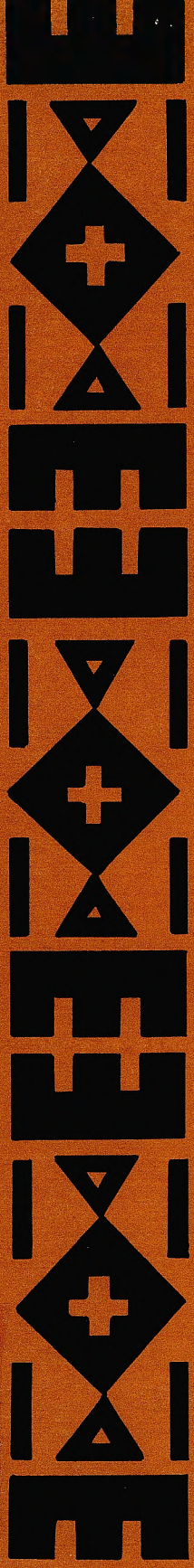

ECONOMIC POTENTIAL OF THE BLOOD INDIAN RESERVE

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

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(Forest Management)

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People

I. HISTORY

In the days of the ancient ones, a Blackfoot came to the Blood Indian camp. "Who is the chief here?" he asked the first man he met. "I am" was the reply. A second man stopped, and said: "I am the chief". Soon the bewildered Blackfoot was surrounded by several men, all claiming to be Chief of the Bloods. "I will call you the tribe of Many Chiefs" he said at last. So it was then that they received the name *Kainai* (from *Aka* – "many" and *Nina* – "chief").[1]

This legend has a theme which is evident throughout the history of the Bloods. Just as the early people showed such independence that each was a chief unto himself, so did the tribe maintain a spirit of freedom, self-confidence and pride during its recorded nomadic history.

While they call themselves *Kainai*, the Cree term for the tribe is *Mih'-kwee-ye-ne-wuk*, which means Blood People. This name is likely a variation of *Mih'-kwow-ye-ne-wuk* or Red People, from their use of red ochre on their faces and ceremonial objects.[2] The first traders adopted the name "Bloods", a name which has come in common use.

During the early 1800's the Bloods lived and hunted primarily in southern and south-eastern Alberta, and in northern Montana. There were no rigidly defined hunting areas, but the favorite places for the Bloods were in the region of the Hand Hills near Drumheller, in the Sweetgrass Hills region and in the present Lethbridge district. Some of their best wintering grounds were along the Belly River, the Highwood River and, for the northern bands, on the Battle River.

The main enemies of the Bloods were the Cree and Assiniboine to the north and east; the Crow to the south; and the Shoshoni, Nez Perce, Pend d'Oreille, Flathead and Kutenai across the mountains. The Sarcee, an off-shoot of the Beaver Indians of northern Alberta, became their allies, and adopted a Blackfoot culture. The Gros Ventres also were allies until 1861 when a misunderstanding over a stolen horse resulted in bitter hostilities.

The Bloods were excellent horsemen, and their main interests were hunting and warfare. Through a complex life of societies, religious and military organizations, each member retained a strong tribal identity. Because the buffalo provided their main supply of food, several bands would travel together, and at times the whole tribe might camp in one area.

A band was basically a small family unit of which the members lived and hunted together.[3] Each band had a name, such as Fish Eaters, All Short People and Lone Fighters, which was given because of some incident or characteristic trait of the group. The band chief was sometimes the senior member of the family group, but it was only through personal ability that a man maintained such an eminent position. Although no one would attempt to depose a poor leader, members would drift away to other bands.

During the nomadic years the Bloods had no head chief. Fur traders bestowed this position upon certain influential band chiefs, for convenience, but such appointments were not recognized by the Indians themselves. There were, however, two other types of chiefs whose influence went beyond their own band group. These were the war chief and the political chief. If a camp was in danger of attack, or if a large war party was to be formed to avenge a killing, the people turned to a notable warrior to take control. His authority during the crisis surpassed that of any band or political chief. When the danger had passed, however, he reverted to his normal status. The position of war chief was not necessarily restricted to one person at any given time. During the 1870's two band chiefs, White Calf and Button Chief, both were recognized.

The position of political chief is more difficult to describe. He was the man usually chosen to represent the people when the whole tribe went to trade or a peace treaty was being made with another tribe. He usually was quite popular and had some characteristics of a head chief; yet his influence over bands other than his own was purely of an advisory nature. Red Crow, who later became official head chief, was an outstanding example, as was his uncle, Péenaquim, or Seen From Afar.

Authority for maintaining order in the camps rested with the societies of All Comrades. These societies were a type of military organization for males of various ages. A boy about fifteen would probably join the Pigeons Society and after a few years would transfer to the Mosquitoes Society. As he grew older, he would pass through the Braves, Brave Dogs, Black Catchers, Crow Carriers, Dogs, Horns, Catchers, and Bulls – all societies with their own medicine bundles and ceremonies.

The main purpose of each society was to police the camp. Members of some would act as night guards and maintain harmony among the people. When a move of camp or a hunt was to take place, the leading chief would place authority for the organization and execution of these activities in one or more of these societies.

The religion of the Bloods was based upon the belief that the Sun was the major diety, the Moon was his wife, and the Morning Star their son. Each summer the tribe would gather for the Sun Dance ceremony which was performed in fulfilment of a holy woman's vow.

Dreams had considerable significance and guided much of the adult life of the people. Certain creatures might be considered to be the protector of an individual and would guide him through visions. Much of the religious life was based on dreams, while many objects, particularly unusual ones, were considered to have holy powers. Unusual rock formations, a lone tree on the prairies, an albino buffalo, or even a demented person, might be considered sacred.

The average young man went to war when he was twelve or thirteen years old. At that age, he would go only as a servant of an experienced warrior and would receive a liberal education in warfare techniques. Within a year or two, he might become an independent warrior and active horse raider himself, usually giving away almost as many horses as he kept for himself. He could stop going to war whenever he pleased, but would not likely do so until his early twenties.

Beside warfare a man would be responsible for providing sustenance for his family. Buffalo was the main source of food, clothing and shelter, and the hunts were rigidly controlled. The men were not allowed to hunt buffalo by themselves so as to prevent a herd from stampeding away for miles. When a herd was sighted, the camp police would name the hour when all hunters would attack. Any solitary hunter, even if he were a chief, would be subject to disciplinary action, and had he killed a buffalo for his own needs, it would be taken away from him and divided among all others in the camp.In the autumn, it was also customary for many bands, or sometimes the whole tribe, to drive buffalo over a cliff or into an impoundment where they were slaughtered. When that happened, the women might work for days, cutting the meat, drying it and preparing pemmican.

The importance of warfare in the Blood society had a significant effect on the social life of the tribe. Because of the men killed on the warpath there was usually an overabundance of women which resulted in polygamous marriages. Wealthy men often took several wives. It became common for a man to marry two or more sisters and, if his brother was killed in battle, he might take his sister-in-law as his wife also.

At the same time, the moral code was extremely harsh for the women. The native religion required women to be either virgins or faithful wives, and social customs made it difficult for a man to forgive an errent wife. He would usually cut off her nose or ears or, in some cases, kill her. A man who failed to take action against an unfaithful wife would be shunned by members of his age-grade society, and ridiculed by all in the tribe. Should, on the other hand, an extra-marital affair of a man be exposed, he would usually flee from the camp until the affair was forgotten. If he was killed or injured by the angry husband, a bitter dispute between the families of the two men could follow.

The people generally tended towards excessive behaviour. A woman mourning a lost husband would not merely cry; she would cut off her hair, slash her legs, rub charcoal in the wounds and wail in grief for many days. Revenge upon an enemy would not be left to the survivors of a fallen victim. Instead, a large party, often numbering two hundred men, would form to slaughter ruthlessly any enemy which they encountered. Once blood had been spilled, the revenge was complete.

The woman's duties in the tribe were many. She was the drudge who was entirely responsible for moving and maintaining the tipi, caring for the pack dogs, butchering the buffalo, cooking, caring for the children, manufacturing clothing and utensils, and performing numerous other duties which were beneath the dignity of her husband.

With a few exceptions, such as the Old Woman's Society, women took little active part in tribal affairs. Their leisure time was limited, and was usually spent in creative arts such as quillworking or in the age-old pastime of visiting.

The horse and the gun, both of European origin, were largely responsible for the high degree of organization and mobility of the Bloods. As far as can be determined, the Bloods obtained their first horses in the early 1700's, possibly from the Nez Perces or other Plateau tribes. Until the Spanish brought horses into Mexico, these beasts had been unknown to the North American Indians. But the Bloods, like other tribes, quickly adopted the animal which soon became a necessary part of their lives. Horses provided a means of easier hunting and, as a symbol of wealth, a reason for warfare. No longer were a man's possessions limited to the load carried by a few dogs; gone were the constant hunts for buffalo which came within range of the flint-tipped arrows or could be driven over cliffs; the precarious mode of existence which left little time for war or pleasure became something of the past.

The gun also came to the Bloods long before they saw their first white man. The Crees along

HISTORICAL MAP FOR SOUTHERN ALBERTA

LEGEND

Present Blood Indian Reserve

Originol Reserve For Blaod, Blockfoot and Sarcee Indians

Scale of Miles

0 16 32 48

Hudson Bay obtained firearms and their fellow tribesmen to the west soon sent the Blackfoot tribes in retreat from the terrifying weapon. But then the Crees and Blackfoot tribes were often at peace and even joined forces, as one trader recorded, to make war against a common enemy, the Shoshoni. Gradually other metallic objects found their way into the Blood camps.

The initial effect of European influence was felt only through objects of trade, and it was not until the latter part of the nineteenth century that European customs and values began to take on much significance. Except for the fur traders, the only white people who came into contact with the Bloods before the 1860's were occasional travellers and missionaries.

As the fur traders moved westward from Hudson Bay and the Great Lakes in the 1700's, many woodland tribes came to depend upon objects of trade and in turn, were employed as trappers. They developed a desire for guns, metal utensils, clothing, paint, and also for alcohol.

The Plains tribes proved to be less eager for possession of these items. When Anthony Henday, an employee of the Hudson's Bay Company, went among the Blackfoot tribes in 1754 and '55, he found that they had neither desire to turn their attention to trapping, nor were they anxious to travel to the trading posts. They were satisfied with a few European articles obtained from neighbouring tribes.

By the 1790's fur trading forts were established on the edge of Blackfoot country, yet the only pelts the Indians were interested in hunting were the buffalo and the prairie wolf. Traders tried to bring them under their influence through the sale of alcohol and thus induce them to trap beaver and other valuable furs. But again the Blackfoot differed from their northern neighbours. They refused to purchase liquor, calling it *Nápioki* (White Man's Water),

"These people are not so far enervated by the use of spirituous liquors, as to be slaves to it" commented Edward Umfreville in 1790, "when they come to trade they drink moderately, and buy themselves necessaries for war, and domestic conveniences. They annually bring a good quantity of skins to the traders, but a greater number by far of wolves."[4] Gradually, however, liquor, together with other European imports, such as firearms, metal objects and other trade goods, became an integral part of Blood Indian life.

During the early 1800's the men were noted for their attention to their appearance. Young warriors might spend hours combing their hair and braiding it. A daily bath was taken winter or summer when water was nearby. And special suits trimmed with weasel, human hair, quills and other ornaments were kept for special occasions such as dances, visits to other tribes, and trading expeditions.

Initially the entire Blood trade was with the Hudson's Bay or North West Company on the North Saskatchewan River. The killing of a Peigan Indian by the Lewis and Clark expedition in 1806 had made the Blackfoot tribes hostile to any white men coming from the south. Peace did not come until 1831, when a chief of the Bloods, Bull Back Fat, permitted the American Fur Company to build Fort Peigan on the upper Missouri River. From that time on, the Bloods became shrewd traders, pitting the British against the Americans to obtain the best prices for robes and pemmican.

In 1855 a treaty was signed between the Blackfoot nation and the American government. The eight Bloods who signed were Seen From Afar, Father of Many Children, Bull Back Fat, Many Spotted Horses, Button Chief, Calf Shirt, Plume and White Eagle. The treaty had no immediate effect upon the tribe. It continued a nomadic life, crossing back and forth from American to British territory at will.

The decade of the 1860's marked the first big change in the life of the Bloods. Gold miners began moving into Montana, followed by small ranchers. The inevitable skirmishes of the American frontier followed, with the Bloods often being involved.

A notable incident occurred in 1865 when a Blood chief was murdered by drunken whites at Fort Benton. A short time later a revenge party, led by Calf Shirt, encountered twelve woodchoppers who were building the new town of Ophir in Montana. In the ensuing battle, the Indians wiped out the entire party.[5] With the battle lines drawn, the Bloods became ruthless enemies of any unwary prospector, trader or traveller.

Another factor in the degeneration of conditions was the number of free traders who followed the gold miners into the area. These men were primarily whiskey traders, and their concoctions were often laced with laudenum, red ink, Brazil tobacco and other ingredients to give them "fire". The mixtures inflamed the Indians, demoralized them and reduced them to poverty.

During this time, most of the trade was carried on in northern Montana, along the Missouri and its tributaries. But in 1869, when the Hudson's Bay Company gave up all legal rights to western Canada, the American traders began to move into Alberta. Fort Whoop-Up was built at the confluence of the Oldman and St. Mary Rivers (near the present Lethbridge) during that season. Trade was so successful

that within two or three years, posts were scattered throughout the Blood hunting grounds in southern Alberta. Most prominent of these were Standoff, Kipp, Slideout, Spitzee and Elbow River posts.

Demoralization of the Bloods was rapid. In one winter, seventy Bloods were killed in drunken quarrels at just one of these posts.[6] Repeating rifles were introduced and the buffalo, which had been gradually declining, were slaughtered en masse for their hides. Liquor became tremendously important to Blood Indian life. Clothing, horses, anything of value was traded to the Americans. In winter people froze to death in drunken stupors and families suffered privations because of the inability of the men to hunt.

This condition was noted at Fort Edmonton, where the Hudson's Bay Company had lost almost all the Blackfoot trade. Missionaries who went among the tribes also saw the conditions and reported them to Ottawa. Typical were the comments of Father Constantine Scollen, an Irish priest: "... the Americans crossed the line and established themselves on Belly River, where they carried on to an extraordinary extent the illicit traffic in intoxicating liquor to the Blackfeet. The fiery water flowed as freely, if I may use the metaphor, as the streams running from the Rocky Mountains, and hundreds of the poor Indians fell victims to the white man's craving for money, some poisoned, some frozen to death whilst in a state of intoxication, and many shot down by American bullets. ...In the summer of 1874, I was travelling amongst the Blackfeet. It was painful to me to see the state of poverty to which they had been reduced. Formerly they had been the most opulent Indians in the country, and now they were clothed in rags, without horses and without guns."[7]

Finally acting upon such information, the Canadian government created in 1873 the North-West Mounted Police, and in the following year this force arrived in southern Alberta. The post of Ford Macleod was built and within weeks, the whiskey trade was wiped out. The chiefs expressed their happiness in seeing law and order restored, and established friendly relations with the men in scarlet.

For a short time the Bloods were able to resume the old way of life, but it could not last long. The buffalo herds had been greatly reduced and white hunters in the United States were killing them by the thousands. Each year it became harder and harder to find the shaggy animals.

By 1875 the Blackfoot tribes could see the need for a treaty. White men were coming in, taking the best sites, and former enemy tribes were hunting in their favourite areas. Chiefs of the Blackfoot, Bloods and Peigans gathered in council and sent a petition asking for a treaty to the Lieutenant-Governor of the North-West Territories. Eight leading chiefs of the Bloods, including Red Crow and Rainy Chief, signed the petition.[8] Two years later, when the government signed a treaty with the Crees, the Blackfoot sent another message asking for immediate attention to their problems.

Their request was answered in September 1877, when the Blackfoot, Bloods, Peigans, Sarcees and Stonies gathered at Blackfoot Crossing to sign Treaty No. 7. The terms were discussed and throughout the negotiations only one man publicly voiced opposition to them. He was Button Chief, a Blood chief, who stated that the annual treaty money was insufficient and that they should receive compensation from those who settled in their territory before the treaty was made. Commissioner David Laird replied that the Indians should pay for the peace the police had brought.

The record of the treaty says the Indians laughed at their fellow chief,[9] but according to a contemporary account, they were in full sympathy with Button Chief and were laughing at Laird for his foolish statement.[10] There was a considerable amount of opposition to the treaty but all agreed to abide by the judgement of their leading chiefs and spokesmen.

The significance of the treaty, beyond providing some assistance and recognizing the Indian claim to the territory, was lost to most of the Indians. Father Scollen, who was present, wrote in 1879: "Did these Indians, or do they now, understand the real nature of the treaty made between the government and themselves in 1877? My answer to this question is unhesitatingly negative. ...It may be asked: if the Indians did not understand what the treaty meant, why did they sign it? Because previous to the treaty they had always been kindly dealt with by the Authorities, and did not wish to offend them; and although they had many doubts in their minds as to the meaning of the treaty, yet with this precedent before them, they hoped that it simply meant to furnish them with plenty of food and clothing, and particularly the former, every time they stood in need of them."[11]

This trust in the government was amply illustrated by the Bloods agreeing to take a reserve on a piece of land, four miles wide, along the north side of the Bow and South Saskatchewan Rivers, starting from a point 20 miles north westerly of the Blackfoot Crossing and extending to the confluence of the Red Deer River. This land is among the poorest in Alberta.

The government expected the Indians would be self-sufficient for at least another decade, but

events moved too quickly. In 1878 a devastating prairie fire swept across the territory, driving the buffalo herds southward towards the guns of professional white hunters. By the following spring, the whole Blood tribe was in Montana in a last futile effort to hold on to their old way of life. But the buffalo, upon which their entire culture had been built, was almost exterminated.

Then it was all over. The buffalo were gone. Starving and bewildered, the Bloods began drifting back to Alberta early in 1880 where the newly-appointed agent, N.T. Macleod, found them. "They have no clothing," he said, "their lodges are worn to rags and they are consequently drenched by every passing shower. ...There is no game of any kind to be got in sufficient quantity to be of any assistance to them."[12]

By the spring of 1881 all of the tribe was back in Canada and encamped near Fort Macleod. They indicated that they did not want to move to the area chosen in the treaty, so officials obligingly let them camp near the Belly River. Two years later, the Blackfoot nation surrendered the Bow River and South Saskatchewan River lands and the government provided for the Bloods a new reserve between the Belly and St. Mary Rivers.

As in their nomadic life, they settled in bands along the Belly River, strung out all the way from Slideout to Big Bend. Under the guidance of a farm instructor, cottonwood log houses were built to replace the worn tipis and efforts were made to break the land. By 1882 about 250 acres were broken and a few of the more diligent chiefs encouraged their people to plant turnips and potatoes to supplement their rations. At harvest time, some 70,000 pounds of potatoes were turned over to the government root houses, and much more was kept for food. The turnips were equally successful.

During the 1880's the administrators of the reserve frankly were surprised at the willingness of the Bloods to take up gardening. Former warriors seemed anxious to provide for their families and to find a source of income. Such leaders as Blackfoot Old Woman, Bull Back Fat, Button Chief and Red Crow gave their support to the program and soon wheat, oats, barley and vegetables were added to the list of crops.

In 1880 the Anglican Church sent Rev. Samuel Trivett as the first missionary and he opened day schools in the camps. He was followed by Rev. John Maclean, a Methodist missionary, who finally turned his establishment over to the Anglicans. Father Emile Legal, a Roman Catholic missionary, arrived in 1887 and two years later his school was opened.

Although generally speaking, the Bloods made good progress during the 1880's, these years also had difficulties for them. The death rate was extremely high and such diseases as scrofula, erysipelas and tuberculosis were rampant. The dark, smoky cabins and meagre rations reduced the resistance of the people so that every epidemic of influenza, measles or whooping cough resulted in dozens of deaths. The year 1884, with 126 deaths and eight births, is typical of that decade.

By the 1890's the Bloods had grown accustomed to settled life. Intertribal horse stealing had almost disappeared and practices such as self-torture ritual were gradually given up. By this time the Indians had accepted the use of their cayuses for plowing in the same manner as the government work oxen.

Individual initiative also became evident during this period. In 1891 a Blood named Chief Moon took a contract to provide forty tons of hay to the Standoff Mounted Police detachment. With equipment borrowed from the agency, he successfully completed the work and purchased an old mower of his own. In the following year, when his machine was smashed, he had built up sufficient capital to buy a new one. In the next few years, he became a regular hay contractor, competing with white men to supply the Mounted Police and ranchers.

In 1892 Heavy Gun obtained permission from the council to operate a coal mine on the St. Mary River. He took a contract to supply the Indian Agency with one hundred tons and proceeded to hire Indian teamsters and workers. Under the most primitive pick and shovel conditions, the crews mined fourteen tons a week and hauled it about twenty miles to the agency. Completing this work, Heavy Gun took another contract to supply the Anglican mission, and by the end of the year he had a thriving business.

Two years later, he turned the work over to Black Horses who continued to operate the mine with his son Chief Mountain for more than thirty years. During this period, he supplied much coal to the agency and schools, and obtained contracts from ranchers and Lethbridge businesses.

The big change in the routine of the Bloods occurred in 1894 when the first Indian-owned cattle were introduced. Although horses were still a symbol of wealth, four of the leaders agreed to exchange some of their horses for cattle. Red Crow and Crop Eared Wolf each took fifteen head and Blackfoot Old Woman and Sleeps on Top took ten head each to form the nucleus of the Blood cattle industry.

Looking after cattle had some parallels with their old way of life. A man felt more at home in

the saddle riding after four-legged creatures than he did grubbing in the soil. The success of the first owners encouraged others to follow, and soon a thriving business was in operation. By the end of the decade Indians owned almost 1500 head.

Other tribal members began cutting logs and hauling freight, while the agency hired Bloods as mail carriers, scouts and interpreters. The Indian Agent reported that individual Indians had earned over $5000 during 1894. Nevertheless, the sources of income were limited and the majority of the tribe existed on rations issued by the government. At first these rations consisted primarily of meat and flour but later were broadened to include tea, sugar and other goods.

Only one real attempt was made to use rationing to encourage employment. In 1880 the agent reported that rations were set at three-quarters of a pound of beef and half a pound of flour a week to everyone, but a pound of each to those who were steadily employed. Soon, however, it became policy to issue rations only to those who were unemployed and to cut them off as soon as these people had found work. The result often was that a man would refuse work because the income was barely comparable to the weekly rations.

Rations also were used as a weapon of the Indian Agent to enforce government regulations. The Agent curtailed the rations of persons who participated in the Sun Dance, in an effort to suppress the ceremony, or if anyone left the reserve without a permit, even to hunt, his rations were stopped. Intertribal visits were discouraged by refusing to give rations to such visitors.

These actions left an impression that rations were the government's gift to co-operative Indians, and that there was no need to become employed. Gradually such assistance came to be regarded as a right, as if it had been promised in the treaty. In this way, the idea of "the government will look after us" developed. When rationing was discontinued in later years, it became a natural step for many to seek band welfare assistance instead.

It was not until 1907 that the first major attempt was made to bring the Indians from small garden plots in the river bottoms onto the broad prairie lands. About $10,000 band revenue from leasing part of the reserve for grazing was used to buy a large steam ploughing outfit. Farm instructors were engaged and Indians were encouraged to go into farming in a big way. Soon the growing of grains became the most important industry on the reserve. By 1916 the Agent was able to report that the Bloods, without financial aid from the government, had produced 65,150 bushels of wheat on 2600 acres and 26,980 bushels of oats on 768 acres, in addition to 7600 tons of hay.

The introduction of agriculture was timely, for strong pressures were exerted on the Bloods to sell uncultivated parts of their reserve. There was much demand for land at the height of immigration from Europe, and local promoters in Cardston, Ford Macleod and Lethbridge visualized thousands of additional settlers being placed in their areas if Indian reserves were thrown open. The Bloods showed no interest in any of the offers made and were determined to keep the reserve intact. When in 1907 the government supervised a band vote for the sale of 2400 acres of land on the southern limit of the reserve, the feeling of the leaders was so strong that head chief Crop Eared Wolf took immediate action. As reported by the *Macleod Gazette:* "J.A. Markle was conducting the negotiations which were opposed tooth and nail by Crop Eared Wolf, the head chief. This dusky gentleman has missed his vocation. He should have been a politician. He personally canvassed every vote on the reserve. Some he scared, others he coaxed, and others he induced to stay away."[13]

The vote was more than three to one against the sale, and one chief, Running Wolf, who voted in favour was ostracized for several months. Another vote was taken in 1917 when it was felt that uncultivated Indian lands would be useful for soldier resettlement. Again the Bloods voted against the move. A third vote took place in 1918 and sale was approved by a small margin. The head chief, however filed a protest in Ottawa charging "fraud, bribery and intimidation".[14] As a result, the land was not sold.

The resolutions voted on contained the word "surrender" because without Indians giving up first their right to the land, sales could not be made. Consequently, this word became a source of suspicion and even where the band was asked to sign a "surrender for lease", there was a feeling that it might be a legal manoeuvre to take their land.

Once farming and ranching had been established the Bloods entered a period of steady development and were hampered only by crop failures. Not until mass mechanization of Canadian agriculture took place did a wide gap between Indian and non-Indian farmers appear. The importance of the horse as a centre of farm life declined, and with the cultural and educational background of the Indians, it was difficult for them to find a place in the new fast-paced technical world.

During these years of sedentary living the Bloods were able to retain many features of their traditional life. While horse raiding, mutilation of unfaithful wives, the self-torture ritual and other customs had been abandoned, there was still a strong identification with the nomadic culture.

Blackfoot was the first language of all but a few, and braids, moccasins, blankets and shawls remained popular. The age-grade societies of All Comrades flourished, although its emphasis shifted to cultural and social activities. One of the major activities, outside of their own ceremonies, was to sponsor social dances. These societies still would compete among each other in organizing grass dances, owl dances or other forms of entertainment. Most of the religious secrecy was eliminated, with only the Horn Society adhering to the old ways. This former age-grade society became the holy body on the reserve and, with the Old Women's Society, was doing much to maintain an interest in Sun worship.

The history of the tribe after the First World War was one of slow decline. The younger generation often was unwilling to carry on the diligent pursuits of their parents. During the 1930's the generally depressed economic conditions in Canada and the world magnified the problem.

The Second World War marked a major turning point in this picture. The initial change was not in the Bloods, but in the attitudes of the government and of the Canadian people. As one man wrote in 1944: "The time has come ...where the Indians of Alberta may reasonably expect a far better hearing than they have in the past. Everybody realizes today that we will all have to change our social structure for something better than what existed in the past. Any movement for social reform in Canada would be a farce if it did not include Indians..."[15]

Gradually, the improvement of educational facilities, health services, and general government programs are beginning to show beneficial results. Mechanization has progressed to the point where work horses have become a rarity in work on the land. Education has taken young Bloods into such fields as nursing, nurses aides, stenography, barbering, the civil service and private business. The pride and confidence of the people is also being restored so they are again showing that they still belong to a tribe of "Many Chiefs".

NOTES AND REFERENCES

1. Interview with Mr. Jim Whitebull, July 22nd, 1954.
2. The author is indebted to Rev. Stanley Cuthand for information about Cree terms.
3. At first, the Government used the term "Tribe" for the main group of Indians, and "Band" for the family group. In the 1890's they changed to "Band" for the main group and "Village" for the family group. The use of "Village" gradually died out so that only the term "Band" remains. In this chapter the term "Band" has been used during the period when it was the accepted term, and "Tribe" has been used for other periods. This distinction is particularly important during the nomadic period when the term Band would be misleading.
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9. Morris, A., *Op. cit.*, p. 270.
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11. Letter from Father C. Scollen to Lt. Col. A.G. Irvine, Indian Affairs Branch Archives, Ottawa, No. 14924.
12. Letter of N.T. Macleod to the Indian Commission, Sept. 1, 1880, Blood Indian Reserve letter-books.
13. *Macleod Gazette*, June 13, 1907.
14. Wilson, R.N., *Our Betrayed Wards*, privately published, Ottawa, 1921, p. 5. This booklet contains an excellent account of the alleged methods used against the Bloods to bring about the sale of their land.
15. Letter of Malcolm F. Norris to J. Callihoo, Indian Association of Alberta, Feb. 10, 1944 (in author's possession).

II. CONTEMPORARY BLOOD INDIAN COMMUNITY[1]

The contemporary culture of the Blood Indian community is more complex in one sense and less complex in another than that of the tribe in pre-reservation days. It is more complex in that today's culture is partly traditional Blood culture, attenuated to be sure, but nevertheless real and vital; partly a cowboy-frontier culture that sprang into full flower at about the time the Blood went into reservation status but that developed new forms as time went on; partly whiteman culture, as it is interpreted and adapted to fit Blood society; and partly "Indian reservation" culture, a way of life that copes with the outside world and the reality of conditions as they exist within the reservation community but that is not aggressive about changing things. The culture is now less complex in the sense that the Blood in pre-reservation times had a well developed social system, technology and religion, which were adapted to the high plains environment and much (though not all) of this complex whole has been lost.

The next few pages contain a description of certain aspects of the contemporary way of life, for this way of life will affect anything done to or for the Blood, and everything they do for themselves.

SURVIVING TRADITIONAL PATTERNS

There are many aspects of traditional behaviour patterns surviving in the Blood community to-day. For a brief discussion the following have been selected: Blood Indian language, Sun Dance, native medicine, age-societies, hand games, and second names.

Blood Indian Language[2]

The Blood speak their own language. They do not speak it only on special occasions, it is the vernacular -- in the home and family, at social occasions, on the street in town. Many of the people past 45 years of age are hampered in their efforts to communicate fully in English, and turn to a fellow Indian to discuss in Blood what they want to say when a complex or subtle matter is involved, then formulate their thoughts in English. Thinking in Blood is common, unless the content of thought has specifically to do with objections or activities that fall clearly within the domain of the whiteman culture. One man, for instance, has been economically successful; he has a home that is bigger, better-equipped than those of many of the white ranchers in the area, works hard, saves money, and is reliable in financial dealings. But he thinks in his native language, except when he is planning what he must do with his machinery when spring is coming, or how much money he must withdraw from his account, or about his son's grades during the past term in school. He has apparently divided the world in which he lives into two parts -- Indian and white. It is remarkable that he is so able a man in both worlds.

