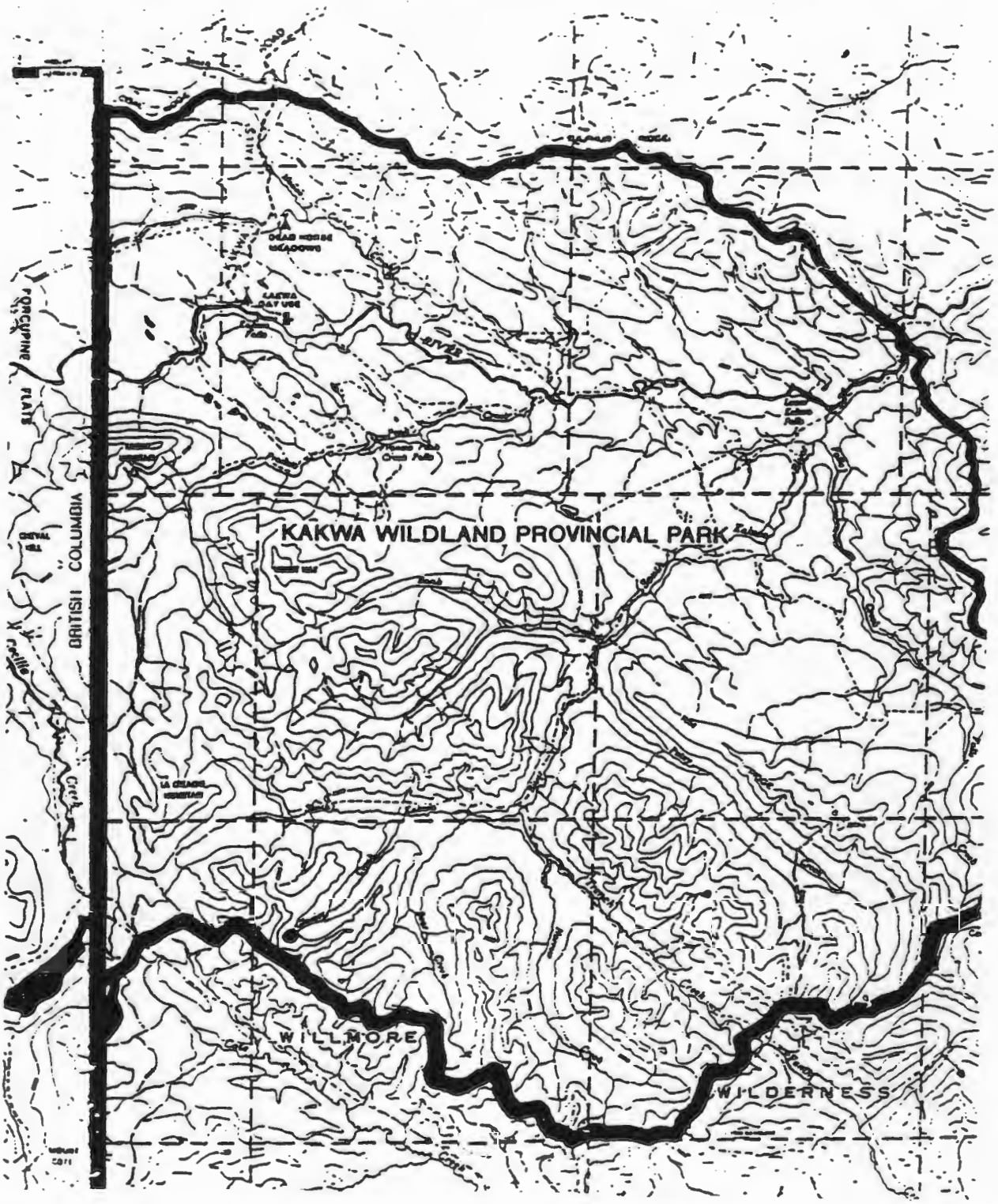

Figure 2.8 Map of Kakwa Wildland Provincial Park in Alberta (Original map not available)

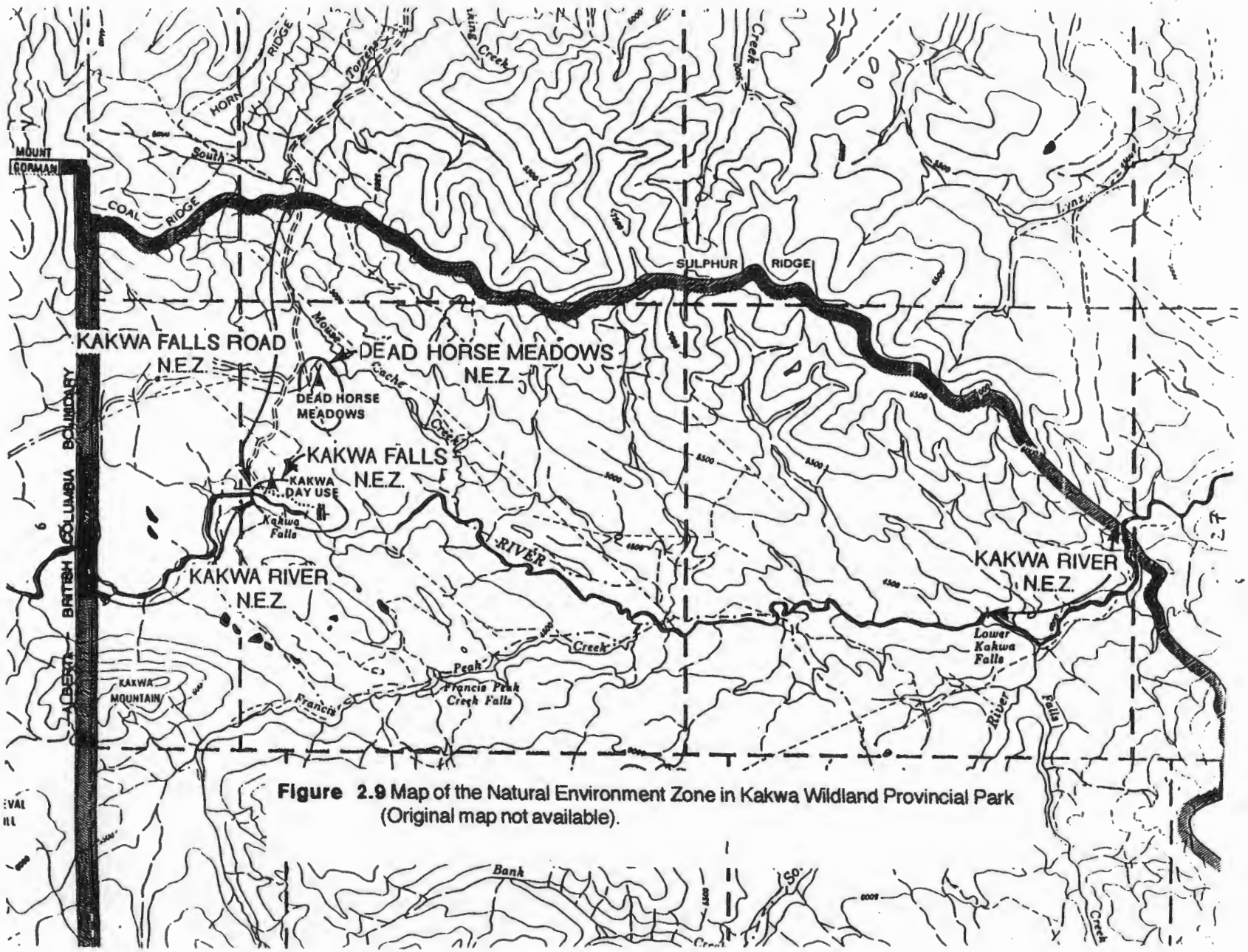

Figure 2.9 Map of the Natural Environment Zone in Kakwa Wildland Provincial Park (Original map not available).

↑ Two Lakes Provincial Recreation Area

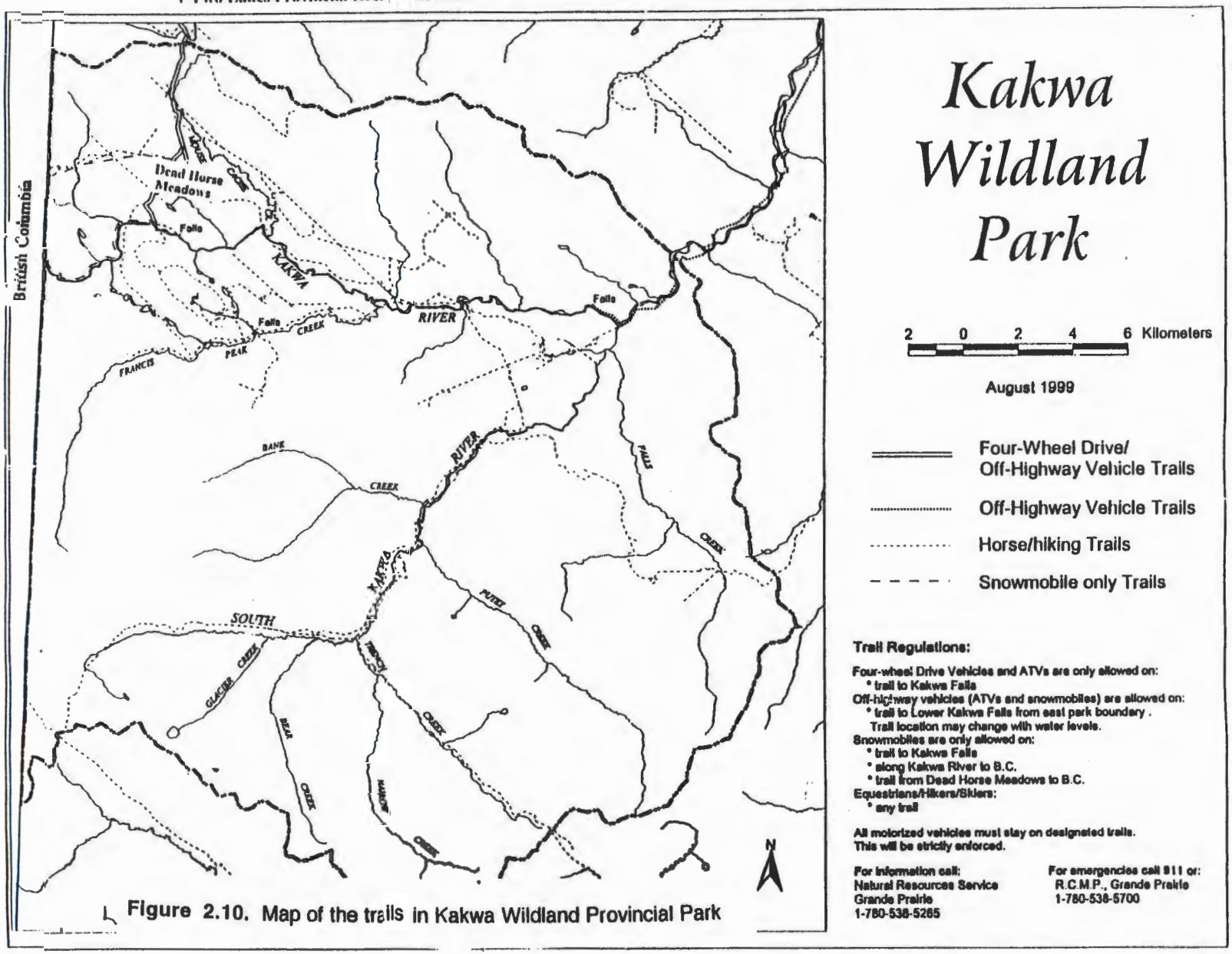

Figure 2.10. Map of the trails in Kakwa Wildland Provincial Park

3.0 MANAGEMENT UNITS OF KAKWA PARK

This chapter examines the application of management units, or geographical units to subdivide the Kakwa Park area. The main reason to divide the park into different units is based on the reality that Kakwa forms a mosaic of ecosystems and landforms. This mosaic creates a large variety of geographical and outdoor recreation features in a relatively small area. Although, some common characteristics are found through the whole area, trying to describe Kakwa Park in general terms would lead to an inaccurate assessment of the park. The limited access to and between the different parts of the park is another reason that justifies the use of the management unit concept for this unique area.

The management unit system of Kakwa described in this paper may help to give some management guidelines concerning the zoning of the park. At this moment, only Wilderness Recreation and Wilderness Conservation need to be considered for the zoning, unless the road to Kakwa Lake is reopened to the public (Appendix B). In that case, a Natural Environment Zone would have to be considered along the road corridor and at the facilities at the south end of Kakwa Lake. For visitors who want to explore the park, the management unit concept will make it easier to plan a trip. Each unit has different recreation features and offers a different experience for visitors.

In defining a management unit, consideration has to be made of the values located there and the access to those values. Natural barriers such as mountain ridges, watersheds or bodies of water may be used to separate the units. The physical differences of the land between the units may also be taken into consideration such as the geological features and the types of vegetation.

In contrast to management units, the concept of zoning, present in all park management plans, divides a park into logical units to apply uniform and consistent management objectives. The zones reflect the intended land use, the degree of human use, and the level of management and development required (Appendix B). A management unit may be subdivided into many zones. The management units concept and the zoning are two different ways to divide a park. The first is based on the physical characteristics of the land, whereas the second is the result of a management decision on the use of the land.

Although the concept of management units is normally applied to simply break up large areas into more manageable sizes, it can be applied to the Kakwa Park area. While not yet adopted by B.C. Parks for Kakwa, I have designed the following management units as part of my project. In the following pages, I will first elaborate on the criteria used to define the units and their boundaries, and also the reason why those particular criteria were chosen for Kakwa. Secondly, I will divide the area in 6 units and provide a description of each of those units. Then I will use the criteria to outline the differences between the units.

3.1 Criteria for the Unit Selection

The criteria used in some of the larger parks in British Columbia to define management units are mostly based on watersheds and ecosystems within the park area. No specific information is found in the different B.C. Parks management plans concerning the choice of the criteria to define the boundaries of the units.

There are a variety of examples in the B.C. Parks System that use the concept of management units. In the Mount Robson Management Plan, the unit distribution is mainly based on the watersheds (Figure 3.1). The Moose River and Upper Fraser River units are defined by the watersheds of those two rivers. In the 1986 Wells Gray Management Plan, some units have been defined by the bodies of water included in them (Figure 3.2), for such as the Murtle Lake unit and the Mahood Lake unit. Other good examples of units based on a body of water are the Chilko Lake units in Tatlow Park (Figure 3.3). The criteria for the Tatlow unit in Tatlow Park was probably influenced by the cultural and spiritual significance for the Xeni Gwet'in Indian Band surrounding Mt. Tatlow which visitors are not allowed to climb.

The criteria that I have applied to define management units are:

1. Watersheds.
2. Access to and between the units
3. Geological features specific to each unit.

Although the diversity of the ecosystems could have been used as a fourth criterion to define the units, it does not appear to me as important as the other criteria. The variation in the ecosystems found in the Kakwa area is mostly related to the watersheds and the altitude of the terrain. Watersheds west of the Continental

Divide spread at lower altitude and receive more rain than those east of the Continental Divide, affecting the types of vegetation found in the valleys on either side of the Divide

3.*1.1 Watersheds*

Watersheds are the single most important criterion to define the boundaries of the management units (Figure 3.4). Watersheds in the Kakwa area are usually separated by rugged terrain forming natural barriers with limited access between them and thus it becomes an even more important criterion than in areas with lesser terrain.

The Continental Divide also divides Kakwa Park into two watersheds: the Fraser River watershed (Pacific Ocean) west of the divide and the Peace River watershed (Arctic Ocean) east of the divide. Valleys on the west side of the divide are very deep whereas those on the east side are very wide. As a result, relief is more considerable on the west side.

The McGregor River and its main tributary, Jarvis Creek, are the two major drainage systems on the west side of the Continental Divide. The eastern part of the McGregor River watershed includes most of the large glaciers near Mount Ida, Mount Sir Alexander and Mount Dimsdale. The upper section of the McGregor Valley is very narrow and the gain in elevation becomes very rapid from Buchanan Creek to Wishaw Lake. The road built along this section provides access to the Wishaw Lake quartzite quarry.

The four westernmost lakes of the Jarvis Lakes chain are the head of the Jarvis

Creek watershed. The lakes are mostly fed by underground water; no significant drainage system can be seen along the lakes. The relief of the Jarvis Creek Valley is high, with elevations ranging from less than 915 metres in the Jarvis Creek valley, to 3050 metres at the top of Mount Ida. The trail along Jarvis was one of the main access routes to the Kakwa area before the road along the McGregor was built. The Jarvis Creek watershed will be used to define the limit of two of the units.

Kitchi Creek and Buchanan Creek are two other tributaries of the McGregor River in Kakwa Park. Kitchi Creek is fed by glaciers located on both sides of the deep valley between the Mount Sir Alexander and Mount Dimsdale massif. The route along the valley gives access to the Edgegrain Creek watershed in the southeast part of the Jarvis Creek watershed. The Buchanan Creek Valley is very narrow where it joins the McGregor River but becomes wider in the upper parts.

On the east side of the Continental Divide, the drainage system is divided into three main watersheds: the Narroway River (along with the Hannington - Gorman Creek tributaries), the Kakwa River and its tributary, Cecilia Creek. The headwaters of those drainage systems contain the three largest lakes in the park: Dimsdale Lake, Kakwa Lake and Cecilia Lake. The valleys created by those systems are wider than the ones found on the west side of the divide. The relief is also lower where very few glaciers and high mountains are present east of the divide. The extended trail and seismic line system existing in those valleys provide access to Kakwa from Alberta. The Kakwa area has traditionally been part of the hunting territory of many outfitters from the Beaverlodge and Grande Prairie areas in Alberta.

3.1.2 Access

Two types of access are discussed in the following paragraphs. First, the main access to the park area itself, and secondly, the access between the different parts of the park. The latter will be used as a criterion to define the management units. Some of the units are only accessible through a single mountain pass from the core area around Kakwa Lake (Figure 3.5).

Although hunting trails could be found in all the main valleys in the park, very few of them are still in use. Since 1984, the construction of roads in the area has provided an easier access to Kakwa Park. The area can be approached from three different directions: the industrial road along the McGregor River from the west, built in 1986, the tote road along the Kakwa River from the east, built in 1984, as well as the horse trail that follows the Continental Divide from the south. The southern part of the park can also be accessed by a new forestry road in the Forgetmenot valley which ends near the base of Intersection Mountain. Hiking, horse riding and bicycling have been the main means of transportation to reach the area. Float planes, either private or charter, occasionally bring fishermen and hunters to Kakwa Lake or Jarvis Lakes. In winter, the area is accessible by snowmobiles along the two existing roads, however, both approaches require long trips and can be difficult depending of the weather and the snow conditions.

The trail system of an area is closely related to its drainage system. Generally, trails and roads follow the moderate slope of the creek and river valleys, leading to a lake or a low pass through a mountain range. This is particularly true on the west side of Kakwa Park where three valleys with low passes at their heads were used to enter the area from B.C.. Before the construction of the industrial road along

McGregor River, horse trails along Jarvis Creek, Kitchi Creek and McGregor River were the only access to the area from B.C.. Today the road along the McGregor is the main access to the park from the B.C. side.

East of the Continental Divide, the low relief has made possible the development of an extensive trail system along the valleys. Trails along Sheep Pass, Narroway River, Hannington Creek and Kakwa River are still used today by horse parties from Alberta. However the tote road along Kakwa River has became the main access to Kakwa from Alberta.

Access between the units is an important criterion to define a unit and the recreation activities possible in this unit. The high passes through the mountain ranges dividing the watersheds limit the access from one watershed to another. In Kakwa Park where the Kakwa and Jarvis Lakes unit is considered the core area of the park, the other units are accessible only through passes in the mountain ranges surrounding the core unit.

The approach to some of those passes is on steep slopes and unmarked routes, making the units only accessible to experienced hikers. The terrain may be too rugged for horses or inexperienced hikers to get through the passes. Consequently, there are a limited number of visitors in these units and a limited range of recreation activities. For example, the Cecilia Lake Unit is only accessible from Kakwa Lake through an unmarked trail making it difficult for fishermen to get to Cecilia Lake. The visitor impact would be considered very low in such units, particularly if horses do not have access.

Access to the park area and between the different parts of the park are important factors to consider in the elaboration of the mangement plan for Kakwa. Visitors concentrate in the areas of the park with easy access.

3.1.3 Geological Features

The geological features present in the Kakwa Park area are important factors used to define a unit and its boundary. Geological processes are responsible for the diversity of terrains and landscapes found in the park. The presence of the Main Ranges, Front Ranges and Foothills within a concentrated area is unique in the B.C. Parks system. These three divisions of the Canadian Rockies have helped to create the variety of scenery found in the park. More details of the rock formations are found in the following chapter on the geological history of Kakwa.

The Main Ranges are present in the western portion of Kakwa Park (Figure 3.6). The layers of quartzite and limestone of the Main Ranges formations are nearly flat-lying and form castle-like peaks, with steep sides all around. The valley between the mountain ranges are very deep and difficult to access. The Main Ranges peaks of the Rockies are well know by mountaineers: climbing is an important activity in the Mount Sir Alexander and Mount Ida area.

The Front Ranges are underlain mostly by limestone forming the peaks and the shale forming the valleys. The rock dips southwest and the ridges are aligned southeast-northwest. In the Kakwa Park area, the Front Ranges are mainly present between Sheep Pass and Jarvis Lakes. The karst areas and fossil sites found in the limestone formations offer recreation features that are unique to those units located in the Front Ranges.

The Foothills are characterized by gently sloping ridges and are underlain mostly by brownish sandstone and shale with few metre long folds. In the Kakwa Park area, the Foothills are present in the eastern portion of the park. The mountains are lower and the slopes of the ridges are gentler than those of the rest of the park. The gentle slopes of those mountainsides make the area very accessible for hikers and horse riders.

3.2 Defining the Management Units for Kakwa

The management unit approach used by B.C. Parks has been applied in large protected areas such as Wells Gray Park, Mount Robson Park, Tweedsmuir and Ts'il-os Park. The Wells Gray Park Management Plan has been the first to use the system in its 1986 Master Plan to help simplify the management of the area. More recently, the 1996 Ts'il-os Park Master Plan has been created also using the same system.

Although the management unit approach by B.C. Parks is used in large protected areas, I believe that the use of management units for Kakwa Park may be justified by the diversity of the natural and recreation features in a such small area in the Rocky Mountain context and the limited access between the different units. The Kakwa Park area has been broken up in six management units based on the three criteria discussed. Those units are Jarvis and Kakwa Lakes unit, Mt. Sir Alexander and Mt. Ida unit, Cecilia Lake unit, Sheep Pass unit, Moonias Pass and Dimsdale Lake unit and Hannington Pass Unit.

3.2.1 UNIT 1: The Jarvis and Kakwa Lakes Unit

This unit constitutes the central portion of Kakwa Park and includes Jarvis Lakes and Kakwa Lake. The mountain range between Mount St George and Mount St Andrews divides the unit in two sub-units; the northern sub-unit includes the area between Edgegrain Lake and Jarvis Pass, the southern one encompasses Kakwa Lake, Wishaw and LaGlace Lakes, Mount Ruth and Broadview Lake.

Kakwa Lake is the destination of most of the visitors coming from B.C. through McGregor Pass. The industrial road to Wishaw Lake provides an easy access to the park. Although the road is closed to private vehicles, hikers and cyclists may use the road to reach Kakwa Lake. From Kakwa Lake, most of the unit is accessible by trails or alpine routes.

Hiking, horse riding, fishing and wildlife viewing are the main recreation activities of the unit. The Jarvis Lakes area is also very popular for goat hunters who stay at the B.C. Parks cabin. The three most popular destinations of the unit are Mount Ruth, LaGlace Lake and the Babette Lake Cirque. This last area is accessible by the tote road leading to the old mineral exploration site. Kakwa Lake has been a very popular destination for fishermen before the road was closed to motorised vehicles.

The zoning of this unit will depend on whether the road to Kakwa Lake is reopened to motorised vehicles. In the 1990 Interim Management Statement, the Kakwa Lake area was zoned Natural Environment. At the time, motorised vehicles were allowed on the tote road and there was a long-term possibility to improve the road to allow two-wheel drive vehicle traffic. Today, snowmobiles are the only motorised vehicles allowed in the park. If the closure of the road becomes permanent, the whole unit

can be classified as Wilderness Recreation zone with some controlled snowmobile access through the unit.

This 354 sq. km unit covers about 21% of the park but receives the large majority of the visitors in the park. The southern end of Kakwa Lake receives an higher density of users due to the facilities provided at this location and also the presence of the park headquarter. Large groups use this location as a base camp to explore the surrounding area.

3.2.2 UNIT 2: The Mt. Sir Alexander and Mt. Ida Unit

This unit is located in the western portion of Kakwa Park and is characterized by high peaks, icefields and steep mountainsides. The McGregor River, Jarvis Creek and Edgegrain Creek (south of Jarvis Creek) Valleys constitute a natural boundary around the unit. Much of the terrain along those valleys is very steep and cliffs are common, making the area very difficult to access. The unit itself is subdivided by the steep cliffs of the Kitchi Creek Valley. Mount Sir Alexander massif and its surrounding icefield constitute the southern part of the unit. The northern part is dominated by the Mount Ida and Mount Dimsdale massif. Mountains, glaciers and waterfalls are the main attractions of the unit. The 539 sq. km unit covers approximately 31 % of the park and may be designated a Wilderness Conservation zone.

Mountaineering is the primary recreation activity. Mount Sir Alexander is a nationally significant area for climbers. Although the unit may be accessed through Bellevue Pass, west of Mount St Patrick or along Edgegrain Creek, helicopter is the means of transportation used by mountaineers to reach the base of the high

mountains. Signs of old horse trails exist along Jarvis Creek, Kitchi Creek and Edgegrain Creek. Only the trail along the Edgegrain Creek has been partly maintained and is still used by hikers.

3.2.3 UNIT 3: The Cecilia Lake Unit

This unit is bounded by Mount Ruth and Wallbridge Mountain, and the B.C.- Alberta border from Kakwa River to Surprise Pass. The 121 sq. km unit covers about 7 % of the park and contains the Cecilia Creek watershed including Cecilia Lake and the area north of Surprise Pass. Cecilia is a typical turquoise lake of the Rocky Mountains partly fed by the Wallbridge Glacier. The Cecilia Valley is very narrow at Cecilia Lake which is surrounded by a dense forest leaving no easy access to the lake except at the north end. As the valley extends north, it becomes more open and extensive meadows are found along Cecilia Creek.

The area covered by this unit has been designated a Wilderness Conservation zone in the 1990 Interim Management Statement on Kakwa Recreation Area. The zoning was justified the area is contiguous with Alberta's Willmore Wilderness Area and the new Kakwa Wildland Provincial Park, which do not allow aircraft or other mechanised access. A small area east of Wallbridge Mountain contains a rock formation rich in fossils, including some very well preserved examples of stromatoporoids and brachiopods. These are part of the Flume formation also present in the Fossil Pass area.

Horse riders coming from Alberta along Kakwa River and Cecilia Creek, and going to the Willmore Wilderness area are the main users of this unit. A seismic line on the east side of the valley is now used by horses to access the area. At the south

end of the valley another trail crosses the unit from Providence Pass to Surprise Pass. Although the lake has been stocked with fish, the remoteness of the area has prevented access to the lake by fishermen. Kakwa Mountain located on the B.C. - Alberta border offers a panoramic view of Kakwa Park. The whole Cecilia Valley represents an opportunity for a true wilderness experience.

3.2.4 UNIT 4: The Sheep Pass Unit

This unit covers the southern part of Kakwa Park. It is bounded east by the B.C. - Alberta border and Intersection Mountain marks the southern limit of the unit. The unit extends west and south to the park boundary. The northern limit of the unit has been set by Goat Pass which corresponds to the boundary of the Buchanan watershed located in the souther part of the unit 1.

The core area is located between Intersection Mountain, Goat Pass and the upper part of the Buchanan Creek watershed. Long interconnected meadows allow an easy access to the core area from Goat Pass or Surprise Pass. Another pass exists west of Intersection Mountain which allows access from Forgetmenot Creek. A horse trail along Sheep Creek in the Willmore Wilderness Area is used by visitors coming from Alberta and heading to Kakwa Lake through Goat Pass and Kakwa Pass. The 90 sq. km unit covers approximately 5% of the park.

3.2.5 UNIT 5: The Moonias Pass and Dimsdale Unit

This unit is located north of Jarvis Creek and is bounded by the western and northern boundaries of the park. The eastern limit begins at Moonias Pass located

at the southeast corner of the unit and follows a line in direction of the Belcourt Pass and includes the upper part of the Narraway River watershed.

The alpine area along the Continental Divide is the main recreation feature of the eastern part of the unit. The view of the Mount Ida area from the ridge along the Continental Divide is spectacular. Dimsdale Lake and the high mountains west of Dimsdale Lake represent the main attraction of the Gray Pass area. A world significant fish fossil site is found in a calcareous siltstone formation on the north side of Moonias Mountain. Although the fossil bed is located high on a cliff, some specimens can be found in the rocks at the base of the cliff.

As the trail from Jarvis Lakes to Moonias Pass is not very well maintained, few visitors venture into this unit. Some primitive campsites exist at Moonias Lake which represent the destination of most of the visitors in the area. No trail exist between Moonias Lake and Gray Pass, but an alpine route is possible north of the Continental Divide.

The 246 sq. km unit covers about 14% of the park and represents one of the most remote parts of the park. Considering the limited access and the pristine state of the unit, it can be considered a Wilderness Conservation zone rather than Wilderness Recreation zone (see Appendix B).

3.2.6 UNIT 6: The Hannington Pass Unit

This unit is located at the northeast corner of Kakwa and is accessible by Hannington Pass at its southern limit. The entire unit lies within the watershed of the Narraway River. Mount Minnes, visible from Kakwa Lake, dominates the

landscape east of Hannington Pass. This unit contains the foothill mountains characterized by brownish dolomitic limestone formations, which contrast with the massive grey limestone formations west of Hannington Pass. The gentle slopes of Mount Minnes and the ridges around allow easy access to the alpine area.

The 374 sq. km unit covers about 21% of Kakwa Park and is bounded by the northern and eastern boundaries of the park and in the south by the Continental Divide and East Jarvis Creek. The western limit has been set to the Moonias Pass and Dimsdale Lake unit. The unit may be classified as a Wilderness Conservation zone due to the limited access to the area and the absence of well-maintained trails through the unit. It is also adjacent to Kakwa Wildland Park in Alberta which is designated a non-motorised area.

3.3 Summary

I believe the management unit concept is a useful tool to understand the Kakwa Park area. By breaking up the area into six units, it becomes evident by looking at each individual unit that each unit forms an entity with its own attributes.
In my study, I have used these three simple criteria to define the units: watershed, access and geological features. Ecosections, biogeoclimatic zones, wildlife habitat and status of the land adjacent to the unit boundaries are other criteria that may be used to define the units.

Geographical or management units may also be used by the visitors who want to explore the various parts of the park. Each unit has different recreation features which offer a varied experience to the visitors. To include the unit system in

information them would make it easier for the visitors to plan a trip. Although the zoning of the park was not the focus of my study, the management unit and the criteria used to define them may be useful in defining the recreation opportunity zones of the park. In a future study, I would like to explore the possible scenarios concerning the zoning. Some political issues like the road access will influence the zoning of the Kakwa Lake area. Critical habitat will influence the zoning of some units. Most of the units outside the Kakwa Lake area correspond to the criteria for Wilderness Recreation and Wilderness Conservation, hunting being the main difference between those two zones.

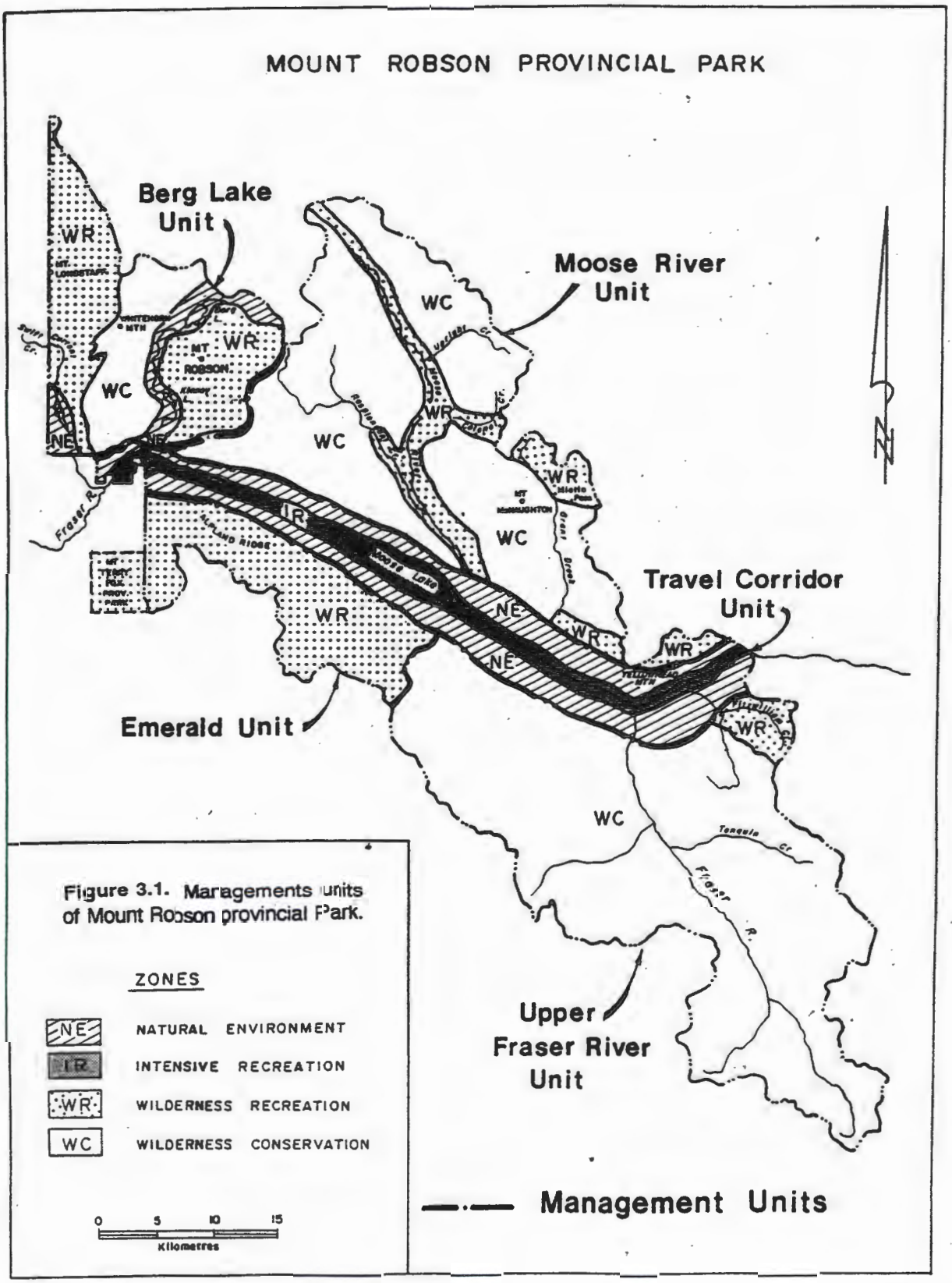

Figure 3.1. Maragements units of Mount Robson provincial Park.

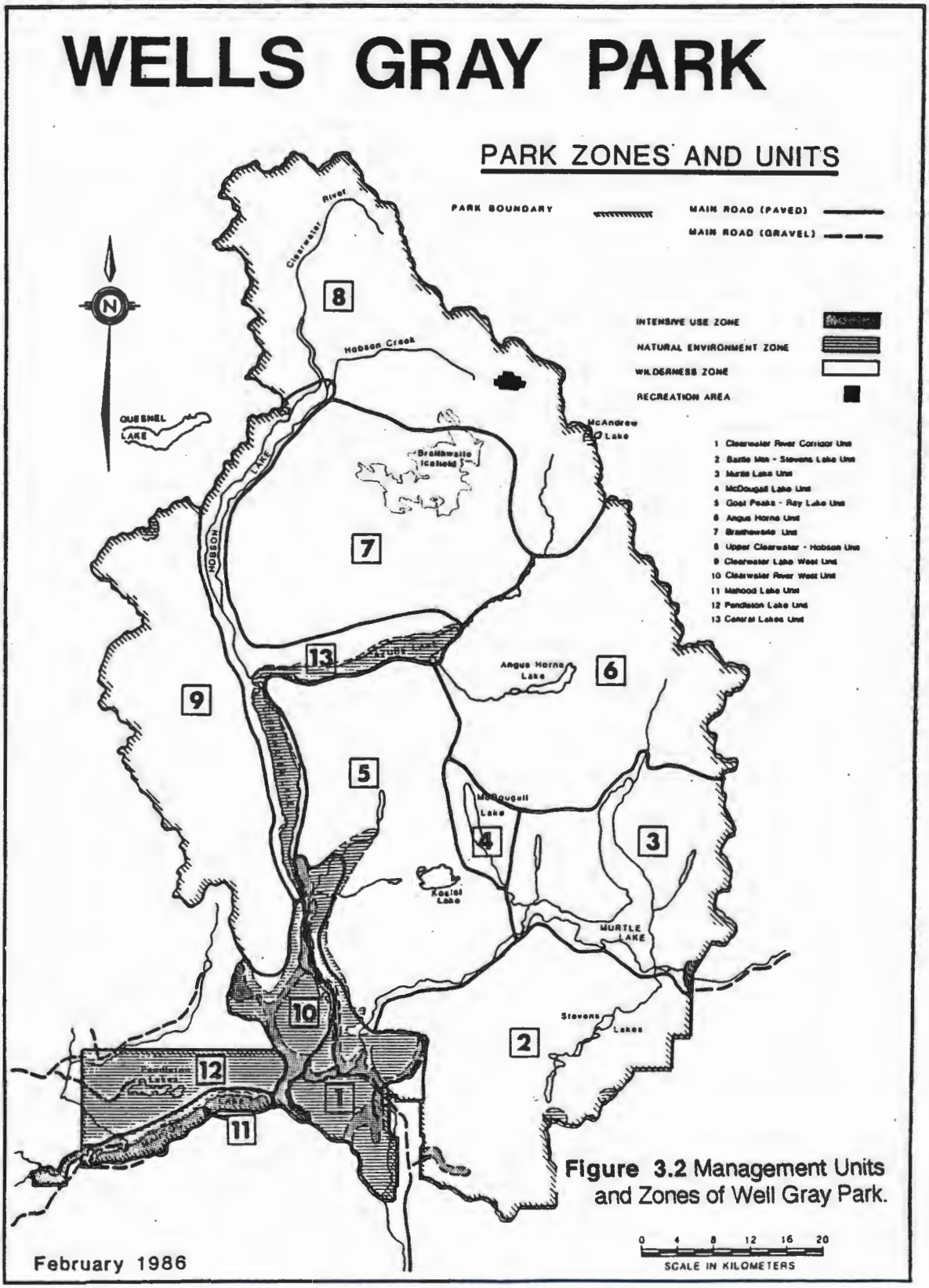

Figure 3.2 Management Units and Zones of Well Gray Park.

Tŝ'il?os Provincial Park Management Units

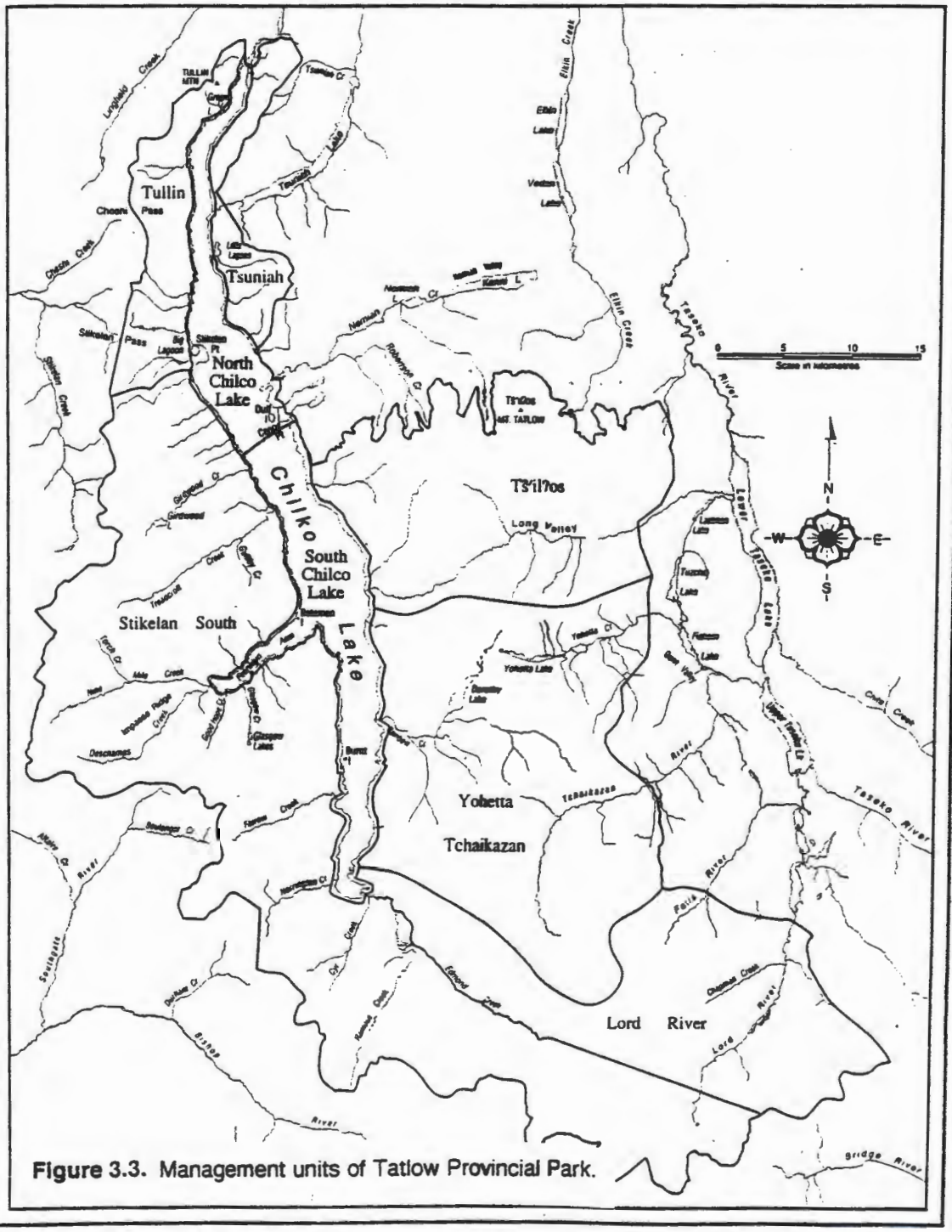

Figure 3.3. Management units of Tatlow Provincial Park.