It has become commonplace knowledge that language is the vehicle of thought, and an important determinant of action. Language is also a reflection of education within a specific social and cultural framework. The Blood language is fully adequate as a means of complex and subtle expression, and is, more concrete in its specification of action contexts than European languages. Different forms are used to denote action taking place before our eyes, close to us, action taking place a short distance away, and action taking place elsewhere, out of direct observation. Many of the conditional phrases that are so common in English -- the "coulds", the "ifs", the "maybes" -- have no direct counterparts in Blood.

A man thinking in as well as speaking the Blood language is thinking differently than a man thinking in English. He is not, because of this, a less efficient thinker, but his understandings, his conclusions, and his actions will be frequently quite unexpected from the English-speaking white point of view.

The Blood community is a speech community as well as a socio-economic enclave.[3] One who does not speak and understand the vernacular is really never a member of this community -- he is a stranger, an alien, and remains one no matter how good his intentions, congenial his company, or generous his pocket-book. This fact applies to the anthropologist as well as to the administrator, teacher, or priest.

Sun Dance

No one who has attended the annual Sun Dance ceremony and particularly during the time when the Horn Society carries out the public aspect of its rituals, could fail to be impressed with the fact that much traditional culture has survived.

During the ordinary days of the Sun Dance various men's societies sponsor social dances and give-aways. A group of singers forms around a large drum and

produces music for dancing. To the casual white observer all the songs sound alike, and the beat of the drum dominates all other sounds. To the knowledgeable observer, however, there is a highly patterned variation drawn from a well-developed musical and choreographic context. Different songs are sung for different dances, and for different parts of the program.

The songs and dances, as well as the costumes worn, are not all specifically Blood in origin. A movement of musical patterns and social and exhibition dancing has spread over the entire plains area of North America in very recent times, so that today, though there are tribal variations, the shared patterns are more apparent than the differences. There is much change, if one takes the traditional customs as the baseline, but the change has not been all in the whiteman's direction. It has been in the direction of a synthesis and standardization of formerly separate tribal patterns.

The ritual activities of the Horn Society and Mohwtokay Society (a Traditional women's organization) are of a different nature. The rituals are specifically ancient in their origin, sacred in their conception and purpose, and should not be confused with the everyday social and "fancy" (solo exhibitions) dancing and give-aways sponsored by the men's societies and open to any observer, white or Indian.

Native Medicine

Another indication of the strength of traditional Blood culture is the fact that a few native doctors and medicine-men still practise on the reserve. The doctors treat illness with herbal remedies, and their ability to cure is thought of by the Blood as partly secular in its origin -- a man has learned, from a relative or some older person, a specific way of using the elements of material nature to cure specific complaints. The extent to which the Bloods make use of native doctors and their medicines is almost impossible to estimate accurately. About one third of the people interviewed indicated that they had at one time or another occasion to use an herbal remedy, though one gets the feeling that these were rarely dispensed by a regular Indian doctor, and more often by an older member of the family who knew about common and simple "home remedies".

The native doctor merges into the role of the medicine-man who is believed to have acquired sacred power as a consequence of some specific dream event. The general feeling is that while the powers of the medicine-man were valid in times past, their powers are much weaker or non-existent today. Such a medicine-man (there are only a very few left), it is believed, may cure illness of either psychological or physical origin. In the cure of physical disease the medicine-man is expected to use what whites would call magical means.

Age-Grade Societies

Age-grade societies, or men's societies, are an important part of the contemporary Blood social system. All males interviewed belong to a society, except for a few of the younger men under 25, and some of these will join -- either one of their own creation or the one just above them in age grade. Participation in the societies' activities does vary, however, and some are members by definition only.

The societies are rather loosely organized. The more active ones have an elected president and treasurer. Women are part of the organization by virtue of their marriage to a man who is a member. They play an auxiliary role, for these are basically men's societies. Meetings are not held on a regular basis, but only for the purpose of planning and implementing sponsorships of activities.

In the old days these societies had many functions, and membership in them was more strictly governed. As discussed in the preceding chapter, one of their main duties was to police the camp and all activities occurring within it. This function, as well as others, has disappeared and today the societies are clearly social clubs. As such they play an important, if attenuated, role in the life of the community and reflect the basically Indian-oriented character of the Blood reserve culture and social life. There is no reason to anticipate their rapid disappearance. A new society was formed only a few years ago and now is made up of men between about 25 to 35 years of age. Another may be formed for the younger men in the near future.

Whether these societies could be utilized in some way as channels for on-reserve development is an interesting possibility. There are competitive elements built into them, for traditionally odd-numbered societies tried to exceed even-numbered societies in their sponsorship of dances and other social affairs. But they are not economic or work units in a direct sense. Work units for economically relevant production are usually composed of kin, grouped around a particularly able or well-to-do man who owns machinery. It might be worth experimenting, however, to see whether these societies could be utilized as forum groups for discussion of current

problems within the framework of which decisions will eventually have to be made. Perhaps some economic consequences will result, and it is not impossible that such a society would eventually sponsor and run, for example, a tribal store (or stores) though competitive jealousy might prove to be a factor in who would patronize it.

Hand Games

The hand games that take place as a prominent part of most social gatherings are another indication of "Indian orientation". This gambling game involves two opposing sides of up to about ten on each side. The "teams" are separated by boards, laid on the ground, on which those who are not playing the "dice" (short sticks with distinguishing markings that are skillfully passed from hand to hand in stylized motions that can only be described as a sitting dance) beat a fast rhythm with sticks. Much money changes hands during the game, which may last all day and well into the evening. It is true that gambling, which is exciting to whites as well as Indians, makes the hand game attractive, but the liveliness and fun of the game contribute in no small measure to its popularity.

Hand games at the Sun Dance encampment are always ringed with many spectators. The hand game songs are lively and light in their melody, and the motions of the players as they move the sticks rapidly from one hand to another -- sometimes behind their backs, sometimes beneath their folded knees -- are a combination of sleight of hand and graceful dance. Some players become so involved with the activity that they seem to lose consciousness of their surroundings and become totally entranced with the movement and rhythm. It is not surprising, then, that the hand game is one of the favourite recreational pursuits of the Blood. Its rhythms are heard not only at social gatherings of a major type, such as the Sun Dance encampment, but also on many evenings at Standoff, the Glenwood district, and Moses Lake, the three main concentrations of population on the reserve.

Second Names

The widespread distribution of acquired Indian names is another significant indication of Indian orientation current in the Blood community. Men inherit their family names today, following the whiteman custom, and these usually have their English and Blood translations, but most men interviewed also had Indian names which were acquired. Names of this kind are given to signify and commemorate some important event. A long trip, an accident (that turned out all right), an act of bravery, even a humorous incident, may be so commemorated. When something of this kind has occurred that is regarded as sufficiently noteworthy, a name is usually given formally, at a dance, or a smaller gathering of family and kin -- often with an exchange of gifts and a "feast". In the old days these names were acquired in recognition of bravery on war or raiding parties. They were regarded as a final "coming of age", and were the proper names.

. . .

Today much of the meaning of the old culture has been lost, but many customs survive, and this is an indication that the Blood have not compromised all of their basic values and customs in exchange for those of the whiteman. The strong survival of traditional culture must be accepted as a fact in economic development for it is one of the forces that makes the Blood community different from any white community.

BEING INDIAN

The Blood today live not only in a physical environment where the temperature may shift 40 degrees in a few hours, but also are surrounded by a social environment that the whiteman and his beliefs have brought, and that at times is equally unpredictable.

The opinions that Blood Indians and whites have of each other are not always favourable. Some whites in nearby towns say that the Blood do not want to work, that they cannot be depended on to "come through", or "deliver the goods" on any project, that they "can't even trust each other". Some Blood Indians characterize whites as cold and heartless, as always "after the dollar", as stingy, tense, and cruel, ready to cheat anyone on a business deal -- but especially an Indian -- and unfriendly to each other, as well as to Indians.

There are many exceptions. Some Blood Indians are willing to admit that there are different kinds of whitemen. When they make such discriminations it is usually on the basis of a specific experience with a specific whiteman or woman. In general the Blood seem to retain a capacity for judging each situation and each person on its own merits. There are also many exceptions among whites, and those who know the Blood the best seem to have the highest opinion of them.

It is not our purpose to analyze the truth or falsity of the mutually unflattering stereotypes. In fact, they cannot be investigated objectively. They

are part of the culture of any group, and are a result of interaction between people. But the fact of prejudice on the part of many whites towards Blood Indians and on the part of some Blood towards whites can be established, and must be considered as a barrier of importance to the effective accommodation of the Blood to the impact of white social and economic structure. Whatever the reality, it seems that few Blood Indians today reach maturity without feeling that they cannot become full and equal participants in the whiteman's world, no matter how they behave. So they stay Indian, because this is the only way they can feel secure. This brings us to the subject of what it means to be an Indian in terms of attitudes and values.

Attitudes and Values

One part of being Indian has already been described. Being an Indian sometimes means that one feels that he or she is regarded as an inferior being by whites. This feeling reaches deep into the core of personality and character, and directly affects behavior. It affects ambition, work habits, and ability to learn in school. It is a factor in delinquent and criminal behavior. It has a lot to do with excessive drinking. As several Blood Indians have said to us: "The only time we feel like men is when we're drunk". Feeling inferior has much to do with giving up attempts to live the whiteman way of life.

Many times an Indian will make dramatic progress towards success by white values. He works hard, saves, invests in livestock and works his land. He may even move off the reserve, usually to an urban centre, to try to make a go of it in the whiteman world. But then just as dramatically he gives up, and tries merely to get by. What does his success get him? He loses his Indian identity, his Indian friends, the security and warmth of Indian social interaction. He does not always make new white friends, or acquire a new identity, or become accepted in the white community.

Being an Indian means other things as well. To be a good Indian, in Indian terms, one must be hospitable and generous to a point that transcends common sense from the white point of view. A good Indian gives unstintingly of what he has to friends and kin, however remote the claim to hospitality. This quality is a factor of no mean proportions in the poverty of many Indian families. On the other hand it has its recompenses. As an Indian one can get a free meal and lodging in virtually any Indian community in North America. There is a kind of security in this life that whites do not have.

Generosity also finds expression at giveaways during a dance or other social affair. The flow of money and goods at these occasions is impressive. Many times money will be given to total strangers who have travelled some distance. There is, of course, the possibility that the giver will some day be in the position of the receiver.

Being Indian means helping friends or kin to do their work. This co-operation is particularly apparent during haying -- an activity that should not be underestimated for both its economic and social importance. The work gangs are usually composed of relatives among whom profits are to be shared. Usually such sharing is unrealistic with respect to the expenses of the man who owns the equipment. The individualistic entrepreneur is the object of suspicion, and more than one Blood has been accused of "acting just like a whiteman" in his effort to make a profit.

Being an Indian means also being in an ambivalent state of mind concerning one's self, one's identity as an Indian, and concerning whites with their values. This can be best portrayed by letting some Blood speak for themselves.

> God put Indians on this side of the world to live, and you whitemen on the other part. The Indian lived just with what was here, the meat, the berries, the hides of animals. The Indians ate fresh meat all the time. Their teeth were good, and they never had diseases like diabetes, T.B., or cancer. They could run long distances, and never get tired. They could run down a deer.
>
> But now they can't run 300 feet without getting beat. You people come over here, teach us everything. The clothes we wear, the tools we use, the cloth, seeds, all what we do and have now -- you people make it. We can't make nothing. Even those trees (we were sitting in a planted grove near an old trading post site) you planted. That tree there (and he pointed to a half-dead elm) -- your people would look at that and say it has some disease. Then you find out what it is and cure it or cut the tree down so the disease won't spread. Indian people, they would never think of that. They just live. We don't know nothing.
>
> You people made writing, so you don't have to remember nothing. I guess that's why you white people have such bad memories. I notice I can tell you something one day, if you don't write it down you don't remember it the next. We Indians can remember everything that happens, even when we were little kids. It's all clear.

You people have dentists to fix your teeth. You need them because you eat dead food. Before you come over here the Indians all had good teeth. My grandfather had a full set of good teeth in his head when he died, and he was almost ninety years old. You people have Doctors that can cut a person up and put them back together again. You have factories to make cars, everything you need. You have scientists, and they take what's in the ground and make atom bombs. Some day there's going to be a terrible war and you'll blow yourselves all up. Then maybe we'll be the only ones left around. You white people have a different kind of brain. Your mind is open to everything. You learn new things all the time. You're always inventing something. We Indians just lived. We took what God put on this earth in its regular form and used it. We didn't change nothing. You white people are smart. The Indians are the lowest class of people on earth. We're even lower than the black man.

We reminded him that before the whiteman came the Indians knew things about game, about weather, and that they not only made effective tools and weapons, but also had some powers to control the spiritual forces about them. He replied: "Yes, but that's all gone now. Everything is different. None of that's any good now. We don't learn nothing new."

His attitude is self-contradictory. He admires what whitemen can do -- the things they can make, their knowledge, their "open minds". At the same time he runs down the very abilities he admires, and particularly the destructive aspects of their influence on the Indian way of life, for which he has deep nostalgia. He is convinced of the futility of thinking about the past, or trying to recreate it, but does not believe that Indians have the capacity for moving into the future. In a sense, he is at dead center.

Another Blood friend spoke to us at some length when we were passing the Sun Dance grounds on our way to Lethbridge.

That's our Holy Ground. It is sacred to us, just like Jerusalem is to Christians. In the old days this is where we came back to each year after our wanderings. Everything was different then. When we signed that treaty number 7 we were the most powerful tribe in all this part of the west. We had chased the Crows, Kutenai, and Cree out of all this land. No one came here without our permission. When we signed this treaty we promised to put away our spears, our bows and arrows, and our rifles, and never fight again. We kept our promise. We are friends to everybody, all different peoples. But now you white people fight among yourselves, and you hate the Indians. You want our land, and you don't want us even to mix with you. Now you kill each other. That's no good! No good! You know, God put us on this earth, and gave us this land to live on. Now you people dig up what's in the earth and use it to kill men with. That's not what God put it there for. In the Bible it says someday this earth is going to burn up. That's what this atomic is. Some day you'll be sorry. It's no good. If I could explain myself better you would know just what I mean. Then you wouldn't say 'that crazy Indian'.

As in the first case quoted, his feelings of nostalgia and regret over the past, and his mixed feelings towards whites and what they have done to what he regards as his land are clear. These feelings are widespread among the Blood.

The monologue of another Blood man is worth quoting at some length. His attitude is both the same and somewhat different than those just quoted.

My education was nothing. I didn't speak a word of English when I went to school, and when I finished the sixth grade I still didn't speak good English because all the nuns were French and spoke broken English. I still have an accent, but I learned English working around with white farmers, and I keep trying to learn to talk better. I can speak good Blackfeet, and some French too.

I think integration would be a slaughter. The Indians aren't educated, they have no trades. If they was taxed like white people they would go under. They're not used to operating under these burdens. I don't think we should even get to drink like white men. It would be the first step, and pretty soon we would lose all our treaty rights.

You white people are smart. Maybe too smart. You have everything figured out. You even tell us where we come from. I read a book about Indians that said we came over the Bering Straits. I can't believe it. It don't make no sense at all.

You know, white people say they could make a million living on this reserve. They say we have the land and resources to do anything we want. Maybe it's true that we have the land, but you white men couldn't do no better than we do if you had a ball and chain around your

neck. We can't even sell beef without going to the agent. We can't grow no wheat unless we get permission. (We asked him how people like ....., a successful Blood rancher, could do so well.) That's because he had a chance. He started earlier, at a time when there wasn't so many restrictions on cropping and grazing. (He went on at some length citing instances why he couldn't run cattle in sufficient number to make a living, or cut more than a certain amount of hay.)

We had a paradise before you white people came over here, before we even had the horse. Our people had dogs that dragged travois behind them to carry things on. There was no war then. There wasn't nothing to fight over! We had plenty to eat. There was buffalo in every coulee. There was no work, no starvation. We was all healthy. When the horse came we had to fight to keep other Indians off our land. Then you people came here and we got your diseases. We had to live on white flour and lard, and the meat you gave us was sprinkled with lime to keep it from spoiling, so we got stomach trouble. The Blood dropped from 4000 to 900 in two years, and before that from 25,000 because of your T.B., smallpox, and venereal disease. We used to live on boiled and barbecued meat, berries, and roots. We lived to an old age with a mouthful of good teeth. Now look at us! We're a sorry bunch!

If you people would get off our neck maybe we could amount to something.

Particularly noteworthy is his deep hostility towards whites, his nostalgia for a golden past, and his self-contradiction about dependence and independence. He wants to have the "ball and chain" taken off his neck; he wants to be free from all restrictions on his economic endeavours, but at the same time is against integration. He wants the fruits of a dependent relationship with white society, and at the same time wants independence. This conflict of attitudes is also widespread among the Blood today.

The attitudes expressed in these quotations are complex, self-contradicting, and intense. They make the Blood uncertain about the future, about themselves, and their capacity to make a go of it. The Blood are self-critical, and both admiring of whites and hostile towards them. They feel that they are injured parties, and that whites owe them recompense that they have scarcely begun to pay. The Blood hate themselves for their dependency upon whites and at the same moment they demand more from them. This complex of attitudes complicates economic development and any effort to help the Blood to help themselves.

Being an Indian, at least a Blood Indian, means other things too. The Blood admire masculinity. To them the ideal type of man is hardy, vigorous, enduring, tough, and risk-taking. The young men think of stampedes (bronc riding, steer dogging, calf roping) or boxing, when they think of what they would like to be. Older men say they want to work outdoors in the fresh air that it keeps them strong and healthy. The ideal man is an athlete from youth to old age. Old men prize their ability to dance like men many years younger. The Blood look for excitement, and are bored by repetitious labour.

Men talk about themselves and their exploits in a way reminiscent of warrior's accounts in the old days of their war adventures and their coup counting. What whites would regard as boasting is regarded as acceptable behaviour among the Bloods. It is probably particularly difficult for a people who have these concepts of manliness to accept a dependent role in relation to other men who they often appraise as less manly than themselves.

The high value placed on manliness has a direct bearing on drinking behavior. The Blood say they drink much in order to feel like men, but to us it often seemed that the main purpose in "going to Babb"[4] was not so much the drinking itself as the atmosphere of the war party. The trip is a raid on enemy territory. A car or pickup loaded with young men goes across the border. Everyone drinks, although they try to keep one sober enough to drive back. They go to a bar, usually manage to get into some exciting trouble, then try to smuggle liquor back to the reserve. Ingenious methods of smuggling are employed. When a successful smuggling raid has been carried out everyone involved feels satisfaction. They have outsmarted the border patrol, and they have brought back the loot. Liquor has been substituted for scalps and horses. A man is one who dares to do it, and preferably, gets away with it.

Leadership and Status

The signs of power and prestige among the Blood are not obvious to the white observer. A "leader" among the Blood does not lead. He is a man who "helps the people", who will "talk friendly with anyone", or who "always talks nice". He is generous with his time, his equipment, his food, and his money. He is a man who is in the network of face-to-face communication. He talks with kin

and friends about every issue. He is a friend to everyone and especially to relatives. He is also dignified. On public and ceremonial occasions he seems reserved and aloof. If he dances, he dances erectly, almost expressionless. When he talks, he speaks slowly and carefully, weighing his words for their effect. He never orders anyone to do anything. He can exercise influence, but not direct power.

The Blood have a concept of rank, but rank and direct power are not related, as they usually are in white society. The Blood are courteous and dignified, especially on public occasions where rank is involved.

A man who has rank may or may not have socio-economic status in whiteman terms. The coincidence of these two attributes is an accident in Blood eyes. This situation makes it difficult for an administration imposed from outside the Blood system to determine the sources of influence in the community. Sometimes the people who have the greatest influence are those who are not at all motivated by the whiteman's concept of the necessary economic status and power. Yet the Blood view of leadership, rank, and influence, cannot be disregarded. The channels of communication and of influence that are functioning in the community must be utilized if any plan for development or change is to be formulated, agreed upon, and implemented.

COMMUNICATION

The Blood are constantly on the move. Some of the movement is necessary because of economic activities. Cutting hay, loading it and taking it to a weighing and storage station, or moving livestock, trucking grain, working as a carpenter on a house being built some distance from one's own, all require movement. Some of the movement is the consequence of the size of the reserve and the distribution of its population. Most Bloods must travel miles to get to the community hall, or to the Indian Agency office, farm headquarters, schools, or to do their shopping. In addition there is much movement as a result of the need to communicate with each other. The widely separated houses and settlements on the reserve are not linked together with telephone wires. There is no daily newspaper to carry news and gossip about one's distant neighbours into one's home. The people depend on direct face-to-face contact for communication -- they are great visitors.

No administrative decision issued from the Agency office or by the tribal council goes untalked about for long. Face-to-face communication is effective, and apparently almost simultaneously activated in all of its parts. Not infrequently the news and gossip is about a decision that has already been made. And once a decision has been made the only thing left to talk about is whether it is good or bad. Under these circumstances the formation of negative sentiments and resentment is very likely to predominate. Perhaps if this network of face-to-face communication could be utilized as a means of collecting sentiment before decisions were made, the decisions, once made, might be accepted more willingly.

HOME AND HOUSE

To many Blood families and individuals a house is just a shelter, not a home. It is a place to sleep, sometimes to eat, or to visit, but not to stay, improve and decorate with the prideful care characteristic of the more stay-at-home whites. A family that has a house at Standoff may be found "visiting" (for a day, a week, or a month) the house of an older relative at Moses Lake, or living in a tent on the prairie close to where hay is being cut, or at the Calgary stampede. Part of this spatial mobility is due to environmental considerations, part of it is a result of the need to communicate, but some of it seems to be a survival of a very recent past when the Blood were a nomadic people who roamed constantly over the vast expanse of prairie that they regarded as theirs. In contrast the whiteman culture stretches back over centuries of sedentary existence.

For these reasons the material inventory of a Blood house means little. Houses sheltering as many as eight or ten individuals often lack storage for food -- and yet the people look well fed. Storage closets for clothing, bureaus and chests for possessions, are at a minimum, compared with white standards. The people do not burden themselves with many possessions. Because they are not "home" very much there is little done about the appearance of the house or the area about it. Trees are not planted, for how would one water them from the precious store of cistern water hauled in barrels in a pickup truck or wagon from a river, spring, or public pump? For the same reason, and also because it would have little meaning in the Blood concept of rightness, there is rarely anything resembling a lawn.

As a consequence of these many factors most houses do not seem "homey". They are lived in, intermittently, but are not a means of representing one's status and self, except in the case of a minority of Blood who have adopted the whiteman's concept of home.

Yet the Blood have a concept of "rightness" about places in which one lives. Tents out on the prairie are not carelessly erected. They stand as firm as a rock in the whistling prairie winds. The inside area of the tent is usually neat and well ordered. Blankets and comforters are rolled up in the daytime, possessions and clothing are neatly packed away in boxes or trunks. Considering the number of people who come and go the absence of litter is impressive. The same applies to the Sun Dance encampment, where as many as five hundred people may be camped for many days, and many more come and go during the days and evenings of socializing and semi-public events.

Nor will one often find that Blood houses are in a state of obvious disorder. The whiteman's eye (or particularly the whitewoman's eye), accustomed to gleaming, polished floors, shining chrome and tile, enamelled and varnished woodwork, painted or papered walls, may find the interior of Blood homes unappealing at first. Carpets are found in only the better homes of those most accommodated to white ways and concepts of a home. Bed coverings are frequently worn and shabby. Wood surfaces are usually left untreated. But there is little real disorder. Blood women, when interrupted in their housework, feel uncomfortable, and apologize for the pile of dust and grime they have swept up to take outside. Old Blood men, wearing braids and with the customary paint on their cheeks and forehead, are often model housekeepers.

The Blood also have definite concepts of where a house should be situated. They love the prairie and its open space. Men complain that the prairie is getting all "cut up" with fences. "When I was a boy you could ride from here to Cardston (20 miles away, but we could see the town from where we stood) in a straight line. Now there's a fence every few yards." The Blood resent the difficulties of access created by land leased to whitemen: "I have to go two miles this way, three more that way, and go over two coulees to get to any good hay now."

The Blood have a concept of the appropriate place for people to live, and the appropriate way to keep house, but they do not understand the desire of the whiteman for a "nest", a cozy place that is his own, and that is his private world. Factors such as this must be taken into consideration when planning new housing or communities.

STAYING INDIAN

The Blood are concerned about keeping their identity. The social dances are a visible manifestation of this concern. These dances are surprising to anyone who believes that Indian culture in North America is dying or dead, and that only a few meaningless remnants are surviving. Costumes, style of dancing, the proud and dignified postures of chiefs, the social rituals of give-away and name-giving, use of native language, songs and rhythms, are all manifestly Indian, if not solely Blood in origin and character.

Blood parents want their children to keep their Indian identity. In our interviews the vast majority of parents were able to make specific statements to the effect that they wanted their children to keep "traditions" alive. As one man put it:

> We (his wife and he) speak our own language, and we want our kids to learn it. That little guy there (about four) can talk pretty good now. He don't know no English. Those other two (about eight and ten years old) go to school in town. They had a parade. We made costumes for our kids. Some white people might look at those kids and think they don't know nothing. They're "just dumb Indian kids", they might say. But if they can wear a good Indian costume they might think different. They see they can dance, they think that's pretty good. Maybe they know something.

A successful man who lives in a modern house with excellent furnishings and household equipment was vehement when we asked him if he would ever consider "passing" into white society and raising his children to be whites.

> I'd *never* do that! I am a Blood Indian and I'll never try to be anything else. If I can't make it as an Indian I'll never make it at all, I want my children to learn how to get along and make something of themselves. I want them to have a good education and learn how to work. But I don't want them to forget they're Blood Indians. We're teaching them how to speak good Blackfeet, and we want them to learn respect for the old traditions. They don't have to believe everything. They should go to church, sure, but that doesn't mean they have to laugh at everything that isn't like the whiteman. No sir, this reservation is a good place.

There are several elements combined in these expressed attitudes. There is the fear that if their children (and themselves) do not stay recognizably Blood Indian they will be nothing. There is also pride. Though there are feelings of inadequacy built into their concepts of themselves, they are also proud of being Blood. This pride is rooted in their

history and is projected forward through the present into their future. The Blood feel they are richer, more influential, healthier, than most Indians, and in some ways they do not envy whites. They boast about their singers, their dancers, their houses, and the broad expanse of their land. Sometimes this pride only makes the situation more painful but at the same time it is one of the primary and crucial sources of the vitality and basic optimism of the contemporary Blood character. Their pride is a positive resource. If the events of the next few decades destroy the sources of this pride, the Blood will become just another clump of disheartened, poor and dependent, marginal people with whom the Canadian government will have to deal. A way must be found through which the Blood will progress economically and socially, and at the same time continue to keep their identity.

The question of who are the models for the Blood arises. The Blood see white ranchers and farmers around the reserve making what looks to them like a successful adjustment to the same physical environment in which they live themselves. These models seem very remote to most Blood. The Blood also come in touch with shopkeepers, used car salesmen, and other business men in nearby towns, but these men cannot be models for Bloods to which to aspire. There are too many barriers and differences. The Blood are educated in schools run by whites. Most of the teachers in these schools are women, and how can a Blood Indian boy learn from a woman. In Blood eyes to learn from a woman is to try to be one. White school-teachers do not fit the Blood models of being a woman either, however excellent they may be as models in white eyes. About the only white models that provide any meaningful profile to most Blood males today are the rodeo hands. They are risk-takers, and are tough and masculine. The problem is that the Blood get into trouble when they try to emulate them in every respect. The young Blood see white rodeo hands swaggering around with a bottle. But when an Indian rodeo hand swings around with a bottle in his hand he runs a more serious risk of being caught and punished. So he learns again that what is all right for whites is not all right for an Indian.

For successful economic development it is important that the Blood can draw from a greater variety of models than are now available or acceptable to them. Attempts must be made to open some new channels of communication with the off-reserve world, and in doing so, provide new models for the young Blood.

. . .

The foregoing discussions lead to a most important point. The Blood community today is a medley of traditionally Indian elements, old-time cowboy and frontier culture, rodeo hand behaviour and attitudes, pan-Indianism[5], and contemporary whiteman behaviour and attitudes of several different kinds.

Each Blood Indian draws from the cultural fund of the Blood community somewhat differently. He may divide his or her world into two parts: Indian and white, and manages to keep these parts separate. He may become more Indian as he matures and tries to find his identity more or less exclusively within the framework of Indian values and behaviours. He may try to escape from marginality and discredit of Indian identification (in the eyes of some whites) by competing with whites in exhibitionistic contests of skill and strength, such as rodeo competitions and boxing. He may withdraw as much as possible from contact with either white or Indian and live in an isolated world of non-Indianness and non-whiteness. He may, although it is a rare form of adaptation, attempt to become wholly white, or at least as wholly white as conditions permit, and try to deny his identity. Or he may become a bum who does little but look for ways to get the next drink down his throat.

The most usual type just tries to get along. He copes with life as it is, and does not try to change the conditions of his existence, no matter how disadvantageous they may seem to him. To him the whiteman, the vagaries of the white's attitude towards him, the variable policies of administration and law, are like the climate. They are unpredictable factors he must cope with. He works when he can, but does not try to save. When he is down and out he goes to the Indian Agency office and tries to get relief. He can work well enough to be moderately useful, but sees little point in learning a trade foi where would he practice it? He goes to Indian style dances, plays the handgame, may dress up in costume, or may not, watches television if there is a set available, and in general draws from the cultural possibilities afforded by the Blood community as he needs for his survival.

A whiteman has difficulty understanding a Blood Indian not only because the Blood's grandparents were buffalo hunters and the whiteman's were ranchers, or traders, or sellers of whisky, but because the Blood community today is a very different kind of community than the one he, the whiteman, lives in. Contemporary culture of the whiteman has evolved from the traditions and events of the past, whereas present Blood Indian culture is partly continuous with the past, and partly disjunctive. Parts of the

latter are drawn from potentially incompatible, if not unrelated, sources. The Blood have pulled these parts together into a framework that may make sense if viewed from the inside, but is virtually incomprehensible, if viewed from the outside.

No economic development, no drive for independent, self-respecting citizenship for the Blood, no attempt to accommodate the Blood to full participation in today's world, can succeed, even partially, if these attempts to share the fruits as well as the responsibilities of economic participation, are made without full accounting for the characteristics of the contemporary Blood community and for ways the Blood adapt to their environment.

NOTES

1. The findings in this chapter and also in Chapter III are the outcome of field work of the author with collaboration of Dr. Louise S. Spindler, and assistance of Mr. Anthony D. Fisher. Further details are given in their report to the Indian Affairs Branch (1963).
2. The term "Blood language" is used here to denote the Blackfeet tongue as spoken by Blood Indians, even though the correct term would be "Blackfoot language".
3. An enclave is a distinct community surrounded by a population of different characteristics.
4. Babb is a small community in Montana where the Bloods frequently go and visit the bars.
5. The term "Pan-Indianism" refers to a tendency for Indian customs from different regions and tribes to fuse together into one common culture.

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Mr. Ewers, who once served as curator of the Museum of the Plains Indians at Browning, Montana, writes a readable and informative book that covers the history and ethnology of the Blackfoot-speaking people. His approach is designed to cover the broad sweep of the culture and behaviour of the Blackfoot confederacy. Although his writing is based primarily on South Piegan informants, it is quite germain to an understanding of the Blood Band.

Goldfrank, Esther S., *Changing Configurations in the Social Organization of a Blackfoot Tribe During the Reserve Period*, American Ethnological Society Monographs, New York, 1945.

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In this paper Wissler and Duvall combine to record an interesting and entertaining sample of Blackfoot mythology. It, too, is derived mainly from South Piegan information, but as Dr. Wissler states, most of the action in the stories occurs in the country that is now the Blood Indian Reserve. In this work one gains an insight into the style and feeling of traditional Blackfoot life. Again it is interesting to note persisting attitudes.

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III. PSYCHOLOGICAL CHARACTERISTICS, WORK PREFERENCES, AND VALUES

PSYCHOLOGICAL CHARACTERISTICS

As a result of a series of Rorschach tests[1], involving 60 adult Blood men and 58 adult Blood women, some tentative generalizations about the Blood personality can be made.

1. The Blood seem able to accept tasks that are totally strange to them and perform them quite adequately. Their imaginative and intellectual capacities function freely. There is a competitive element in their responses to the Rorschach test. The Blood respondents were frequently concerned over whether they had produced as many answers as other Band members who had taken the test.

2. The Blood are not apathetic or beaten, in spite of their frustrations. They are aggressive and vigorous in their views of the world about them, and in their behaviour. They are strongly oriented around survival, and are not inclined (as a group) toward passive acceptance. The psychic energy for any task is available, if it can be channelled and rewarded.

3. The Blood are not, on the whole, philosophical. They see in the Rorschach "ink-blots" real objects, such as people and animals, usually engaged in action. The meaning given to these objects is concrete and specific. The Blood appear to be practical-minded and action-oriented.

4. The Blood are emotionally open. Their emotions come quickly to the surface, in aggression and affection. This quality also suggests that psychic energy is available for any use the Blood wish to make of it. The energy is not deeply controlled or repressed.

5. The mental health of the Blood interviewed appears to be good. Although not philosophically minded, their practicality and the lack of repressive controls seems to allow for a good balance between the individual and the outside world. Even in cases where poverty, excessive drinking, and other handicaps are characteristic, there does not seem to be a concomitant psychological pathology.

These generalized characteristics suggest that the Blood personality is more congruent with the whiteman personality than that displayed by most other Indian groups with whom the author is familiar.[2] This generalization is, to be sure, quite broad. Nevertheless, at this point, it seems valid. The cultural overlay that differentiates a Blood Indian from a whiteman obscures psychological qualities both have in common. It is important for the Bloods to be aggressive, emotionally open, and competitive so as to be capable of coping with demands of the whiteman system.

WORK PREFERENCES

Through a different technique insights were also gained in the likes and dislikes of the Blood for certain activities and occupations.[3]

Following is a listing of activities ordered according to the number of times they were chosen as favourites by all people interviewed.

A. Activities (occupations) chosen by one third or more of the respondents:
   - mechanic (most often chosen)
   - carpentry
   - farming, calf branding, haying, calf roping (in a rodeo)

B. Activities (occupations) chosen by at least one sixth but less than one third of the respondents:
   - artist, doctor, office worker
   - bronc rider (rodeo context)
   - chicken dancer, barber

C. Activities (occupations) chosen by one sixth or less of the respondents:
   - nurse (for their daughters)
   - milking (in a dairy)
   - politician
   - priest
   - oil rig worker
   - chief-making, cook, medicine man, storekeeper
   - boxing
   - marrying white man or woman
   - bartender (least often chosen)

The activities chosen by one third or more of the people are practical in the modern reserve environment. Activities, occupations and statuses, that are part of the outside world are rather infrequently chosen. Some items (bronc rider, investiture, chicken dancer, medicine-man), have split rankings, that is they are frequently rejected and yet are chosen by a significant number of people as favourites. This occurrence suggests a high degree of community ambivalence about these activities and associated values. The fact that three of the activities are tradition-oriented suggests that some of the Blood

want to retain the most visible aspects of cultural tradition whereas at the same time others regard these traditions as antiquated.

The split ranking of bronc-riding is suggestive of the observed behaviours with respect to this activity. Some Blood reject bronc-riding because it often results in crippling injuries and is not economically productive, at the same time others view it as an exciting and interesting activity.

Male-Female Differences

The differences in responses of males and females are of interest. Some activities are favoured more by men whereas others are favoured more by women, as the following listing shows.

A. Activities chosen by more males than females as favourites: farming, carpentry, branding, bronc riding, haying, calf roping, nursing, marrying white woman.
B. Occupations chosen by more females than males as favourites: barber, doctor, cook.

Men seem to prefer activities that are meaningful within the existing reserve community. Women seem to be oriented more towards movement into whiteman society, and away from goals obtainable within the reserve community. This difference between men and women may become important in economic development, because the two sexes are striving for different goals.

Socio-Economic Status Differences

It turned out that mechanics, branding, office work, and being a doctor were favoured more by the group with a relatively high socio-economic status, whereas haying, bronc riding, calf roping, and being a chicken dancer, artist and medicine-man was favoured more by the group with a relatively low status. These differences are not unexpected. The economically most successful men chose more frequently those activities that require skill, are goal-oriented, and acquisitively oriented in an economic sense. Less successful men more frequently chose activities that are economically unproductive and irrelevant to goal-attainment in whiteman terms. They are also more oriented towards reserve Indian status, and less towards the outside world. Differences based on socio-economic status seem to run deeper than factional tendencies and differences (including religious differences) and should be recognized in economic development.

Religious Differences

The likes and dislikes were also analyzed on the basis of religion (Anglican, Catholic, and Horn Society). No significant differences were discovered.

VALUES

An appreciation of values generally upheld in the Blood community is important in economic development work, because programs and approaches that would cause serious conflicts with current values are bound to fail. An attempt was made, therefore, to analyze responses in the interviews for specific values. Values expressed most frequently are listed below for specific population groups.

Values Of The Old Timers (65 to 87 years of age)

Regarded as good are:

- keeping up one's appearance
- making money, "good money"
- dancing and participating in traditional activities
- being a cowboy
- being strong
- helping others, "talking nice"

Regarded as bad are:

- looking awkward or ridiculous
- disfigured face (particularly with regard to boxing)
- stealing and fighting
- getting crippled, "losing your body"
- getting cheated
- telling someone else what to do, or being told what to do
- being "smart" and "cocky" (again with reference to boxing)

Men in this age group make relatively few definite value judgements. Such statements are too conjectural for them, because they are strongly reality-centered and talking about how things should be seems to be regarded as beside the point.

These men do not appear to be in the same world as most other people interviewed. They display little recognition of a job as an avenue to achievement, and see activity only as a way of maintaining oneself. Status is not based on a job but on criteria such as controlling sacred powers, sacred possessions, ability as a dancer or speaker, one's generosity and manner.

Values of the Young Blood (18 to 26 years of age)

Regarded as good are:

- making money, "sure money", "good money"
- rodeo competition (steer decorating, not bronc riding; "lots of fun", "good sport")
- work outdoors, work with livestock ("hate to be cramped up")
- being able to fix one's own car or tractor, building one's own house or fixing it up (only a minority see such skills as leading to status achievement, and very few see such skills as a channel to adaptation to the outside world)
- being independent (a corollary to the preceding value)
- easy work (this value is particularly prevalent in connection with office work, which is perceived by most as an "easy", "clean", or "lazy" job with "sure money")

Regarded as bad are:

- getting hurt or crippled (particularly in connection with boxing or bronc riding)
- politics ("telling other people what to do")
- giving up freedoms

Like the older generation the young Blood value making money. They do not specifically value traditional characteristics, such as "talking nice", "helping others", or participating in native-oriented affairs. The young Blood would like to be more independent than they are, but are confused about how to move into a position of independence in the world as it is. Independence is seen as limited to acquiring specific skills that will help them to get along better with the tools at hand. In selecting activities, such as mechanic, they do not see themselves as a mechanic but as someone who can fix his own car or tractor. Their concept of office work is particularly revealing. There appears to be little evidence of comprehending what a white-collar occupation is, or how to prepare oneself for such a job. On the whole the young Blood have no clear picture of the world outside the reserve.

Values of the group which has been economically successful

Regarded as good are:

- being one's own boss (run a ranch, have a herd, own business)
- work outdoors, in the open air
- make money, especially steady or "sure money"
- work hard, plan ahead
- being strong and healthy
- keeping some traditions, particularly language

Regarded as bad are:

- getting hurt or crippled
- being cooped up with a desk job
- politicking
- being told what to do

The striving for independence is consistent with the other two groups. So is the concern for being healthy and vigorous. The concept of independence is different from that of the young Blood. The successful men think of independence as a state to be gained by hard work and acquiring goods and economic security. This point of view has probably made them successful.

Values of the Remaining Males Interviewed.

Regarded as good:

- making money
- working outdoors
- travelling and seeing new places
- ranch and stock work (as against farming)
- working with machinery
- helping others
- having enough to eat, having good food
- the "good old days" (when cattle and cowboys were all)
- being strong, vigorous and healthy
- having horses, riding
- sport rodeo, horse racing, gambling (handgame)
- keeping traditions (language, dancing, tepees, Sun Dance gathering, being able to cope, fixing own machinery, curing own ills)
- taking it easy (mentioned particularly in connection with choices of barber, cook, doctor, office worker, and storekeeper)

Regarded as bad:

- telling people how to run things
- making a show of traditions (particularly in connection with investiture)
- getting "punchy" or disfigured (boxing and bronc riding)
- being smart, aggressive, and cocky (again particularly with reference to boxing)

. . .

Some values are the same for all groups (keeping healthy, making money, not being told what to do, working outside). There is widespread concern with the necessities of life (food, keeping warm, etc.). On the whole there appears to be little recognition or understanding of the whiteman socio-economic system. All specific values have to do with the reserve community, not with moving out of it into

the whiteman world. Until the majority of the Blood understand the off-reserve world better they will have difficulty adjusting to it.

Certain themes kept reoccurring in the responses of the Blood to the research techniques used. The Blood value autonomy very highly. Every man is his own boss. No one has the right to tell anyone what he is to do. One is answerable only for his own actions – not even for those of his (or her) children. The Blood value activity; an active, outdoor life is good; it keeps one young and healthy. The Blood value their identity. Being an Indian makes one different, they say. An Indian is always an Indian, and can never be a white man. The Blood are practical. They believe that it is good to have skills because they can be used on the spot, to keep things running, but not for the attainment of goals far off in the future. The Blood are literal-minded. What is, is; what will be, no man knows. Choices are limited by reality. Conditional and conjectural thinking are severely limited. Men would choose only activities they could actually perform when they were twenty. They could not choose in terms of "if you were twenty again and could do anything you wanted". The Blood as a whole have a world view that is different from that of the whiteman, although some aspects overlap. The whiteman has an orientation towards the future, and a strong tendency to project goals. To a large extent the whiteman lives in a world in terms of how he would like it to be, and thinks it should be. The Blood Indian lives in and thinks about the world as it is, or at any rate, as it seems to him to be.

The implication with respect to economic development is clear. It is absolutely crucial to know the facts about the world view of a people that are moving rapidly into the twentieth century. For economic development to be a success the results must be understood by the Blood in terms of the present, and not in the long-range future. Their enthusiasm depends on the practical and beneficial outcome in hand. Economic development programs aimed at rapid change in the Blood community are doomed to failure unless these features of the Blood Indian mind and culture are taken into account.

NOTES

1. The Rorschach test is a device developed by psychologists for testing aspects of personality. The test consists of a series of cards on each of which is printed a "pattern", such as is formed by dropping a blot of ink on a piece of paper and folding the paper over to spread the blot. The tester shows the cards to the person interviewed and asks him what he sees in the pattern. The tester draws up a score, or "protocol", from which he can formulate a pattern of personality characteristics of the person interviewed. Because the blot patterns are not representational pictures, there are no right or wrong answers, and any response is significant.
2. A comparison was also made with Rorschach test responses of ten other Indian tribes collected by other anthropologists.
3. This technique consists of a series of cards with drawings depicting various activities that can be considered as instrumental in getting along in today's world. These activities included traditional ones (such as a medicine-man treating a patient, and chief-making), modern economic activities (such as haying, farming, and branding calves), competitive activities (such as boxing, and bronc riding), wage-work (such as workshop mechanics, or carpentry), and professions (such as medical doctor treating a patient in a clinic, and white-collar desk worker).

   The men (48 of them) were requested to select those activities that they would like to do most if they had an opportunity, or (in the case of men over 50 years of age) they would like their sons to undertake. Women (34 in number) were asked to select activities that they would like their sons or daughters to choose. All persons interviewed were also asked to indicate activities they would not like to engage in, or have their offspring choose. From the responses the kinds of occupations the Blood like or dislike were determined; and also why they feel the way they do about them. We also obtained a rich sample of statements that enabled us to describe the values or world view of the Blood, and some characteristics of their thinking.

IV. POPULATION GROWTH[1]

DEVELOPMENTS, PAST AND RECENT

Remote Contact, 1730-1750 – Even before the first European traders visited the Bloods around 1750, European technology, in the form of the horse and the gun, had reached the area. It is not possible to say what the consequences of this remote contact were on the Blood population. On the one hand, the increased mastery over nature that the horse and gun afforded may have made a larger population possible, but on the other hand, social and political dislocations brought about by initial acculturation, manifest possibly in increased warfare, might actually have decreased the population.

Early Direct Contact 1750-1850 – The effect of early contact with the traders who visited the region after 1750 is more certain. Population, on a number of occasions, was drastically reduced by disease against which the Blood had no immunity. There were epidemics of smallpox, measles or scarlet fever reported for 1781, 1819-20, 1837, 1864, and 1869-70 that on each occasion carried off from one quarter to two thirds of the Blood population[2]. Despite these cataclysmic setbacks, the population apparently was able to recover and to maintain a size of 2,000 or more, though undoubtedly there were major fluctuations, e.g., Prince Maximilian in 1833, 13 years after a major epidemic and 4 years before the next epidemic, estimated the number of Bloods at 4,500 persons[3].

1851-1877 – As contact intensified, and settlers moved into the traditional hunting grounds of the Blood, their plight became worse. Disease continued to ravage the population. In addition, the buffalo, on which the Blood depended for food became scarce and in 1878 disappeared altogether. Furthermore, an illicit traffic in intoxicating liquor was carried on by traders. "Fiery water flowed as the streams flowing from the Rocky Mountains" and "hundreds of poor Indians fell victim to the whiteman's craving for money, some poisoned, some frozen to death, whilst in a state of intoxication and many shot down by American bullets."[4]

1877-1885 – More complete statistical data are available for the Blood population after the Treaty of 1877. Beginning at this time records were kept of Treaty payments to Band members. However, little confidence can be placed in the accuracy of the payment records as a measure of the population size until about 1886. The reasons for this are twofold: the Bloods were a nomadic people who did not settle on the reserve immediately and, the Bloods attempted to collect Treaty money illegally by giving fictitious names, borrowing other people's children, and changing their own costumes. The numbers receiving payments are shown in Table 1. The importance of of nomadism can be seen in the year 1880 when only about a third of the band – the aged, the infirm and the destitute were present. The others were in Montana hunting remnant buffalo. The importance of overpayment can be seen by comparing the number of payments in 1882 to the number in 1883, the first year that there was a major attempt to correct the overpayments.

Table 1. – Treaty Payments to Blood Band Members 1877-1885

Year	Number Present at Payment	Number Claiming Arrears and Dates of Claims	Total
1877	1,810	248 (Dec. 1877)	
		216 (1878)	
		22 (1879)	
		26 (1881)	2,422
1878	2,488	1 (1879)	2,516
		27 (1881)	
1879	3,071	13 (1880)	
		161 (1881)	3,245
1880	1,019	2,439 (1881)	3,458
1881	3,560	57 (1882)	3,617
1882	3,521	1 (1883)	3,522
1883		(First major attempt to correct overpayments)	2,589
1884			2,270
1885			2,329

Source – Department of Indian Affairs and Northern Development, Indian Affairs Branch: *Annuity Paylists.* Corrections for underpayments were supplied by Hugh A. Dempsey.

Migration – Population development after 1885 will be analysed in terms of births and deaths in the Band. Migration can influence population size and rate of growth but it does not appear to have been an important factor. Table 2 shows the apparent net migration for the decades following 1886[5]. The apparently high net outmigration of the decade 1886-95 seems to have the result of unsettled conditions that did not persist. Part of the apparent outmigration may be the result of more accurate identification of Band

members and consequent disappearance of fictitious Band members, though there may have been true out-migration to other Bands as nomads adjusted to reserve conditions.

Table 2. – Apparent Net Migration[a] of Blood Indian Population Over Specified Periods, 1886-1962

Period	Interval	Net Migration
1886-1895	10 years	–641
1896-1905	" "	–41
1906-1915	" "	– 4
1916-1925	" "	+10
1926-1935	" "	–12
1936-1945	" "	– 4
1946-1955	" "	+ 4
1956-1962	" "	+42
1896-1962	67 "	– 5
1886-1962	77 "	–646

a See note 10.
Source – Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch Annuity Paylists.

1886-1905 – Although much of the decline *over* these decades was attributable to migration, some of it was certainly due to high death rates, especially in the years 1894 to 1897 (Figure1).[6]

The population during this period fell from 2,329 to 1,181 a decrease of almost 50 per cent. Migration may have accounted for more than half of this depopulation but almost half is accounted for simply by the excess of deaths over births.

The very high and fluctuating death rate is an indication that the tide of social disorganization and economic deterioration was not stemmed by the Treaty. The death rates did decline, however, at the turn of the century from nearly 70 per thousand in 1895 to less than 50 per thousand in 1905.

There was also a significant increase in the birth rate from just over 30 per thousand to about 50 per thousand though the "increase" might only reflect better records of births.[7] The year 1905 was thus the first point in the period with adequate data when the birth rate was at the same level as the death rate. At the same time out-migration had become negligible and population had reached a fixed size.

Period 1906 to 1925 – The change that took place during this period is illustrated by the fact that in 1905 the Blood demanded 900 head of cattle still due under the Treaty. "Having once refused them, these men, seeing the advance made by cattle herders...changed their minds".[8] Also, an early maturing strain of wheat was developed that could be cultivated on the Prairies, and shortly before 1910 land was thrown open for farming. By 1919 nearly 2,800 acres of the reserve were sown to wheat.[9] There were still economic difficulties, such as the severe winters of 1919 and 1920 killing most of the cattle, and wheat prices fluctuating in the post-war market but a certain element of stability had been introduced. This stability is reflected in the vital statistics of this period. The gross death rate hovered for the most part between 40 and 50 per thousand until the flu epidemic of 1918 and '19 was passed, and then begun to plummet downward. Meanwhile birth rates remained relatively constant in the range of 40 to 47 per thousand. Net migration was insignificant. Thus for most of these 20 years, the population remained at the minimal level of around 1,150.

Period 1926 to 1945 – Even though economic conditions on the reserve were adversely affected by the widespread depression during the 1930's (between 1930 and 1932, for instance, the number of acres cultivated decreased by 50 per cent),[10] the birth rate increased from around 40 per thousand to around 50 per thousand. This rise was largely due to the maturation of those born during the period of high birth rates after 1900. The high death rate had removed predominately the very old and the very young, though progressively fewer of the very young as time went on because the sharply falling death rate largely represented a steep decline in infant mortality. The decline in infant mortality combined with a constantly high birth rate, produced rather large numbers in the child-bearing age groups for the 1935 to '45 decade. The overall death rate also fell sharply which indicates marked improvement in the general level of health as a result of improved control over infectious diseases, availability of medical care, and effective public health practices. The falling death was also partly a result of the increasing relative "youngness" of the population. It would be interesting to understand better to what degree the plateau in the death rate of around 25 deaths per thousand (first reached in 1932 following the steep drop which started in the previous decade, and then maintained until shortly after 1945) resulted from a more stable population age structure or from lack of further progress in and possible inattention to Indian problems during the depression and war years.

There was almost no apparent migration throughout this period, and thus the marked excess of births over deaths produced a continuous growth in population from 1,146 to 1,713 between 1926 and '45, a growth of almost 50 per cent over these two decades.

Figure 1. – Total Population, Gross Birth and Death Rates, Blood Indian Band, 1886 to 1961

Note – Total population at 5 year intervals; gross birth and death rates as 5 year moving averages

Table 3. – Schematic Summary of the Growth of the Blood Indian Band, by Periods Pre-Contact to 1962

Stages	Degree of Contact	Economic Base	General Description	Births and Deaths	Changes in Total Population	Total Size of Population
1730 - 1750	Remote contact; horses and guns adopted	Hunting and gathering subsistence	Population and resources in more or less long-run balance	?	?	?
About 1751 to 1850	Early contact with traders	Improved hunting and gathering; fur trade with Europeans	Bloods better equipped to exploit resource base	High birth rate; periodically high death rate	Fluctuating; high growth with major setbacks	Fluctuating about 2,500
About 1851 to 1876	Intense contact; Euro-Canadian settlement and encroachment	Disorganized hunting and gathering; dwindling trade	Disease; disappearing buffalo; alcohol trade	Fluctuating death rate	Fluctuating without long-run growth	Fluctuating about 2,500
1877 to 1905	Transition from nomadism to reserve life	Relief	Disease; buffalo vanished	Deaths less fluctuating; still higher than births	Decreasing rapidly	Decrease from 2,500 to 1,154
1906 to 1925	Adjustment to the reserve	Cattle raising; some farming	Utilization of reserve resources	Births and deaths about the same	Relatively constant	Around 1,150
1926 to 1945	Enclavement	Farming, some cattle raising	Rising standard of living	More births than deaths	Increasing rapidly	Increased from 1,146 to 1,713
1945 to 1962	Enclavement	Viable rural economy with underemployment	Rising standard of living	Death rate plummetted down to national levels	Increasing at accelerating rate	Increased from 1,743 to 3,211

Period 1946 to 1962 – During this period the birth rate remained high and fairly stable between 44 and 50 per thousand. The death rates, however, resumed a sharp and steady downward decline, falling from 25 to 7 per thousand, which is about the Canadian national rate.

As the excess of births over deaths increased each year, the rate of population growth accelerated. The population jumped from 1,743 in 1946 to 3,211 in 1962, or an increase of 84 per cent over those 16 years. The size of the Band population surpassed its 1887 level in 1954, and, apart from the possible peaks of 1881 and '82, the population is now probably larger than at any other time in its history.

AGE-SEX STRUCTURE OF THE PRESENT BAND POPULATION

The three factors that determine the age-sex composition of a population are fertility, mortality, and migration. Differences in these factors lead to different population structures, and it is interesting to make a comparison between the Blood Indian Band and the total Canadian population.

The main difference is the proportionately larger number of children for the Blood than for the Canadian population as a whole. The total Canadian population has, on the other hand, a higher proportion of people in the age-groups above 30 years of age. These differences are to be ascribed to the constantly high birth rate of around 45 per thousand among the Blood, whereas the birth rate of the total Canadian population has been between 20 and 30 per thousand. The age-group 20 to 30 of the Canadian population is disproportionately low because of the quite low birth rates during the 1930's. Another reason is the decline of the Blood Indian death rate, which has been falling faster for infants than for the older age-groups.

One important practical application of studying a population structure is that one can determine the ratio of population eligible for the labour market to the population economically dependent due to extreme youth or age. A comparison of the Blood and Canadian ratios shows that the Blood have a heavy dependency burden which depresses the average income per person (Table 4).

Over half of the Blood population is less than 15 years old, and altogether there are 55 dependents supported by only 45 actives for every 100 persons. For the Canadian population, only 38 dependents (30 young and 8 old) are supported by 62 potential actives. If the dependency ratio of the Blood population were more like the dependency ratio of the Canadian population, then Blood income per person would rise 30 or more per cent above current levels, other circumstances remaining unchanged.[11] If births continue to exceed deaths in sufficient numbers to maintain the present rate of net natural population increase, then the dependency problem and low per capita incomes will persist, but will diminish once the recently born cohorts grow to maturity.

MIGRATION, FERTILITY AND MORTALITY IN RECENT YEARS

RECENT MIGRATION

During the years 1956 to '62 the population of the Band increased by 42 persons not accounted for by an excess of births over deaths (Table 2). Because net migration has been negligible over previous years (except the transition years, particularly the 1886 to '95 period) the question arises whether the recent inflow is in any way a significant new development.

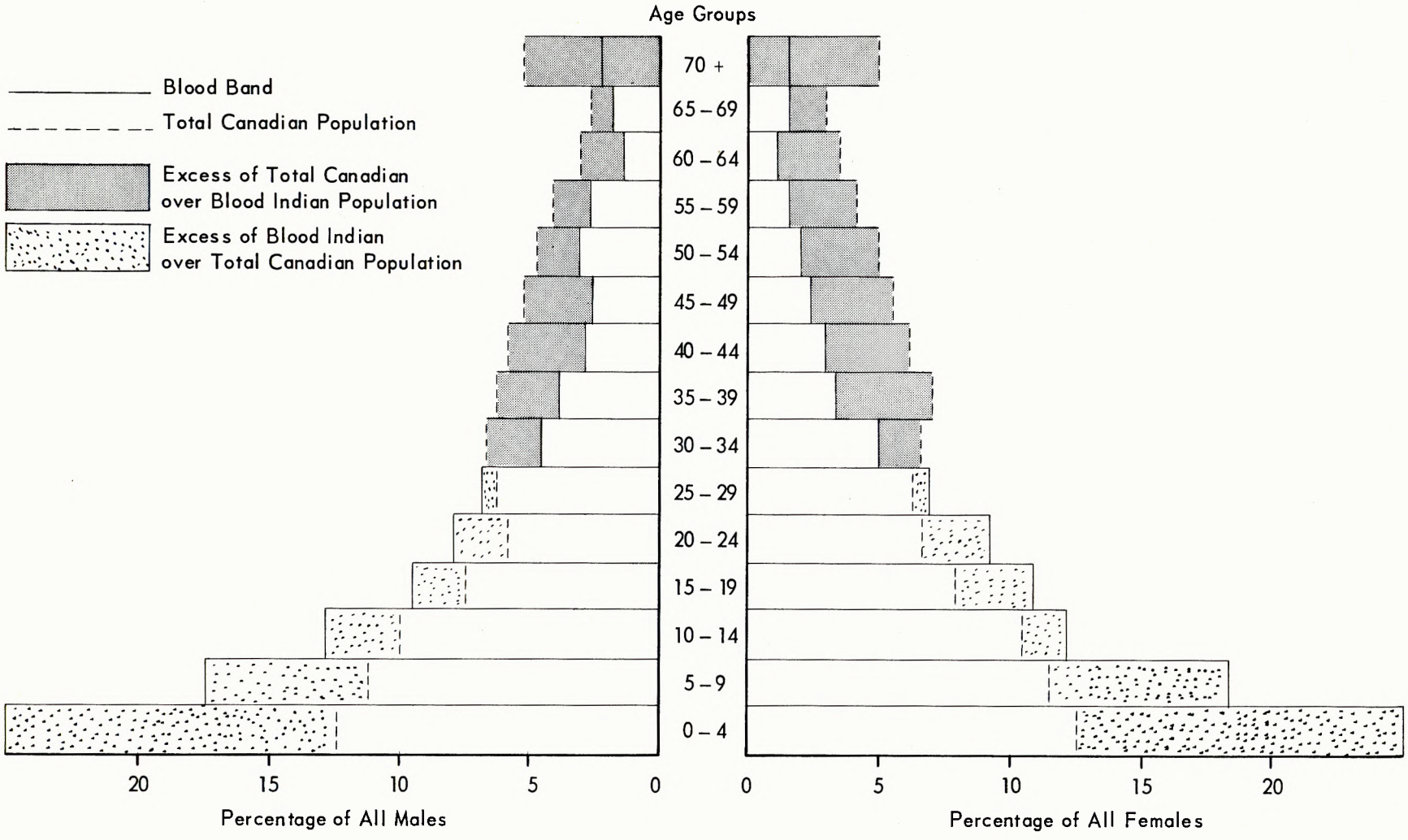
In examining this question one should not lose sight of the fact that net migration figures may conceal much larger gross figures of in and out-migration. It may even have been possible that a fair outflow of young adults leaving for education or work outside the reserve is offset by an inflow of older adults returning to the security of the reserve, thus leaving an even balance of net migration. If such a migration pattern took place it would be reflected in the age structure of the Blood population. Indeed, there appears to be a relative shortage of men in the group 30 to 34 years old, and a relative surplus of men over 50 years of age (Figure 2), which is quite unusual by

Table 4. – Dependency Ratios for the Blood Indian Band and Total Canadian Population, 1961

Population	Total Population	Eligible Economically Active (15 to 64 Years Old)	Young Dependents	Old Dependents
Blood Indian Band	100.0	44.9	52.1	3.0
Total Canadian Population	100.0	61.8	30.4	7.8

Source – Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch Annuity Paylists.