Kakwa Park Watersheds

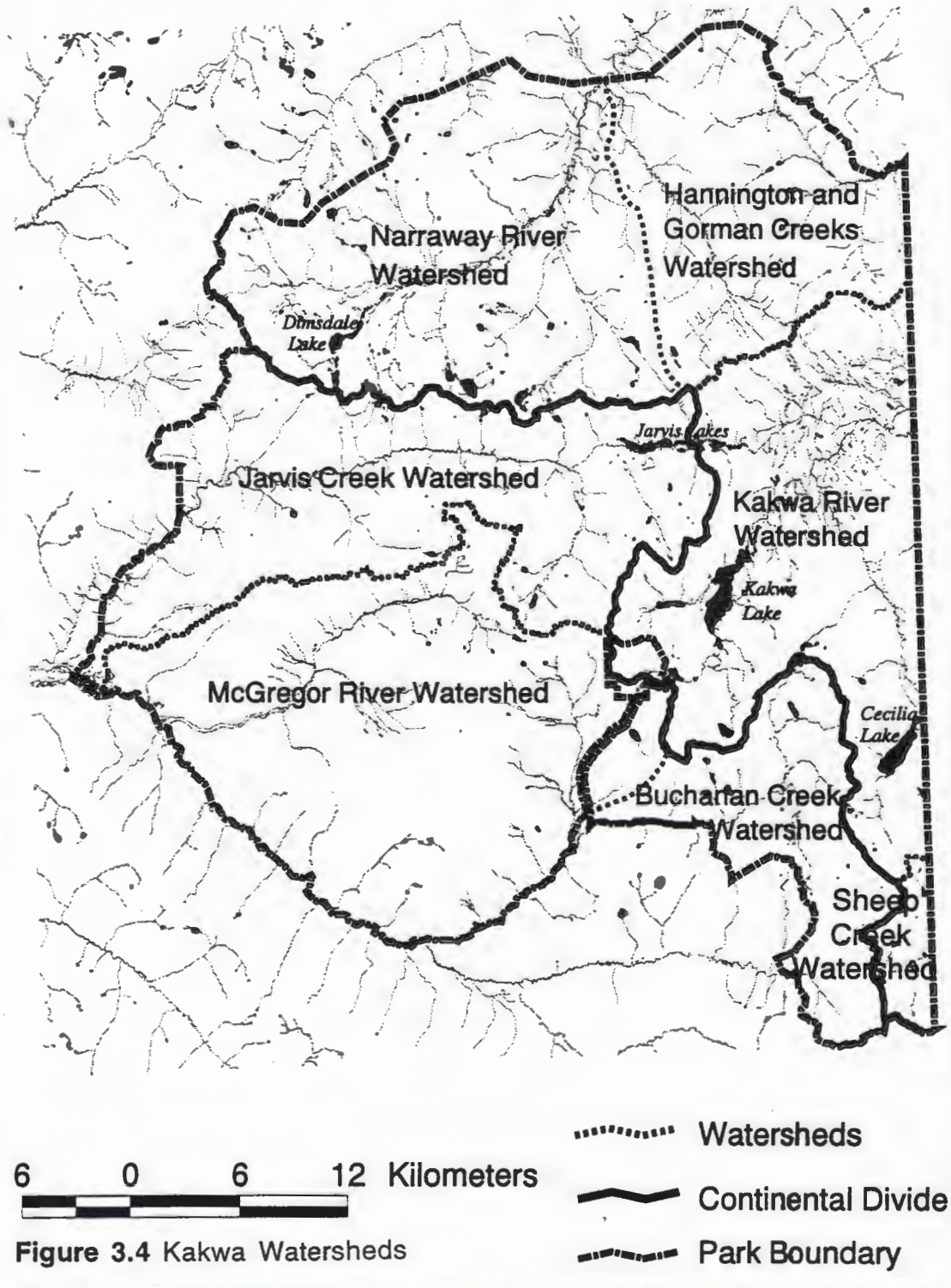

Figure 3.4 Kakwa Watersheds

Access Passes from Kakwa-Jarvis Unit

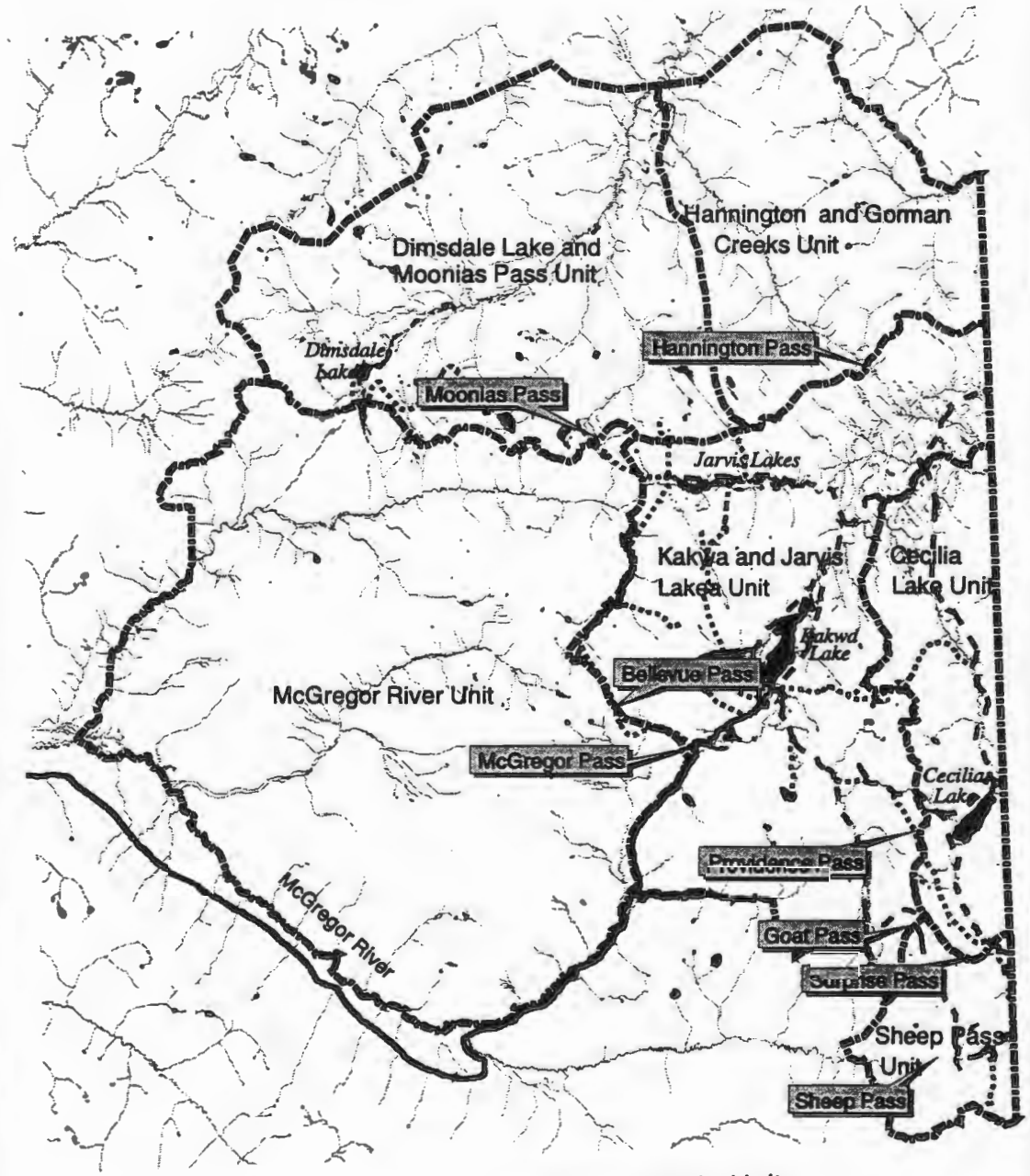

Figure 3.5. Access Passes from the Kakwa- Jarvis Unit

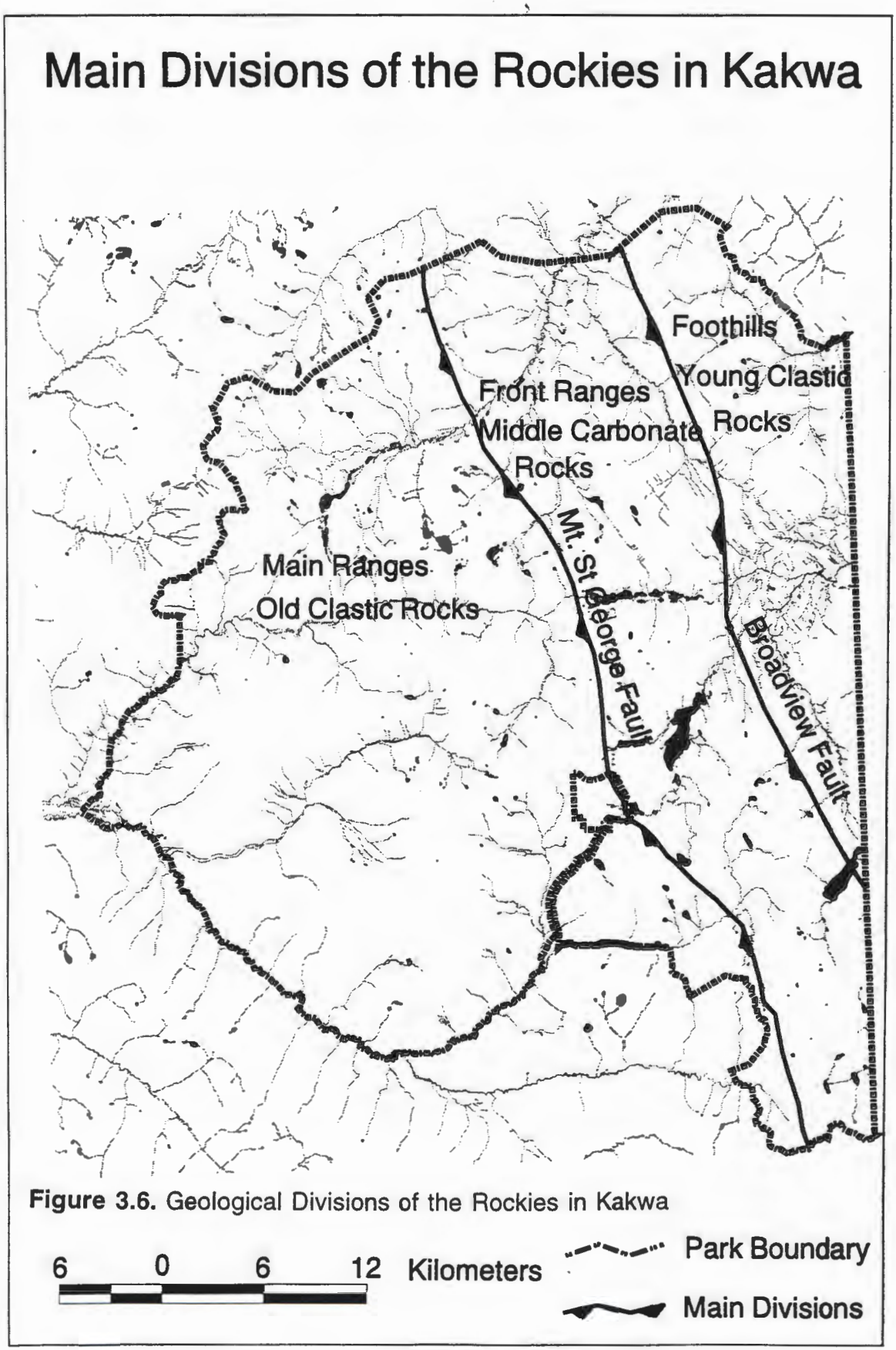

Figure 3.6. Geological Divisions of the Rockies in Kakwa

Kakwa Park Management Units

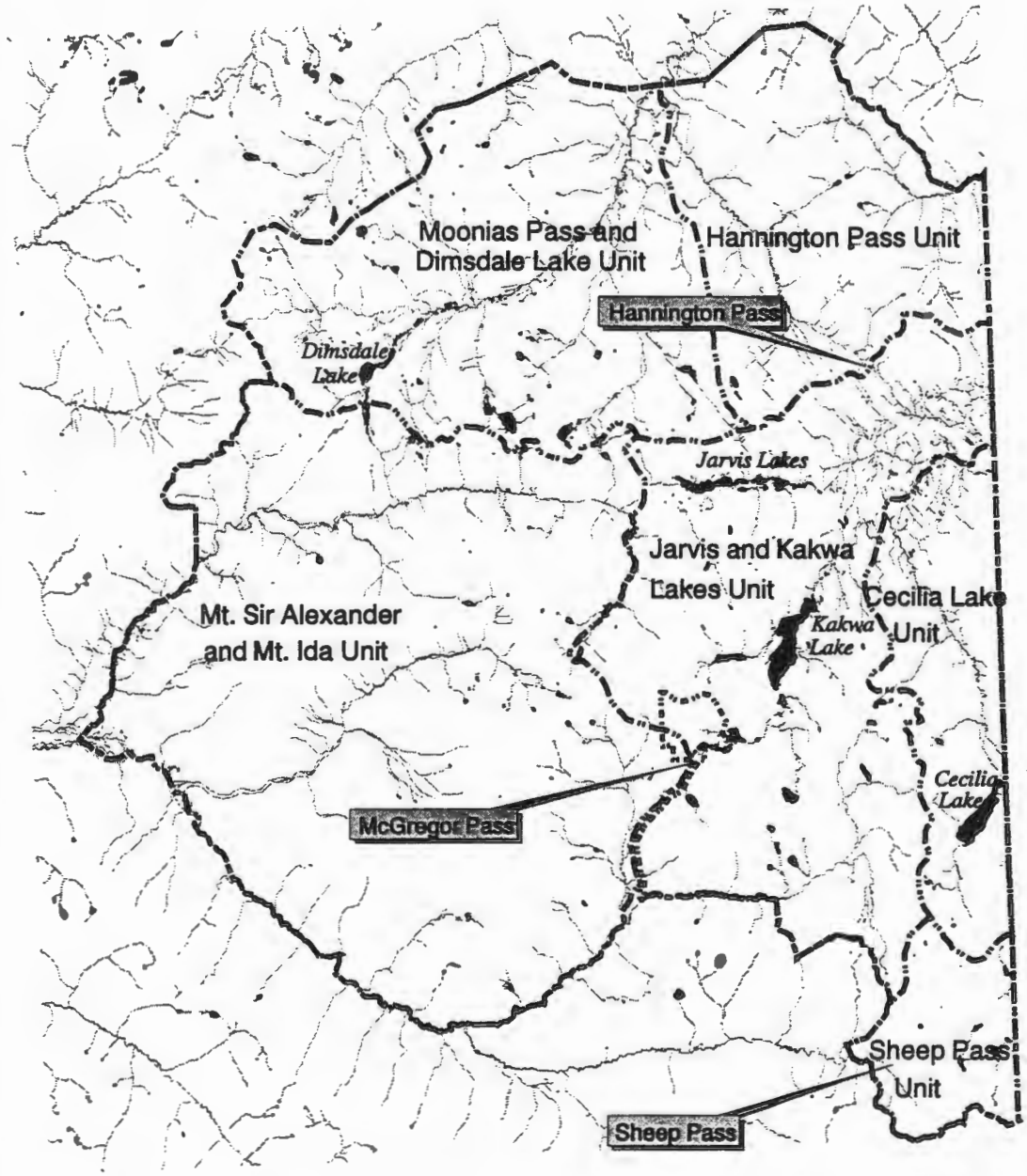

Figure 3.7. Management Units of Kakwa Park

4.0 GEOLOGICAL HISTORY

The Kakwa Park area provides a quasi-complete record of the main formations found in the Canadian Rockies. The concentration of those formations in such a small area makes it an excellent place to study the geological history of the Canadian Rockies.

The area is underlain by strata which range in age from Late Precambrian to Early Cretaceous and can be divided in three domains with very different stratigraphy and structural styles, bounded by major thrust faults (Pell and Hammack, 1992). The three domains coincide with the three main divisions of the Canadian Rockies: the Foothills, the Main Ranges and the Front Ranges. The eastern domain is underlain by Mesozoic rocks, predominantly shales and thin-bedded sandstones, and characterized by small disharmonic chevron folds. The central domain contains middle and upper Paleozoic carbonate rocks with some thick interbeds of shale. Large-scale folds are common in this domain with minor thrusts and normal faults. The western domain contains thick-bedded lower Paleozoic quartzites and carbonate rocks with broad open folds, small thrusts and abundant normal faults. The combination of these domaines provides a comprehensive geological history of the main formations of the Canadian Rockies.

4.1 Stratigraphic Location of Kakwa in the Canadian Rockies

The Canadian Rockies are the eastern most part of the Canadian Cordillera, the physiographic name for all the mountains of western Canada. The Interior Plains are the eastern boundary of the Cordillera. The Rocky Mountain Trench, a long

valley that runs from southern British Columbia to the Liard River, is the western limit of the Rockies. The Liard River separates the Rockies from the Liard Lowland and the Hyland Highland to the north and Marias Pass in Montana is the southern limit of the Canadian Rockies.

From north to south, the Canadian Rockies can be divided into three main regions: the Southern Canadian Rockies (south of Crownest Pass), the Central Canadian Rockies (Crownest Pass to Peace River) and the Northern Canadian Rockies (north of Peace River). The Rockies are also divided in three long strips: the Foothills between the plains and the mountains, the Front Ranges, which are the eastern mountain front and the Main Ranges, the backbone of the Rockies (Gadd, 1995).

The Canadian Rockies, as we see them today have been through three different stages of formation: sedimentation, collision and glaciation. The sedimentary rocks are the result of 1.5 million years of sedimentation on top of the west-coast continental shelf. When subduction started, the pile of sediment had reached a thickness of 20 km in some locations. Rock as old as the Precambrian era appears in the bottom layers. Oil and natural gas from the Devonian reefs, and coal from the Cretaceous forest are derived as energy resources from these rocks.

During a 100 million year period, beginning 140 million ago, the sediment of the continental shelf was pushed inland to the northeast, up to a distance of 300 kilometres. The original flat layers slid on top of the granitic basement and bent into folds and thrust sheets of rocks that slid up and over one another.

In the last 2 million years, glaciation has carved deep and wide valleys between the

steep walls of the high ridges and the sharp summits. Hundreds of glaciers along the Continental Divide survive, on a smaller scale, and help to build the landscape and dump fragments of rock into the rivers and lakes of the Rockies.

From the east to the west, the Central Region of the Canadian Rockies is divided into three long strips approximately 40-50 km wide each in a southeast-northwest direction parallel to the Continental Divide: the Foothills, the Front Ranges and the Main Ranges. The direction of the dip is to the southwest.

The Foothills located between the plains and the mountains of the Front Ranges, are underlain mostly by Cretaceous sandstone and shale folded and thrust-faulted 50-60 million year ago. The Foothills are characterized by gently sloping ridges brown to orange in color.

The Front Ranges are underlain mostly by Late Paleozoic limestone forming the peaks and Mesozoic shale forming the valleys. The steep sides of the mountains are to the northeast, and the dip slope is southwest. The Front Ranges are characterized by spectacular folds and thrust faults.

The Main Ranges are underlain by Precambrian and Early Paleozoic rock. The folds are broad and gentle; the layers of quartzite and limestone are nearly flat-lying and form castle-like steep-sided peaks.

Kakwa Park is located in the northern portion of the Central Region, near the southern limit of the Transitional Region. Although, the area is considered to be in the Central Region, the Minnes and the Monkman Formations belong to the

Transitional Region.

In Kakwa Park, the three main physiographic regions of the Canadian Rockies seem to correspond to three different geological units. The Main range is located in the old clastic and early Paleozoic shale and dolomite unit, the Front Ranges correspond to the middle carbonate unit and the Foothills is associated into the young clastic unit. In the literature, the Foothills are described as the area between the Interior Plains and the mountains, although a line between the Foothills and the Front Ranges is not always evident (Gadd, 1995). The seismic lines, so characteristic of the Foothills landscape, are found as far west as Mount Minnes (see fig. 1.2), giving an indication of the western limit of the Foothills.

Travelling east along the old road from the McGregor Valley to the Alberta border, the landscape and the geology change drastically. The Early Paleozoic old clastic unit of the Main Ranges is present in the lower part of the McGregor Valley. Mounts St George and St David with their flat layers of rock and steep sides are good examples of this unit (Figure 4.1)

East of Wishaw Lake, the St George Fault marks the beginning of the middle carbonate unit characterized by its folded layers of limestone and shale. The knife-edge ridges of Mount St Andrew's and the Francis Peak-Broadview Mountain are good examples of the Front Ranges mountains (Figure 4.2).

Figure 4.1. View of Mt. St. George (left) and Mt. St. David (right) showing the flat layers of Cambrian rock very characteristic of the Main Ranges of the Canadian Rockies.

Figure 4.2. View of Mount St. Andrew's which is located in the Front Ranges mountains. The folded limestone formations are part of the Middle Carbonate unit of the Rockies.

About 7-8 kms east of the St George Fault, the Broadview Fault marks the end of the middle carbonate unit and the beginning of the young clastic unit. The orange brownish rock is least resistant to weathering and erosion compared to the other units. The rock dips southwest, allowing easy access to the ridges. The cliffs on the northeast side of the mountains show the thin layers of sandstone, siltstone and mudstone which are chevron folded. Mounts Minnes and Gorman at the Alberta border are good examples of the young unit rock formations of the area (Figure 4.3). From Kakwa Lake, looking northeast, we can see the contrast between Mount St Andrew's in the middle carbonate unit and Mount Minnes in the young clastic unit. Even more striking is the contrast if you look southwest at the tall wall forming the northeast side of Wishaw Mountain located in the old clastic unit of the Main Ranges.

Figure 4.3. The Mesozoic rock of the Mount Gorman ridge in the back is located in the young clastic unit.

4.2 Geological History of Kakwa Park (Figures 4.4 and 4.5)

The intent of this chapter is not to duplicate the work already done on the area, but to provide a more simple approach to describe the rock formations, so that the visitor with no earth-science background can understand and appreciate the importance of the geology in Kakwa Park.

Since most of the visitors are concentrated in the area between Jarvis Lakes and Intersection Mountain, the formations present in this section will be more detailed. Other formations are important for such reasons as: the large surface they cover, their presence in some dominant landscapes, their contrast with the surrounding rocks, their special geological features, or simply because thet are more visible.

Previous work in the area includes regional mapping by Campbell, Mountjoy and Young (1973), McMechan (1986), McMechan and Thompson (1985), Pell, Hammock, Fletcher and Harris (1992) and Taylor and Stott (1979).

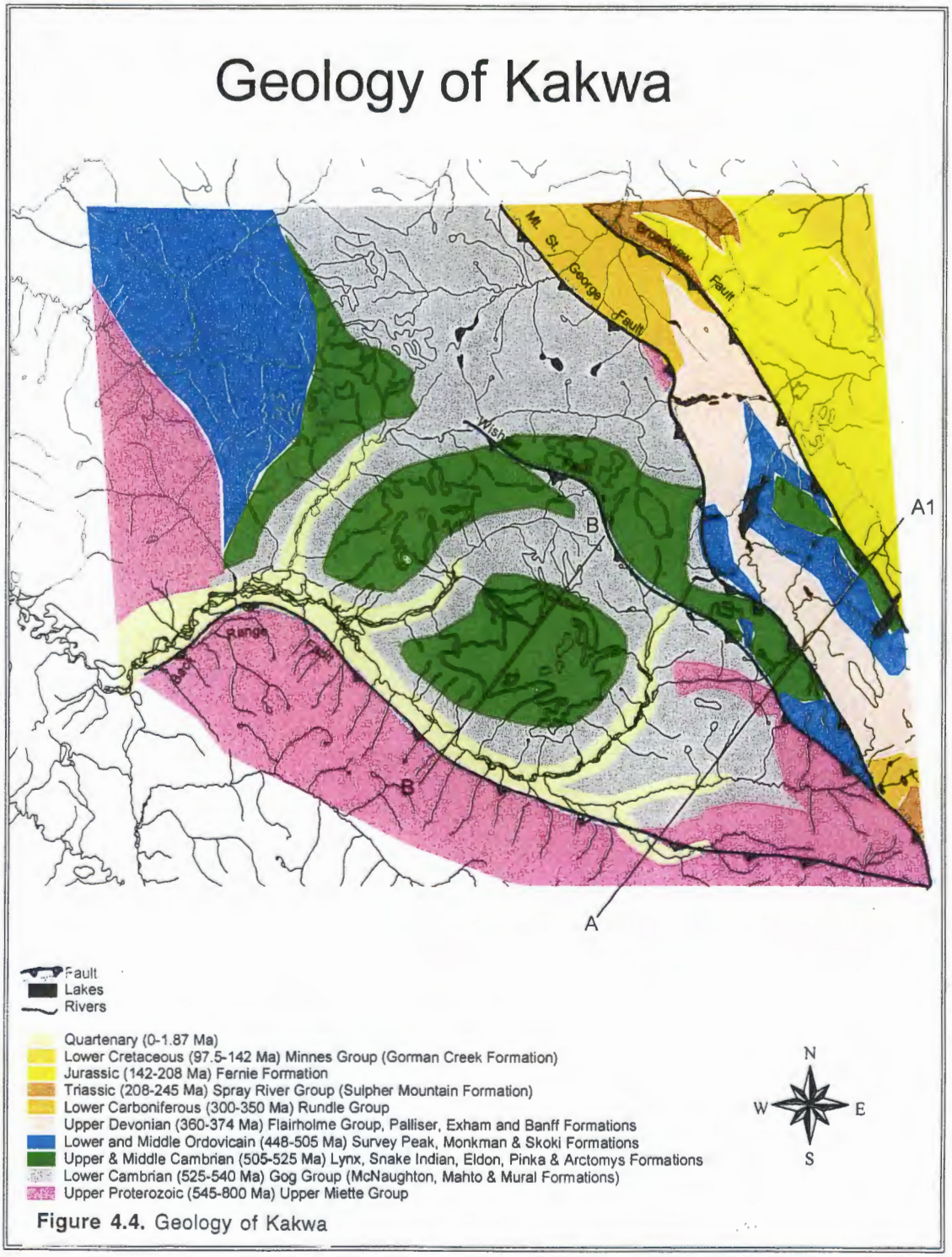

Figure 4.4. Geology of Kakwa

Diagrammatic Cross-sections

SCALE 1:2500,000

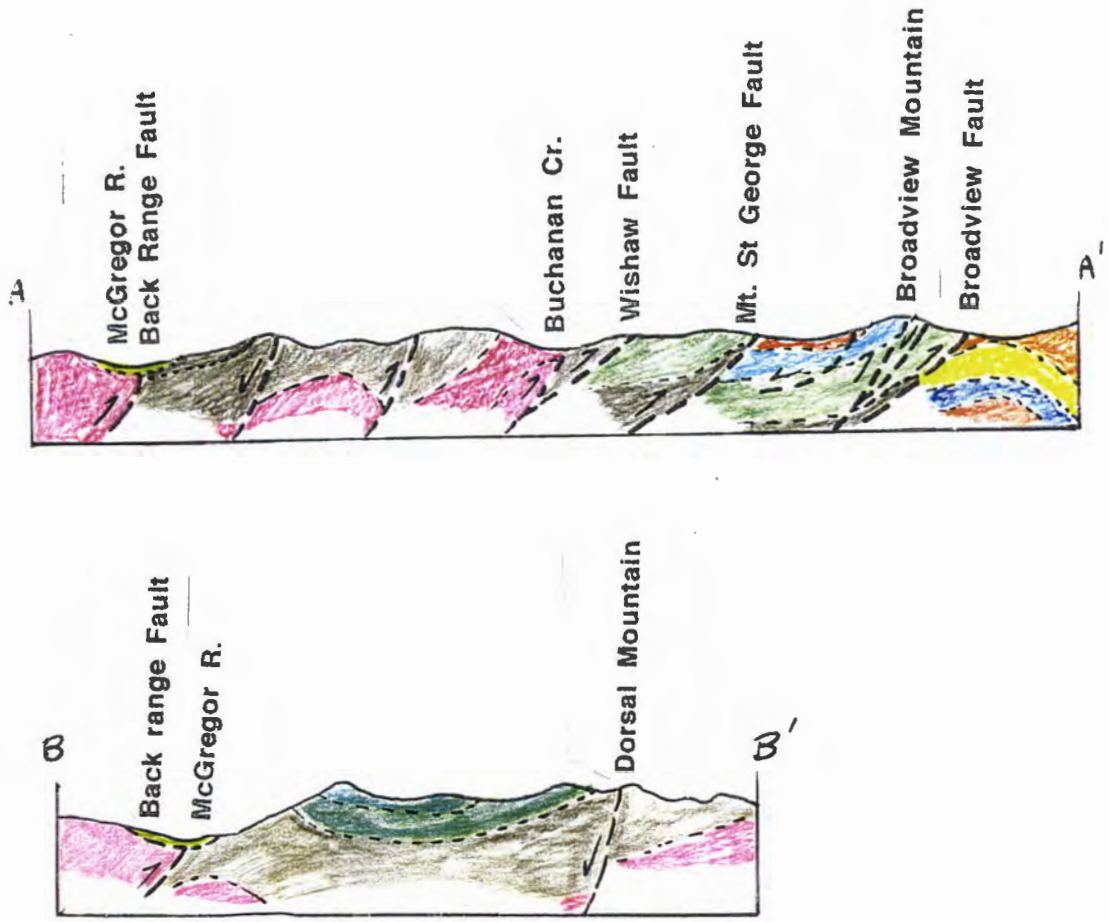

Figure 4.5. Cross sections A-A1 and B-B1 on figure 4.4

4.2.1 Upper Proterozoic (545 - 800 Ma)

The Upper Miette Group (Table 4.1) is exposed along the Mount St. George Fault in the Moonias Mountain area and west of Wishaw Fault in the Intersection Mountain area. Outside the Kakwa Recreation Area, rocks of the Middle Miette are exposed west of the Back Range Fault (McMechan, 1986). The name of the group originates from the Miette River in Jasper .

The Miette Group underlies most of the Rockies and is exposed mostly in the Main Ranges near or west of the continental divide. At Moonias Mountain, the Upper Miette has an approximate thickness of 500 metres in which two distinct lithologic units can be observed. The lowest unit consist of medium brown weathering quartzite-granule to peddle conglomerate, quartz wacke and medium grey quartz arenite, interbedded with brown and grey-weathering argillite and light grey quartz arenite. The second unit is a 200 metres of dark brown-grey argillite thinly bedded, with thin silty interbeds. Some tan-weathering breccia blocks stand out in relief against the more recessive argillite. In the Intersection Mountain area, rocks of the Miette Group are in well-bedded unit consisting of medium orange-brown weathering, dark, calcareous quartzite granule conglomerate and quartz wacke with interbedded medium to dark grey phyllite.

As one approches the Kakwa Recreation Area from the McGregor Valley most of the cambrian formations can be seen looking from the bottom of the valley to the top of Mount Sir Alexander. The 2000 meter (6600 feet) difference in elevation represents about 40 million years of deposition on the sea floor during the Cambrian period.

4.2.2 Lower Cambrian (525 - 540 Ma)

The Lower Cambrian Gog Group (Table 4.1) covers a large portion of the area between the Mt St George and the Back Range Faults and lays in disconformity on top of the Paleozoic rocks.

The Gog Group rock is mostly quartzite, the hardest rock in the Rockies, and forms the upper part of the old clastic unit of the Canadian Rockies. The group ranges in thickness from 75 - 4000 metres and is present continuously from Mt. Assiniboine to the Peace River. North of Peace River, the Gog contains more conglomerate and the name changes to the Atan Group. Some iron-oxide-rich zones weather into brilliant reddish-orange patches in the mountainsides. Lichens grow thickly on the rocks and give them a grey appearance from a distance. Named after Gog Lake, near Mt Assiniboine, the Gog Group is mainly exposed in the Main Ranges. The Gog quartzite is very resistant to erosion, forming enormous cliffs. Some good examples of this type of cliff are found at Mt. Pyramid and Mt. Edith Cavell near the town of Jasper.

In Kakwa Park, the Gog Group is represented by the McNaughton, Mural and Mahto Formations. The McNaghton Formation forms the base of the Gog Group and is estimated to be approximately 1500 metres thick. It is present in the lower cliffs of the peaks west of the Divide, and overlies the whole area north of Jarvis Creek and west of Moonias Pass. The resistant, rusty to black weathering unit forms a thick and fairly monotonous sequence dominated by medium to thick-bedded light grey quartzite. Trace fossils such as worm tubes and worm trails occur in the upper parts of the unit. The formation has been named after Mt. McNaughton in Mt.

Robson Provincial Park.

The Mural Formation, 70 - 450 metre thick, is found in the upper part of the Gog Group, between the McNaughton and the Mahto Formations and is present on the cliffs of Netim Mountain and at the top of Ochakwin Mountain east of Dimsdale Lake. Although the formation is not very thick in the Kakwa Lake area, the brown to orange weathered rock of the bottom contrasts with the grey weathering of the rest of the Gog Group. The lower unit is composed of dolostone and dolomitic quartzite with grey and greenish shale on top. Limestone and dolostone are present in the upper unit.

In Mural time, sand was not being laid down, so organisms depending on clear water could survive. It's also likely that the climate warmed, favoring the growth of sponges and other lime-depositing organisms that produce the rock. The limestone deposition ended after Mural time when sand deposition returned again to form the quartzite rock of the Matho Formation (300 - 3500 meter thick) that is very similar in composition to the Naughton formation. The Matho rock is present at the top of Netim Mountain (Figure 4.6).

4.2.3 Middle Cambrian (515 - 525 Ma)

From the Middle Cambrian to Late Ordovician periods in the central Canadian Rockies, the rock types tend to be repetitions. A shale formation is overlain by a limestone / dolomite formation, then by more shale, then limestone / dolomite again until a total of seven major sedimentary cycles is present.

Figure 4.6. The Lower Cambrian Gog Group formations are well exposed at Netim Mountain. The three units (dolomite, shale and limestone units) of the Mural Formation (E_{MR}) contrast with the quartzite rock of the McNaughton Formation (E_{MN}) at the bottom, and the Mahto Formation (E_{MH}) on top.

At this time, the continental platform was very wide and shallow. Such regions are very sensitive to changes in water depth, tidal effects and currents. As the water level changes, the type of deposition changes. When the water depth was stable, abundant sea life would produce a layer of limestone that quickly thicked, reaching nearly to the surface, and spreading over vast areas of the continental platform, the

water was so shallow that large waves could not reach the shoreline. The rise in sea level would have sent the shoreline farther inland and the large waves would have then reached the shoreline causing rapid erosion. The limestone depositions are overlain by layer of shale material created by the erosion of the continental shelf and carried on the platform by return currents moving along the bottom. Later, when the sea level stopped rising, erosion along the shore would stop, clear-water conditions would return, and the lime producing organisms would establish themselves again, completing the cycle.

The Middle Cambrian rocks are found in the mid-section of the high mountains located west of the Continental Divide. The Snake Indian Formation, approximately 400 metres thick, lays on top of the Mahto Formation. The lower part is more recessive with tan weathering and consists of green, red and grey shale and siltstone. The upper part of the formation is ribbed weathering and consists of thick limestone units separated by recessive bands of shale.

Massive, cliff-forming, dark grey limestones of the Eldon Formation overlie the Snake Indian shales and carbonates. These limestones vary from thin bedded and nodular to thick bedded. The Eldon Formation is approximatively 350 to 375 metres thick in the Kakwa area and is overlain by appoximatively 80 to 100 metres of ribbed-weathering limestone and dolomite strata of the Pika Formation.

The top of the Middle Cambrian sequence is marked by the Arctomys Formation, a distinctive, red-weathering recessive unit, 50 to 100 metres thick. It comprises of blood-red and minor amounts of dark green dolomitic shale and silty shale and thin bedded, tan-weathering dolostone.

4.2.4 Upper Cambrian (505 - 515 Ma)

The Lynx Formation is a resistant, cliff-forming unit found on top of most of the highest mountains in the area and is characterized by well-defined buff and grey colour-banding and bedding.The formation is also called Lynx Group and has been named after Lynx Mountain, a peak near Mt. Robson. The formation is estimated to be 600 to 800 metres thick. The lower part consist mainly of dolomite and the upper part is dominated by limestone.

4.2.5 Lower and Middle Ordovician (448 - 505 Ma)

The Ordovician formations can be seen on the east side of Mount Ian Monroe and the west side of Broadview Mountain. The Lower Ordovician Survey Peak Formation which forms the peak of Mount Ida is a resistant limestone unit, 450 to 600 metres thick and has approximately 30 to 70 metres of recessive calcerous shale and shaly limestone at its base.

The Survey Peak Formation is overlain by the Monkman Quartzite Formation. The Monkman is a resistant, light grey to buff-weathering marker unit that averages between 70 and 100 metres thick. The Monkman Quartzite is very similar to the rock found in the Gog Group.

The Middle Ordovician Skoki Formation overlying the Monkman is a dolomite unit characterized by monotonous, medium to thick bedded, finely crystalline dolostones. The formation is approximately 110 to 380 metres thick.

4.2.6 Upper Devonian (360 - 374 Ma)

Between the Middle Ordovician and Late Devonian periods not very much happened in the area in terms of deposition. A mild uplift of the continental shelf raised the middle carbonate rock out of the water, creating the West Alberta Ridge. The erosion began to carry away the exposed carbonate, causing a disconformity which underlies all the Devonian rock in the Canadian Rockies.

At the end of the Middle Devonian, Western Canada was in the tropics at that time and the West Alberta Ridge was eroded away. The climate was warm, and the clear, sunlit seabed was swarming with life. The Devonian reefs, rich in gas and oil were starting to build up and the Upper Devonian Fairholme Group is the result of those reefs. The Group comprises the Flume, Perdrix, Mount Hawk and Simla formations. In the Kakwa Recreation Area, the Fairholme Group is found between the Mt. St. George and Broadview Faults.

The Flume Formation is a very important formation to know because of its abundance of fossils. Although it is not very thick, 75 to 85 metres, the formation is a classic biostrome that formed the base upon which the Devonian reefs grew. The best place to see the Flume fossils is between Wapiti Mountain and Surprise Pass. The formation consists of shaly limestone, stromoporoid biostrome, and calcareous shale with discontinuous limestone beds where brachiopods are locally abundant. The fossils of the Flume Formation are discussed in more detail in the section on the significant cultural features of Kakwa Park.

The Perdrix Formation overlies most of the Flume Formation. Perdrix clay and silt were deposited on and between the reefs killing most stromatoporoids, except for the organisms on slightly raised areas. The greyish green to black Perdrix shale is found at the base of the ridge west of Kakwa Lake and the area between Kakwa Lake and Wallbridge Mountain. Thickness of the Perdrix Formation is estimated at between 185 and 470 metres.

The Mount Hawk Formation overlies the Perdrix shale and consists of cliff-forming grey limestone with a ribbed weathering pattern. It can be seen on the cliff of Wallbridge Mountain. The formation is approximately 90 to 215 metres thick. The Simla Formation marks the top of the Fairholme Group and is very similar to the Mount Hawk Formation. From a distance the lighter weathering colour of the Simla Formation makes it easier to distinguish the two units. Thickness of the formation is estimated around 65 metres.

The Palliser Formation disconformably overlies the Fairholme Group. It is the most massively layered, most homogeneous limestone in the Rockies. The formation is almost absent north of Jasper, except in Kakwa Park where a depression in the seabed allowed the Palliser sediments to cumulate up to 530 metres thick.

The Palliser is easy to recognize, with its light grey weathering massive layers contrasting with the brownish grey weathering formations east of Broadview Fault. The Palliser limestone forms the top of the ridge west of Kakwa Lake. Mount Hanington, northeast of Jarvis Lakes and Bastille Mountain, north of Sheep Pass (Figure 4.7) with their massive beds of Palliser limestone dipping to the southwest, are classic examples of the formation.