Figure 2 – Males and Females by Age Groups as a Percentage of Total in Each Group, Blood Indian Band, 1961, and Total Canadian Population, 1961



Saurces –

Blaad Indian Band: Canada Department of Indian Affairs and Narthern Develapment, Statistical Unit, Ottawa.

Total Canadian Papulatian: Dominian Bureau af Statistics, Census of Canada, 1961, Bull 1.2, Ottawa, 1962

national standards. Yet on the basis of information available for recent years few migrants seem to move for economic reasons.

The apparent net in-migration of 42 during the 1956 to '62 period noted in Table 2 is inflated since a number of these apparent migrants were children who entered the Band without a parent moving at the same time and thus represent in most cases delayed registration of offspring rather than true migration. Excluding unaccompanied child migration, net migration is only 9 for the period, made up of 57 in-migrants and 48 out-migrants a total of 105 migrants. (Table 5)

The most important reason for either in- or out-migration is marriage (Table 5). Although intermarriage usually takes place between nearby Bands,[12] yet 25 per cent of girls marrying outside the Band married whitemen. The net flow of females into the Band indicates that future population growth is not restricted by internal imbalances of males and females, as happens sometimes in isolated societies, or in areas where there is a particular lead in migration by one sex.

There does not seem to be a clear or significant pattern of out-migration in response to employment and income opportunities outside the reserve. It should be noted, however, that there may be a good deal of daily commuting to jobs near the reserve, or seasonal migration of those who spend part of a year off the reserve taking casual or seasonal employment, but there is no migration which entails breaking basic bonds with the Band.

RECENT FERTILITY

The number of children a woman bears depends on many factors. The main ones are her physiological capacity, whether or not she is married, the age at which she marries, her (and her husband's) desire to have children, her attitude towards family planning and knowledge of contraceptive techniques. The decisions a woman makes with respect to most of these factors are bound up with cultural aspects, such as the "right" age at which to marry, and the appropriateness of of practising birth control. These aspects do not change abruptly, and it would be fallacious to assume that acquisition of western ways of making a living would quickly affect the birth rate. An economically new way of life may increase the birth rate by removing traditional or economic barriers to early marriage, or by raising the level of health and reducing sterility, but one may also find that fertility is reduced because early marriage is made more difficult, or the birth rate may not be affected at all.

Although the birth rate among the Blood has been subject to fluctuations caused by changes in the age structure, it has been on the whole remarkably consistent over the last 50 years. This is also apparent in the fertility rate for the last few years for which appropriate statistics are available (Table 6).[13]

The age structure of women of child-bearing years was similar for each of these years, and does not, therefore, affect the fertility rate.

Table 5. – In and Out-Migration by Type and Sex, Blood Indian Band, 1956 to 1961

Type of Migrant	Sex	Out-Migrant	In-Migrant
Unmarried adults	M	0	1
	F	1	1
Adults moving as family unit	M	3	0
	F	3	0
Adults enfranchised	M	1	–
	F	4	–
Children moving with one or both parents	M and F	9	14
Adults moving to get married	M	1	1
	F	26	40
Total		48	57
Adults moving to get married as a percentage		56%	72%
Migration for reasons other than to get married			
Adults		24%	4%
Children		19%	25%

Source – Canada Department of Indian Affairs and Nothern Development, Indian Affairs Branch, Annuity Paylists.

Table 6. – Crude Birth Rate and Fertility Rate, Blood Indian Band, 1957 to 1960

Year	Crude Birth Rate[7]	Fertility Rate[13]
1957	50	254
1958	49	251
1959	49	258
1960	47	247

Source – Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch, Statistical Unit, Ottawa.

Family formation continues throughout the fecund span but is most pronouced for the age-group of 35 to 39 years old (Table 7). The young child rates of women under 25 years of age is rather low as compared with those of women of the older age groups. This difference may be due to a fairly high age of marriage, or, if age of marriage is not the reason, it may be that the general birth rate is beginning to fall for the new generations. Evidence seems to point, however, to the possibility of a decline in the age of marriage which may be enhanced as a result of an increase in economic independence through economic development.

At present there is no reason to anticipate much of a decline in the birth rate in the immediate future. If and when such a decline were to set in, it would most likely proceed gradually, as has been the experience in other parts of the world. According to a United Nations report: "New attitudes and practices have been adopted first by small groups of the population and gradually diffused among wider and wider elements, so that the general level of fertility declined only gradually at first but with growing momentum when substantially lower levels were reached. There have been few, if any, examples in modern times of a rapid decline of fertility from a very high level."[14]

For the Blood Band, the most important factor intervening between technological change and transformation of birth or migration rates is enclavement.[15] The distinguishing characteristics of Reserve enclavement are: social separation from surrounding communities; and, economic protection and benefits in perpetuity to the Band as a collective entity. The effects of enclavement have been and are:

1. To provide the means for steadily improving level of health and well being on a subsidized basis.
2. To provide psychological and economic discouragement to out-migration and to integration.
3. To reduce the effectiveness of possible economic incentive or controls with respect to population.

RECENT MORTALITY

Because there have been so few deaths recently in the Blood population, sex and age specific death rates[16] show fluctuations that must be attributed to chance. For the purpose of selecting a model life table[17] the more stable series of age and sex specific death rates for all Indians in Canada were used in conjunction with those for the Blood Indian Band (Table 8). In doing so one must keep in mind that many Bands are much more geographically isolated, and consequently less likely to have medical facilities and health conditions comparable to those of the Blood.

A model life table has the virtue of smoothing out chance fluctuations in past death rates while representing the probable underlying pattern as nearly as it can be approximated on the basis of existing evidence. According to the selected model life table values, the life expectancy at birth for both sexes of

Table 7. – Distribution of Children under Five years of Age, by Age and Marital Status of Mother[a], 1961

Age of Mother By Group	Total No. of Women in Age Group	Young Child Rates (No. of children under 5 per 100 Mothers in the age group)	Distribution of Young Child Rates by Marital Status of Mother			
			Married	Married by Indian Custom	Widowed Divorced Separated	Unwed
15–19	168	49	17	0	0	32
20–24	140	135	69	10	1	55
25–29	107	186	99	19	19	49
30–34	79	180	124	27	13	16
35–39	50	212	152	40	0	20
40–44	43	100	74	16	3	7
45 +	34	33	24	9	0	0

Source – Department of Indian Affairs and Northern Development, Indian Affairs Branch, Statistical Section.

a Excludes 4 children living with their father.

Table 8. – Age Specific Death Rates, Blood Indian Band and All Canadian Indians, and Model Life Table for Blood Indian Band, By Sexes

Age Group	Males			Females		
	Death Rates			Death Rates		
	Blood Indian Band[a]	All Canadian Indians[b]	Model Life Table[c]	Blood Indian Band[a]	All Canadian Indians[b]	Model Life Table[c]
0	41.5	84.7	52.5	25.3	67.9	42.7
1–4	2.7	3.9	5.2	3.1	3.5	4.6
5–9	–	1.3	1.5	–	1.1	1.2
10–14	–	0.7	1.1	–	0.7	0.9
15–19	1.0	1.4	1.8	–	0.8	1.5
20–24	–	3.9	2.5	3.1	1.6	2.0
25–29	3.1	4.3	2.6	1.3	2.3	2.2
30–34	5.9	3.2	2.8	–	4.7	2.5
35–39	4.5	3.4	3.3	–	3.6	2.8
40–44	–	3.6	4.5	10.0	3.0	3.6
45–49	–	6.5	6.6	–	3.7	5.0
50–54	11.6	9.7	10.0	5.0	6.3	7.2
55–59	–	9.8	14.9	6.7	9.3	10.5
60–64	41.0	17.2	23.2	–	16.7	16.6
65–69	–	25.2	36.1	7.0	24.5	27.4
70–74	143.3		56.9	14.0		46.5
75–79	23.3		89.2	7.3		76.3
80–84	–	67.4	137.7	107.5	50.9	121.5
85–89	96.7		244.3	290.0		235.2
90+	140.0			140.0		

Sources: – a. Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch, Statistical Unit (deaths for period 1955 to 1961, and population as of December 31, 1961).
b. Ibid., (A sex ratio of deaths of 105 males per 100 females was assumed; population as of mid-year 1961).
c. Op. cit. (note 18), p. 44

the Blood Indian Band is about 66 years, or nearly the same as the Euro-Canadian life expectancy in 1941. Unlike a change in birth rate, a death rate comparable to that of the Euro-Canadian is a matter of borrowed techniques requiring only minor cultural adjustments.

POPULATION PROJECTION

Because future population is an important consideration in economic development it is necessary to make a population projection. In such a projection one has to make certain assumptions about future growth, and the estimated future population is valid only to the extent the underlying assumptions are accurate.[18]

On the basis of analysis in the preceding sections the assumptions about factors determining the future growth of the Blood Indian population until 1981 are as follows:

(1) Life expectancy at birth, at present estimated at around 65.8 years for both sexes, will increase uniformly at a rate of about 5 years a decade to reach 73 years by 1981 (extrapolation of Canadian life expectancy will yield only a slightly higher value).

(2) There are three fertility assumptions, which will be referred to as the "high", "medium", and "low" fertility assumptions. The rate under the high assumption is a continuation of the present fertility rate of about 250 live births (per 1000 women of 15 to 44 years of age) until 1981. The medium assumption involves the same fertility rate of 250 live births until 1971, and a fertility rate of 225 live births for the decade 1971 to '81. The rate under the low assumption is 225 live births for the decade 1961 to '71, and a further decline in each of the following 5-year periods, which amounts to a fertility rate of

175 for the period 1976 to '81 (the low assumption is rather unrealistic because it is based on an immediate transition to Canadian birth rates).[19]

(3) There are two assumptions about migration. The first (and more realistic of the two) is that net out-migration for employment off the reserve will continue to be about zero, and net out-migration for reasons other than employment will not affect either size or sex-age composition of the Band population. The second assumption is based entirely on the amount of net out-migration that would be required to keep the annual population growth rate on the reserve down to 2 per cent a year. For the latter assumption it is further assumed that net out-migration is half male and half female, and that by 1981 there will be an additional loss of 1.875 children (who would have been born on the reserve had no migration taken place) for every 2 migrants.[20]

(4) The sex ratio of all future births is assumed to be 105 males for every 100 females.

Under conditions of continued high fertility and no out-migration the total population will grow from 3,092 in 1961 to slightly over 7,500 in 1981, On the basis of the medium and low fertility assumptions the Blood Indian population in 1981 will be close to 7,300 and 6,600 respectively, (Table 9).

Table 9. – Blood Indian Population Projections[a] for 1966, 1971, 1976 and 1981,[b] by Males, Females, and Total Population Using High, Medium and Low Birth Rate Assumptions[c]

Year	Population	Birth Rate Assumptions		
		High	Medium	Low
1966	Males	1,887	1,887	1,848
	Females	1,905	1,905	1,867
	Total	3,792	3,792	3,715
1971	Males	2,357	2,357	2,267
	Females	2,370	2,370	2,282
	Total	4,727	4,727	4,549
1976	Males	2,984	2,917	2,762
	Females	2,983	2,919	2,766
	Total	5,967	5,836	5,528
1981	Males	3,784	3,632	3,291
	Females	3,757	3,644	3,280
	Total	7,541	7,276	6,571

a. Based on "component" method. For detailed description of this method, see source given in reference note 14, pp. 54 to 58.
b. December 31 of each year.
c. For explanation of assumptions see text; because the effect of out-migration is treated separately (Table 11) the assumptions regarding migration were not used.

Economic development on the reserve may be such that it would be impossible in terms of gainful employment to absorb the entire population growth on the reserve. Should economic development on the reserve permit a population growth of only 2 per cent a year then 2,437 people would be required to leave the reserve for employment elsewhere under the high fertility assumption (Table 10). Even with accelerated economic development a drop in birth rate an outflow of over a thousand people would be required. To avoid out-migration entirely a population growth of 4 per cent should be made possible and then only if the birth rate were to start dropping sharply. It would be unrealistic, however, to count on such a development to take place.

Table 10. – Net Out-Migration Required to Keep Growth of Reserve Population at 2, 3, and 4 Per Cent a Year Under High, Medium, and Low Birth Rate Assumptions, Blood Indian Band, 1966 to 1981[a]

Calculation of Required Out-Migration	Fertility Assumptions		
	High	Medium	Low
Projected population in 1966[b]	3,792	3,792	3,792
Projected population in 1981	7,541	7,276	6,571
Population in 1981 at growth rate:			
2 per cent	5,104	5,104	5,104
3 per cent	5,908	5,908	5,908
4 per cent	6,829	6,829	6,829
Required out-migration in 1981 with growth rate:			
2 per cent	2,437	2,172	1,467
3 per cent	1,633	1,368	663
4 per cent	712	447	–

a. See note 21.
b. For comparison the same 1966 population is assumed.

Education and appropriate training are major factors in economic development, and to give an idea of the size of the school-age population a separate projection has been made for 1981. This projection is based on the high birth rate assumption, because it is a realistic one, and also because a reduction to the medium birth rate would not affect the school-age population until 1977.

As is shown in Table II the school-age population almost tripled between 1944 and 1966, and will almost double between 1966 and 1981. In 1966 school-age children will constitute 33 per cent of the population This proportion will fall gradually, but only slightly, to 30 per cent by 1981. The total school-age population

Table 11. – Actual and Projected Numbers of Boys and Girls of School-Age and Reaching 16 Years of Age, 5-Year Intervals 1944 to 1981, Blood Indian Band

Year	Age Group	School-Age Population			School-Age Population as Percentage of Total Population	Reaching Age 16 at Given Year	
		Boys	Girls	Total		Boys	Girls
1944	7–16 incl.	226	213	439	27	15	16
1949	7–15 incl.	290	217	507	27	21	21
1954	7–15 incl.	231	250	481	22	25	28
1959	6–15 incl.	370	410	780	27	30	36
1966	6–16 incl.	611	643	1,254	33	41	38
1971	6–16 incl.	755	777	1,532	32	54	59
1976	6–16 incl.	919	901	1,817	30	70	72
1981	6–16 incl.	1,141	1,134	2,275	30	79	78

Sources. – 1944-1959: Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch, *Census of Indians in Canada*, 1944, 49, 54, and 59.
1966-81: Interpolation of population projection using Sprague multipliers (Source--Note 18, p. 68).

in 1981 will be 2,275 or 5 times the school population in 1954, and almost the same as the total band population of that year.

By 1966 the number of new entrants into the labour force will be about 40 boys and 40 girls yearly.[22] The numbers will rise to 55 for both boys and girls in 1971, and to 70 for both boys and girls in 1976. In 1981 the annual addition to the Blood Indian labour force will be about 80 of each sex.

Taking into account deaths but not allowing for delayed entrance into the labour force because of further education, between 1961 and 1971, there will be an addition to the labour force of 339 young men and 342 young women. If the girls get married it may to some extent ease the burden of creating or finding gainful employment. But the task of providing employment for the young men who get married is made more urgent.

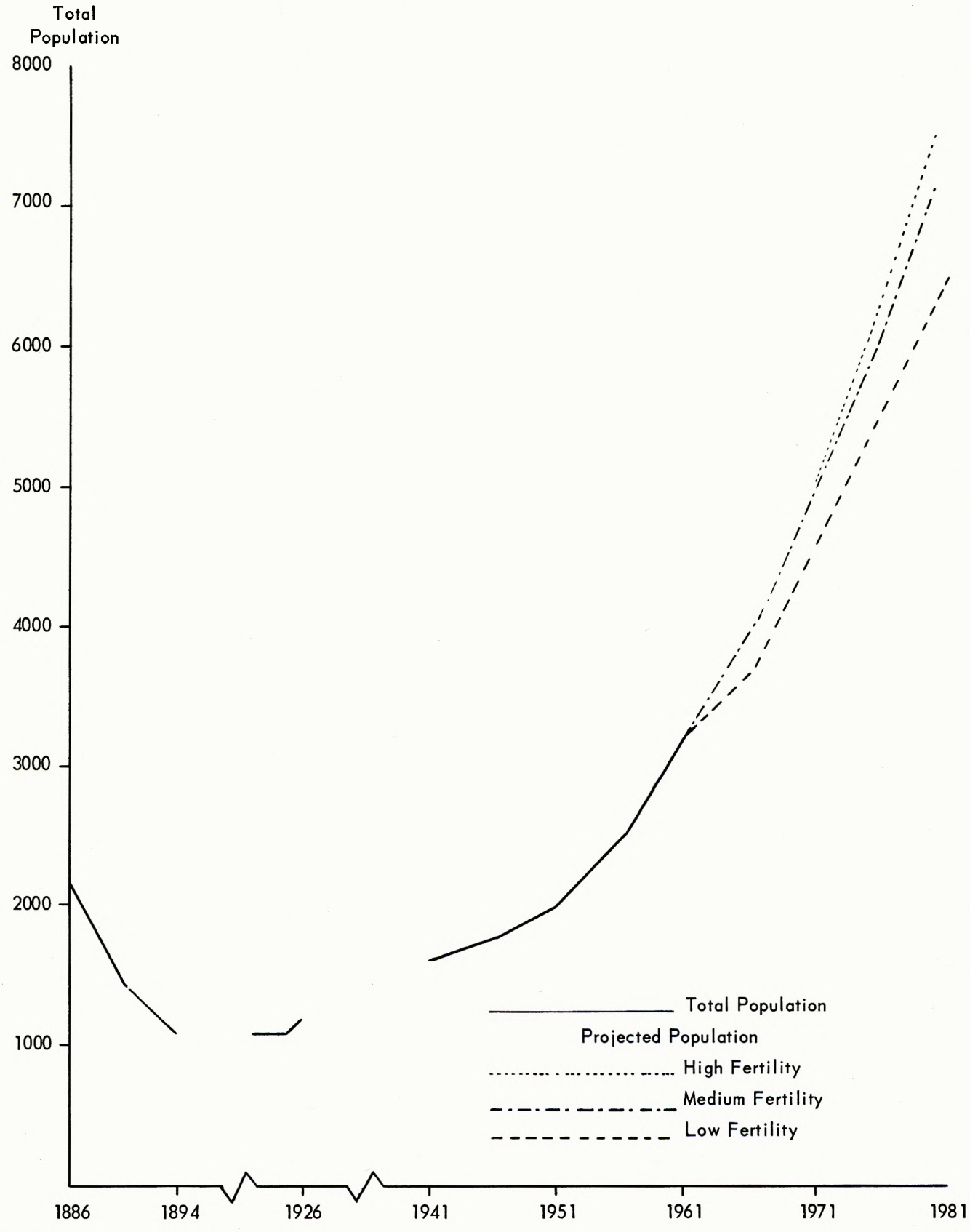
It should be stressed that the projection of the addition to the labour force is not based on assumed birth rates, but on children born and living on the reserve now, the overwhelming majority of whom will be alive and healthy in 1971. These people represent the new adults for the coming decade. Their potential productive capacity can be a boon for themselves and their community. If no steps are taken to prepare these people for either self- or wage-employment, there will be a large pool of unsettled young adults.

Out-migration can be an effective short-run solution to unemployment but as far as the reserve is concerned it is a wasteful expedient which ignores the real problem. This is the accelerating natural increase in population (Figure 3) brought about by a high birth rate of nearly 45 per thousand and a death rate of less than 10 per thousand. The result is that over one-half of the population are young dependents less than 15 years old. This high dependency ratio cannot be solved by out-migration, but only through lower birth rate.

As is shown in Table 12 the proportion of the economically active part of the population will remain fixed at about 45 per cent of the total population for the next 20 years if birth and death rates remain unchanged and without out-migration. If, however, birth rates fall (and excluding out-migration) the proportion of the Blood population in the active age group of 15 to 44 will increase to 47.2 per cent for the medium rate, and 51.1 per cent for the low rate. The result of out-migration to keep the growth of the reserve population at 2 per cent a year is a reduction in the proportion of economically active people to about 44 per cent under the assumption of continuous high birth rate. A reduction in this proportion would also take place under the medium and low birth rate assumptions, and regardless of the size of out-migration (unless the out-migrants were mostly females). The effect of out-migration, therefore, will nearly always be a reduction in the proportion of the bread-winners.

The question arises, of course, how many people can be supported on the reserve. This question will be answered later in the report.[23] Here it should be pointed out, however, that even if the high birth rate should continue and no out-migration were to take place, the population density in 1981 will be no higher

Figure 3. – Population Growth (1886 to 1961) and Projection (1961 to 1981), Blood Indian Band



than 13 persons per square mile of reserve land—a density which is roughly the same as that of the nearby census district that includes Lethbridge. At present this adjacent district is well developed in terms of urbanization and industrialization. If the economy of the reserve can be diversified and expanded to the same degree a problem of overpopulation may not arise and out-migration may not be necessary-at least not in the next two decades.

Table 12. – Projected Population Structure in Percentages Under High, Medium, and Low Birth Rate Assumptions, Without and With Out-Migration, Blood Indian Band, 5-Year Intervals 1966 to 1981

Birth Rate and Migration Assumptions	Age Group	Age Groups as Percentages of Total Population			
		1966	1971	1976	1981
High Birth Rate	0–14	53.0	52.3	51.7	52.6
No migration	15–64	44.6	45.4	46.2	45.6
	65 and over	2.4	2.3	2.1	1.8
	Total	100.0	100.0	100.0	100.0
Medium Birth Rate	0–14	53.0	52.3	50.6	50.9
No migration	15–64	44.6	45.4	47.3	47.2
	65 and over	2.4	2.3	2.1	1.9
	Total	100.0	100.0	100.0	100.0
Low Birth Rate	0–14	52.1	50.4	47.7	46.8
No migration	15–64	45.5	47.2	50.0	51.1
	65 and over	2.4	2.4	2.3	2.1
	Total	100.0	100.0	100.0	100.0
High Birth Rate	0–14				53.1
Migration[a]	15–64				44.2
	65 and over				2.7
	Total				100.0

a. Out-migration of equal numbers of males and females who have no children so that the rate of growth of the reserve population is 2 per cent annually.

NOTES AND REFERENCES

1. The term population in this chapter refers to the membership of the Blood Indian Band as legally recognized under the Indian Act. It does not necessarily correspond to the population of the Blood Indian Reserve, which may include a few Euro-Canadians and members of other Bands, and may exclude non-resident members of the Band. The Band is also to be distinguished from Blood Indians as defined by kinship and descent, which would include individuals and their offspring who have renounced or lost Band membership.
2. Umfreville estimated that the Blackfoot tribes (Blood, Blackfoot and Peigan) lost half their populations in the smallpox epidemic of 1781; in the winter of 1819-20, one third of the Blackfoot tribes died of measles: in the 1837 smallpox epidemic the Blackfoot tribes were estimated to have lost two thirds of their population: in 1864 1,100 died of scarlet fever; and the smallpox epidemic of 1869-70 killed 630 Bloods. I am indebted to Hugh A. Dempsey editor of the Alberta Historical Review for these data.
3. Estimates were made at various times by traders, travellers and officials, usually on the basis of a count of lodges or tents which were assumed to contain a certain number of persons. The accounts are of uneven reliability. The historian Dempsey regards the estimate of Doty in 1854 of around 2,400 as one of the more accurate. That of Maximilian, according to Dempsey is probably too high.
4. Cited in Goldfrank, Esther S., *Changing Configuration in the Social Organization of a Blackfoot Tribe During the Reserve Period (The Blood of Alberta Canada).* American Ethnological Society Monographs, New York, 1945, p. 248.
5. Apparent net migration is the change in the number of Band members other than through net natural increase or decrease of the population. It consists of the difference in population between the beginning and end of a period, less the number of births and plus the number of deaths during that period. As such enfranchisements are included. Delayed official recognition of births, deaths and enfranchisements may affect these figures slightly, and the term "apparent net migration" has therefore been used.
6. Unless otherwise specified in this report by death rate is meant gross death rate, i.e. annual number of deaths per 1000 of population.
7. Unless otherwise specified in this report by birth rate is meant crude birth rate, i.e. annual number of live births per 1000 of population.
8. Goldfrank, *op. cit.*, p..25
9. Canada Department of Indian Affairs and Northern Development, Indian Affairs Branch, *Annual Report,* 1919, (Vol. 9, No. 27), p. 36.
10. Goldfrank, *op. cit.*, p. 35
11. Cf. Joseph J. Spengler, "The Population Obstacle to Economic Betterment". *American Economic Review,* Vol. 41 (May 1951), pp. 343-354. In the case of the Blood economy a reduction in the number of children would directly reduce Band income by reducing family allowances, treaty money and other subsidies.
12. The sex *ratio* of this migration is consistent with the historical Blackfoot custom of patrilineal residence. See Goldfrank, *op. cit.*, p. 5.
13. Fertility rate means the number of annual births per 1000 females in the age-group of 15 to 44.
14. United Nations, *Methods for Population Projections by Sex and Age,* Manual III ST/SOA/ Series A, Population Studies No. 25, (New York, 1956), p. 48.
15. The enclave status of the reserve is discussed and defined in Chapter II, p. 13.
16. Age specific death rate means the death rate for a specific age or age-group.
17. A model life table is "...designed to represent a typical combination of age-sex, specific functions of mortality, or survival, corresponding to a given general level of mortality" (*op.cit.*, reference 18, p. 27).
18. The reader should keep in mind that standard demographic analysis applied to a micro-population is to some degree inappropriate, since one cannot assume random distribution of relevant factors. Therefore, there are likely to be anomolies in the sex-age structure of the population attributable to chance of fluctuations.
19. Continuing this pattern of accelerated decline, the Blood Indian fertility rate will be about the same as the Canadian rate by 1986.
20. Calculated on the basis of a birth rate of 250 per thousand of female out-migrants.
21. The migration figures are based on the assumption that all migrants are moving in family units consisting of adults and children. Should all migrants move as single persons or as married couples without children the required out-migration need be only 52 per cent of the totals reported in the Table, provided that these adults were half males and half females, and that the specific birth rate for the migrating females was 250.
22. Based on the number of 16 year olds who would be at school leaving age and eligible to work. Further education would delay such entrance of the eligibles.
23. For an excellent short treatment of economic theory and optium population, see *Planned Migration: The Social Determinants of the Dutch Canadian Movement* by William Peterson (Univ. of California Press, Berkley and Los Angeles, 1955) pp. 210-214.

Natural Resources Inventory

V. CLIMATE

The Reserve lies on the southwestern edge of hat is called the Prairie Grasslands Climatic egion,[1] where the continental type of climate is odified by the proximity of the Rocky Mountains. or lack of climatological data pertaining to the eserve it was necessary to use information from eather stations around the Reserve.

TEMPERATURE

Temperature is one of the dominating factors ı determining the kind and growth of vegetation. he length of time between the last frost in spring ıd first frost in fall (the frost-free period) has an ffect on the kind of vegetation, whereas the amount f sun heat available to plants during that period s important in affecting growth.

The length of the frost-free period varies appreciably from year to year and from place to place (Table 13). The average for the northern part of the Reserve is about 118 days, and along the southern boundary about 100 days. In terms of probability it is almost certain that near Cardston frost will still occur in the first half of May and again by the beginning of October; by the middle of June and August the chances of freezing temperatures are still one in ten. Farther north on the Reserve the conditions become somewhat more favourable. On the whole it is fairly certain that the length of the frost-free season is at least about 75 days near Cardston and about 95 days near Fort Macleod. These periods are long enough to permit growing of most cereal and forage crops.

The period during which plant growth can take place is usually longer than the frost-free period because on a day (or night) with a frost reading the temperature during most of that day may have been warm enough to allow plant growth. Equally,

Table 13.– Frost Data for Weather Stations Around Blood Indian Reserve[a]

A. Days of frost-free period

Weather Station	Lethbridge	Raymond	Cardston	Caldwell	Fort Macleod
umber of Years ıata Collected	22	21	46	26	64
ıverage period	118	122	110	93	129
ongest period	165	122	150	135	165
hortest period	86	98	57	29	49

B. Probabilities of last frost in spring on (or after) specified dates, and first frost in fall on (or before) specified dates

Season	Spring		Fall	
Probability	9 in 10	1 in 10	1 in 10	9 in 10
ardston	May 11	June 17	Aug. 21	Sept. 28
ort Macleod	May 3	June 7	Sept. 4	Sept. 30

C. Probabilities of length of frost-free season equal to or less than indicated period in days

Probability	1 in 10	1 in 4	1 in 2	3 in 4	9 in 10
ardston	77	91	105	120	133
ort Macleod	96	107	120	133	144

. The location of the weather stations is given on the Key Map of the folded Topographic Map (see envelope inside cover).
ources.– Canada Department of Transport, Meteorological Branch based on data through 1960 supplied on request.

if not more important, therefore, is the so-called growing season. This season indicates the number of days between the first date in spring and the last date in fall on which the daily mean temperature is 42 degrees Fahrenheit. This season stretches for the area in which the Reserve is situated from the middle of April to the middle of October, a period of about 180 days.[2]

In general the summers are warm. Day temperatures easily rise into the 80's and maximum temperatures reach into the 90's, and rarely pass the 100 mark.[3] The nights are comfortably cool, however, and one will find that the average of the highest and lowest reading during 24 hours (i.e. the daily mean temperature) is usually in the 50's and 60's (Table 14). Even in July, usually the hottest month of the year, the daily mean temperature hardly exceeds 70 degrees.