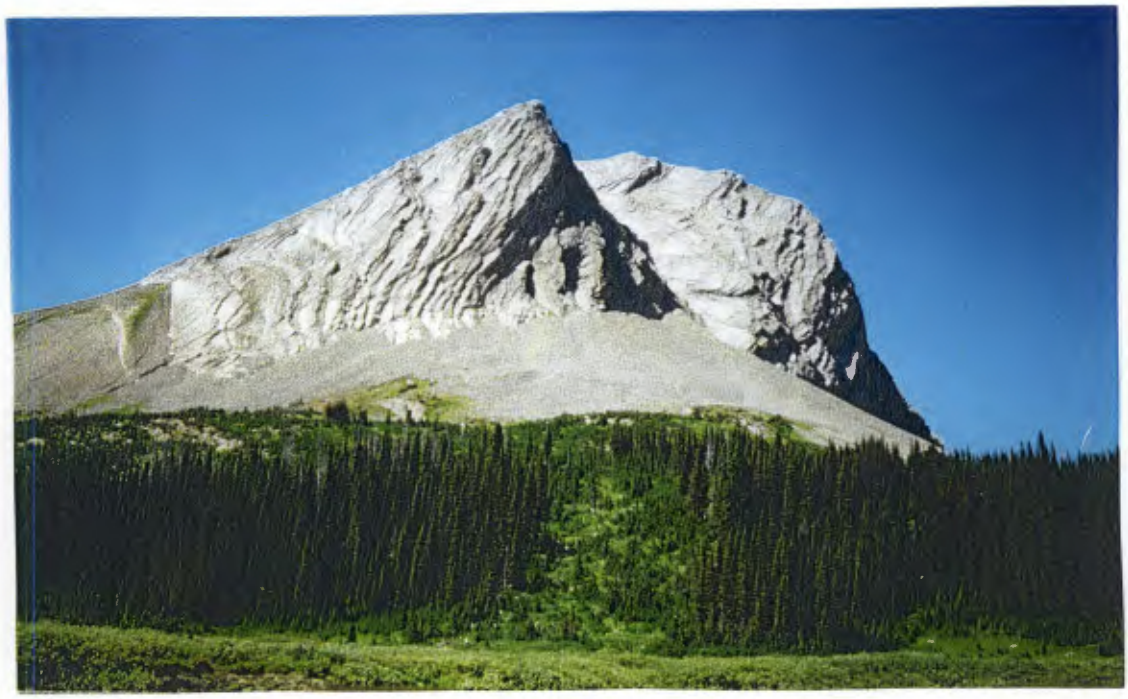

Figure 4.7. The thick-bedded, light gray-weathering and homogeneous limestone of the Palliser Formation is well-exposed at Bastille Mountain in the Sheep Pass area. The Palliser Formation is one of the more massively layered, most homogeneous limestone in the Rockies and contrasts with the other rock formations present in the Kakwa Park.

The Exshaw and Banff formations represent the end of the Devonian period and the beginning of the Carboniferous period. They disconformably overlie the Palliser Formation. The two formations are very similar in composition and consist predominantly of black shales with thin interbeds of lime wackestone, and are recessive and poorly exposed in Kakwa Park. A thickness of 180 to 260 metres has been estimated for the combined Banff and Exham formations, which are present in the lower part of the ridge north of Jarvis lakes, and also west of Intersection Mountain.

4.2.7 Lower Carboniferous (300 - 350 Ma)

The Lower Carboniferous Rundle Group consist of three limestone and one dolomite formations. The light grey weathering Rundle rocks are very similar to those of the Palliser Formation. The Rundle units are limited to the Intersection Mountain area and northeast of Moonias Mountain. They reach a thickness of 400 metres.

4.2.8 Upper Permian (245 - 258 Ma)

Widespread uplift during the Permian period left an erosion surface on top of the Paleozoic formations of the Rockies. In Kakwa Park, a thin layer of sandstone escaped erosion; the Upper Permian Mowick Formation, which is typically least than 10 metres thick. It is easily distinguished by its dark color and its stratigraphic position between the grey carbonate of the Ruddle Group and the orange to brown-weathering siltstone of the Triassic Sulphur Mountain Formation. This sequence can be found at Moonias Mountain and south of Intersection Mountain.

4.2.9 Triassic (208 - 245 Ma)

The Triassic period marks the beginning of the Mesozoic era and the rock of the Triassic Spray River Group forms the base of the young clastic units. Most of the rocks of the young clastic units are made of particles worn from nearby landmasses.

During the Mesozoic era, many things happened: an inland seaway linking the Gulf

of Mexico with the Arctic; a volcano in the southern Rockies, and the collision of groups of islands with North America, creating the mountains of Western Canada. The Rocky Mountain Trough was created between the mountains and the continent by the weight of the growing stack of folded, overthrust rock pushing the edge of the continent down into the mantle. For the rest of the Mesozoic and into the palaocene Epoch of the Tertiary Period, sediments from the west filled the Rocky Mountain Trough.

In Kakwa Park, the Triassic Spray River Group (Sulphur Mountain and Whitehorse formations) unconformably overlies Permian rocks. The Sulphur Mountain Formation is a moderately resistant, dark reddish, brown to brownish orange-weathering unit. The Sulphur Mountain rock consists of siltstone and silty limestone, and is approximately 405 - 470 metres thick. Fish fossils are found in the Vega-Phroso member. The formation is exposed in the cliffs of Moonias Mountain and south of Intersection Mountain. The Whitehorse Formation is not well exposed in Kakwa Park (Pell and Hammack, 1992).

4.2.10 Jurassic (142 - 208 Ma)

The Jurassic Fernie Formation is a recessive poorly exposed unit that unconformably overlies the Triassic Whitehorse Formation. Thickness is estimated to be between 250 and 900 metres. The upper part consists of brown-grey, very thin to thin bedded, red-brown weathering siltstone and silty sandstone. The lower part is almost absent of the area.

In Kakwa Park, the Fernie rock outcrops east of the Broadview fault. The brown

weathering Fernie rock of Mount Minnes which can be seen from Kakwa Lake contrasts with the light grey rock of the Devonian limestone exposed west of Kakwa Lake.

4.2.11 Lower Cretaceous (97.5 - 142 Ma)

The Lower Cretaceous is mainly represented by the Gorman Creek Formation which is present in the northeast part of Kakwa. It comprises a thick, orange-brown, ribbed-weathering succession of interlayered sandstone, siltstone, mudstone and carbonaceous shale. Some thin coal beds are found in the upper part of the formation. The thickness is estimated at 650 to 1000 metres. In the Mount Gorman area, the formation is unconformably overlain by two coal-bearing formations, the Gething and Gates, which are occupied very limited areas south and north of Mount Gorman.

4.2.12 Quaternary (0 - 1.87 Ma)

The Quaternary Period was the coldest and snowiest period in this area with ice building up in the Rockies. In the Kakwa Park, only deposits attributable to the most recent glaciation remain (the Fraser or Late Wisconsin Glaciation, which terminated approximately 10000 to 12000 years ago). Some of the major landforms in the area are the result of these glaciations. The most distinctive glacial landforms are cirques which generally occur on the northeast facing slopes.

Five types of deposits are found in the area: alluvium, colluvium, till deposits, moraine deposits and landslide deposits. The first type cover the bottom of the

deep valleys west of the Continental Divide. Moraine deposits are located nearby the existing glaciers, the largest and most accessible are found at the end of the Babette Lake road at the bottom of Mount St. George. The most recent type of Quaternary deposits is landslides which can only be found in the karst west of Mount St. George where large coherent blocks have detached from the Middle Cambrian limestone bedrock, making it very difficult to hike across the area.

TABLE 4.1 FORMATIONS AND GROUPS

Lower Cretaceous	Gorman Creek Fm	ss, slt, col	650-1000 m
Jurassic	Fernie Fm	sh, slt, sh	250-900 m
	unconformity		
Triassic	Sulphur Mountain Fm	slt, ls	405-475 m
	unconformity		
Permian	Mowick Fm	ss, cgl	10 m
	unconformity		
Lower Carbon.	Ruddle Group	ls, dol	400 m
Upper Devonian	Exham & Banff fms	sh, ls	180-250 m
	unconformity		
	Palliser Fm	ls (fossil-poor)	530 m
	unconformity		
	Flairholme Group		
	Simla Fm	ls (biostromal)	60-70 m
	Mount Hawk Fm	ls (fossiliferous)	90-140 m
	Perdrix Fm	sh (laminated)	85-470 m
	Flume Fm	ls (stromatoporoids)	75-145 m
	unconformity		
Lower & Middle	Skoki Fm	dol	110-380 m
	unconformity		
Ordovician	Monkman Fm	qtz	30-75 m
	Survey Peak Fm	dol, ls, sh	450-600 m
Upper & Middle Cambrian	Lynx Fm	ls, dol, arg	600-800 m
	Arctomys Fm	sh, dol	50-100m
	Pika Fm	ls, dol	80-100 m
	Eldon Fm	ls, dol	350-375 m
	Snake Indian Fm	ls, dol, slt	400 m
Lower Cambrian	Gog Group		
	Mahto Fm	qtz, dol	300-350 m
	Mural Fm	dol, qtz, ls, sh	225-300 m
	McNaughton Fm	qtz, cgl	1500 m
	unconformity		
Upper Proterozoic	Upper Miette Group	arg, ss, cgl	300 m

ABBREVIATIONS

arg	**argillite**	**cgl**	**conglomerate**	**col**	**coal**
dol	**dolomite**	**ls**	**limestone**	**qtz**	**quartzite**
sh	**shale**	**slt**	**siltstone**	**ss**	**sandstone**

4.3 Structure

Kakwa Park is divided into three structural domains. The eastern domain, includes the Jurassic and Cretaceous strata, east of the Broadview fault. The shale and thin-bedded sandstone of the area are relatively incompetent with chevron style folding (Figure 4.8).

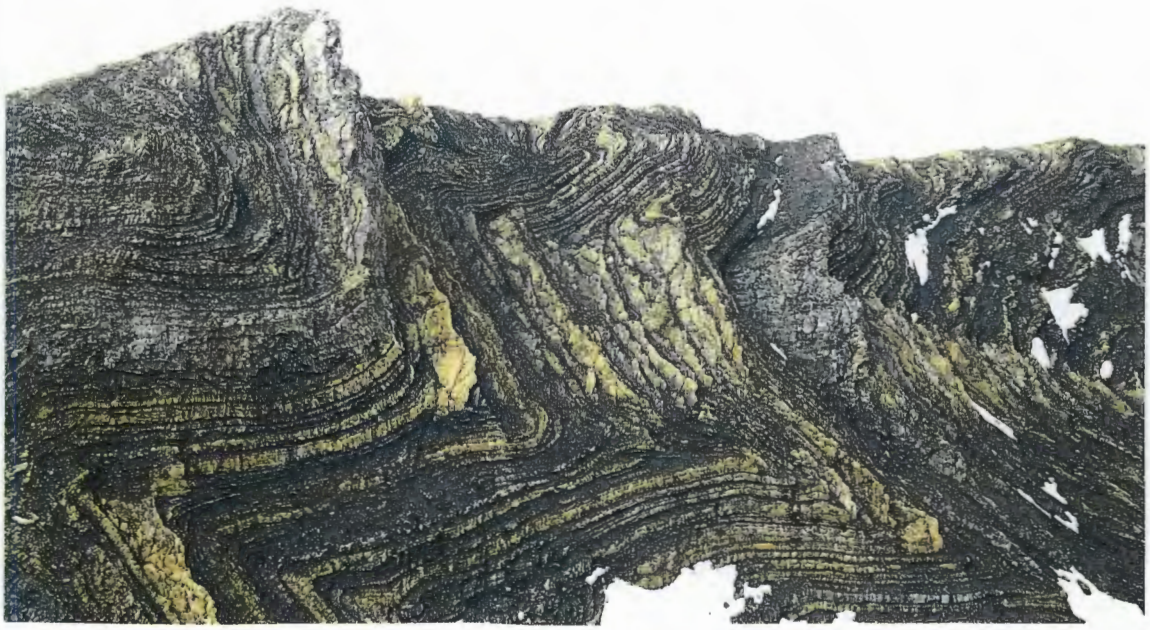

Figure 4.8. This shale and thin-bedded sandstone formation with chevron style folding found in the Mount Minnes area is typical of the eastern domain

The central domain is bounded by the Broadview fault to the east and, to the west, by the Wishaw fault in the south and the Mount St George Fault, north of Mount Buchanan. Many minor thrusts occur within this major sheet; and the rock is very folded. Spectacular folds such as Mount St Andrew's and Mount Jarrah (Figure

folded. Spectacular folds such as Mount St Andrew's and Mount Jarrah (Figure 4.9), south of Jarvis Lakes, can be seen in the central domain . The domain is overlain mostly by Middle and Late Paleozoic limestone, which is fairly competent. However thick incompetent units also occur within the sequence.

The western domain lies west of Wishaw fault, south of Mount Buchanan, and west of Mount St George, north of Mount Buchanan. The southern and western boundaries of this domain are the Back Range fault. The domain is underlain by Cambrian quartzite and carbonate rock, which are medium to thick bedded and quite competent. The mountains are castle-like, with steep sides all around. The dominant structures in this part of the area are open folds and broad warps. Normals faults are prominent within the block, particularly in the southwestern area near Mount Sir Alexander.

All the major faults in Kakwa Park converge south of Intersection Mountain to join the Back Range-Snake River faults system which goes as far south as Jasper Park. Along its middle section, the Broadview fault separates two domains with very contrasting elements: the grey weathered, competent, folded and thick-bedded limestone formations of the Upper Paleozoic period, and the brown to orange weathering, thin-bedded, incompetent shale and sandstone formations of the Mesozoic period. An anomaly in this fault system is the occurence of dense rocks called concretions. A concretion is a compact mass of mineral matter, usually specrical or disk-shaped and embedded in a host rock of a different composition. The concretions found in Kakwa Park are rich in iron oxide (Figure 4.10).

Figure 4.9. The anticline-syncline system showed on the folded limestone layers of Mount Jarrah, south of Jarvis Lakes, is located near the Mount St. George fault.

Figure 4.10. This oval shaped concretion is found in the Broadview fault north of Kakwa Lake. The rock is very dense compared to the surrounding rocks.

The spectacular Cambrian cliffs of Wishaw Mountain, Mount St George and Mount St David indicate the west side of the Mount St George fault. North of Mount St David, a large sink hole is located on the fault. In Moonias Mountain area, the fault put in contact the Upper Paleozoic rock with the old clastic formations. The gentle dip of the Cambrian formations on the west side of the fault contrasts with the steep dip and very folded Upper Paleozoic formations on the east side (Figure 4.11).

West of Mount St Patrick, the Wishaw fault marks the limit between the Mount Sir Alexander massive cliffs area and the Mount St Patrick and St David range. The southern part of Wishaw fault is joined by the Mount St George Fault and delimited the same formations as the northern part of Mount St George Fault.

The Back Range fault located outside Kakwa Park, along the McGregor River and the Bastille Creek on the east, marks the limit between the Proterozoic Upper Miette Group and the Paleozoic Gog Group. South of Intersection Mountain, the Mount St George and Broadview faults join the Back Range fault to become part of the Snake Indian fault system which extends southeast.

Figure 4.11. The Mt. St. George fault located at the bottom of Mount St David on the left separates the flat layers of Main Ranges from the very folded rock of the Front Ranges on the right.

4.4 SIGNIFICANT GEOLOGICAL FEATURES

4.4.1 Cultural

Fossil Fish (Moonias Mountain)

The Triassic fossil fish site of the Moonias Mountain area is one of the two best sites in British Columbia; the other site is located in the Wapiti Lake area, north of Kakwa Park. This second location was found in 1947 by a group of researchers from the University of Wisconsin, and has provided one of the best records of the Lower Triassic fish in North America. Since that time, many expeditions have visited the area, including some commercial collecting groups. The area is now considered a Provincial Heritage Site and is protected.

The Moonias Mountain fossil fish site was originally found by Dr. Barry Richards of the Geological Survey of Canada in the early 1980s. It was surveyed in 1991 by J. Pell and J.L. Hammack of the Ministry of Energy, Mines and Petroleum Resources of British Columbia. The fish fossils are found in the Vega-Phoro siltstone member of the Sulphur Mountain Formation. In the Moonias area, (the upper members of the Sulphur Mountain Formation) the Whistler and Llama which overlain the Vega-Phroso, have been eroded away or truncated by a northeasterly directed thrust fault.

The fossil fish are generally found on buff to orange weathering slabs of calcareous siltstone. Seven genera of fish, belonging to the Class *Osteichthyes* (bony fish) have been identified from the Sulphur Mountain Formation. *Bobasatrania*

canadensis is one of the more common genera found in the Moonias site where some very well-preserved specimens can be found. Generally they are 15 to 20 centimetres in length and have a distinctive diamond shape, a curved vertebral column and an asymmetrical tail (Figure 4.12). Ammonites, pelecypods are also common but not well-preserved.

Figure 4.12. *Bobasatrania canadensis*: the bluish phosphatic specimen with its distinct vertebral column and asymmetrical tail was found *in situ* on the cliffs of Moonias Mountain.

Figure 4.13. *Boreosomus sp.*; only the front part of the specimen is present. The specimen is approximately 40 centimetres long.

Figure 4.14. Chondrichthian spine; the spine is believed to represent some part of the skin of ancient sharks.

Stromatoporoids Biostrome (Surprise Pass)

In the late Devonian Period, the main reef-builders were stromatoporoids. When those organisms died, they turned into dolomite, which destroyed the fine detail; what remains are fist-sized grey blobs with hollow centres. After finding some intact fossils, paleontologists learned that the blobs were in fact, colonies of sponges that often grew in limy crusts and layers. At the end of the Devonian Period, a mass-extinction event (a meteorite or a comet) killed most of the creatures in the seas, and the stromatoporoids ceased to be important in the fossil record.

The lower part of the Flume Formation contains a stomotoporoid biostrome which is well exposed in the Surprise Pass area. Some large, mound-shaped and locally silicified specimens in apparent life position appear on top of the bedrock.

Brachiopod Gravels (Wapiti Mountain)

The upper part of the Flume Formation consists of shaly limestone, relatively recessive, thin-bedded to nodular units that become increasingly shaly in the upper layers. They contain corals, crinoids and particularly brachiopods. The most common genera of brachiopods are the Atrypa, the Allanaria and the Athyris.

On the flat summit of Wapiti Mountain, the weathering of a layer of extremely abundant brachiopods formed brachiopod gravels where the more recessive, shaly limestone matrix eroded to leave the brachiopods laying by themselves like pebbles in a gravel pit. The gravel is more abundant on the southern slope of Wapiti Mountain. In the Fossil Pass area, where the upper part of the Flume

Formation is also exposed, the same brachiopod gravel can be found, although it is not as abundant.

4.4.2 Economic

Coal deposits (Mount Gorman)

Coal is the most valuable mineral mined in the Northeast-Central Region of BC. The Quitette and Bullmoose mines located near Tumbler Ridge produce metallurgical grade coal that is exported to Japan. The 1977-78 Northeast Coal report studied the feasibility of exploiting the Saxon Ridge deposit located south of the Narraway River and adjacent to the Alberta border. The three possible transportation routes would have passed through Kakwa Park (McGregor Pass, Jarvis Pass and Gray Pass). At present, given the low price for coal and the economic situation in Japan the project is not economically viable, and even the survival of the existing mines is now in doubt.

Coal deposits are also present in the northeast corner of Kakwa Recreation Area. Thin coal beds, averaging 30 to 50 centimetres in thickness are located in the upper part of the Lower Cretaceous Gorman Creek Formation. On the ridge south of Mount Gorman, four significant seams have been found in the Gething and Gates formations which overlain the Gorman Creek Formation. The thickness of the seams range from two to six metres thick.

Dimension Stones (Wishaw and Babette Lakes)

In two areas near Wishaw and Babette Lakes, quartzites of the Lower Cambrian Mahto Formation were examined in the late 1970s and early 1980s for their potential use as dimension stone. At that time, the existing logging road in the McGregor River valley was extended to the prospects. In 1997, Ava Resources tried to proceed with a quarry operation at the Wishaw Lake deposit which was worked unsuccessfully in the early 1980s.

The quartzite found at Wishaw Lake site is creamy white, beige or light pink in colour with colour banding, while at the Babette Lake site the colour varies from creamy white to dark maroon in colour; some beds are uniform in colour, while others have attractive colour banding. The quartzite from these prospects has a colour and textural qualities comparable to high-quality marble and a strength comparable to high-quality granite.

Due to the extreme hardness of the material, it is more difficult and more expensive to finish than either marble or granite. The variable porosity of these quartzites causes another concern. In some places, the rock is well cemented, while in others, it is very porous, and stains easily if not treated with some types of sealant coating to reduce staining. At the Wishaw Lake deposit, bedding thickness ranges from 50 centimetres to just over 1 meter, making it difficult to quarry blocks with the size range preferred by industry (1.4 x 1.6 x 3 m). Figure 4.15 shows quartzite blocks at the Wishaw Lake site. In contrast at the Babette Lake deposit, high quality material at or near surface was found in beds ranging from 7.6 to 8.7 metres thick (Pell and Hammack, 1992).

Figure 4.15. Quartzite blocks quarried at the Wishaw Lake site. Those particulary blocks are not in the size range preferred by industry (1.4 x 1.6 x 3 m)

4.4.3 Recreational

Cliff Fallscape (Pommel Mountain)

Waterfall landscapes or fallscapes are localised concentrations of several falls, which tend to occur in association with glacial melt-water and steep descents over

cliff faces. In the Mount Sir Alexander area, the considerable volumes of water which debouch from the rock wall of Pommel Mountain suggest the presence of extensive underground drainage systems (Figure 4.16). The glacial melt-water probably leaks through some minor faults and reaches as low as the limestone layers of the Upper Snake Indian Formation and follows the dip of those layers out on the face of the cliffs. The absence of limestone in the Lower Cambrian formations may prevent the expansion of the drainage system below the upper part of the Snake Indian Formation, which marks the lower limit of the thick limestone units in the area.