The amount of sun heat available during the growing season is fairly favourable as compared with other regions in Canada,[4] and certainly sufficient to permit rapid growth of crops if other growth requirements are adequately satisfied. One danger is the effect of warm and drying winds. These winds can be quite destructive to growing crops, particularly during long dry spells.

During winter the temperature can drop to 30 degrees below zero, and temperatures of minus 50 have been recorded.[5] These low temperatures are interrupted by the moderating effects of the Chinook winds which sweep down from the mountains and are heated in their descent. Coming as they do with great suddenness they may raise the temperature from sub-zero readings to well above the freezing point in a few hours. Snow melts on the range and winter grazing becomes possible.

PRECIPITATION

The average annual precipitation varies from about 16 inches on the north and east side of the Reserve to about 17 on the west and south side. In the south-westerly corner it may be somewhat higher (Table 15). These long-term averages seem to indicate that the precipitation is fairly evenly distributed over the area but this may not be so of course in any one year. Variation may be considerable between years and in some the precipitation can be over twice the amount of that in other years.

Although annual rainfall is fairly small, it is fortunate that about 40 per cent of it falls during May, June and July, when it is most needed for the growth of plants. Another 30 per cent falls just before and after these three summer months when the soil is receptive to absorbing moisture (Table 16). In connection with this pattern of rainfall it should be noted that there are two peaks: one in June and another, somewhat less pronounced, in September.

Snowfall is quite irregularly distributed over the Reserve. According to snowfall data for weather

Table 14.– Monthly and Annual Averages of Daily Mean Temperatures,[a] Weather Stations Around Blood Indian Reserve

Weather Station	Lethbridge	Raymond 10–19 yrs	Cardston	Caldwell	Fort Macleod
			degrees Fahrenheit		
January	17	17	19	18	18
February	19	17	20	20	21
March	28	29	28	27	28
April	42	41	40	39	42
May	52	54	51	49	53
June	59	60	57	55	59
July	66	66	64	63	67
August	63	63	61	59	64
September	55	54	53	51	55
October	43	45	44	42	47
November	31	31	31	31	32
December	24	25	24	24	25
Year	42	42	41	40	43

a. Averages over 1931 – 60 period, except for Raymond.
Source:– Canada Department of Transport, Meteorological Branch, *Temperature Normals for Alberta Based on the Period 1931* Climatic Data Sheet 9-64.

Table 15.– Average Total Monthly and Yearly Precipitation (based on 1931–60 period), and Highest and Lowest Annual Precipitation (1931–60 period) for Weather Stations Around the Blood Indian Reserve

Weather Station	Lethbridge	Raymond	Cardston	Caldwell	Fort Macleod
			inches		
anuary	0.9	0.8	0.8	1.9	0.7
ebruary	1.1	0.8	0.9	1.7	1.0
larch	1.1	1.1	1.1	1.8	1.2
pril	1.4	1.7	1.4	2.6	1.3
lay	2.1	1.7	2.4	2.9	2.4
une	3.2	2.5	3.6	4.2	3.6
uly	1.7	1.2	1.6	1.6	1.7
ugust	1.6	1.7	1.5	1.7	1.6
eptember	1.4	1.3	1.8	2.0	1.7
ctober	1.1	1.2	1.2	1.9	0.9
ovember	1.1	1.2	0.9	1.7	0.9
ecember	0.8	1.0	0.9	1.7	0.8
ear	17.2	16.0	18.0	25.6	17.7
ecorded extremes:					
ighest Precipitation	27.4	–	36.2	52.8	26.9*
owest Precipitation	11.3	–	9.5	18.0	4.9

*A higher value of total precipitation was recorded in 1951 but with missing data in one month an exact annual total is not available.

ources.–Canada Department of Transport, Meteorological Branch, *Precipitation Normals for Alberta Based on the Period 1931--1960,* Climatic Data Sheet 5-65, highest and lowest precipitation supplied on request.

Table 16.– Total Inches of Precipitation and Percentages of Annual Total for Selected Periods (based on 1931–60 period) for Weather Stations Around the Blood Indian Reserve

Weather Station	Lethbridge	Raymond	Cardston	Caldwell	Fort Macleod
			inches		
ay, June, July, Aug., Sept., Oct.,	7.0	5.3	7.6	8.7	7.7
April	5.4	5.8	5.8	8.2	5.5
otal for 7 months	12.4	11.2	13.4	16.8	13.2
otal for 12 months	17.2	16.0	18.0	25.6	17.7
			percentages		
ay, June, July, Aug., Sept., Oct.,	41	33	42	34	44
April	31	36	32	32	31
otal for 7 months	72	70	74	66	75
otal for 12 months	100	100	100	100	100

ource.– Table 15.

Table 17.– Total Average, Highest and Lowest Annual Snowfall[a], for Weather Stations Around the Blood Indian Reserve

Recorded	Average	Highest	Lowest
		inches	
Lethbridge (1936–60)	66	106('51)	35('39)
Cardston	65	101('46) & ('51)	30('52)
Caldwell	126	233('51)	47('31)
Fort Macleod	53	104('33)	5('43)

a. Averages over 1931–50 period, except for Lethbridge.
Source.– Canada Department of Transport, Meteorological Branch, supplied on request.

stations around the Reserve it appears that on the average about 60 inches a year drop in the easterly sections of the Reserve. The snowfall appears to be higher in the southeasterly corner, and somewhat lower in the northeasterly portion (Table 17). The

TABLE 18. – Depth of Snow on the Ground Measured on the Last Day of the Month, Lethbridge

Recording Period	Average 1941–60
January	2.4
February	2.7
March	0.3
April	0.3
September	0.0
October	0.7
November	1.4
December	1.4

Source.–Canada Department of Transport, Meteorological Branch, supplied on request.

snow adds little, if any, moisture to the soil, becaus the ground is generally frozen when it melts and much lost through evaporation and runoff.

The snow may disappear from the ground duri any of the winter months as can be seen from the dep of snow measured at the end of each month (Table 18 The erratic nature of the snow adds to the danger wind erosion of crop land, particularly during the hi winds that often occur during the winter season. C the other hand the moderate snow cover, or lack of makes winter grazing possible.

WIND

The only available wind data from near th Reserve come from Lethbridge and Cowley (Tab 19), and some difference between those data ar wind conditions on the Reserve are to be expecte as a result of passes and windgaps through th mountains. It appears that throughout the year, th prevailing winds are from the west and southwes and these winds are also higher in velocity tha winds from other directions. During fall and wint the winds are stronger than during the rest of th

Table 19.– Wind Data for Lethbridge and Cowley Airports[a]

A. Average percentage frequency of hours (by calendar quarters) during which the wind was blowing from given directions

Stations	Lethbridge				Cowley			
Calendar Quarters	1	2	3	4	1	2	3	4
				percentages				
Wind direction:								
N	11	11	9	8	24	25	28	22
NE	9	8	8	5	2	3	3	2
E	7	8	7	4	3	6	4	2
SE	4	8	7	4	10	8	9	6
S	8	10	10	10	10	7	6	8
SW	23	20	22	29	18	18	17	25
W	29	25	25	31	25	22	20	25
NW	7	10	11	8	5	7	9	6
Calm	2	–	1	1	3	4	4	4

Table 19 (cont'd)

B. Average wind speed in miles per hour (by calendar quarters)

Stations	Lethbridge				Cowley			
Calendar Quarters	1	2	3	4	1	2	3	4
	miles per hour							
Wind direction:								
N	11	12	10	10	8	10	9	8
NE	9	11	9	9	7	8	7	6
E	8	11	8	7	7	9	8	7
SE	8	11	9	8	8	8	8	8
S	11	11	11	11	7	8	7	8
SW	19	16	14	18	18	15	14	18
W	20	18	15	21	19	16	14	18
NW	10	12	11	11	8	9	8	9

C. Average wind speed in miles per hour from any direction by months and for year

Stations	Lethbridge	Cowley
	miles per hour	
January	15	12
February	15	12
March	14	11
April	15	11
May	14	11
June	13	11
July	12	10
August	11	10
September	13	10
October	15	11
November	15	11
December	16	13
Year	14	12

D. Extreme Wind Speed Values

Stations	Lethbridge	Cowley
	miles per hour	
Maximum observed hourly speed	77	82
Computed maximum gust speed	119	125

a. Averages over 1939-60 period.
Source.— Canada Department of Transport, Meteorological Branch, supplied on request.

year, and although the average speed of those winds is around 15 miles an hour, speeds between 70 and 80 miles an hour are not uncommon. Gust speeds may be close to or even exceed 100 miles an hour. The danger of soil blowing is obvious, and it is extremely important that farmers adhere to appropriate soil management practices to protect the soil when it is bare of vegetation.

NOTES AND REFERENCES

1. **Kendrew**, W.J. and B.W. Currie, *The Climate of Central Canada*, Queen's Printer, Ottawa, 1955.
2. **Boughner**, C.C. and G.R. Kendall, *Growing Degree-Days in Canada*, Circ. 3203, Can. Department of Transport, Meteorological Branch, Toronto, 1959, Figures 1 and 2.
3. Mean annual maximum temperature lies between 90 and 95 degrees; the highest temperatures recorded for the region are between 100 and 105 degrees (*Atlas of Canada*, Plate 22, Department of Energy, Mines and Resources, Ottawa, 1957.
4. The amount of sun heat available to plants during the growing season is measured in terms of "growing degree-day units". The value of a growing degree-day normal indicates the amount of heat available for plant growth. The average monthly growing degree-day value is determined according to the formula (t-42) D, where t is the mean temperature for the month, D is the number of days in that month, and when t is smaller than 42°, the bracketed part of the formula is made equal to zero. Monthly growing degree-day values can be accumulated for seasons or a year; yearly values can be averaged to give a "growing degree-day normal". The "growing degree-day normal" in southwestern Alberta lies close to 3000 (Lethbridge 2930) and about 2500 (Lethbridge 2539) for the period May to September. These values are significant only in a relative sense of comparison with other areas. The yearly normal for Aklavik (N.W.T.), for instance, is 985, and for Windsor (Ont.) 4424. (*Growing Degree-Days in Canada, op. cit.*, pp. 3 to 5, 7, and Figures 5 and 6).
5. Mean annual minimum temperature lies between 30 and 35 below zero; the lowest temperatures recorded for the region are in the neighbourhood of minus 50 degrees (*Atlas of Canada, ibid.*).

VI. GEOLOGY AND MINERAL RESOURCES

INTRODUCTION

Geology is the science that deals with the earth, and includes studies of its surface shape, structure and composition, and the changes that have taken place with the passing of time. The knowledge gained through these studies is most useful, perhaps essential, in locating deposits and formations that are beneficial to man's life.

The geologist skilled in the tools of his profession, is interested in the shape of the land because it may reveal to him what happened in the past. He also searches for places, such as steep sides of buttes or along walls of river valleys and coulees, where the various layers of the earth's crust can be closely examined.

Rock formations are usually covered by loose earth, clay, sand and gravel, which have been transported and laid down by water, glaciers, wind, or simply slid down a slope through the force of gravity. On the Reserve this material, which geologists refer to as surficial deposits, is largely due to the action of glaciers. The immediately under-lying rock formations, the bedrock, can be studied wherever exposures are found.

In addition to these geological features that can be observed and studied in travelling over the surface of the land, a great deal of information about that part of the earth's crust below surface is revealed in the search for gas and oil. During drilling on the Reserve samples of the rock and electric and radioactive logs were taken, and from this evidence the so-called subsurface geology could be determined.

Other sources of information are the geophysical surveys which depend on certain physical characteristics of the earth to locate rock structures in which oil and gas may be trapped. These surveys are carried out by ground parties or from an airplane, and may be of several types. Seismic surveys measure the response of the crust of the earth to shock waves from exploding dynamite. In gravity surveys measurements are made of the forces of gravity at various locations, and in magnetic surveys the variations and directions of the earth's magnetic field are determined.

Each of these surveys has been carried out on the Reserve, and the results have been interpreted by geologists in attempts not only to locate the best places to drill for oil and gas but also to learn more about formations too deep or costly for a drill to probe.

The Table of Geological Formations (p. 54) shows the various rock formations under the Reserve from the shallow and relatively young Willow Creek Formation to the very old Precambrian rock normally at a depth of 10,000 feet or more. The Precambrian rocks which include many types, have an age varying from 600 to 3,000 million years. They are of no interest in this report because of their great depth and their absence of gas and oil accumulations.

The strata overlying the Precambrian rocks were formed largely from sediments deposited in layers near the shores of seas which spread across the interior of the continent at various times. As layer after layer of the sediments were laid down in water, the underlying layers were compressed and hardened into rock. Mud became shale, sand became sandstone, and shell animals became limestone. Some of the formations were formed in fresh water, others in water that had become brackish or salty. In the northeastern part of the Reserve the total thickness of these layered or sedimentary formations is about 10,000 feet. The thickness increases towards the southwest as a result of downwarping of the seabottom close to where the Rocky Mountains now stand during the time of deposition. This downwarping also causes the formations, particularly the older ones, to dip gently to the southwest.

The deposition of the sedimentary rocks started some 500 million years ago during the Middle Cambrian. Much later during the Mississippian period, about 250 million years ago, valuable oil and gas bearing rocks were formed. The coal is of Upper Cretaceous age, and came into being about 100 million years ago. It is generally believed that oil was formed from the remains of tiny sea animals, whereas coal formed from the remains of trees preserved in swamp waters.

At the close of the Paleozoic era, about 200 million years ago, there was a broad upwarping of the earth crust which centered in Montana. The resulting arch, known as the Sweet Grass arch, plunges northward into Alberta giving expression to a number of smaller arches. One of these, the Del Bonita structure, extends in northwesterly direction through Del Bonita, Spring Coulee and the central part of the Reserve.[2] As a result the formations north and east of Stand Off dip gently to the northwest, rather than conform to the southwesterly regional dip.

TABLE OF GEOLOGICAL FORMATIONS, BLOOD INDIAN RESERVE

ERA	PERIOD OR EPOCH	GROUP	FORMATION AND THICKNESS	MARKER OR MEMBER AND THICKNESS	LITHOLOGY
MESOZOIC	CRETACEOUS AND/OR TERT.		WILLOW CREEK 0 – ? 1000'		Not recognized in wells SANDSTONE – grey, SHALE green red and grey, some limeston
	UPPER CRETACEOUS		ST. MARY RIVER 1070'+		Top of formation not exposed. 305' Interbedded SANDSTONE and varicolored SHALE. Minor c within formation and at the base of the formation
			BLOOD RESERVE ? thickness		SANDSTONE not differentiated in wells
			BEARPAW 700' – 800'		SHALE – lead grey with bentonite beds and marine fossils. Co near the top of formation
		BELLY RIVER	OLDMAN ? ? FOREMOST 1200'- 1400'		SANDSTONE – grey, argillaceous and calcareous, grey carbons SHALE, some coal seams and lenses, impure LIMESTONE
			PAKOWKI 64'–85'		SHALE – grey, micromicaceous. Trace sandstone near middle c formation
			MILK RIVER	UPPER 130'–194'	SANDSTONE – coarse grained, calcareous, with interbeds of d and grey green SHALE
				LOWER 275'–327'	SANDSTONE – coarse grained, calcareous, minor green SHALE
		COLORADO	TOP TO BOW ISLAND FORMATION 1310'–1630'		SHALE – medium to dark grey, in part calcareous, with minor i of SANDSTONE. Increase of ss towards base
	LOWER CRETACEOUS		BOW ISLAND 320'–435'		SANDSTONE lenses and interbeds of grey SHALE
		MANNVILLE	UPPER MANNVILLE / LOWER MANNVILLE 580'– 770'		SANDSTONE – grey to green grey, interbedded with varicolored Brown SHALE and LIMESTONE overlie a basal coarse che SANDSTONE called Cutbank member
	UNCONFORMITY				
	UPPER JURASSIC	ELLIS	SWIFT 0'–50'		0'–20' SANDSTONE – clean, quartzose 30' SHALE – light grey, fissile
			RIERDON 148'–280'		SHALE – grey, calcareous interbedded with light grey dense v argillaceous LIMESTONE
	UPPER MIDDLE JURASSIC		SAWTOOTH 0'–150'		SANDSTONE – light grey siliceous, some glauconite, little lim
	UNCONFORMITY				
PALAEOZOIC	LOWER MISSISSIPPIAN	RUNDLE	TURNER VALLEY 170'±	MIDDLE DENSE 80'±	60' DOLOMITE – silty, cherty, finely crystalline 20' DOLOMITE – sandy
				ELKTON 90'±	DOLOMITE – coarsely fragmental, cherty
			SHUNDA 160'±		60' DOLOMITE – dense, cherty, silty 80' Interbedded LIMESTONE and cherty DOLOMITE 20' DOLOMITE – silty, calcareous
			PEKISKO 260'±		Cherty LIMESTONE with minor DOLOMITE
			BANFF 550'±	UPPER MIDDLE LOWER	170' LIMESTONE – grey argillaceous pyritic 360' SHALE – grey calcareous 20' LIMESTONE – grey argillaceous and dark grey SHALE
			EXSHAW 25'±		Black SHALE and SANDSTONE, grey, LIMESTONE and DOLC and grey buff glauconitic LIMESTONE
	UPPER DEVONIAN	WABAMUN	BIG VALLEY 15'±		LIMESTONE – oolitic
			STETTLER 380'±		ANHYDRITE with interbeds of DOLOMITE
		WINTERBURN	CROWFOOT ? 38'±		DOLOMITE – sandy and argillaceous green and grey and SAN green argillaceous and anhydrite
		FAIRHOLME	DELIA 85'±		DOLOMITE with minor SHALE near base
			PEECHEE 190'±		80' ANHYDRITE and minor DOLOMITE 110' DOLOMITE
			CAIRN 525'±		Interbedded LIMESTONE and DOLOMITE
	MIDDLE DEVONIAN		BEAVERHILL LAKE 355'±		110' LIMESTONE with minor grey SHALE and traces of DO 245' DOLOMITE and interbedded ANHYDRITE
	PRE-UPPER DEVONIAN		ELK POINT ? 100'±		SHALE – green and red and LIMESTONE anhydritic interbed b dolomite and shale
	UNCONFORMITY				
	ORDOVICIAN OR CAMBRIAN		70'±		Interbedded LIMESTONE and DOLOMITE
	UNCONFORMITY				
	MIDDLE CAMBRIAN		1000'±		905' LIMESTONE Interbedded with calcareous splintery SH 95' SANDSTONE (Basal) with interbeds of SHALE
	UNCONFORMITY				
PRECAMBRIAN ERAS					Biotite quartz diorite GNEISS

In the southwestern part of the Reserve the sedimentary formations ranging in age from Upper Cretaceous to Paleocene have been folded into a trough-like structure which is called the Alberta syncline. The axis of this syncline (see Bedrock Geology Map) separates the Reserve into two structural zones. Northeast of the axis the formations dip gently west and southwest (about 120 feet per mile), and a few miles southwest of the axis the Disturbed or Foothills Belt of the Rocky Mountains commences. This belt is characterized by intense thrust faulting and folding, and dips of 30 to 40 degrees to the northeast and southwest are common. Compressional stresses from the west have thrust thick slices of sedimentary rock one over another. The individual slices are separated by flat to steep westerly dipping thrust faults. About 10 per cent of the Reserve, including the Timber Limit lies within the Disturbed Belt; the remainder is located within the Interior Plains region.

In relatively recent times, but still something like a million years ago, the climate became colder than we know it now, and large ice masses reached the Reserve. First Cordilleran glaciers came down from the Rocky Mountains through the valleys of the St. Mary and Belly Rivers. Later an ice-sheet from a northerly direction (the Laurentide ice) spread over the whole area, and replaced the Cordilleran ice.

Whenever the climate became warmer the ice-sheets retreated, leaving blankets of material in their wake. Several glaciations have been recognized, and each time the advancing ice-sheets removed much of the material that had been laid down earlier. The last glacier, thought to be of classical Wisconsin age, covered all but the southwestern part of the Reserve. With the lowering of the ice surface, ice from the Athabasca Valley flowed southward along the Foothills and crossed the Reserve in an easterly direction. This ice carried with it huge boulders, several of which were left on the Reserve (particularly in tps. 5 and 6). Further lowering of the ice caused, through blocking of rivers, the ponding of large glacial lakes which lasted until the ice retreated beyond the borders of the Reserve.[3]

. . .

The discussion of the geology pertaining to the Reserve will begin with a description of the surficial material, and will continue from there with a description of bedrock and subsurface formations that may have economic significance. Following the geology will be a discussion of the economic potential of resources contained in these formations.

SURFICIAL GEOLOGY

The rather loose formations overlying the bedrock are grouped into preglacial, glacial, late-glacial and early post-glacial, and post-glacial deposits (see Surficial Geology Map).

Preglacial Deposits

Preglacial deposits do not appear at the land surface but were observed in stream cuts and encountered in seismic shot-holes. On the basis of these observations the largest area of preglacial gravel and sand occurs within the valley of the preglacial Belly River along the west side of the Reserve north of Mokowan Butte. Other occurrences, rather small in area, are mainly confined to valleys that were tributary to the preglacial valleys of the Belly, St. Mary, and Oldman Rivers. The thickness of the gravel is generally from 10 to 20 feet, although thicknesses of 40 feet were encountered in some shot-holes. On the whole the gravels are clean, well-sorted, well-bedded, and do not contain material carried from the Precambrian Shield, such as is found in all younger gravel deposits of the area.

Preglacial sand and gravel were deposited over an extended period, including the late Tertiary and early Quaternary before the advance of the ice. Swift rivers at that time dropped their loads where the valleys widened and currents slowed after crossing resistant bedrock onto zones of soft rocks. As the rivers cut deeper, gravel terraces were left at various altitudes in the valleys as markers of the former levels of the river beds. With the approach of the ice-sheets and mountain glaciers (Cordilleran) advancing down the river valleys some outwash was added to the gravel beds. At the same time continental (Laurentide) glaciers advancing from the north and east blocked the rivers to form proglacial lakes, in which the fine material found locally above the gravel beds was deposited. The Laurentide glaciers finally overran the whole area now occupied by the Reserve, and ended the deposition of preglacial gravel and sand.

Glacial Deposits

The glaciers which overran the Reserve deposited material (commonly called drift) which consists mostly of till with small amounts of material deposited by glacial streams.[4] This material is present over all the Reserve except for small areas of exposed bedrock, newly eroded valleys, and an area (tps. 7 and 8, rge. 24) of proglacial-lake deposits. In general the surface till is a rather thin, fairly smooth

blanket of ground moraine. This is particularly true on the high land where the underlying bedrock hills are smooth and broad, and in the southwestern part of the Reserve where the till has had long exposure to the elements. In low areas, lake deposits normally overlie the ground moraine. The surface till also occurs as hummocky moraine, particularly in the hilly country of the southwestern part of the Reserve. The drift is probably about 25 feet thick in most places, but where it has filled preglacial valleys thicknesses of more than 200 feet occur locally (see thickness contours of drift on Groundwater Map).

When the Cordilleran glaciers moved over the Reserve they were near the limits of their advance, and only minor amounts of till and outwash were left behind. More prominent are the Laurentide tills, although these also contain much material of Rocky Mountain origin. Several different Laurentide tills and two different Cordilleran tills are present on the Reserve. Although the various tills have a somewhat similar composition, each has its own characteristic colour, degree of consolidation and fracturing.

Little is known about the ages of the tills. It appears, however, that most of the till on the Reserve is of classical Wisconsin age. The till in the southwestern portion is probably older, although still Wisconsin. Here the lime zone is deeper than elsewhere on the Reserve, and modification of walls of spillways is pronounced. In addition, and perhaps more important, there occurs in places a well-developed soil profile, which is buried beneath river alluvium, volcanic ash, and glacial-lake deposits (a good exposure is on the walls of the Belly River in sec. 22, tp. 4, rge. 27). These soil profiles developed before burial by lake and river deposits related to the last glaciation, and before cutting of the Belly River valley through these deposits to its present depth.

Late Glacial and Early Post-Glacial Deposits

These deposits which cover more than half of the Reserve were laid down beyond the ice margin during the waning of the last glacier. The main components are inwash, proglacial lake deposits, and alluvium of spillways or rivers.

Small deposits of inwash are found in the southwestern part of the Reserve where it is in general 10 feet thick, but thicknesses of as much as 50 feet occur in some places. Coarse alluvium is also found on the high terraces of the Oldman and St. Mary Rivers in the eastern part of the Reserve.

A narrow lake bordered the last glacier during most of its retreat from the Reserve. This lake was formed as a result of the downward slope of the land surface towards the ice, and the damming of the broad valleys which caused water to be ponded in front of the ice. Evidence of the lake can be found in the form of extensive and widespread lacustrine deposits consisting of fine silt and clay, much of which is varved. Most of these deposits are confined to areas of low relief north of the Disturbed Belt. Where streams entered the lake, coarser, more sandy material is present. An extensive area of sand west and north of Wild Turnip Hill is a nearshore deposit which formed during a high stage of the former lake.

Most of the lake deposits are only a few feet thick, and although they modify, they do not fully mask the underlying drift topography. In some places thicknesses of 20 feet are common, and even as much as 100 feet occur (sec. 29, tp. 8, rge. 24, where these deposits lie directly on the bedrock). Stones up to two feet long are scattered over the areas of lake deposits. A few of these may have been brought in by ice-rafting. Most, however, were raised to the surface when the lake deposits and underlying till were contorted, in a manner which defies explanation. The number of stones lying on the surface depends upon the amount of till that has risen through the lake deposits. Most of these areas of part till and part lake deposits are mapped as lake deposits to indicate more closely the extent of the lake.

Post-Glacial Deposits

Post-glacial deposits were laid down after the last glacier had disappeared from the region of the Reserve. They include stream deposits (alluvium), and also deposits resulting from sliding and slumping (colluvium).

Alluvium is found mainly along the valleys of the Belly and Oldman Rivers where its thickness probably ranges between five and 25 feet. The composition of this deposit varies from clay and silt where the current of the rivers was slow to sand and gravel where the current was fast.

Slump and slide deposits of importance are located in the area of Mokowan Butte, where small pinkish fragments of Willow Creek Formation siltstone were washed onto the flats and terraces of the Belly River during formation of the adjacent badlands. Large slumps and extensive deposits of colluvium are prominent along the valleys of the Oldman River and the northern part of the St. Mary

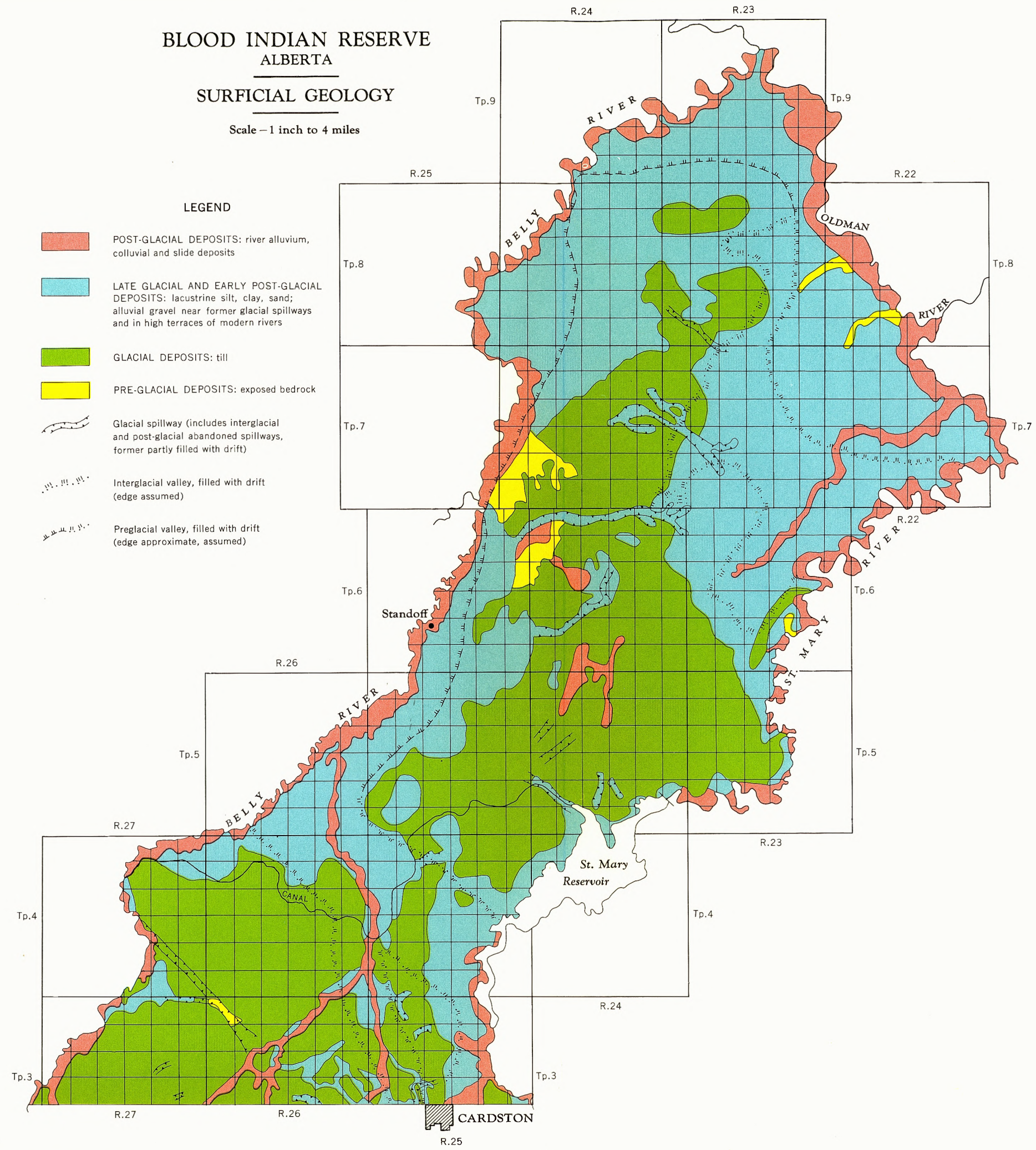
BLOOD INDIAN RESERVE
ALBERTA

SURFICIAL GEOLOGY

Scale – 1 inch to 4 miles

LEGEND

- POST-GLACIAL DEPOSITS: river alluvium, colluvial and slide deposits
- LATE GLACIAL AND EARLY POST-GLACIAL DEPOSITS: lacustrine silt, clay, sand; alluvial gravel near former glacial spillways and in high terraces of modern rivers
- GLACIAL DEPOSITS: till
- PRE-GLACIAL DEPOSITS: exposed bedrock
- Glacial spillway (includes interglacial and post-glacial abandoned spillways, former partly filled with drift)
- Interglacial valley, filled with drift (edge assumed)
- Preglacial valley, filled with drift (edge approximate, assumed)



River. In carving these valleys the rivers had to cut through thick fill in preglacial valleys before reaching bedrock. There is commonly much water seepage at the base of the fill just above the relatively impermeable bedrock, and slumping occurs readily in this contact zone. Some of these slumps are up to a mile in length, and commonly occur in a series of rotational slices. Large-scale slumping also has taken place along the Belly River (tps. 3 and 4) where the river cuts through thick fill in crossing several interglacial valleys.