Figure 4.16. On the southwest flank of Pommel Mountain, water surges from the grey weathering, thick limestone units of the Snake Indian Formation which are separated by bands of tan weathering shale and interbedded dolostone.

Sink Holes (Corniche Pass)

Sink holes (or swallow holes) are karst features. Karst formations are defined as any place in which the landscape is altered by solution, and are always associated with limestone rock which dissolves easily in rain water, a mild solution of carbonate acid (H_2CO_3) (Figure 4.17). The solution combines with calcium carbonate ($CaCO_3$) to produce carbon dioxyde (CO_2) and calcium bicarbonate ($Ca[HCO_3]_2$), and leaves no insoluble residue other than impurities within the limestone.

In Kakwa Park, many sink holes are found in the Palliser Formation. The most impressive is located in the Corniche Pass area, south of Jarvis Lakes, where the whole drainage system converges to a creek which disappears in a large hole in the bedrock. The sink hole is located on the Mount St George fault that separates the Cambrian quartzite of the McNaughton Formation and the Devonian limestone of the Palliser Formation.

High peaks and glaciers (The Sir Alexander Group)

The Sir Alexander Group located west of the Continental Divide marks the northern end of the great peaks in the Canadian Rockies. A distance of 90 kilometres separates this group from the Resthaven Group in Jasper Park. The area between the two groups contains no peaks exceeding 2700 metres, and no icefield can be found. This isolated group is dominated by two high peaks, Mount Sir Alexander and Mount Ida (Figure 4.18) which may be lower than peaks further south, but because the valleys are lower than elsewhere in the Rockies and the treeline and

snowline are lower as well, they look equally impressive.

The northwest face of Mount Ida in the figure 4.19 showed the 2000 meter drop between the top of Mount Ida and the bottom of the Jarvis Creek Valley. The Hart Ranges located north of Jarvis Creek also present some signifiant mountains and glaciers but are not as impressive as the Sir Alexander Group.

Located 6 kilometres south of Kakwa Lake, the Wishaw Glacier is the most accessible glacier in the area. It covers a area of four square kms and is surrounded on three sides by steep cliffs and allow to access the summit of Wishaw Mountain.

Figure 4.17. This deeply fissured limestone surface are a good example of karst. Water has dissolved the cracks, working its way underground.

Figure 4.18. Mount Sir Alexander (3270 metres) is the highest peak in Kakwa Park.

Figure 4.19. The northwest face of Mount Ida viewed from the ridge north of Jarvis Creek. A 2000 meter difference in elevation separated the top of Mount Ida and the bottom of the Jarvis Creek Valley.

5.0 THE TRAIL AND ROUTE SYSTEM IN KAKWA PARK

This chapter describes some of the main routes and trails of Kakwa Park. I learned to be careful when given information about the trail and route system in Kakwa. Using the term trail to describe a way to go from point A to point B instead of the term route has mislead a few visitors used to the well-marked horse trails of our National Parks.

In the dictionary, the term "route" is defined as a course or way taken in travelling from one point to another. On the other hand, the term "trail" refers to a path or track made by repeated passages of persons or animals, especially a path made by repeated passages through wilderness. A route may eventually become a trail if there is an increasing number of persons or animals using exactly that same route. The opposite may also be true, a trail may become a route if the trail is not used anymore by a consistent number of persons or animals. Then the term route becomes more appropriate to use when describing abandoned horse trails where the only remained signs are the blazes left on the trees.

In Kakwa Park, I have used the term trail to describe a path marked and consistently used by horses which remain the main means of transportation in the area. Most of the routes described in the text are not marked and are not accessible by horses. High mountain passes have often to be crossed along those routes. Although some routes in the Cecilia Lake area are sometimes used by horses, they are not visited regularly and are not well indicated. Some of the trails appear on the out of date topographic maps but cannot be found on the ground. The routes indicated on my Kakwa trails and routes system are those that I judged would be the most enjoyable

and memorable for visitors, over diverse landscapes. I also chose to indicate the routes and trails that have the least impact on wildlife and presented a minimum of hazards to the hikers. There are routes that I did not describe in this paper, leaving the chance for others to discover their own secret places.

The trails and routes system has been divided into three main parts: the first part is a description of the day hikes from Kakwa Lake campsite, the second is on day hikes from Jarvis Lakes cabin and the third is a description of two overnight trips from Kakwa Lake. A brief description of the Boundary Trail which is part of the Kakwa Lake - Mount Robson Divide trail concludes this chapter.

5.1 Day Hikes from the Kakwa Lake Campsite (Figure 5.1)

The Kakwa Lake campsite is the base camp for most visitors in the park. It is close to the Kakwa Park HQ where a park ranger or a park host can provide the latest information about trail conditions and park regulations. The campsite has a minimum of facilities such as toilets and bear poles, and provides the best location along Kakwa Lake to fish from the shore.

From the campsite, visitors can make day trips in the surrounding area which is generally more accessible than the rest of Kakwa Park, and offers representative samples of the different landscapes present in Kakwa Park. The four major destinations of the Kakwa Lake area are Mount Ruth, LaGlace Lake, Mount Ian Munroe and Babette Lake which each constitutes a day hike from the Kakwa Lake campsite.

5.1.1 Mount Ruth

At 8310 feet high, Mount Ruth constitutes the highest point east of Kakwa Lake. The 360 degrees view at the summit offers an unique opportunity for the visitors to see most of the high peaks of the Kakwa Park area. In clear weather, Mount Robson may be seen to the southeast.

The south west ridge of Mount Ruth can be accessed along a recently flagged route which starts about 100 metres north of Wapumum Meadow along the East Kakwa Lake horse trail. The route goes through an old burned area in an east direction until it reaches a large alpine meadow from which the south west ridge of Mount Ruth can be seen. The slope of the ridge is low to moderate near the top. There is a scree area in the middle section of the ridge with sharp limestone rocks. The elevation gain from Kakwa Lake is 3400 feet. The hike to the top is about 3 - 4 hours (one way) and there is no water available along the route.

5.1.2 Mount Ian Munroe

Although Mount Ian Munroe is only 7100' high, the summit offers a spectacular view of the Babette Lake area with the colourful stripes of the Mounts St George and St David cliffs on the west side. Morning is the best time to catch the sun shining on the cliffs and the whole Babette Lake cirque. The summit can be reached on the east side from the road where a sign indicates the route to the top of Ian Munroe. It is a short but steep route to the summit. The elevation gain is about 2000 feet from Kakwa Lake and the trip takes about 2 hours (one way).

5.1.3 Babette Lake

As suggested by its former name, Bear Lake, the area is a prime habitat for grizzly bears. Extra precaution is needed when travelling in the area. Babette Lake is easily accessed along the old mining road which goes as high as the front moraine of the glacier located at the base of Mount St George. The road is still in very good condition and makes it possible for cyclists to ride the whole road. From Kakwa Lake, there is a short cut trail starting at the Park HQ which allows quick access to the road. The hike to the end of the road takes about 2 - 3 hours (one way) and the elevation gain is about 700 feet. From the end of the road it is possible to explore the glacier and the alpine meadow on the east side of the cirque.

An alternative route to come back is to climb the saddle located between Mount Ian Munroe and Mount St George. The summit of Mount Ian Munroe can also be accessed from this point. On the saddle, the road is visible in the McGregor Pass area. The whole loop to Kakwa Lake takes about 7 - 8 hours.

5.1.4 LaGlace Lake

The front moraine left by the recession of Wishaw Glacier has formed a dam on the north side of the present lake. Today the depression between the glacier and the front moraine has been filled by glacier water which created LaGlace Lake. Although Wishaw Glacier is no longer visible from the lake, it continues to feed the lake through an underground drainage system which gives the milky blue color to the lake.

The trip to the lake is a relatively easy hike. From the Kakwa Lake campsite the trail crosses the creek and follows the Kakwa Pass horse trail on the east side of Wapumum. About 3 kms from Kakwa Lake, there is a sign on the right side of the trail indicating the route to LaGlace Lake. From this point the route follows some open meadows. At the south end of the last meadow, there is a steep wooded hill at the top of which the lake can be seen. The trip to the lake is about 2 - 3 hours (one way) and the elevation gain is about 300 feet; although the shores are not easily accessible, it is possible to circle the lake. Wishaw Glacier and Wishaw Mountain can be reached from the lake area.

5.2 Day Hikes from the Jarvis Lakes Cabin (Figure 5.2)

The park cabin located on the north shore of the largest lake of Jarvis Lakes is used by many hikers as a base camp to visit the ridges on both sides of the lakes. Built in 1988 with logs from the old lodge that was situated near the same location, the new cabin offers comfort and refuge against the elements. The presence of the cabin incites people to stay longer in the area and do day trips from the cabin. From the cabin doorstep, the spectacular view of Mount Ida and its reflection on the lake offers to the visitors an unforgettable memory of the area.

From Kakwa Lake, Jarvis Lakes can be accessed via the horse trail on the west side of Kakwa Lake and along Kakwa River. At the Twin Lakes, a sign on the left indicates the trail to Jarvis Lakes. The trip lasts about 4 - 5 hours and the elevation gain is around zero. Although the trail is not well-maintained, it is the easiest way to reach Jarvis Lakes from Kakwa Lake. Some very challenging routes through high passes may also be used between the two areas and they will be discussed later in the next section.The horse trail along the north side of the lakes, which ends about 2 kilometres west of the cabin is the only marked trail in the area. From that point, the old trail crossed a swampy area and becomes impossible to follow. Some of the routes described in this section follow parts of the old remnant horse trails to Moonias Pass and Edgegrain Creek.

From the Jarvis Lakes cabin, visitors can make day trips on the mountains north of the lakes or at the sink hole and Mount Jarrah area on the south side of the lakes. The four more popular destinations of the Jarvis Lakes area are Moonias Mountain, Moonias Pass, Calcaire Pass and the sink holes and Mount Jarrah area.

The four day hikes involve significant elevation gains and bushwhacking in some cases.

5.2.1 The sink holes and Mount Jarrah area

The area is about five kilometres south of the cabin. The main sink hole is located directly south of Mount Jarrah on the St George Fault which separates the quartzite rocks of the Main Ranges of the Rockies on the west side from the limestone rock of the Front Ranges on the east side. The creek that drains the whole valley suddenly disappears in a large hole which is often covered by ice and snow.

The route to the sink holes valley and Mount Jarrah starts at the east end of the largest lake which can be reached from the cabin via the horse trail and the shoreline. Once the creek is crossed, by hiking on a straight line south through the forest, a small lake east of Mount Jarrah is reached. The lake is at the beginning of the alpine zone. From there, the south ridge of Mount Jarrah is visible and the base of the ridge can be reached through the alpine meadows. From this point, the creek flowing from the lakes at the bottom of the valley can be seen disappearing under the ridge. The route to the summit of Mount Jarrah follows the top of the ridge. The summit offers a spectacular view of Jarvis Lakes and the cliffs of the Mount Hannington and Moonias Mountain area on the north side of Jarvis Lakes.

5.2.2 Moonias Mountain

The Moonias Mountain area has two unique geological features in Kakwa Park. The Precambrian Miette Formation (730 - 540 millions year old), which appears at

the summit of Moonias Mountain and extends south down to Jarvis Creek is the oldest rock formation in the park. The Triassic Sulphur Mountain Formation 245 - 208 million year old), east of Moonias Mountain contains well preserved fossil fish. It is one of the few localities in the world where Triassic fossil fish can be found.

The hike to the top of the ridge starts near the end of the marked trail, about two kilometres west of the cabin. From there the route follows a creek up to the alpine area. The slope is moderate to steep near the top and the elevation gain is about 2000 feet. The hike from the cabin to the top of the ridge is 2 -3 hours (one direction), and another 30 minutes to reach the summit of Moonias Mountain. From the ridge, there is a panoramic view of Mount St George glacier and Mount Ida.

5.2.3 Calcaire Pass

Calcaire Pass is located in the mountains north of Jarvis Lakes, and gives access to Bev Lake and the area on the north side of Mount Hannington. The limestone scree and high cliffs on each side of the pass makes the area very unique in Kakwa Park. The route starts along the horse trail, about 2 kilometres east of the cabin. An open area with a creek running from the pass area (the second creek from the cabin) marks the beginning of the route. The elevation gain is 1400 feet with a moderate to steep slope up to to the pass where slope levels off. The trip takes 2 - 3 hours (one way) from the cabin. Although a route is possible to the Hannington area, it is very steep in places and is not recommended to experienced hikers.

5.2.4 Moonias Pass

Moonias Pass gives access to the alpine area along the Continental Divide between Moonias Lake and Dimsdale Lake. An abandoned horse trail links Jarvis Lakes to Moonias Lake through Moonias Pass and continues along Moonias Creek to the Narraway River. From Moonias Lake, an alpine route is possible on the north side of the Continental Divide and allows access to the Dimsdale Lake area. The trip to Dimsdale Lake takes 3 - 4 days and the same route has to be used to return to Jarvis Lakes, unless aircraft are used.

The mountains north of Moonias Lake are easily accessible through Miten Pass, north of Nitem Mountain. The summits of the mountains offer a spectacular view of the Narraway Valley and Manitou Mountain at the northern limit of Kakwa. However the trip to this area represents an overnight trip from the Jarvis Lakes cabin. The horse camp on the north side of Moonias Lake can be used as a base camp to explore the area behind Miten Pass.

The hike to Moonias Pass from the Jarvis Lakes cabin starts along the horse trail in the west direction and follows it for about three kilometres where the trail disappears on the ground. Blazes on the trees continue to mark the location of the old horse trail leading to the alpine meadow, south of the pass. Although the elevation gain is only 600 feet and the slope moderate, the whole route up to the pass is through a forest covered area which may make hiking difficult; the trip is 2-3 hours (one way).

5.3 Overnight trips in Kakwa Park

There are many possibilities for overnight trips in Kakwa Park for longer-term visitors. The hike to access Kakwa Park from Buchanan Creek in British Columbia or Dead Horse Meadows in Alberta takes one day in each direction. Those two days to get in and out of the area limit the number of days visitors can spend on overnight trips in the park.

The two overnight trips described in this section represent the most spectacular hikes in the park characteristic of the Canadian Rockies. Both trips make a loop from Kakwa Lake and last about 4 or 5 days. The two loops combined together cover a selection of the major natural features that Kakwa Park and the Rockies have to offer to the visitors. The first loop trip is the hike to Jarvis Lakes through Corniche Pass and returning along Edgegrain Creek and through Bellevue Pass to Kakwa Lake. The loop is mostly along unmarked routes through difficult passes impassable for horses. It travels through the Main Ranges of the Rockies at the foot of the high peaks in the vicinity of the Mount Ida and Mount Sir Alexander.

The second loop trip is the hike from Kakwa Lake to the Sheep Pass via Surprise Pass and Goat Pass. The loop follows some of the few horse trails regularly used by horse parties from Alberta and travels through some fossiliferous and karst formations characteristic of the Front Ranges of the Rockies. The low and gentle slopes of the Foothills ridges visible on the east side of Sheep Pass contrast with the high cliffs of the Main Ranges on the west side. Although long overnight trips are also possible to Cecilia Valley, Hannington Pass and Dimsdale Lake, those hikes do not have as much diversity as the two trips described in this section, and

they don't offer the possibility to make loops trips from Kakwa Lake.

5.3.1 The Jarvis Lakes Loop Trip (Figure 5.3)

The loop trip to Jarvis Lakes from Kakwa Lake through Corniche Pass and Bellevue Pass offers many challenges to the hikers who are well accustomed to the rigours of bushwhacking and rock scrambling. The high passes and rough terrain make the trip difficult, but justified by the alpine scenery and the natural features experienced.

The three suitable campsites found along the circuit are the Jarvis Lakes cabin site, the old horse camp at the north end of Edgegrain Lake and the horse camp at Muriel Lake by McGregor Pass. Another location at the bottom of the falls on Edgegrain Creek is also a good campsite for those who want to hike to the top of Mount St David. The Muriel Lake campsite is a good location for hikers who want to return directly to Buchanan Creek parking area the next day.

The first portion of the circuit, from Kakwa Lake to Jarvis Lakes through Corniche Pass, can be used as an alternative route to the less scenic but easier horse trails at the bottom of the valleys. However the 2500 feet elevation gain from Kakwa Lake to Corniche pass and the steep slope on the north side of the pass make the trip to Jarvis Lakes much more demanding than the horse trails. The alpine meadow on the south side of the Corniche Pass with the colourful cliff of Mount St David and Babette Lake, a typical cirque lake, at the bottom of the cirque make this part of the route very scenic. On the north side of the pass, the glacier deposits covering the bottom of the valley contrast with the alpine meadow of the south side. The creeks flowing from the small lakes found on the bottom valley converge toward the main

sink hole at the base of Mount Jarrah.

After the torturous descent on the left side of the pass, the hike to the northern limit of the alpine area is easy and pleasant. Once the lake on the east side of Mount Jarrah is reached, there is about 2 kilometres of bushwhacking to get down to the east end of the main lake of the Jarvis Lakes chain. The horse trail along the chain can be found about 100 metres after fording the creek which is never very high. The cabin, which can provide shelter for the night, is situated 1.5 kilometres along the trail in the west direction. One advantage of taking the route through Corniche Pass is to see the sink holes and Mount Jarrah area which otherwise would be a full day trip from Jarvis Lakes cabin. The area is described in section 5.2.1, day trips from Jarvis Lakes.

The next portion of the circuit, from Jarvis Lakes cabin to Edgegrain Lake, follows an old horse trail along Edgegrain Creek that was used to link Jarvis Lakes to the McGregor Valley along Kitchi Creek. The elevation gain is only 500 feet between Jarvis Lakes and Edegegrain Lake and the ascent is very gradual up to the falls area. The old horse trail starts about 2 kilometres west of the cabin along the route heading to Moonias Pass. After fording the creek at the west end of Jarvis Lakes, the well-defined horse trail follows a 4 kilometre straight line to the dry riverbed of Edgegrain Creek. A cairn beside the creek indicates where the trail continues on the other side. The creek can be hazardous to ford during high water periods, but it is better to cross the creek at this point since the east shore becomes steeper and difficult to travel. The old trail becomes more difficult to find on the other side of the creek, but the terrain is easy to travel. About one kilometre before the falls, the trail leaves the shore and starts to climb on the mountain side to join the creek again at

the top of the falls. From there, it is mostly open area up to Edgegrain Lake.

The Edgegrain valley is narrow and not very scenic until the falls area is reached. At the falls, water from the Mount St George Glacier pours from the top of the cliffs creating some cliff falls fed by an underground drainage. For the hikers who want to visit the falls and do a day hike to Mount St David, there is a good location for a campsite at the end of the second dry riverbed.

The third portion of the circuit, between Edgegrain Lake and Muriel Lake, is an alpine route through Bellevue Pass and on the mountainside of Mount St Patrick and Mount St George. From the Edgegrain Lake campsite, the route goes on the east side of the lake to the creek which flows from the Bellevue Pass area. The pass is at the base of the west ridge of Mount St Patrick. The grade of the route is moderate to steep up to the pass, but there are no major difficulties in reaching the summit of the pass.

At the summit, there is a delightful view of the area north of the pass. Mount Ida, Edgegrain Mountain and the Three Sisters are in the background. The icefield in the centre plan forms an harmonious whole where each element balances well with the others. All seem to be ready for a picture. Edgegrain Lake in the frontground with the green forest and alpine cover spreading from the lake up to the mountains contrast with the grey of the cliffs and the white of the icefield.

From Bellevue Pass, the trip may present a real challenge, depending on the route chosen or the weather conditions. Some boulder hoppings may be necessary in the area before the south ridge of Mount St George. In bad weather, the trip may be

risky since the high route is very exposed to the west, where the summit of Mount Sir Alexander and its icefield can generate bad weather. The route is roughly at the 6500 feet elevation level, which allows the passage down the cliff that forms the east side of the Mount St George south ridge. The passage is obvious in the other direction but difficult to find when coming from Bellevue Pass. Although going down the 20 metre cliff may be strenuous or frightening, the rest of the route is much easier. The view of Mount Sir Alexander and the adjacent peaks is remarkable: the drastic drop in elevation between the peaks and the bottom of the valley leave the image of an inaccessible massif.

From the south ridge of Mount St George, the route continues to follow the mountainside across a creek and up to the low saddle east of the depression. From there, the route follows the base of a cliff down to the forest where the road can be seen. After 200 metres of bushwhacking, the road is reached below Wishaw Lake. The Muriel Lake campsite is about 2 kilometres in the east direction. Kakwa Lake is another five kilometres along the road in the same direction.

The trip from Edgegrain Lake to Muriel Lake is 5 - 6 hours and another hour to reach Kakwa Lake. Doing the circuit in the direction described above (counter clockwise direction) gives the hikers the option to head to Buchanan Creek parking area without having to return to Kakwa Lake.The circuit can also be done in the other direction, which presents the advantage of doing the difficult section of Muriel Lake to Bellevue Pass first. The elevation gain is high in a short distance, but it is easier to find the route than in the other direction. If the weather is bad, the Muriel Lake campsite offers good protection against the elements until the weather improves and makes the trip to Edgegrain Lake more enjoyable.

5.3.2 The Sheep Pass Loop Trip (Figure 5.4)

The loop trip from Kakwa Lake to Sheep Pass is very different in many respects from the Jarvis Lakes loop. The Sheep Pass loop follows horse trails for most of its length and does not go through rough terrain, unless one chooses the alpine route from Providence Pass to Surprise Pass through Gravel Pass. The southern part of the circuit travels through an array of subalpine and alpine terrains. Although there are no high peaks along the circuit, the long cliff of Wallbridge and Bastille Mountains, with the icefield at its base, presents an impressive view to visitors.

There are three suitable locations for campsites. The first one is the horse camp at the south end of Broadview Lake. The second location is along the middle lake in the Sheep Pass area. In Sheep Pass, water has to be taken from the lakes since Sheep Creek is running underground in its Kakwa Park section. The third location is an old horse camp located at the base of the Buchanan icefield. The three campsites are situated about a day hike distance from each other. A minimum of 3 - 4 days is needed to complete the whole circuit from Kakwa Lake to Sheep Pass. An extra day should be spent to explore the Sheep Pass area.

The first portion of the circuit is between Kakwa Lake and Broadview Lake. Starting at the Kakwa Lake campsite, the trail crosses the creek and follows the east shore of Wapumun Lake. From the south end of the lake, the horse trail is well-defined on the ground. It comes close to LaGlace Creek in some places, although the creek is never seen from the trail. Some sections of the trail before Kakwa Pass have been churned to mush by heavy horse use and poor trail location. Those sections can be avoided by walking on the high side of the trail. When Kakwa Pass is reached,

which is only noticable by the water running in the other direction, the area becomes more open and the meadows drier. At the point where the trail reaches the north branch of Buchanan Creek, the creek has to be forded and a route in the east direction has to be taken to reach Broadview Lake. There is a horse trail going from Kakwa Lake to Sheep Pass, but the section between Broadview Lake and Kakwa Lake is not visible anymore. The elevation gain from Kakwa Lake to Broadview Lake is about 440 feet and the trip takes about 4 - 5 hours.

For the second portion of the circuit, between Broadview Lake and Sheep Pass, visitors have the choice of using the alpine route through Gravel Pass or following the horse trail at the bottom of the valley. If the weather is bad, the only sensible choice is the horse trail. The alpine route is very exposed to bad weather coming from the west, and it is easy to get lost on Wapiti Mountain, since the route is not marked. From the Broadview Lake campsite, the trail continues across the creek in the Providence Pass direction. Although the trail may be difficult to follow in the wet meadows, it is well defined on the ground in the Providence Pass area. Extra caution is needed in Providence Pass where grizzly bears are often seen on the mountainsides.

The creek at the southern end of Cecilia Lake may be difficult to ford at high water due to the glacial water and fast current. An alternative route is to bushwhack at the top of the falls where the water is calm and the bottom of the creek is sandy. Once the creek is crossed, the horse trail makes a few switchbacks to reach the flat area on top of the falls, and follows the east side of the creek up to the alpine. Then the trails climbs on the east side of Surprise Pass where the panoramic view of Wallbridge and Wapiti Mountains and the icefield at their bases should have come

as a real surprise to the first travellers coming from the south.

From Surprise Pass, the horse trail switches east toward Willmore Wilderness Park in Alberta where it joins the Sheep Creek trail coming from the east. To avoid making a long detour by following the existing trail, it is possible to take a shortcut route along the creek flowing from the lake located south of the pass. The creek runs almost parallel to the park boundary. The bottom of the hill, the shortcut route eventually intercepts the trail along Sheep Creek which is well-defined on the ground. The trail continues west before switching north toward Goat Pass. The trip from Broadview Lake to Sheep Pass is 7 - 8 hours and the only elevation gain is about 1400 feet from Cecilia Lake to Surprise Pass. The horse trail is relatively easy to follow on most of its part, particularly in the alpine terrain where the trail is well-defined on the ground.

A large open meadow constitutes the lower part of the Sheep Pass area with an array of interconnected smaller meadows on its north side. The meadows are pleasant to cross, particularly in mid-summer when the flowers are blooming. On a sunny day, the beauty of the scenery and the feeling of isolation of the area are an invitation to relax and spend more time in this peaceful place. Although, there are many good locations for campsites along the lakes, the south end of the middle lake offers better protection and is along the route going to Intersection Pass.

The third portion of the loop, between Sheep pass and Kakwa Lake, can be done in a long day or can be divided into two days. The old horse camp at the base of Buchanan Icefield provides a good location for those who prefer to make the return trip to Kakwa Lake in two days. From Sheep Pass, the trail heads north in the

meadows and slowly climbs above the treeline and travels through Goat Pass where snow often lies deep until late July. The ground is denuded of vegetation on most of its three kilometre length. In the pass, there are two small ponds whose water flows in a creek that suddenly disapears into a sink hole in the limestone rock. At the end of the pass, the trail switches west and goes down to the bottom of the valley where a creek has to be forded to reach the second creek at the base of Buchanan Icefield. The location of the old camp is along that second creek.

From the Buchanan Icefield camp, the trail follows the west side of the south branch of Buchanan Creek down to the end of the meadow where the creek has to be crossed again. The trail leaves the meadow to enter into a forested area where it stays at the same elevation until the beginning of another meadow is reached along the north branch of Buchanan Creek. From there, the trail is well-defined on the ground of the meadow which expands up the Kakwa Pass at the jonction of the route to Broadview Lake. At this point, the loop trip has been completed. The rest of the trip from Kakwa Pass to Kakwa Lake is along the same trail used at the beginning of the trip.

5.4 The Boundary Trail (Divide Trail)

Kakwa Lake is considered as the northern terminus of the Great Divide Trail of the Canadian Rockies. Although an alpine route is possible for hikers along the Divide from Kakwa Lake to Monkman Park, no trail actually exists.

South of Kakwa Lake, the section of the Great Divide Trail between Mount Robson and Kakwa Lake is not maintained and often difficult to find. Some segments of the horse trail used by the first land surveyors and climbers are still used today by horse groups who visit the western portion of Willmore Wilderness Park. Alternative routes at higher elevation allow to avoid buggy sections used by horses in some of the valleys, like the Jackpine Valley north of Jackpine Pass. This section of the Great Divide Trail between Mount Robson and Kakwa Lake may eventually become a popular trail for adventurers who want to continue north along the divide, a route exists between Kakwa Lake and Dimsdale Lake. From Kakwa Lake it goes across Corniche Pass, Moonias Pass and Miten Pass. The route is spectacular and and stays in the alpine for most of the way to Dimsdale Lake. However the only easy way to get out of the Dimsdale Lake area is to fly out or come back to Kakwa Lake along the same route. North of Dimsdale, there is no easy way, and adventurers will face major routefinding challenges. The valleys get lower and more bushwhacking is involved between the passes. The area between Dimsdale and Monkman has also the reputation of having very wet and cold weather conditions.

Day Hikes from Kakwa Lake

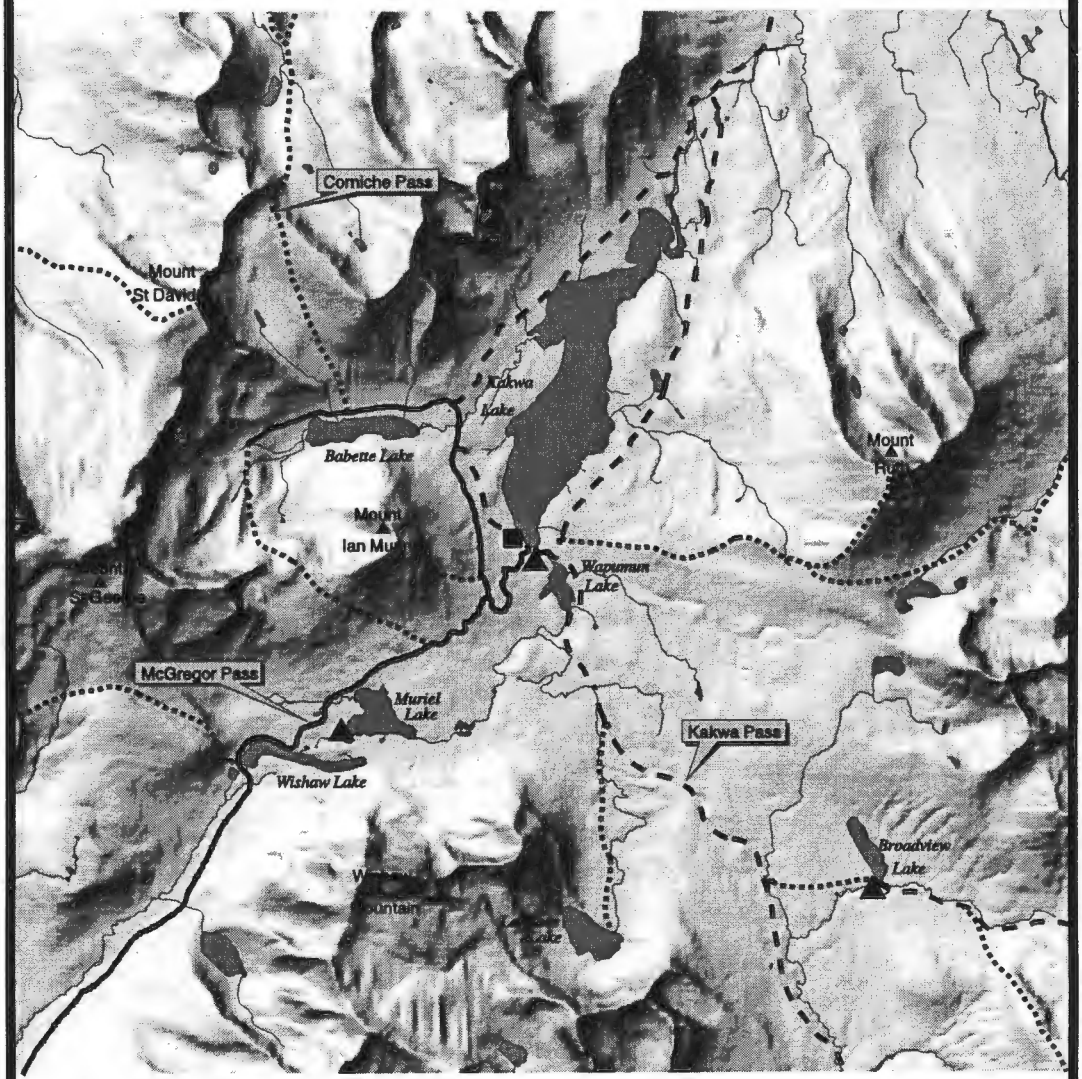

Figure 5.1 Day Hikes from Kakwa Lake Campsite

Day Hikes From Jarvis Lakes

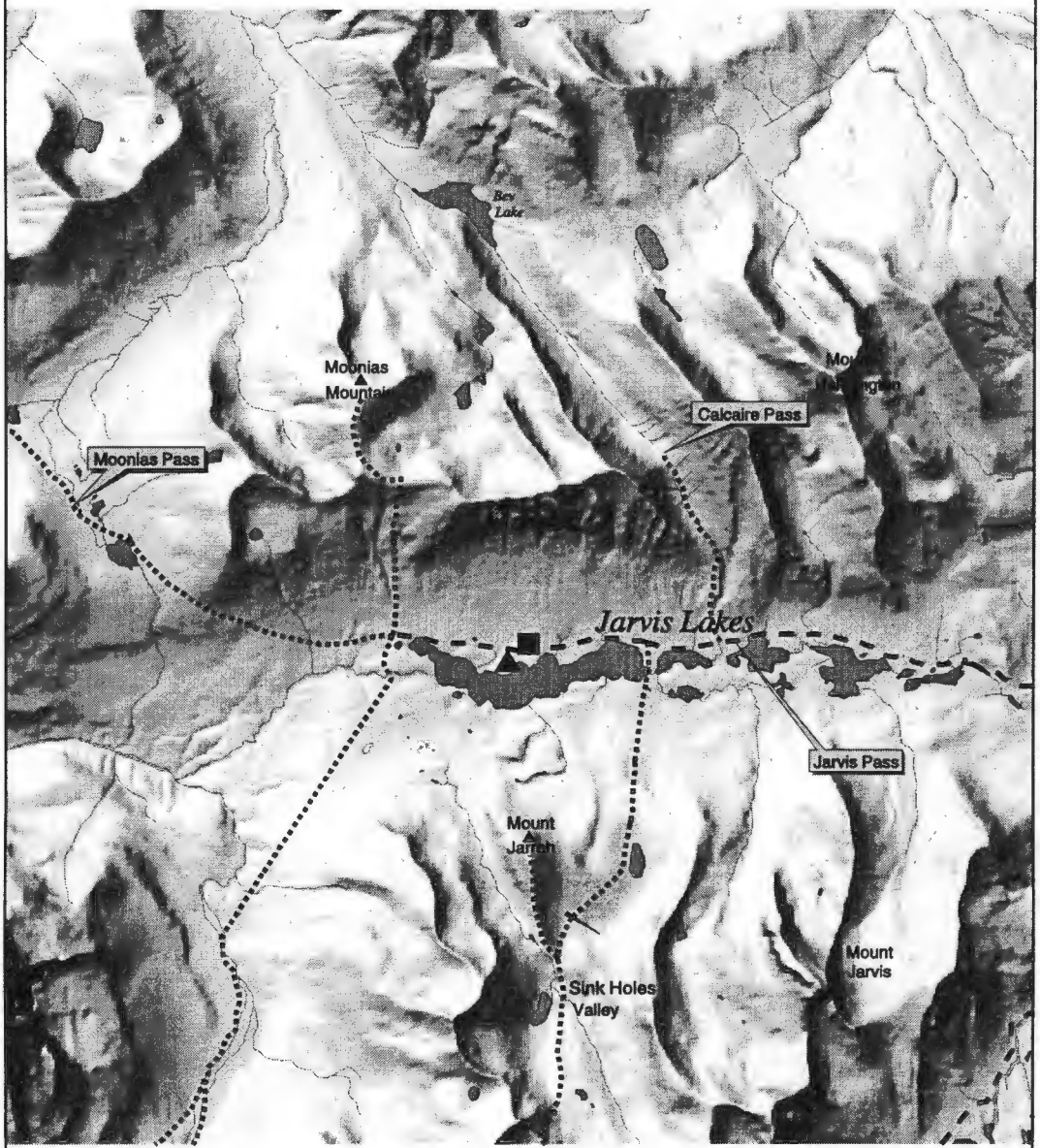

Figure 5.2 Day hikes from Jarvis Lakes Cabin

Jarvis Lakes Loop Trip

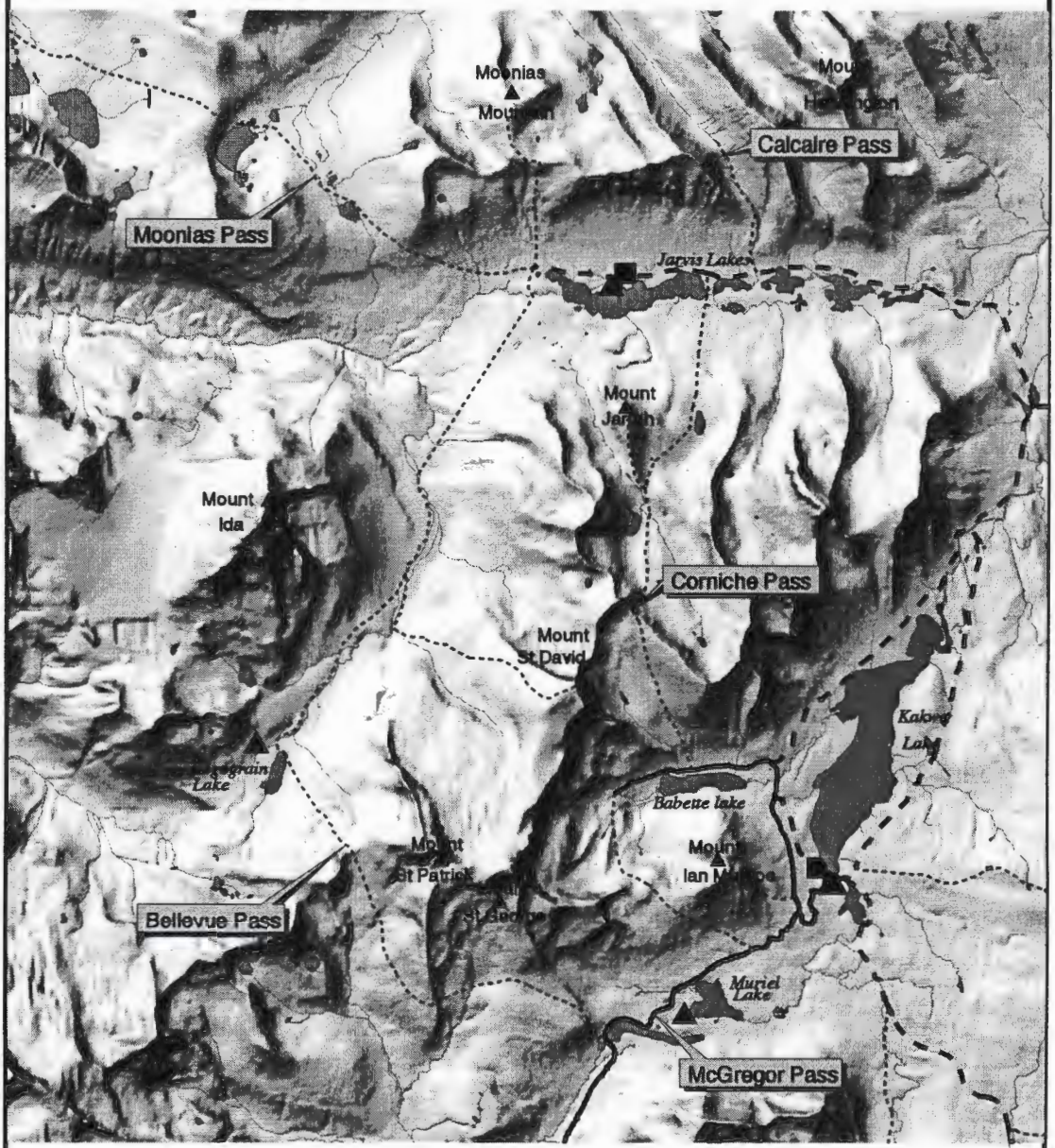

Figure 5.3 Jarvis Lakes Loop Trip

Sheep Pass Loop Trip

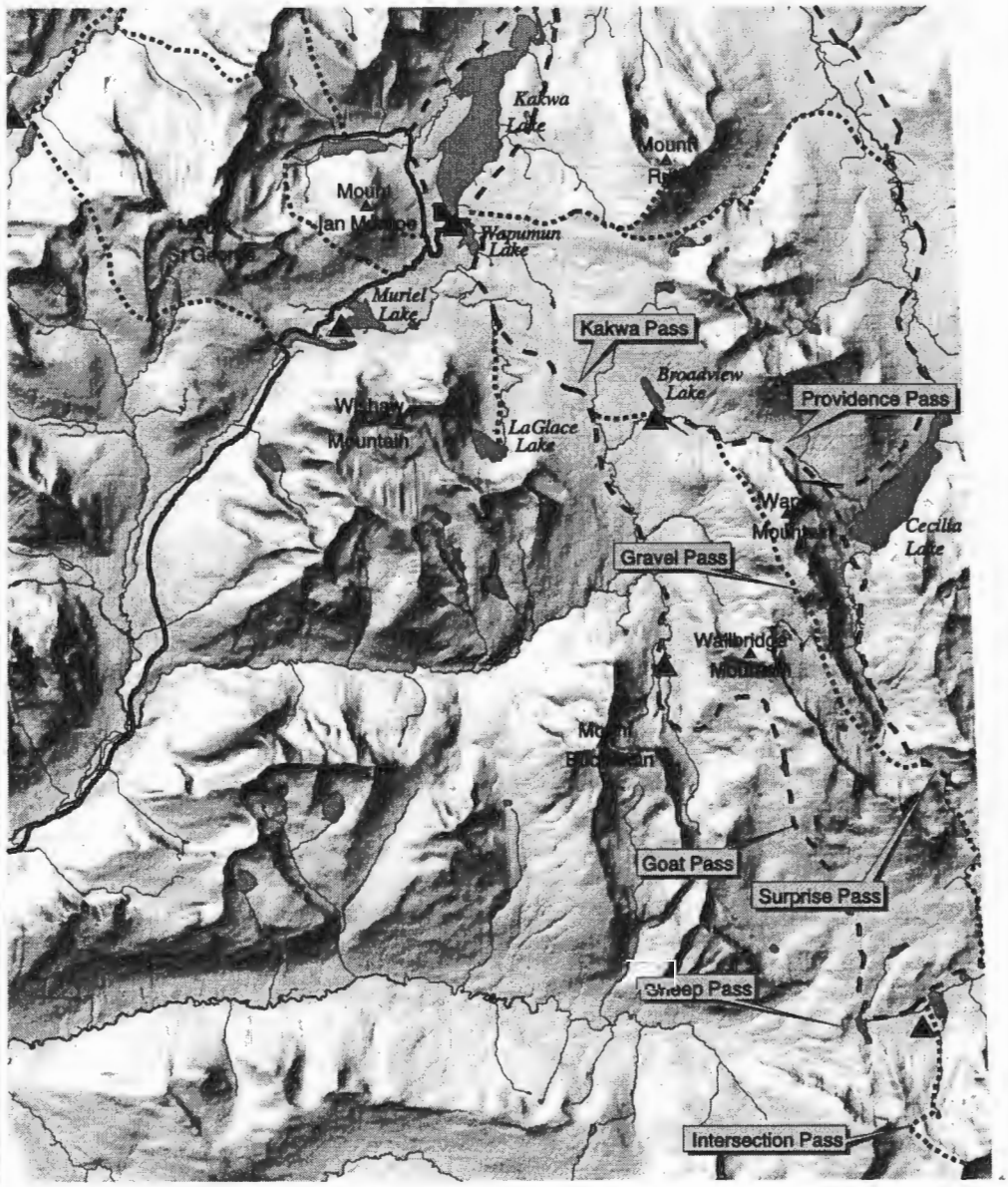

Figure 5.4 Sheep Pass Loop Trail

6.0 Conclusion

This project describes how Kakwa Park has an important role to play in the conservation of the Rocky Mountain ecosystems, as one of the last unprotected and undeveloped areas in the Central Rockies with outstanding scenery. Most of the geological features and rock formations characteristic of the Main Ranges and the Front Ranges are found in the Kakwa area. The Foothills also present in the eastern part of the area, contribute to make Kakwa the only BC provincial park with the three geological divisions of the Canadian Rockies. In the context of the four larger systems discussed in the paper, Kakwa Park occupies a key location in the distribution of those large systems. The use of management units helps to understand the diversity of the landscape and the natural boundaries that divide each of those units.