BEDROCK GEOLOGY

This section deals with rock formations that reach the bedrock surface or are encountered in shallow test holes. The bedrock formations on the Reserve (see Bedrock Geology Map) include the formations of the Belly River Group, the Bearpaw, Blood Reserve, and St. Mary River Formations of Upper Cretaceous age, and the Willow Creek Formation of Upper Cretaceous and Paleocene age. Marine deposits are confined largely to the Bearpaw Formation which directly underlies the drift in the eastern part of the Reserve. The other formations on the Reserve are mostly fresh or brackish water in origin. Most of the bedrock is poorly consolidated but there is sufficient difference in resistance to erosion to enable certain beds, particularly sandstone beds, to remain as hills and erosion remnants.

Belly River Group

This group is exposed in the Disturbed Belt where it has been brought to the surface by faulting. The only other area where it occurs at the surface is in the extreme eastern part of the Reserve (tp. 7). Here coal has been mined from its uppermost beds. The thickness of this group ranges from 1200 to 1400 feet. Beds consist of light grey to greenish grey, fine-grained sandstones, interbedded with shale. Minor beds of coal, limestone and bentonite occur within the formation.

Bearpaw Formation

This formation is exposed both in the Disturbed Belt and along the valleys of the Oldman and St. Mary Rivers in the northeastern part of the Reserve. The rocks are dark brownish grey, soft, and contain thin layers of bentonite and fine grained sandstone. The formation encountered in bore-holes north of the axis of the Alberta syncline is 700 to 800 feet thick.

Blood Reserve Formation

The Bedrock Geology Map shows that a band of this formation occurs on the east side of the Reserve. Outcrops also occur within the Disturbed Belt between the Bearpaw and St. Mary River Formation. The Blood Reserve Formation consists entirely of thick-bedded, uniformly coarse- to medium-grained sandstone. The uniformity, which is in marked contrast to other formations, is significant in connection with groundwater possibilities (discussed later in this Chapter). Thicknesses of 77 feet of sandstone have been observed in the outcrop area of the northeastern part of the Reserve, but farther north in the valley of the Oldman River only 40 feet of sandstone occur.

St. Mary River Formation

This formation underlies the drift over a large area in the east half of the Reserve, and also occurs in the Disturbed Belt. Oyster (Ostrea coquina) beds and thin coal seams occur at its base. The oyster beds reach a thickness of 25 feet in the Disturbed Belt but are less than two feet in the northeast part of the Reserve. It is probable that these beds, although varying in thickness, are continuous beneath the surface. Most of the St. Mary Formation contains hard, medium-grained, lense-shaped beds of sandstone, which are interbedded with crumbly, sandy shales. The thickness of the formation ranges from 1000 to 1200 feet.

Willow Creek Formation

The Willow Creek Formation was deposited during the formation of the Rocky Mountains. Good exposures occur on Mokowan Butte, northeast of Stand Off. Under the drift it extends over a large area to the southwest. This formation consists of interbedded green and maroon shales and greenish grey, fine-grained sandstone. The thickness is about 1000 feet.

SUBSURFACE GEOLOGY

Information on rock formations at greater depth than those described in the previous section is obtained from wells drilled on the Reserve for crude oil and natural gas. Most drilling stopped in the upper part of rocks of Mississippian age; a few wells penetrated some of the Devonian formations; and only one, the International Blood No. 1, reached Precambrian rocks. The locations of the 19 wells drilled on the main Reserve together with the three

drilled on the Timber Reserve, are shown on the Oil and Gas Wells Map. Following this map is a cross-section of formations penetrated in a number of the wells which is based on a study of cuttings samples, cores, and electric and radio-active logs. Results of drilling are further summarized in the Table of Formations (p. 54). Of the formations shown in the Table, the Rundle Group merits further attention because of oil and gas encountered in the wells.

The Rundle Group

In ascending order towards the surface this group is divided into the Pekisko, Shunda, Turner Valley, and Mount Head Formations. Following the Mississippian period the forces of erosion removed the Mount Head Formation and about half of the Turner Valley Formation. The top member (Upper Porous) of the Turner Valley Formation completely disappeared, and only about 80 feet of the middle member (Middle Dense; typically 100 feet thick), and the bottom member (Elkton) are left. The Middle Dense member is composed of light grey, very fine-grained, silty and cherty dolomite with some vuggy porosity in the upper ten feet. The top 30 feet of the Elkton member is a grey to buff, cherty dolomite; the remaining 50 to 60 feet consist of beds of coarse, porous dolomite, limestone, and finely crystalline dolomite.

The Shunda Formation consists of about 160 feet of grey to buff limestone and dolomite, with a few stringers of calcareous shale in the bottom 70 feet, and silty and cherty beds in the remainder. The Pekisko Formation is about 260 feet thick and is composed of white, finely crystalline, slightly cherty limestone. In the bottom 40 feet are some interbeds of dolomite.

GEOLOGY OF THE TIMBER LIMIT (BLOOD INDIAN RESERVE 148A)

All the Timber Limit lies within the Disturbed Belt. The formations of Jurassic and Cretaceous age contain numerous thrust faults, which show up clearly in the local topography and in the repetition of the same formations in the subsurface. The numerous thrust faults on the surface are closely spaced and lie in a direction of north 50 degrees west.

The Livingstone Formation (equivalent to the Rundle Group) of Mississippian age is the deepest horizon penetrated during well drilling (see Natural Gas Resources, Lookout Butte Gas Field Map). This formation is composed of limestone, cherty limestone and porous dolomite. On top of the Mississippian sub-erosional surface is the Jurassic marine shale-sandstone sequence. Its top few feet contain thin stringers of coal. In ascending order to the surface, formations of the Lower Cretaceous period consist of Dalhousie fresh water sandstone (with cherty fragments) and a Blairmore fresh water sand-shale sequence (with some thin shaly limestone beds near the base). Next in succession are marine sediments (Containing Blackstone siltstone and shale), the Cardium sandstone-shale sequence, and the Wapiabi shale and siltstone, all of the Upper Cretaceous period. Finally there follow the fresh water sandstones and shales of the Belly River Group (Upper Cretaceous), the youngest stratum in this area.

OIL AND GAS

Several wells have been drilled on Blood Indian Reserve land, but only those drilled recently in the Timber Limit have been commercially successful.[1] These wells are capable of producing gas condensate, of which much will become a liquid when brought to the surface where it is exposed to normal atmospheric temperature and pressure. The high ratio of condensate to gas (about 100 barrels per million cubic feet of gas) adds to the value of this resource, although for the time being dry gas will be injected back into the reservoir and kept there for future use. Another important constituent of the gas is hydrogen sulphide which can be extracted and made into sulphur.

Nearly all the Timber Limit lies within the Lookout Butte gas field. The gas reservoir of this field is an elongated structure extending north-northwest from the international boundary on the south, through Waterton Lakes National Park and the Blood Indian Timber Limit, to the northern boundary of township 2, range 28. The Livingstone Formation at an average depth of 7,500 feet below sea level is the gas containing layer.

Interest in exploration for gas on the Timber Limit was first sparked by the discovery of wet gas in the Pincher Creek field in 1947. It was not until 10 years later, however, that oil and gas rights to the Timber Limit (totalling 4754 acres) were offered to the public. Shell Canada Limited succeeded in acquiring leases to this area.

The discovery well of the Lookout Butte Gas Field (Lookout Butte well 11-31) is located only half a mile north of the Timber Limit (see Natural Gas Resources Map). It was completed in December

BLOOD INDIAN RESERVE
ALBERTA

BEDROCK GEOLOGY
AND PROPOSED TEST HOLES FOR GROUNDWATER

Scale – 1 inch to 4 miles

LEGEND

CRETACEOUS AND TERTIARY

Upper Cretaceous and Paleocene

5 Willow Creek Formation

CRETACEOUS

Upper Cretaceous

4 St. Mary River Formation

3 Blood Reserve Formation

2 Bearpaw Formation

1 Belly River Group

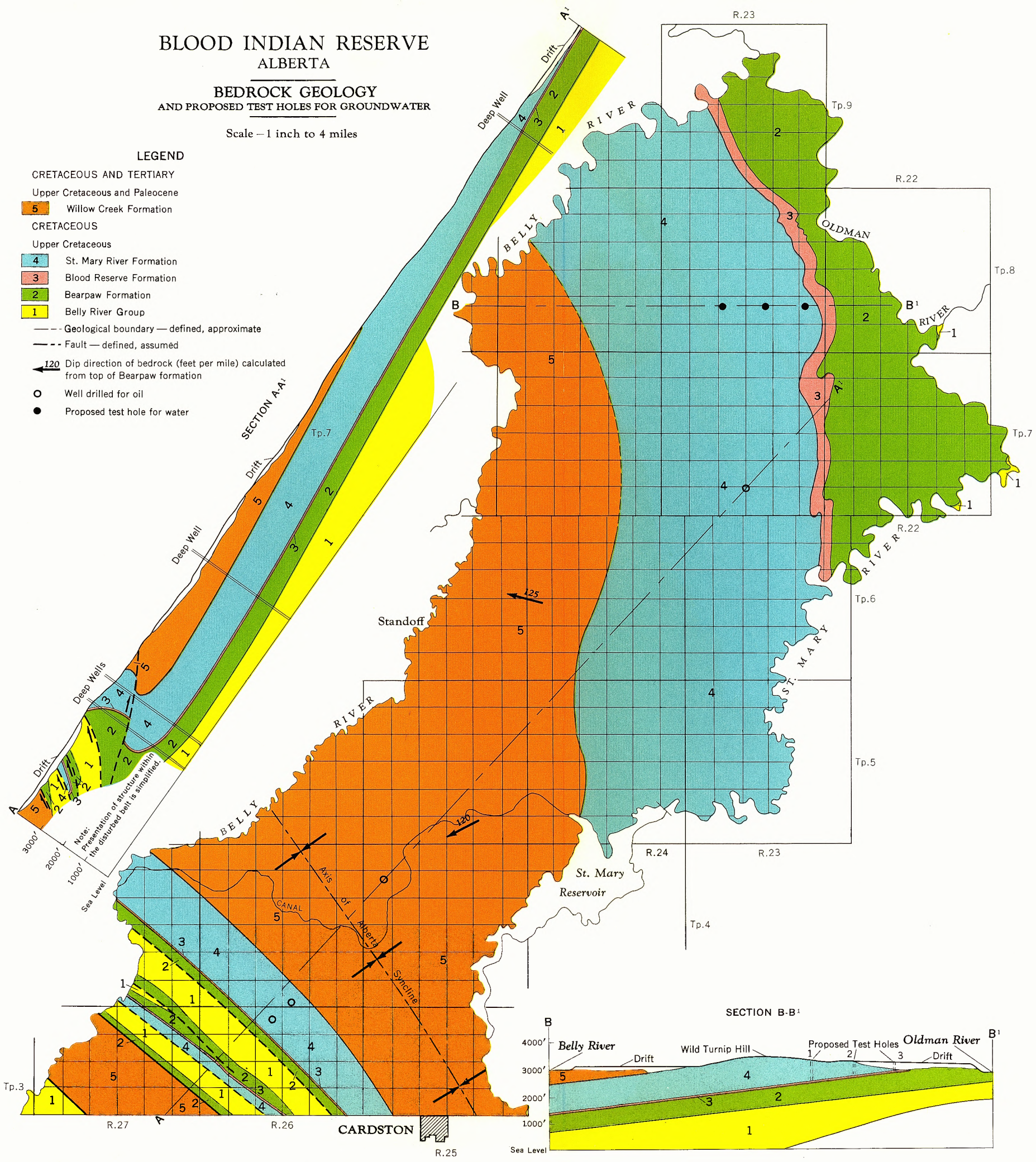
—— – Geological boundary — defined, approximate

—— - Fault — defined, assumed

120 Dip direction of bedrock (feet per mile) calculated from top of Bearpaw formation

O Well drilled for oil

● Proposed test hole for water



SECTION B-B¹

BLOOD INDIAN RESERVE
ALBERTA
OIL AND GAS WELLS

Scale of Miles
0 5 10

See also Cross Section A-A' on next page.

Index to Wells

1 White Rose Home Western et al Blood 6-33 6-33-3-26 W4
2 Western White Rose et al Blood 3-3-4-26 W4
3 White Rose Home-Western Blood 10-30 10-30-4-25 W4
4 Western Blood 17-9 9-17-5-25 W4
5 Northland National Blood #2 10-17-5-23 W4
6 Northland National Blood #1 15-17-5-23 W4
7 North West-West #1 3-20-5-23 W4
8 Pan American K-1 Blood I.R. 12-20-5-23 W4
9 Imperial Oil Blood Indian Reserve #1 10-31-5-23 W4
10 Pan American A-1 Blood Indian Reserve 8-23-6-24 W4
11 Pan American A-2 Blood Indian Reserve 14-23-6-24 W4
12 Sinclair Blood Indian Reserve #1 1-4-7-24 W4
13 Pan American Imperial A-1 Blood I.R. 4-10-7-23 W4
14 Sweetgrass Decalta Blood #1 13-19-7-22 W4
15 Lee Carlson Maygill Gateway #1 4-30-7-22 W4
16 Naco Blood #1 1-25-7-23 W4
17 International Blood #1 2-7-8-22 W4
18 Northwest Treaty #1 4-17-8-23 W4
19 Imperial Monarch 13-35-8-23 W4
20 Shell Chief Mountain 7-20-1-28 W4
21 Shell #2 Chief Mountain 3-29-1-28 W4
22 Shell #3 Chief Mountain 12-16-1-28 W4

Granum
Monarch
Diamond City
Fort Macleod
Lethbridge
Raymond
Magrath
Milk River Ridge Reservoir
Hillspring
Spring Coulee
Jensen Reservoir
St. Mary Reservoir
Cardston
Mountain View
Aetna
Ross L.
Kimball
Waterton Park
Waterton Lake
CANADA
U. S. A.

Oldman River
Belly River
Waterton River
St. Mary River
OLDMAN RIVER
BLOOD INDIAN RESERVE

PINCHER CREEK FIELD
WATERTON FIELD
SPRING COULEE FIELD
WATERTON LAKES NATIONAL PARK
LOOKOUT BUTTE FIELD
BLOOD INDIAN RESERVE
DEL BONITA FIELD

A
A'
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

FIFTH MERIDIAN

Tp. 10
Tp. 9
Tp. 8
Tp. 7
Tp. 6
Tp. 5
Tp. 4
Tp. 3
Tp. 2
Tp. 1

R. 30 R. 29 R. 28 R. 27 R. 26 R. 25 R. 24 R. 23 R. 22 R. 21 R. 20

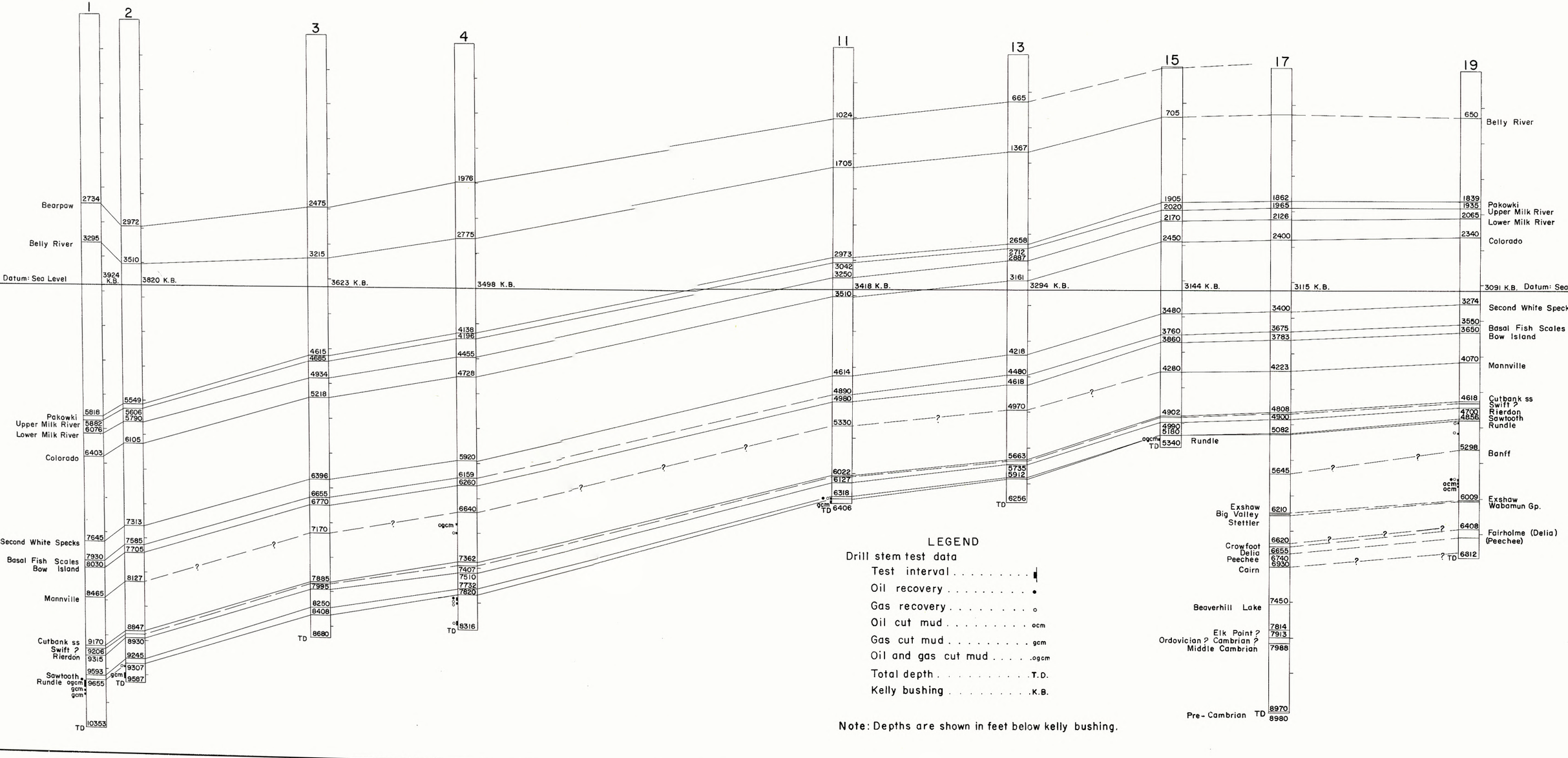
BLOOD INDIAN RESERVE
ALBERTA
CROSS SECTION THROUGH OIL AND GAS WELLS

Scales

Horizontal 0 1 2 3 4 5 6 Miles

Vertical 0 500 1000 1500 2000 Feet

To accompany Oil and Gas Well map.



BLOOD INDIAN RESERVE 148A
ALBERTA
NATURAL GAS RESOURCES
LOOKOUT BUTTE GAS FIELD

Hydrocarbon pore volume contours based on tilted gas-water surface { — 7950′ at 7-20 well; — 7666′ at 7-23 well

Scale in Miles

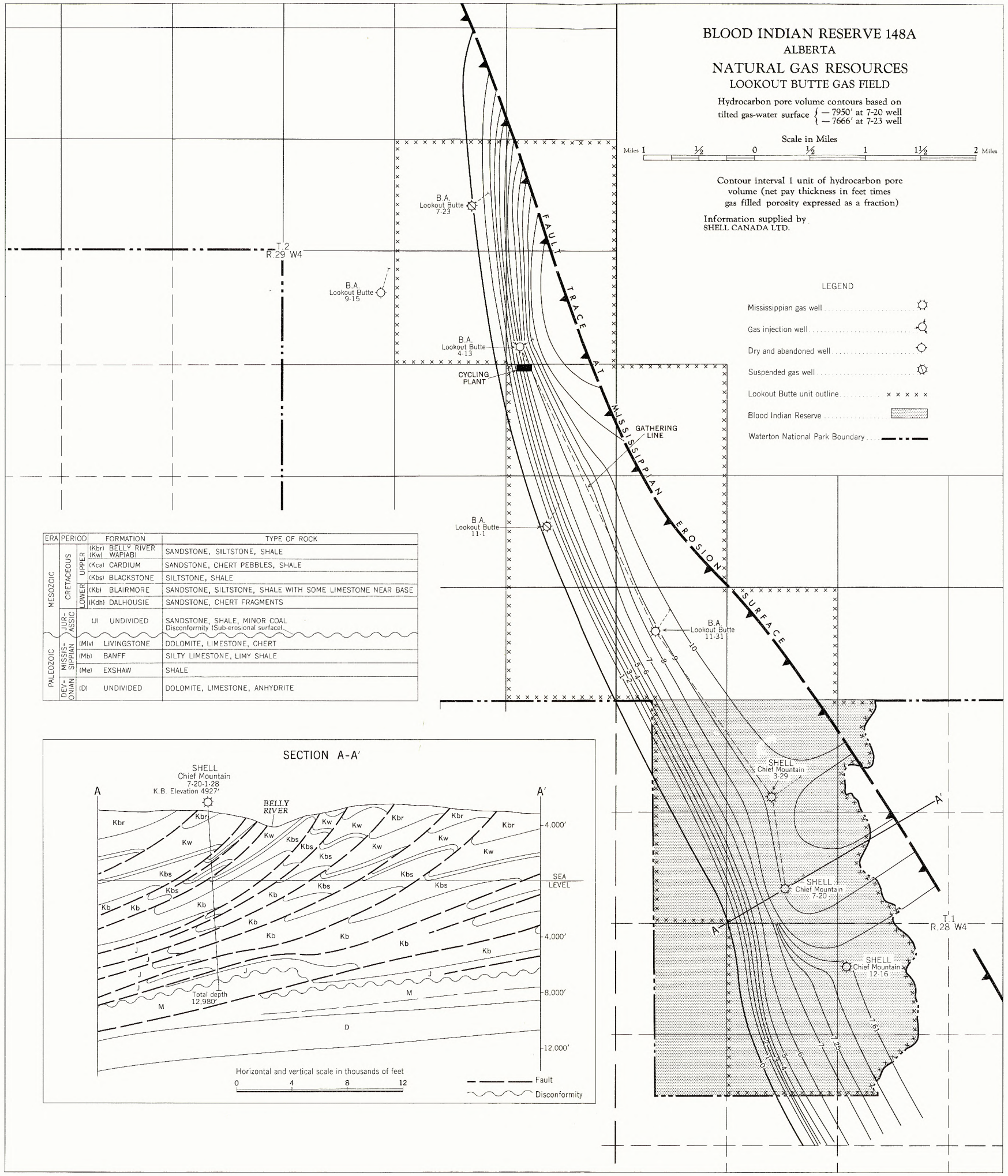
Miles 1 | ½ | 0 | ½ | 1 | 1½ | 2 Miles

Contour interval 1 unit of hydrocarbon pore volume (net pay thickness in feet times gas filled porosity expressed as a fraction)

Information supplied by SHELL CANADA LTD.

LEGEND

- Mississippian gas well
- Gas injection well
- Dry and abandoned well
- Suspended gas well
- Lookout Butte unit outline
- Blood Indian Reserve
- Waterton National Park Boundary



ERA	PERIOD		FORMATION	TYPE OF ROCK
MESOZOIC	CRETACEOUS	UPPER	(Kbr) BELLY RIVER (Kw) WAPIABI	SANDSTONE, SILTSTONE, SHALE
			(Kca) CARDIUM	SANDSTONE, CHERT PEBBLES, SHALE
			(Kbs) BLACKSTONE	SILTSTONE, SHALE
		LOWER	(Kb) BLAIRMORE	SANDSTONE, SILTSTONE, SHALE WITH SOME LIMESTONE NEAR BASE
			(Kdh) DALHOUSIE	SANDSTONE, CHERT FRAGMENTS
	JURASSIC		(J) UNDIVIDED	SANDSTONE, SHALE, MINOR COAL Disconformity (Sub-erosional surface)
PALEOZOIC	MISSISSIPPIAN		(Mlv) LIVINGSTONE	DOLOMITE, LIMESTONE, CHERT
			(Mb) BANFF	SILTY LIMESTONE, LIMY SHALE
			(Me) EXSHAW	SHALE
	DEVONIAN		(D) UNDIVIDED	DOLOMITE, LIMESTONE, ANHYDRITE

SECTION A-A′

1959, and further development did not occur until a year later when the British American Oil Company completed B.A. Lookout Butte well 11-1. Drilling activity increased in 1961 and '62 when four potential gas wells and one dry hole were added. The last well drilled (Shell Chief Mountain 12-16) was completed in June 1963.

Five of the seven wells that have penetrated the gas bearing reservoir are productive, and three of these are on the Timber Limit. Estimates of the amount of gas condensate contained in the reservoir under the Timber Limit have not been completed, but on the basis of present data the total recoverable raw gas is in the order of 220 billion cubic feet.

. . .

During drilling operations on the main Reserve oil and gas shows have been reported from formations ranging in age from Upper Devonian to Upper Cretaceous (see cross-section of wells) but the only production has been from the Rundle Group of Mississippian age. Rocks of Devonian age have intergranular and pin-point porosity in the Beaverhill, Cairn, and Delia Formations, and a show of oil was reported in beds of the Peechee Formations which belong to the same group (Imperial Monarch well, number 19 on Oil and Gas Map). Oil shows were also reported in the Banff Formations, and many wells gave evidence of oil in the Rundle Group. In this group vuggy porosity has been noted, and some beds show what appears to be fracture porosity. Porosity appears also in the sandstone formations of the Jurassic and several sands (Cutbank and Bow Island Formations) of Cretaceous age. Even the sands of the Belly River Group have some intergranular porosity, and in a few wells small gas shows have been reported from these beds.

COAL

Coal seams outcrop in the extreme eastern part of the Reserve along the St. Mary River between 8 and 14 miles above its confluence with the Oldman River (see Coal, Gravel, and Oyster Shell Deposits Map). Coal is exposed also within the Disturbed Belt on the Belly River and Bullhorn Coulee, and has been found in some drill holes of oil and gas explorations in the northeastern part of the Reserve. In these holes coal seams of up to seven feet were intersected at depths ranging from 167 to 924 feet from the surface.[6]

Mineable coal is confined to the uppermost shale and sandstone beds of the Oldman Formation in the Belly River group, and for this reason the coal in this area is often called Belly River Coal. The coal is classified as high volatile C bituminous, and is suitable for use as domestic fuel and as industrial steam coal. Its gross calorific value ranges from 10,000 to 11,000 B.T.U. per pound.[7]

St. Mary River Occurrences

Where coal outcrops occur along the St. Mary River, the valley is about 200 feet deep and the banks are steep (see Coal Occurrences Along St. Mary River Map). In these banks the Oldman Formation consists of shale and sandstone with coal seams only in the uppermost part. The overlying Bearpaw Formation consists of marine shales and does not contain coal. Both formations dip gently to the northwest at angles not greater than five degrees.

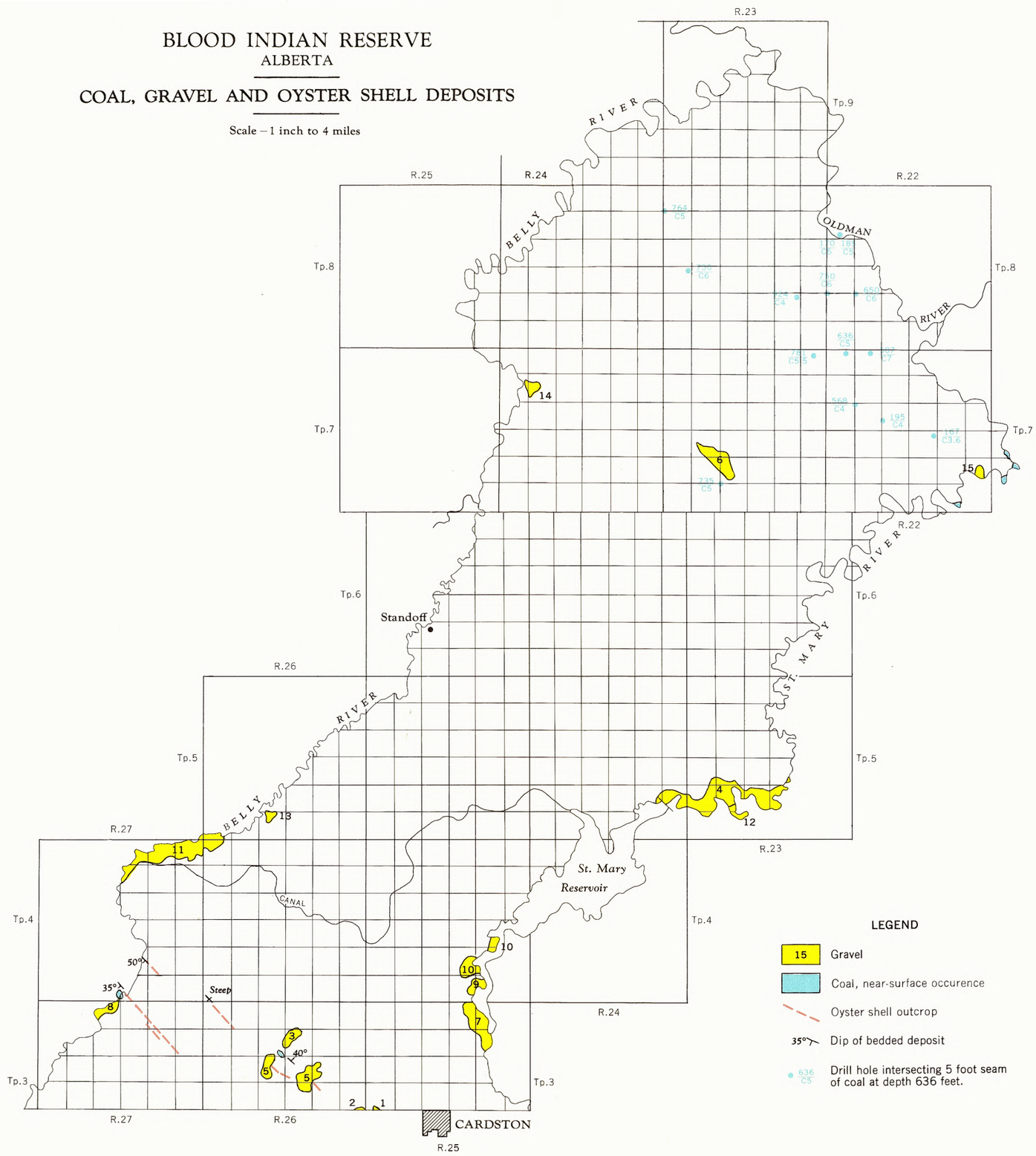
Some exposed sections of the uppermost part of the Oldman Formation reveal three or four coal seams of variable thicknesses as shown in the following cross-section. It appears that seam #1

Description of Layers	Between Locality 2 and 3	Locality 3
Overburden	20'-40'	75'
Ironstone	1'	Coal: 8''
Shale	5'	4' 8''
Coal, and shale (# 1 seam)	2' 9''	1' 7''
Shale	15' approx.	15' approx.
Coal (# 2 seam)	3' 6''	4'
Shale with fine sandstone bands	3'	3'
Coal (# 3 seam)	8"	1' 6''
Shale, greyish-green	3'	Coal continues
Ironstone-band	1'	in river bed
Shale	8' 6''	under water.
Covered	8' approx	
Coal (# 4 seam)	1' 3''	
Shale and concealed intervals	20' approx.	

BLOOD INDIAN RESERVE
ALBERTA

COAL, GRAVEL AND OYSTER SHELL DEPOSITS

Scale – 1 inch to 4 miles



LEGEND

- 15 — Gravel
- Coal, near-surface occurence
- Oyster shell outcrop
- 35° — Dip of bedded deposit
- 636 C5 — Drill hole intersecting 5 foot seam of coal at depth 636 feet.

RANGE 22

RANGE 21

BLOOD INDIAN RESERVE

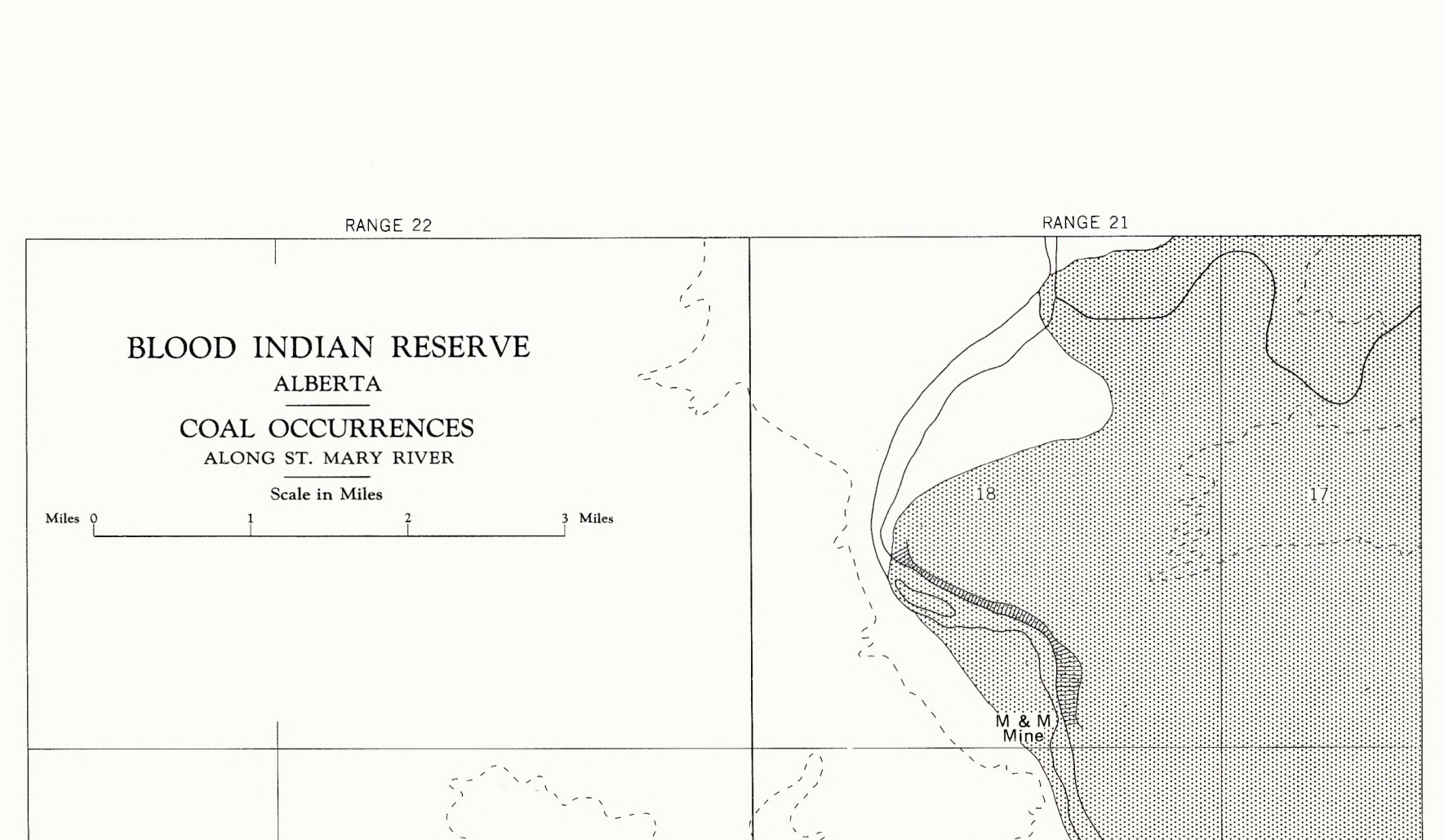
ALBERTA

COAL OCCURRENCES

ALONG ST. MARY RIVER

Scale in Miles

Miles 0 1 2 3 Miles



RANGE 22

RANGE 21

thins out to the southwest, whereas seam #2 maintains almost the same thickness, and seam #3 thickens to the southwest.

Other Occurrences

About a quarter of a mile downstream from the Hillspring Road bridge is a coal seam in the bed of the Belly River. This seam, which is visible only below the water level, appears to be over three feet wide. Like other formations in the area the seam extends in a northwesterly direction, and dips 20 degrees to the southwest.

Another seam is exposed in the bank of the Bullhorn Creek (southeast corner of sec. 28, tp. 3, rge. 26). Here the coal, which is about four feet thick, dips to the northeast at 40 degrees. The coal is interbedded with sandstone, shale and oyster shell, and is severely sheared.

Other coal outcrops have been reported for the southwestern and northeastern parts of the Reserve, but could not be located during the field work. This failure is due in part to caving of the steep banks in which they had previously been visible.

Drill holes in the northeastern part of the Reserve (tps. 7 and 8, rges, 22 and 23) reveal two coal seams separated by 10 to 20 feet of shale. The deeper and thicker seam is about 3.6 to 7 feet thick at a depth ranging from 167 to 924 feet from the surface. This seam appears to be the same as seam #2 of the St. Mary River exposures.

A study was also made from seismic shot holes and test holes drilled for oil and gas elsewhere on the Reserve. None of these holes, however, revealed any significant new coal deposits.

OYSTER SHELL

Fossil oyster shell beds are found (see Coal, Gravel, and Oyster Shell Deposits Map) in the southwestern part of the Reserve in tps. 3 and 4, rges. 26 and 27. Some good exposures lie close to the Cardston-Hillspring road between the Belly River bridge and a location five miles east of the bridge.

The oysters lived in the latter part of the Mesozoic era, and since have become part of both the Blood Reserve Formation and the overlying beds of the St. Mary River Formation. They are interbedded with fine-grained sandstone, shales and thin seams of coal. Because the oyster beds are more resistant to weathering than adjacent formations they protrude in the Disturbed Belt as elongated ridges. Discontinuity of outcrops makes it difficult to trace the beds for any distance. It appears, however, that through both faulting and folding successive ridges were formed from the same beds.

The oyster shell does not occur in sufficient, and easily accessible quantity to anticipate an industrial use, such as cement manufacture. The wider outcrops range from 10 to 20 feet in width, and the possibility of quarrying operations would be limited by the depth beyond which it becomes uneconomic.

From time to time, however, some interest has been shown in oyster shell as a source of calcium feed for poultry. Chemical analysis established that about 87 per cent of the shell consists of calcium carbonate.[8] The effectiveness of crushed shell as a calcium feed was also compared with that of imported shell in a feed experiment.[9] The results were as follows:

	Regular Oyster Shell	Fossilized Oyster Shell
Number of birds at beginning of test	550	779
Number of birds at end of test	535	766
Per cent mortality	2.7	1.6
Number of bird-days	19,543	27,800
Total oyster shell fed (grams)	88,452	116,575
Average daily consumption (grams)	4.53	4.19
Total number of eggs produced	10,482	14,657
Production per 100 birds	53	53
Total number of eggs broken	96	134
Per cent of eggs broken	0.09	0.09

On the basis of this experiment it was concluded that the palatability of fossil oyster shell is similar to that of imported shell (same average daily consumption), and also that the egg shell quality between the two calcium feeds showed no difference (same percentage of eggs broken).

GRAVEL AND SAND

Surface gravel

The surface gravel includes both glacial and post-glacial deposits. The main deposits are shown on the Coal, Gravel, and Oyster Shell Deposits Map.[10] In addition there are numerous other small pockets of gravel on the early post-glacial terraces and in the alluvium of the modern rivers. In general most of these deposits are too small and too isolated to have economic value.

Although exposed gravel deposits have supplied all local needs thus far, such deposits are not large. The only economically important deltaic gravel deposits are the few small ones in the southwestern part of the Reserve. The large delta deposits are outside the Reserve. Any glacio-fluvial gravel that may have been laid down in the northern part of the Reserve was buried by lake deposits.

Buried Gravel

This gravel is either preglacial or interglacial in origin. Preglacial gravel occurs extensively east of the Belly River in tps. 4 and 5, 8 and 9, as can be seen in the banks of the river.

This gravel is generally buried too deeply (50 to 150 feet below land surface) for economic use, and it is typically coarse. Small quantities might be obtained where it is exposed along river banks, particularly along the Oldman River in the northeastern part of the Reserve. Along the Belly River a small amount might be obtained in the north half of sec. 36, tp. 7, rge. 25. Here an outcrop 12 feet thick extends for some 500 feet along the river bank, but is overlain by 16 feet of till and 13 feet of lake and stream deposits. It is a coarse gravel, and large boulders are present three feet above its base. The gravel reported from drill holes in secs. 19 and 30 in tp. 7, rge. 23 at a depth of 25 to 50 feet is probably also preglacial in origin.

Interglacial gravel is reported from many drill holes. Some of the deposits are undoubtedly extensive, and are usually present in the same areas that are underlain by preglacial gravel. Although closer to the surface than the preglacial gravel the interglacial gravel is still too deep or the beds too thin to be useful.

Sand

There has been little demand for sand on the Reserve, though it is common and fairly well distributed. Sand is particularly prominent in the lake beds around Wild Turnip Hill. Another good source, particularly for the southwestern part of the Reserve, is the poorly consolidated sandstone formations of the bedrock.

GROUNDWATER

In most areas of western Canada data obtained from shallow wells (less than 50 feet deep) and springs show that the water-table follows closely the topography of the land surface. There is no reason why this pattern would be different on the Blood Indian Reserve. A water-table map, however shows only the horizontal component of groundwater flow and is therefore similar to a surface drainage map. The vertical movements of groundwater are of greater significance because they indicate the direction of recharge to areas with groundwater producing potential.

The direction of groundwater movement can most readily be determined from observations of water levels in wells of various depth. Areas of recharge where the movement of groundwater is downward are characterized by lower hydraulic heads as wells get deeper. This means that the static water level in a deep well will be lower than the static water level in a shallow well, provided water enters only at the base of the well. In areas of discharge where groundwater moves upward the situation is just the other way around. Here the hydraulic head increases with an increase in well depth. In an area where the groundwater movement is horizontal the hydraulic head in wells does not change with depth. Areas of groundwater discharge are, therefore, the most suitable locations for wells.

The practical value of an aquifer as a source of groundwater supply is determined by its capacity to yield water freely to wells. This capacity depends to a large extent on the material of which the aquifer is composed. Fine-grained materials, although completely saturated, retain most of their water by capillary or molecular forces. They are poor aquifers. Coarse-grained materials, on the other hand, yield a large percentage of their intergranular water and are thus good aquifers.

Unfortunately many of the wells on the Reserve are abandoned, and logs of those in use are not available. It is possible, however, to get an idea of the groundwater flow on the Reserve by analogy

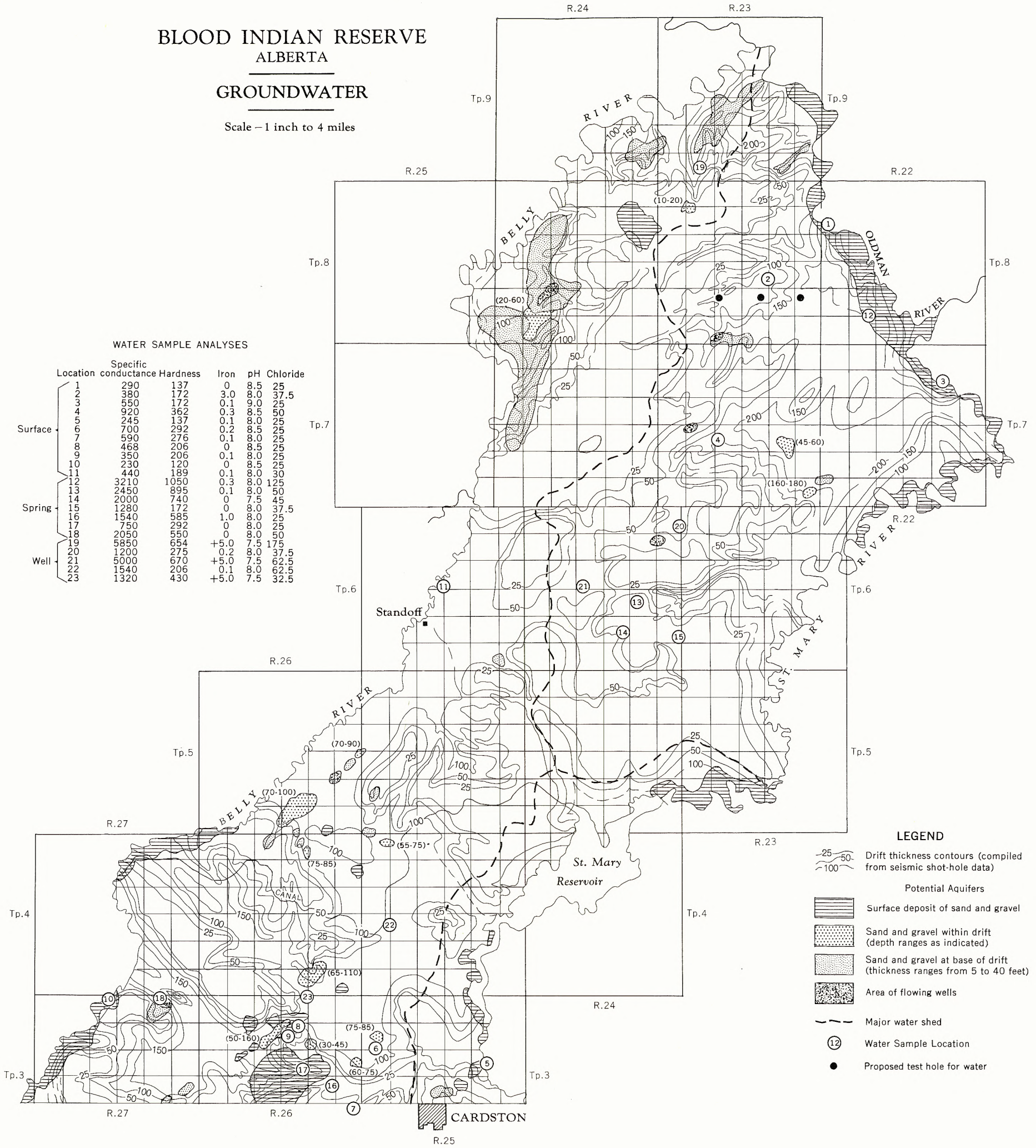
BLOOD INDIAN RESERVE
ALBERTA

GROUNDWATER

Scale – 1 inch to 4 miles

WATER SAMPLE ANALYSES

	Location	Specific conductance	Hardness	Iron	pH	Chloride
Surface	1	290	137	0	8.5	25
	2	380	172	3.0	8.0	37.5
	3	550	172	0.1	9.0	25
	4	920	362	0.3	8.5	50
	5	245	137	0.1	8.0	25
	6	700	292	0.2	8.5	25
	7	590	276	0.1	8.0	25
	8	468	206	0	8.5	25
	9	350	206	0.1	8.0	25
	10	230	120	0	8.5	25
	11	440	189	0.1	8.0	30
Spring	12	3210	1050	0.3	8.0	125
	13	2450	895	0.1	8.0	50
	14	2000	740	0	7.5	45
	15	1280	172	0	8.0	37.5
	16	1540	585	1.0	8.0	25
	17	750	292	0	8.0	25
	18	2050	550	0	8.0	50
Well	19	5850	654	+5.0	7.5	175
	20	1200	275	0.2	8.0	37.5
	21	5000	670	+5.0	7.5	62.5
	22	1540	206	0.1	8.0	62.5
	23	1320	430	+5.0	7.5	32.5



LEGEND

- Drift thickness contours (compiled from seismic shot-hole data)

Potential Aquifers

- Surface deposit of sand and gravel
- Sand and gravel within drift (depth ranges as indicated)
- Sand and gravel at base of drift (thickness ranges from 5 to 40 feet)
- Area of flowing wells
- Major water shed
- Water Sample Location
- Proposed test hole for water

with other areas of similar topography, climate, and geology.

In many ways the topography of the Reserve has the essential elements of a typical groundwater flow system (prairie profile) for western Canada.[11] The major watershed between the Belly and St. Mary Rivers is located along a central topographic high, and the Reserve is bounded on both the east and west by areas of lower elevation. Also with respect to climate and geology the Reserve conforms to the area of the typical prairie profile. The layer of glacial drift, consisting mainly of till, and the underlying beds of the Willow Creek and the upper part of the St. Mary River Formations form a zone of low permeability (see cross-section BB[1] on Bedrock Geology Map). The sandstone at the base of the St. Mary River Formation and the entire Blood Reserve Formation correspond with the lower, more permeable, layer of the prairie profile.

On the basis of this analogy, and substantiated by field observations, it appears that the direction of groundwater movement on the Reserve is downward (recharge areas) near the major watersheds (see Groundwater Map), then lateral through a transition zone composed of the sandstone of the lower St. Mary River and the Blood Reserve Formations, and finally upward in the discharge areas. A groundwater flow near the surface is indicated by the presence of springs (see Groundwater Map) and perennial surface streams, such as Prairie Blood Coulee and Layton Creek, which originate from spring flows. An artesian well in the Belly River flats (near Stand Off) at a depth of 50 feet indicates the presence of a zone of groundwater discharge.

Groundwater Potential in Bedrock

The best potential bedrock aquifers underlying the Reserve are the sandstone layers within the lower part of the St. Mary River Formation and the entire Blood Reserve Formation. The latter is of particular interest because of the uniformity of grain size and of rounding of the particles.[12]

It is not known whether wells on the Reserve have penetrated these formations, but there is evidence outside the Reserve that they contain water.[13] As a result of low permeability, however, the Blood Reserve Formation may have a low yield. Nevertheless exploration of the sandstone beds of both the Blood Reserve Formation and the lower of the St. Mary River Formation is warranted.

Groundwater Potential in Surficial Deposits

Sand and gravel layers within surficial deposits have a potential as aquifers, provided they are located within the flow system. Aquifers within recharge areas are least desirable.

Gravel and sand at the base of drift.– The flowing wells encountered during seismic drilling indicate that deposits of sand and gravel at the base of the drift (see Groundwater Map) are good aquifers. An extensive area of such deposits exists east of the Belly River and 12 miles north of Stand Off. It lies within the zone of upward groundwater flow, and is indeed the most favourable area for groundwater on the Reserve.

Another area with gravel deposits at the base of the drift is in the north end of the Reserve. It is likely that also here the groundwater flow is upward. Other localities with sand and gravel at the base of drift are shown on the Groundwater Map. They are small in area and consequently limited in value as potential aquifers. The Groundwater Map also shows drift thickness contours, which reveal the depth to be drilled before the base of the till is reached.

Gravel and sand within drift.- These deposits are limited in area. Although it is possible that deposits of this kind are more extensive than is revealed in seismic shot holes, they do not appear at present to be major potential sources of groundwater.

Surface deposits of gravel and sand.– The valleys of the Belly and St. Mary Rivers contain gravel and sand from which supplies of groundwater could be readily obtained. Although these deposits are close to an abundance of surface water there are advantages in developing them as a source of groundwater. A properly constructed well or infiltration gallery within gravel and sand deposits adjacent to a river eliminates the problem of ice damage to pipe line intakes in the river, and also reduces the hazard of contamination to which surface water is prone.

On the high ground of the Reserve are also some gravel and sand deposits that may be developed to yield small quantities of groundwater. One of these deposits is located beside the Bullhorn Creek just south of Hillspring Road. Springs issuing water from the base of this deposit indicate that it is saturated at least to some extent.

Yield of Aquifers

It is not possible to make a definite statement as to the probable yield of potential aquifers on the Reserve without quantitative data from wells. It has been established, however, that in other areas of western Canada, where conditions of climate and geology are similar to those of the Reserve, the amount of withdrawal by pumping is in excess of the

amount replenished to an aquifer by natural recharge. Under such conditions continued withdrawal from an aquifer will ultimately deplete its water supply. The time required for depletion depends on the pumping rate and the size and hydrologic characteristics of an aquifer.

Many domestic wells in western Canada that have been developed either in surficial materials or in bedrock commonly yield 10 gallons per minute, and it is likely that wells on the Reserve are capable of yielding about the same amount. Such wells are entirely adequate for domestic consumption and the watering of several hundred head of cattle. Wells of higher yields might be developed from gravels within the valley of the preglacial Belly River, but it is unlikely that any of the potential aquifers are capable of supplying sufficient water for industrial or large-scale irrigation purposes.

Quality of Groundwater[14]

For chemical properties the water on the Reserve is compared with a standard for drinking water established by the Public Health Service of the United States of America (Table 20). This standard includes more components than those for which the water on the Reserve is analysed, but as a preliminary evaluation the comparison will be adequate.

It is apparent that the quality of water from the major streams exceeds the requirements of good drinking water, and that the quality of water from minor streams comes close to those requirements. Water from wells is the most highly mineralized and ranks low in quality. Although this water is poor for human use it may be entirely satisfactory for livestock. Range cattle in the western United States drink water containing 5000 p.p.m. (parts per million) dissolved solids, and have become accustomed to drinking water with 10,000 p.p.m. dissolved solids.[15]

Table 20.– Comparison of Standards of U.S.A. Public Health Services for Drinking Water with Water on Blood Indian Reserve, 1962

Components	Standards U.S.A. Public Health Service	Blood Indian Reserve[a]			
		Major Streams	Minor Streams	Springs	Wells
		parts per million			
Total dissolved components[b]	500 (good)	140 to 360	245 to 600	130 to 2100	780 to 3800
	1000 (fair)				
Calcium and magnesium (hardness)	200 (good)	115 to 190	170 to 375	170 to 1100	200 to 660
Iron and manganese[c]	0.3	0 to 0.11	0.1 to 3.0	0.1 to 1.0	0.1 to 5.5
Chloride	250	25 to 30	25 to 50	27 to 125	37 to 190

a. The location and analyses of each sample taken are given on the Groundwater Map.

b. Values of total dissolved solids for samples from the Reserve were assumed to be 65 per cent of their specific conductance value.

c. Values shown for the Reserve pertain to iron only. The high iron content of well water may in part be due to oxidation of the steel well casing.

NOTES

1. This chapter was compiled by Dr. A.B. Irwin (Indian Affairs Branch) from material supplied by Dr. A. MacS. Stalker (surficial geology survey, 1962), Dr. J.S. Scott (groundwater survey, 1962), Mr. B.A. Latour (coal survey, 1961), Dr. R.T.D. Wickenden and Mr. R.L. Cox (interpretation of logs of petroleum exploration bore holes), Shell Canada Ltd. (Timber Limit), Dr. S.B. Slen (poultry feed experiment), as well as from information gathered during his own fieldwork, and a compilation of seismic shot-hole data carried out under his direction.

   Unless otherwise mentioned all maps for this publication were prepared by the Cartography Section of the Canada Department of Agriculture, Ottawa.

   The general geological features of the Reserve are only summarized. Those who are interested in a fuller treatment should obtain the publications listed as references. Except for two sections which deal with the subsurface geology of, and oil and gas development on the Timber Limit (Blood Indian Reserve 148A), this chapter has been confined to the main Reserve. Although the meaning of some technical terms will be clear in the text, a glossary of such terms is added at the end of the chapter.
2. Also called Spring Coulee arch.
3. For a detailed discussion of the glaciations, see Stalker (Paper 63-25).
4. As many as six different Laurentide and four different Cordilleran tills have been recognized.
5. Two wells, the Northland National Blood, Nos. 1 and 2 (5 and 6 on Oil and Gas Map) were drilled on the Spring Coulee arch in 1952 and '53. These wells produced small amounts of oil from the Rundle group at irregular intervals from 1953 until '58. They were plugged and abandoned in 1961. Another partially successful attempt to produce oil was made in 1957 and '58 when the Pan American wells (10 and 11 on Oil and Gas Map) were drilled on the same arch about 7 miles northwest of the Northland National wells. The A–1 well produced 48 barrels of oil from the Rundle group during its initial 24-hour test, and averaged 20 barrels of oil a day during a period of over one month. The A–2 well was less successful. Production from the A–1 well slowed down until it was suspended in September 1958; both wells were plugged and abandoned in 1960.
6. Russell (1932) has given an excellent record of the formations penetrated during drilling by Associated Securities Ltd. (Commonwealth Petroleums Ltd.) in 1929. From electric logs during drilling in this area by Imperial Oil in 1957 it was also possible to determine layers of coal.
7. Analysis of coal from the area carried out by the Alberta Research Council:

Proximate	
Moisture	10.5 per cent
Ash	13.0 " "
Volatile matter	34.9 " "
Fixed carbon	41.6 " "
Ultimate	
Sulphur	0.7 per cent
Gross calorific value	10,620 B.T.U. per lb.
Classification (A.S.T.M.)	High Volatile C Bituminous

8. Analysis by Provincial Analyst for Alberta (1960):

Silica	4.11 per cent
Iron and aluminum oxides	3.16 " "
Calcium carbonate	87.76 " "
Organic matter	0.83 " "

9. The experiment involving altogether over a 1000 birds was conducted at the Research Station of the Canada Department of Agriculture under direction of Dr. B.S. Slen. It lasted from May 30 to July 3, 1963, and was requested by the Indian Affairs Branch.
10. For a full description of these deposits see Stalker (1963). The numbers of the deposits shown on the Coal, Gravel, and Oyster shell Deposits Map correspond to those of descriptions given in the Appendix of Stalker's publication.
11. Meyboom (1962) studied the groundwater movement in the headwater region of Qu'Appelle River (Saskatchewan), and described a typical groundwater flow system (the "prairie profile") for western Canada. It "... consists of a central topographic high bounded at either side by an area of lower elevation. Geologically the area is made up of two layers of different permeability, the upper layer having the lower permeability. Through the profile is a steady flow of groundwater from the area of recharge to the area of discharge. The ratio of permeabilities is such that groundwater flow is essentially downward through the material of low permeability and lateral and upward through the underlying more permeable layer."
12. *Cf.* Sanderson (see References).
13. The Spring Coulee well (sec. 15, tp. 4, rge. 23), about 14 miles northeast of Cardston, penetrates the St. Mary River and the Blood Reserve Formations. The Milk River Formation, which is similar to the Blood Reserve Formation, forms an artesian aquifer in the area centered about Foremost, about 70 miles east of the Reserve. *Cf.* Yarwood (1931) and Meyboom (1960, 1962).
14. Although biological properties, such as bacterial count, are of crucial importance, they are more appropriately dealt with in a health report.
15. *Cf.* Hem (1959).