Many issues face the future of Kakwa Park such as the road access, the quartzite quarry operation, the restriction of snowmobile use in the park and the level of commercialisation to be tolerated in the park. Although the area has received an official status of class "A" park in 1999, the Management Plan has yet to be completed. The draft copy of the Background Report has been completed in May 2001. The planning process used for the management plan is based on the ecosystems, which means that the surrounding areas on both side of the BC-Alberta boundary has to be considered in the planning process. This ecosystem based Management Plan will ensure the continued ecological integrity of the whole area.

At this point, the road access from BC is not dependable, seasonal washouts

along the McGregor River between Bastille Creek and Buchanan Creek make the road unusable for long periods of time. The maintenance of this section of road is the responsibility of the quartzite quarry owner which faces an uncertain future. In my study I chose not to discuss the snowmobile issue since I did not have the opportunity to visit the area in winter time.

Parks Zoning will determine the opportunities allowed in the park. See the B.C. Park zoning System in Appendix B. The only 2 zone classes that would apply to the area are the Wilderness Recreation Zone in the Kakwa-Jarvis Lakes unit and the Wilderness Conservation Zone for the rest of the park. If sheep and goat hunting are still allowed in the north-east part of the park, this area will have to be classified as Wilderness Recreation Zone.

To conclude my project I would like to mention the paper of Michael J. Tranel at the 1999 Wilderness Conference; "Wilderness Management Planning in an Alaskan National Park: Last chance to do it right?". Advocates of managing Denali National Park as wilderness in its purest sense encourage the park to see its wilderness management planning as the last chance to do it right. Tranel comments that the park planning experience acquired in the southern states should be used to avoid any mistakes in the management of this last large wilderness area. Similar ideas are relevant concerning the Kakwa area since Kakwa is one of the last wilderness area in the Central Rockies, it is important to learn from the past experiences in other Rocky Mountain parks, and to do it right.

7.0 Bibliography

Aalborg G., Ross C. and Brackenbury J. (1973). A Submission to the Environment Conservation Authority for the Establishment of a Wilderness in Wild Kakwa. Grande Prairie: Wild kakwa Society.

Alberta Environmental Protection. (1997). Kakwa Wildland Provincial Park Management Plan. Edmonton: Land and Forest Service and Natural Resources Service.

BC Parks (1999). BC Parks Impact Assessment Process. Victoria: BC Parks

BC Parks (2001).Kakwa Provincial Park, Background Report - Draft. Prince George: BC Parks.

BC Parks (1994). Outdoor recreation in British Columbia. Victoria: BC Parks.

BC Parks (1992). Master Plan for Babine Mountains Recreation Area.Victoria: BC Parks.

BC Parks (1996). Master Plan for Tatlow Provincial Park. Victoria: BC Parks.

BC Parks. (1994). Master Plan for Monkman Provincial Park. Victoria: BC Parks.

BC Parks (1994). Master Plan for Mount Assiniboine provincial Park. Victoria: BC Parks.

BC Parks (1992). Master Plan for Mount Robson Provincial Park. Victoria: BC Parks.

BC Parks (1992). Monkman Provincial Park Master Plan background Document. Victoria: BC Parks.

BC Parks (1987). Mount Assiniboine Provincial Park Background Report. Vancouver: BC Parks.

BC Parks (1990). Parks & Wilderness for the 90's. Victoria: BC Parks

Bowes, G.E. (1963). Peace River Chronicles p 247-251: Prescott Publishing Company

Brinkman, D.B. (1987). "Fossil Fish From Wapiti Lake, British Columbia" in Fossil Quarterly, Spring 1987, pages 31-37.

Cautley, R.W. and Wheeler, A.O. (1925). Report of the Commission Appointed to Delimit the Boundary between the Provinces of Alberta and British Columbia, Ottawa: Office of the Surveyor General.

Campbell, A. (1981). The Carl Brooks Family, Grande Prairie: Wapiti Historical Society, pages 261-262.

Chancellor Partners (1998). The Potential Economic Impact of the Y2Y Initiative on the Forest Industry and on the Economy of British Columbia,Vancouver: Forest Alliance of British Columbia.

Collie, J.N. (1912). Exploration in the Rocky Mountains North of the Yellowhead Pass: Geographical Journal Jan-June 1912, p 223-235.

Comeau Ecological Consultants ltd (1985). Vegetation Resources of the Jarvis Creek-Morkill River Area, Victoria, British Columbia: Ministry of environment, British Columbia.

Deutsch, K. (1992). Sedimentology and Stratigraphy of the Cretaceous Cardium Formation, Kakwa Region, Calgary, Alberta: University of Calgary.

Dott, R. and Batten, R. (1981) Evolution of the Earth, Wisconsin: McGraw-Hill Book.

Dunn A. & F. (1955) First Ascent of Mount Ida, Canadian Alpine Journal 1955 p. 24-28

Edmonds, E.J. and Bloomfield, M. (1984). A study of Woodland Caribou in West Central Alberta 1979 - 1983, Edmonton, Alberta: Alberta Energy Natural Resources Fish and Wildlife Division.

Edmonds, E.J. and Smith, K.G. (1991). Mountain Caribou Calf Production and Survival, Edmonton: Alberta Forestry, Lands and Wildlife.

Erlandson, G. (1991) Summary of Public Comments, Provincial Parks and Wilderness for the 90's, Victoria: Ministry of Forests, British Columbia.

Fay, S.P. (1915). The Canadian Rockies Between the Yellowhead Pass and the Peace River: Apalachia, Vol.XIII, No. 3, p 1-19.

Fay, S.P. (1914). "Mt. Alexander": The Canadian Alpine Journal Vol. 6, 1914-15 p. 170-177.

Fleming, S. (1877). Report Surveys on the Canadian Pacific Railway, Ottawa: MacLean, Roger & Co.

Fleming, S. (1877). Report Surveys on the Canadian Pacific Railway, Ottawa: MacLean, Roger & Co.

Gadd, B. (1995). Handbook of the Canadian Rockies, Jasper: Corax Press.

Gray, P.A. and Davidson, R.J. (2000). An Ecosystem Approch to Living Sustainably, Ontario: Ministry of Natural Ressouces.

Hobbs, B.E. and Means W.D. (1976). An Outline of Structural Geology, New York: John Wiley & Sons Inc.

Jarvis, E.W. (1875). Report on Exploration Across the Rocky Mountains, Winnipeg, Manitoba: Maclean, Roger & Co.

Jobe, M.L. (1915). Mt. Kitchi: a new peak in the Canadian Rockies, New York: American Geographical Society Vol. XLVII p 481-497.

McCool, S.F. and Cole D.N. (1999). Wilderness Science in a Time of Change Conference, Volume 2 page 1 , Missoula, Montana: Rocky Mountain Research Station.

McMechan, M.E. (1986). Geology of the Northeast McBride Map-area (93H/15, 16), British Columbia: Geological Survey of Canada, Open File 1229.

McMechan, M.E. and Thompson, R.I. (1985). Geology of the Southeast Monkman Pass Area (Map-area (93I/1, 2), British Columbia: Geological Survey of Canada, Open File 1150.

Ministry of Parks, Northern Region (1990). Kakwa Lake Area Intererim Management Statement, British Columbia: Ministry of Parks, Northern Region.

Peace River-Liard Regional District (1971). Monkman-Kakwa Proposed Core Area for Recreational Uses, British Columbia: Ministry of lands, Forests and Water Resources.

Peace River-Liard and Fraser-Fort George Regional Districts and the Alberta Peace River Regional Planning Commission (1971). Monkman-Kakwa, Proposal Resource Planning Study, British Columbia: Ministry of lands, Forests and Water Resources.

Pell, J. and Hammack, B. (1992). Kakwa Recreation Area:Northeastern British Columbia Geology and resource Potential (93H/15, 16 93I/1, 2), British Columbia: British Columbia Geological Survey Branch.

Pell, J. and Hammack, B. (1992). Triassic Fossil fish from the Sulphur Mountain

Pell, J. and Hammack, B. (1992). Triassic Fossil fish from the Sulphur Mountain Formation, Kakwa Recreation Area, Northeastern British Columbia (93I/1), British Columbia:British Columbia Geological Survey Branch.

Pomerol C. and Babin C. (1980). Stratigraphie et paléogéographie, Principes et Méthodes, Paris, France: Doin Editeurs.

Resource Analysis Branch. October (1978). Northeast Coal Study Preliminary Environmental Report 1977-1978, British Columbia: Ministry of environment.

Stankey G.H. (2000). Future Trends in Society and Technology: Implications for Wilderness Research and Management, Missoula, Montana: Rocky Mountains Research.

Waffl, N. D. (1930). Mount Sir Alexander, American Alpine Journal, 1930, pages 104-113

Wheeler, A.O., Cautley, R.W. (1925). Topographical Surveys Executed in 1924, Report of the commission Appointed to Delimit the Boundary between the Provinces of Alberta and British Columbia p. 57-79, Ottawa: Office of the Surveyor General.

Wheeler, M. (1979) The Robson Valley Story, McBride Robson Valley Story Group.

Williams, H. and Turner F. J. (1982). Petrography, An introduction to the Study of Rocks, San Francisco: W.H. Freeman and Company.

Wilcox L., Robinson B. and Harvey A. (1998). A SENSE OF PLACE Issues, Attitudes And Resources In The yellowstone To Yukon Ecoregion, Canmore , Alberta: Yellowstone to Yukon Conservation Initiative.

APPENDIX A: Types of Protected Areas in Alberta

Alberta's parks are created through an assortment of Acts that allow for varying levels of protection. Under these Acts, the following types of "protected" areas may be established.

Wilderness Areas prohibit all extraction and industrial uses and all form of travel, other than by foot.

Ecological Reserves are established to protect unique feature or sites. They are small areas averaging a size of 12 km2. The protection is far less than in the wilderness areas. grazing, horse travel, motorised travel, energy resource development and timber harvesting all may occur. Fires are prohibited.

Natural Areas are intended to provide a middle ground between strictly protected sites and intensively developed sites. All type of industrial development are allowed within Natural Areas.

Provincial parks Mining, oil and gas development, quarrying, utilities, cultivation, grazing, cutting trees or timber and off-highway vehicles are all permissible within Provincial Parks.

Wildland Provincial Parks These are subcategories of Provincial Parks created under the Wildland Provincial Park Regulations and are significantly protected. No new dispositions for industrial development or new roads are permitted. However, existing dispositions (e.g. oil or gas leases) may be developed.

Willmore Wilderness Park Act established the Willmore Wilderness. In 1995, the Act was amended to prohibit industrial activities, making Willmore one of the largest truly protected areas on Alberta provincial lands.

APPENDIX B: The BC Parks Zoning System

This appendix provides a description of the BC Parks Zoning system. BC Parks does not specify the level of protection when naming a new park as the Alberta Park system does. For example Willmore Wilderness Park receives a higher level of protection than Kakwa Wildland Park. The term "Wilderness" in the name of the first park means an higher level of protection than the term "Wildland" used for the other park. The Appendix A contains more details about the type of protected areas used in Alberta. The zoning system is also used in the Alberta Parks system. In Kakwa Wildland Park, the area is divided in two zones, a wildland zone and a natural zone.

Recreation Opportunities is the single most important characteristic to observe, since it will directly affect the degree of protection that this part of the park area will receive. The park visitors activities are also limited by the type of opportunities allowed in an area.

The means of access divides the zones in two categories; the mechanised access in the Intensive Recreation and the Natural Environment zones, and the non-mechanised access in the Wilderness Recreation and Wilderness Conservation zones. The Recreation Opportunities will divides the Wilderness zones in two other categories; hunting is allowed in the Wilderness Recreation zone, but not in the Conservation Wilderness zone.

	Intensive Recreation	Natural Environment
OBJECTIVE	To provide for a variety of readily accessible, facility-oriented outdoor recreation opportunities.	To protect scenic values and to provide for backcountry recreation opportunities in a largely undisturbed natural environment.
USE LEVEL	Relatively high density and long duration types of use.	Relatively low use but higher levels in association with nodes of activity or access.
MEANS OF ACCESS	All-weather public roads or other types of access where use levels are high (see "Impacts" below).	Mechanized (power-boats, snowmobiles, all terrain vehicles), non-mechanized (foot, horse, canoe, bicycle). Aircraft and motorboat access to drop-off and pickup points will be permitted.
LOCATION	Contiguous with all-weather roads and covering immediate areas, modified landscapes or other high-use areas.	Removed from all-weather roads but easily accessible on a day-use basis. Accessible by mechanized means such as boat or plane.
SIZE OF ZONE	Small; usually less than 2,000 ha.	Can range from small to large.
BOUNDARY DEFINITION	Includes areas of high facility development in concentrated areas.	Boundaries should consider limits of activity/facility areas relative to ecosystem characteristics and features.
RECREATION OPPORTUNITIES	Vehicle camping, picnicking, beach activities, power-boating, canoeing, kayaking, strolling, historic and nature appreciation, fishing, snowplay, downhill and cross-country skiing, snowshoeing, specialized activities.	Walk-in/boat-in camping, power-boating, hunting, canoeing, kayaking, backpacking, historic and nature appreciation, fishing, cross-country skiing, snowmobiling, river rafting, horseback riding, heli-skiing, heli-hiking, and specialized activities.

Special Feature	Wilderness Recreation	Wilderness Conservation
To protect and present significant natural or cultural resources, features or processes because of their special character, fragility and heritage values.	To protect a remote, undisturbed natural landscape and to provide backcountry recreation opportunities dependent on a pristine environment where air access may be permitted to designated sites.	To protect a remote, undisturbed natural landscape and to provide unassisted backcountry recreation opportunities dependent on a pristine environment where no motorized activities will be allowed.
Generally low.	Very low use, to provide solitary experiences and a wilderness atmosphere. Use may be controlled to protect the environment.	Very low use, to provide solitary experiences and a wilderness atmosphere. Use may be controlled to protect the environment.
Various; may require special access permit.	Non-mechanized; except may permit low frequency air access to designated sites; foot, canoe (horses may be permitted).	Non-mechanized (no air access); foot, canoe (horses may be permitted).
Determined by location of special resources; may be surrounded by or next to any of the other zones.	Remote; generally not visited on a day-use basis.	Remote; not easily visited on a day-use basis.
Small; usually less to 2000 hectares.	Large; greater than 5,000 ha.	Large; greater than 5,000 ha.
Area defined by biophysical characteristics or the nature and extent of cultural resources (adequate to afford protection).	Defined by ecosystem limits and geographic features. Boundaries will encompass areas of visitor interest for specific activities supported by air access. Will be designated under the Park Act.	Defined by ecosystem limits and geographic features. Will be designated under the Park Act.
Sight-seeing, historic and nature appreciation. May be subject to temporary closures or permanently restricted access.	Backpacking, canoeing, kayaking, river rafting, nature and historic appreciation, hunting, fishing, cross-country skiing, snowshoeing, horseback riding, specialized activities (eg. caving, climbing).	Backpacking, canoeing, kayaking, river rafting, nature and historic appreciation, fishing, cross-country skiing, snowshoeing, horseback riding, specialized activities (eg. caving, climbing).

	Intensive Recreation	Natural Environment
FACILITIES	May be intensely developed for user convenience. Campgrounds, landscaped picnic/play areas, trail, accommodation or interpretive buildings, boat launches; administrative buildings, service campgrounds, gravel pits, disposal sites, wood lots, parking lots, etc.	Moderately developed for user convenience. Trails, walk-in/boat-in campsites, shelters; accommodation buildings may be permitted; facilities for motorized access eg. docks, landing strips, fuel storage, etc.
IMPACTS ON NATURAL ENVIRONMENT	Includes natural resource features and phenomena in a primarily natural state but where human presence may be readily visible both through the existence of recreation facilities and of people using the zone. Includes areas of high facility development with significant impact on concentrated areas.	Area where human presence on the land is not normally visible, facility development limited to relatively small areas. Facilities are visually compatible with natural setting.
MANAGEMENT GUIDELINES	Oriented toward maintaining a high quality recreation experience. Intensive management of resource and/or control of visitor activities. Operational facilities designed for efficient operation while remaining unobtrusive to the park visitor.	Oriented to maintaining a natural environment and to providing a high quality recreation experience. Visitor access may be restricted to preserve the recreation experience or to limit impacts. Separation of less compatible recreational activities and transportation modes Designation of transportation may be necessary to avoid potential conflicts (eg. horse trails, cycle paths, hiking trails).
EXAMPLES OF ZONING	Campground in Rathtrevor Beach Park; Gibson Pass ski areas in E.C. Manning Park.	Core area in Cathedral Park; North beach in Naikoon Park.

Special Feature	Wilderness Recreation	Wilderness Conservation
Interpretive facilities only, resources are to be protected.	Minimal facility development. Limited development for user convenience and safety, and protection of the environment eg. trails, primitive campsites, etc. Some basic facilities at access nodes, eg. dock, primitive shelter, etc.	None.
None; resources to be maintained unimpaired.	Natural area generally free of evidence of modern human beings. Evidence of human presence is confined to specific facility sites. Facilities are visually compatible with natural setting.	Natural area generally free of evidence of modern human beings.
High level of management protection with ongoing monitoring. Oriented to maintaining resources and, where appropriate, a high quality recreational and interpretive experience. Active or passive management depending on size, location, and nature of the resource. Visitor access may be restricted to preserve the recreation experience and to limit impacts.	Oriented to protecting a pristine environment. Management actions are minimal and not evident. Managed to ensure low visitor use levels. Visitor access may be restricted to protect the natural environment and visitor experience.	Oriented to protecting a pristine environment. Management actions are minimal and not evident. Managed to ensure low visitor use levels. Visitor access may be restricted to protect the natural environment and visitor experience.
Tidepools in Botanical Beach Park; Sunshine Meadows in Mount Assiniboine Park.	Quanchus Mountains Wilderness in Tweedsmuir Park; Wilderness Zone in Spatsizi Park.	Central Valhallas Wilderness in Valhalla Park; Garibaldi Park Nature Conservancy area.

APPENDIX C: The BC Parks Classification

The *Park Act* classifies "parks" by restricting the granting of interests and the removal of natural resources from park areas. It does this through a general prohibition on such activities, except those specifically permitted through the issuance of a park use permit. Four classes or types of parks can be designated under the *Park Act.*

Class A parks: Commercial resource extraction activities are prohibited. In some new protected areas, certain uses that existed at the time of establishment (e.g., grazing, aquaculture activities and trapping) are allowed to continue as exceptions to the *Park Act,* following amendments introduced in 1995.

Class B parks: These allow greater flexibility concerning alienation of interests and the removal of natural resources. Only two Class B parks currently exist in B.C.: Strathcona and Sooke Mountain. Park use permits for resource extraction cannot be issued in Class B parks "unless, in the opinion of the minister, to do so is not detrimental to the recreational values of the park."

Class C parks: Afforded the same level of protection as Class A parks, these are generally small, close to urban areas, and not necessarily significant contributors to protecting ecosystems or species. Some of these areas have been turned over to municipal and regional governments for administration.

Recreation areas: This is a temporary classification for areas in which a mineral resource evaluation is being done under a time-limited tenure. No commercial logging is allowed and these lands may become Class A parks on completion of the mineral evaluation.