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GLOSSARY OF TERMS

Alluvium	Material deposited by streams.
Anticline	Beds of rock arched to incline away from each other.
Artesian well	A well in which water rises above the water bearing formation.
Bedrock	Solid rock exposed at surface or covered by loose material.
B.T.U.	British Thermal Unit, a measure of the heating quality of a fuel.
Cuttings samples	Samples cut by the rock bit during the drilling of a well and recovered from the circulating drilling fluid.
Dip	The angle at which a bed of rock is inclined below the horizontal.
Drift	Material such as boulders, gravel, sand or clay which has been transported by glaciers.
Fault (faulting)	A break or tear in the earth's crust.
Fold (folding)	A bend in a bed of rock.
Inwash	Alluvium deposited by a non-glacial stream at the margin of a glacier.
Lacustrine deposit	Deposit in a lake.
Lithology	The study of the physical characteristics of rocks; also used for description of characteristics of rocks.
Outwash	Drift washed out beyond the glacier by a stream.
Proglacial lake	A lake occupying a basin in front of a glacier, generally in direct contact with the ice.
Seismic shot holes	Shallow holes which are drilled and exploded with dynamite for seismic surveys.
Subsurface geology	The study of rock formations below surface.
Surficial geology	The study of rock material lying above bedrock.
Syncline	A fold in a bed of rocks in which the bedding dips inward from both sides.
Strike	The direction of a horizontal line on an inclined bed of rock.
Terrace	An elevated plain which was at one time a river valley.
Till	A heterogeneous mixture of clay, silt, sand and stones, which has been deposited by a glacier. Sometimes called boulder clay.
Thrust fault	A fault in which a horizontal slice of the earth's crust moves up and over another part of the crust.
Vuggy porosity	Porosity caused through natural cavities in rocks.
Watershed	The divide from which the natural drainage of a district flows in opposite directions; or the area contained within a drainage divide.

VII. SOILS

The kind of soil that has formed at any one place is the result of climate and organisms, such as vegetation and microorganisms, acting on parent geological material. Two other factors help to determine the kind of soil that forms. They are the topographic position, which affects drainage, and the length of time these various soil forming factors have been at work. Each of the soil forming factors varies in degree from place to place, and consequently soils vary from place to place.

Detailed discussions of the kind of geological material (also its age and thus the length of time soil formation has proceeded), vegetation and climate are given separately in this report. As far as these factors are concerned only a few supplementary comments, specifically related to the kind of soils that formed, are added here.

Most of the parent geological materials (chapter VI) on the Reserve have a clay loam or finer texture, and are moderately to strongly calcareous. For the most part the soils developed under a mixed-grass prairie type of vegetation (chapter VIII). Grass feeds heavily on minerals and its residue decomposes fairly slowly. As a result a surface layer (A horizon) high in organic matter and available minerals has been formed over a long period of time. The soils in the southern part of the Reserve are darker than those in the north, which reflects differences in vegetation and in climate (chapter V) between the two areas.

With regard to topography most of the Reserve can be described as level to undulating (Table 21 and Soil and Topography Map), although small areas of gently rolling land occur throughout. There are two main areas of hilly and rolling land: one is in the southwestern portion of the Reserve, and the other stretches from Mokowan Butte -- the most prominent topographic feature on the Reserve -- in a southeasterly direction to the St. Mary River. The Reserve is on the whole adequately drained by small intermittent streams which flow into the rivers surrounding the Reserve for the most part. There are consequently very few soils that show characteristics of poor drainage.

CLASSIFICATION OF SOILS

For general description purposes the grassland region of the prairies has been divided into soil zones which correspond to climatic and vegetation zones. The Brown soil zone lies in the semi-arid southeastern corner of Alberta. Moving from this corner north and west towards areas where precipitation is getting higher one passes through the Dark Brown soil zone, the Thin Black soil zone, and finally the Black soil zone which is in the most humid part of the grassland region. The boundary between the Dark Brown and the Thin Black soil zones passes through the Reserve from Mokowan Butte in a southeasterly direction to the St. Mary River (see Soil and Topography Map). Although recognition of the soil zones is useful in a general sense it should be clear that they are not part of but rather a supplement to the soil classification system customarily used. This system as it has been used for the soils on the Reserve will be briefly discussed.

In classifying the soils on the Reserve the basic mapping unit used is the soil series. A soil series is a group of soils each of which, except for the texture of the surface horizon, has similar horizons, and also a similar arrangement of horizons. All soils in the group developed from the same kind of parent material. In most cases soil series are named after the place where they were first mapped, but they can

Table 21. – Acreages of Topographic Classes, Blood Indian Reserve

Topography	Slopes	Acreage	Per Cent of Total Area
Level to undulating	less than 4 per cent	232,000	67.3
Gently rolling	4 to 8 per cent	57,000	16.6
Rolling	8 to 15 per cent	22,300	6.5
Hilly	more than 15 per cent	10,000	2.9
Rough broken land adjacent to stream courses		21,500	6.2
Sloughs		1,700	.5
Total		344,500	100.0

BLOOD INDIAN RESERVE
ALBERTA

SOILS AND TOPOGRAPHY

Scale – 1 inch to 4 miles

SOILS *

CHERNOZEMIC SOILS

DARK BROWN

- Moderately coarse textured
- Medium textured
- Moderately fine textured

THIN BLACK

- Medium textured
- Moderately fine textured

SOLONETZIC SOILS

SOLODIZED SOLONETZ

- Medium textured

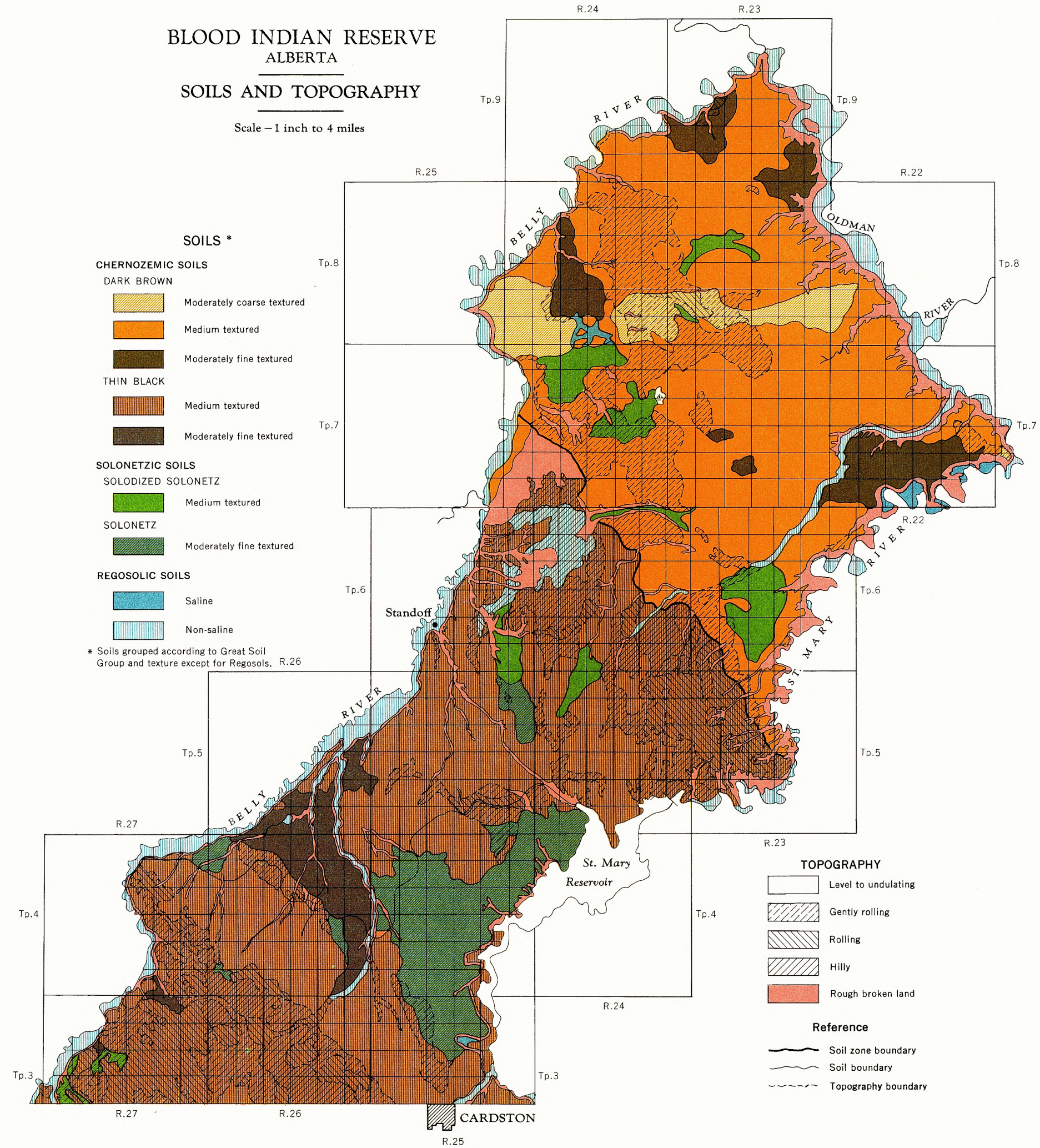
SOLONETZ

- Moderately fine textured

REGOSOLIC SOILS

- Saline
- Non-saline

* Soils grouped according to Great Soil Group and texture except for Regosols.



TOPOGRAPHY

- Level to undulating
- Gently rolling
- Rolling
- Hilly
- Rough broken land

Reference

- Soil zone boundary
- Soil boundary
- Topography boundary

be found also in other locations. Usually two or three soil series occur so closely together that it would be difficult to map them separately. In such a case they are mapped as one area and the name of each of the soil series, together with the percentage of the total area each occupies, is recorded in that area on the map (see Soil and Topography Map in folder). Because very little variation is allowed within any one soil series in their characteristics, the production potential under the same management does not vary greatly for soils within a series, regardless of where they are located. Detailed descriptions of the soil series, together with the results of chemical and physical analyses pertaining to some of these, are given in the appendix to this chapter.

There are major characteristics that are common to more than one series. It is possible, therefore, to arrange soil series into groups on the basis of these common characteristics. In accordance with the accepted soil classification procedure the series mapped for the Reserve were first grouped by profile types, and these types in turn grouped under four major orders (Table 22). These orders are called (1) Chernozemic Soils, (2) Solonetzic soils, (3) Gleysolic Soils, and (4) Regosolic Soils. A brief description of the distinguishing features of each will be appropriate at this point.

1. Chernozemic Soils. – Soils belonging to this order have formed mainly under grass vegetation from non-saline parent material. They are well to imper-

Table 22. – Acreages of Soil Orders, Profile Types, and Soil Series, Blood Indian Reserve

Order	Acres	Profile Type	Acres	Series	Acres
Chernozemic	262,400	Orthic Black	5,900	1. Dunvargan Loam and Clay Loam	5,900
		Orthic (thin) Black	138,000	2. Leavitt Loam and Clay Loam	62,300
				3. Cardston Silt Loam and Silty Clay Loam	51,200
				4. Standoff Silt Loam and Silty Clay Loam	21,200
				5. Pincher Silty Clay Loam	3,000
				6. Ferintosh Loam and Sandy Loam	300
		Eluviated (thin) Black	1,400	7. Bullhorn Silty Clay Loam	1,400
		Orthic Dark Brown	107,100	8. Lethbridge Loam and Silt Loam	57,500
				9. Readymade Loam and Silt Loam	38,500
				10. Coaldale Silty Clay Loam	4,000
				11. Carmangay Sandy Loam	7,000
				12. Scollard Loam	100
		Calcareous Dark Brown	10,000	13. Brocket Clay Loam, Silt Loam, and Silty Clay Loam	10,000
Solonetzic	39,200	Dark Brown Solodized Solonetz	10,000	14. Keho Silt Loam	2,000
				15. Parr Loam	8,000
		(thin) Black Solodized Solonetz	6,600	16. Ninastoko Clay Loam	4,500
				17. Twining Silt Loam	2,100
		(thin) Black Solonetz	22,600	18. Horn Silty Clay Loam	6,000
				19. Mami Clay Loam	16,500
				20. Oxley Loam	100
Gleysolic	1,500	Humic Eluviated Gleysol	1,500	21. Tempest Silt Loam	1,500
Regosolic	18,200	Orthic Regosol	17,100	22. Mokowan Clay Loam (Calco-Regosol)	3,600
				23. Alluvium	13,500
		Saline Regosol	1,100	24. Unnamed	1,100
Erosion and Sloughs	23,200				
Total Reserve Area	344,500				

fectly drained. The surface horizon of these soils is dark brown to black, and their subsoil is usually fairly friable.

2. Solonetzic Soils. – These soils have formed under a vegetation cover of grasses and forbs on saline parent material. Those on the Reserve are imperfectly drained. The surface horizon is loose, usually dark brown to black in colour. The subsurface layers are hard and stained, and have a columnar structure. The surface of the columns is usually dark coloured.

3. Gleysolic Soils. – Soils of this order are formed in areas where drainage is poor. As a result of a high or fluctuating water table the subsoil has a dull bluish colour and is often mottled with red and yellow spots. The Gleysolic soils on the Reserve have a thin dark coloured surface horizon lying over a gray leached layer.

4. Regosolic Soils. – These soils are young (immature) and have not yet developed a clearly discernible profile.

About 76 per cent of the soils on the Reserve belong to the Chernozemic Order, and 11 per cent belong to the Solonetzic Order. The Thin Black zone contains about 55 per cent of the Chernozemic Soils, 75 per cent of the Solonetzic Soils, and 65 per cent of the Regosolic Soils. The small acreage of Gleysolic Soils mapped is entirely in the Dark Brown zone.

In addition to arranging soil series within orders according to profile types one can arrange them also according to soil texture, which is useful from a management point of view. An arrangement of the Reserve soils on this basis shows that most of them have a medium or finer texture (Table 23). On the whole the moisture holding capacity of the Reserve soils is therefore good. The location of the various textural groups is shown on the Soil and Topography Map at a scale of 4 miles to 1 inch (p. 85).

When soil survey results, such as those determined for the Reserve, are known it is then possible to interpret this information for practical purposes. For this report two such interpretations have been made: one is a productivity rating of the soils, and the other deals with irrigation possibilities.

Table 23. – Acreages of Soil Series Classified by Soil Order and Texture, Blood Indian Reserve

Order	Series						Other Soils
	Moderately Coarse Texture		Medium Texture		Moderately Fine Texture		
	Name	Acres	Name	Acres	Name	Acres	
Chernozemic 262,400 acres.....			Lethbridge L. SiL.	57,500	Coaldale SiC L.	4,000	
			Scollard L.	100	Brocket CL.SiL.SiCL.	10,000	
			Readymade L. SiL.	38,500	Pincher SiCL.	3,000	
			Standoff SiL. SiCL.	21,200	Bullhorn SiCL.	1,400	
			Ferintosh L. SL.	300	Dunvargan L. CL.	5,900	
			Leavitt L. CL.	62,300			
			Cardston SiL. SiCL.	51,200			
	Carmangay SL.	7,000	Total	231,100	Total	24,300	
Solonetzic 39,200 acres.....			Keho SiL.	2,000	Ninastoko CL.	4,500	
			Parr L.	8,000	Horn SiCL.	6,000	
			Twining SiL.	2,100	Mami CL.	16,500	
			Oxley L.	100			
			Total	12,200	Total	27,000	
Gleysolic 1,500 acres.....			Tempest SiL.	1,500			
Regosolic 18,200 acres.....	Alluvium	13,500	Mokowan CL.	3,600			1,100 (saline)
Erosion and Sloughs 23,200 acres.....							23,200
Total Reserve Area 344,500 acres.....		20,500		248,400		51,300	24,300

Abbreviations: SL. – Sandy Loam; L. – Loam; SiL. – Silt Loam; SiCL. – Silty Clay Loam; CL. – Clay Loam; L.SiL., for instance, reads Loam and Silt Loam.

Table 24. – Acreages of Land Classes with Average Wheat Yields, Blood Indian Reserve

Land Class	Average Wheat Yield Per Acre [a]	Acres	Percentage of Reserve Area
Good to very good arable	20 to 28 bushels	40,400	11.7
Fairly good to good arable	16 to 20 "	123,100	35.7
Fair to fairly good arable	12 to 16 "	88,900	25.8
Poor to fair arable	less than 12 "	44,400	12.9
Pasture (should be left in native state)		22,900	6.7
Very poor pasture (eroded land)		24,800	7.2
Totals		344,500	100.0

a. Long-term yields.

LAND PRODUCTIVITY RATING

The natural ability of a soil to produce depends not only on the chemical and physical characteristics of the profile but also on factors such as stoniness, topography and precipitation. On the basis of all these factors the soils of the Reserve have been grouped into six land classes which range from good to very good arable to very poor pasture (Table 24 and Land Class Map). The wheat yields given in Table 24 are obtainable under average management and average weather conditions. Under very good management the expected yields will be higher; and the rating of some arable areas may be raised if they are used for certain specialized crops for which they are well suited. The productivity of land used as range for raising cattle is discussed in the next chapter.

Land classed as poor to fair arable is marginal for the growing of field crops, but even without this class there is still almost 75 per cent of the Reserve available for cultivation.

IRRIGABLE LAND

Four areas where irrigation appears suitable have been delineated, and are shown on the Possible Irrigable Areas Map.

Area 1. – The soils in this area are ideal for irrigation. They are deep, free from salts, and have a suitable texture. The topography is also ideal, and it is close to the diversion canal. If and when irrigation is contemplated this area should be considered first.

Area 2. – Here the soils are fairly deep, free from salts, and have a suitable texture. The topography is somewhat rougher than that in Area 1. Although the soils are rated as good for irrigation the area is a considerable distance from the diversion canal.

Area 3. – The soils have a suitable texture but lime carbonate is rather close to the surface and may have a harmful effect on crop growth. Although some of the topography is fairly rough for irrigation the slopes are uniform. This area is a considerable distance from the diversion canal, and in view of the lift, pumping from the Belly and Oldman Rivers will be expensive.

Area 4. – The soils in this area are fine textured, have some salts, and are fairly deep. The topography is gently sloping to very gently undulating. This area could be serviced readily from the nearby diversion canal, but the fine texture and the possible development of saline conditions may ruin an area that is now well suited for dry-land farming.

Important Consideration

Areas 1, 2 and 4 are now used for dry-land farming, and are well suited for that purpose. Area 3 is still in native pasture and it is advisable to leave it as such for the time being (but under controlled grazing).

If irrigation farming were desired on the Reserve one should give consideration to the development of a pilot irrigation project in Area 1. This project might be 2,000 to 3,000 acres in size, and should run at least 10 years before another irrigation development is started. During this period crops suitable for irrigation can be determined, and the best irrigation methods can be demonstrated to a selected group of interested Indian farmers. This group will provide a nucleus of trained personnel to aid in any possible future expansion of irrigation.

Another purpose of the pilot project is to determine the advantages and disadvantages of irrigation and to weigh them against those of dry-land farming.

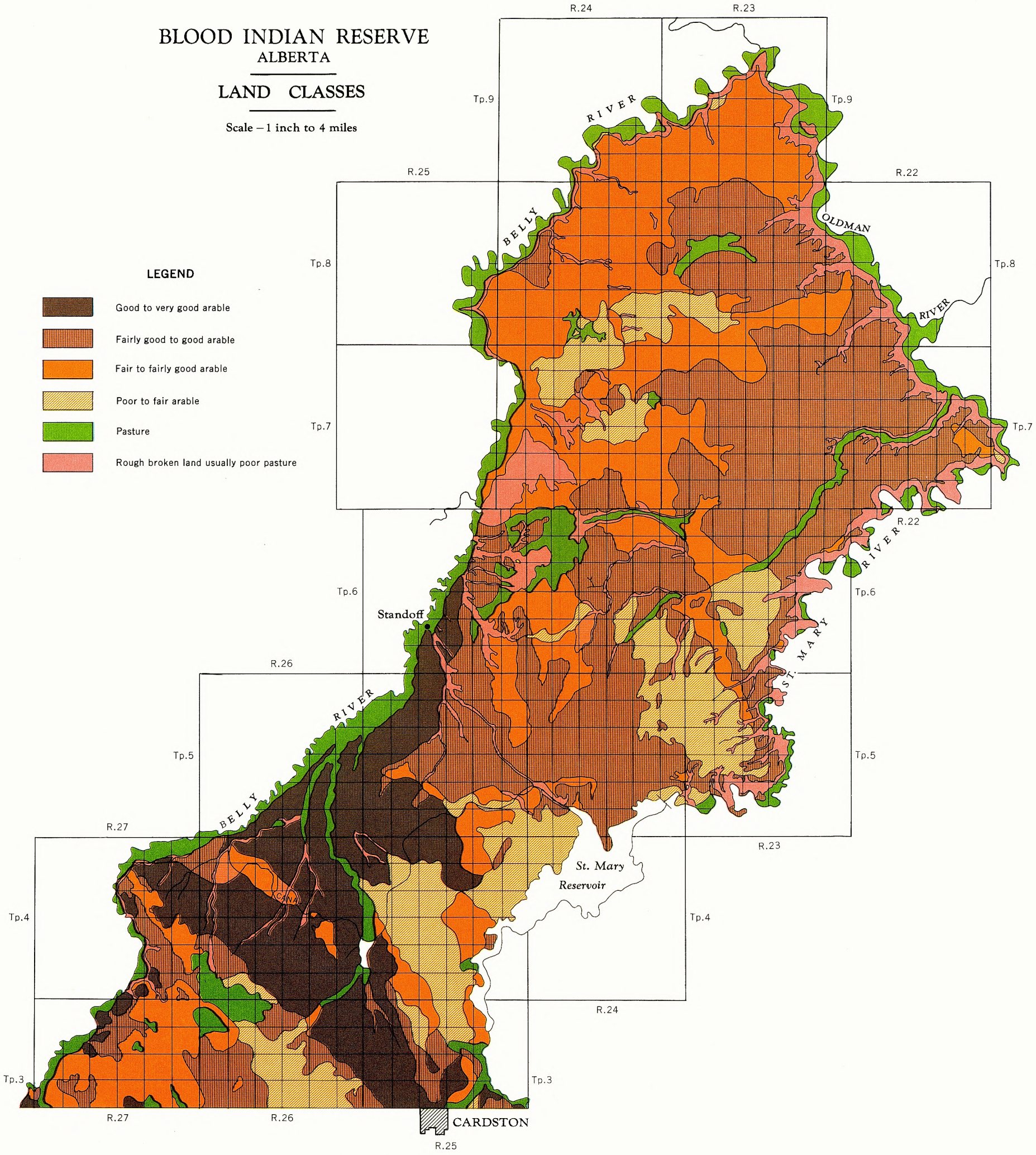
BLOOD INDIAN RESERVE
ALBERTA

LAND CLASSES

Scale – 1 inch to 4 miles

LEGEND

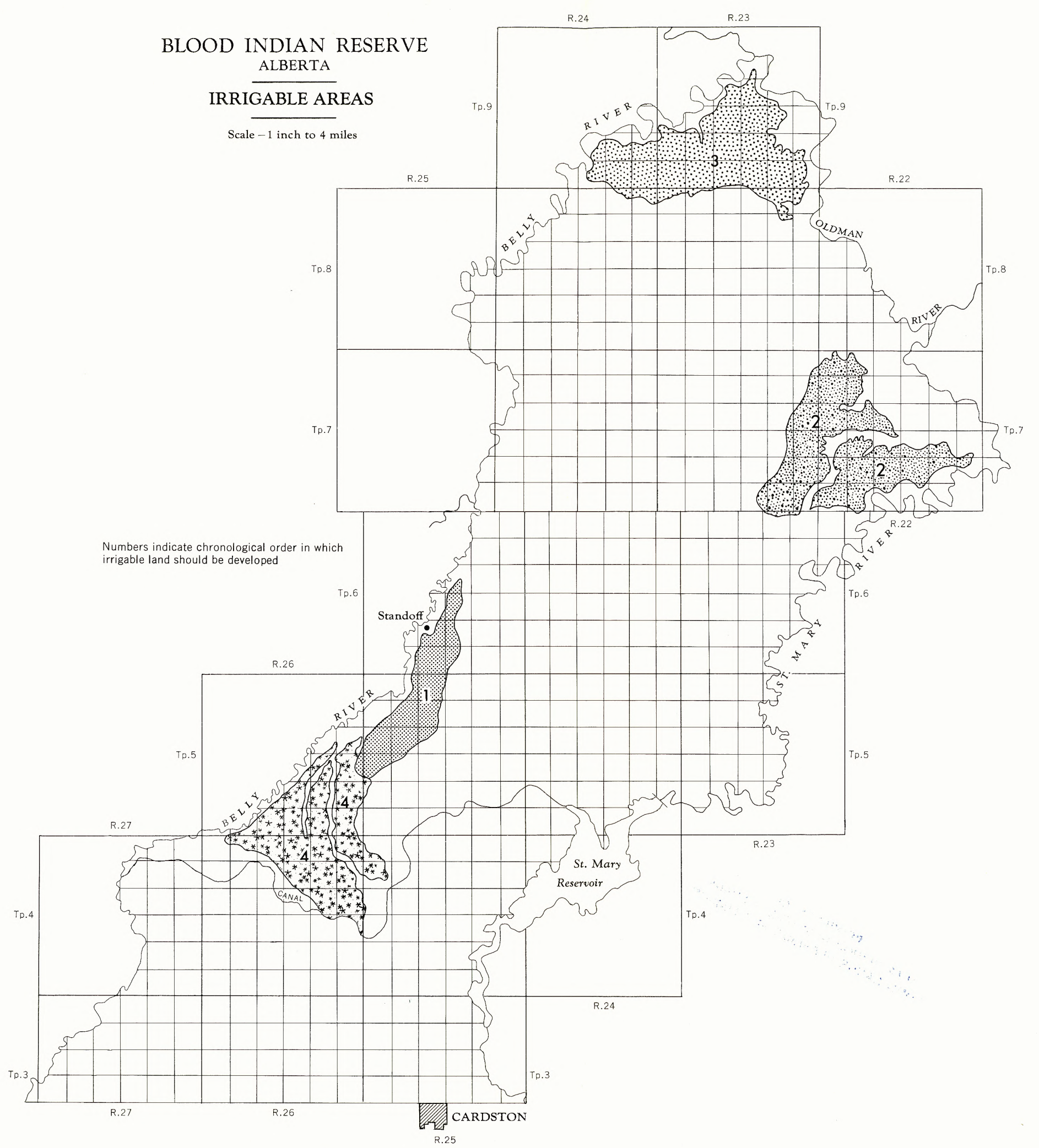
- Good to very good arable
- Fairly good to good arable
- Fair to fairly good arable
- Poor to fair arable
- Pasture
- Rough broken land usually poor pasture



BLOOD INDIAN RESERVE
ALBERTA

IRRIGABLE AREAS

Scale – 1 inch to 4 miles



Numbers indicate chronological order in which irrigable land should be developed

Areas 1 and 4 usually receive sufficient precipitation to produce good crops by dry-land farming, and in such cases any additional returns from irrigation may not be worth the additional work and capital investment. Irrigation would only supplement the rainfall during years of low precipitation. Should the pilot project prove, however, that irrigation on the Reserve can be profitable, and that Blood Indian farmers can become successful irrigation farmers, then steps could be taken to form an irrigation district which might be administered by the St. Mary and Milk Rivers Irrigation District (SMRD). Before embarking on such a development a soil survey more detailed than the present one should be undertaken for the proposed areas. One should also consider proximity to market. In this regard Area 2 is closer to Lethbridge than any of the other areas which is a distinct advantage.

The importance of sound management practices in irrigation farming must be emphasized. If a soil is not irrigated properly it may soon be ruined for plant growth, and it is extremely difficult to rehabilitate such soils. Competent direction of the pilot project is, therefore, essential, and close supervision should be provided if and when irrigation farming were to be adopted by individual farmers. For the same reason the development of small irrigated pastures and gardens which usually result in careless handling of water and damage to surrounding land, should not be undertaken for the time being.

APPENDIX

A. DESCRIPTION OF SOIL SERIES

A description of a soil consists mainly of descriptions of its horizons. A horizon may be defined as a layer of soil, approximately parallel to the soil surface, and with characteristics (that distinguish it from other horizons in the profile) formed by soil forming processes. On examining a fresh road cut one may distinguish a series of such layers from the surface down to the underlying unaltered parent material. Such a section is called a soil profile. There are three main horizons in a soil profile, which, starting from the surface, are designated as A, B, and C horizons.

1. A horizon.– This horizon formed at or near the surface where maximum removal of materials in solution and suspension, and/or maximum accumulation of organic matter, has taken place.

2. B horizon.– This is a mineral horizon which is characterized by enrichment of silicate clays, iron, aluminum, and/or organic matter. It may have a prismatic or columnar structure characterized by the presence of exchangeable sodium.

3. C horizon. – This horizon has remained comparatively unaffected by the soil forming processes that have operated in the A and B horizons, except for the effects of a fluctuating water table (Gleysolic Soils), and the accumulation of some salts soluble in water.

One should not think that soil horizons are always clearly visible, even for the trained eye. These horizons may be poorly developed, as in recent river deposits. There is often a gradual transition from one horizon to the next.

Horizons can be subdivided, and the following suffixes are used to indicate characteristic features:

ca – a horizon with an accumulation of carbonates:
e – a horizon characterized by the removal of clay, iron, aluminum, or organic matter; it is usually lighter in colour than the layer below;
g – a horizon characterized by reduction; it has a gray colour and is often mottled;
h – a horizon enriched with organic matter;
j – a horizon with characteristics that are weakly expressed;
k – a horizon in which carbonates are present;
m – a horizon slightly altered by hydrolysis, oxidation, and/or solution to give a change in colour and/or structure;
n – A horizon in which the ratio of exchangeable calcium to exchangeable sodium is 10 or less. When used with B it must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry.
p – a layer disturbed by man's activities;
sa – a horizon with an accumulation of salts more soluble than carbonates;
s – indicates the presence of salts, including gypsum;
t – a horizon enriched with silicate clay.

The following descriptions of the soil series start with the designation of the horizon, then the approximate average depth of each horizon in inches from the surface, and finally the observable characteristics and pH.

ORDER: CHERNOZEMIC SOILS

Profile Type: Orthic Black

1. Dunvargan Loam or Clay Loam (Dr.L.CL.)

Ah	0-10"	Very dark brown (10YR 2/2) clay loam; weak prismatic to granular; pH 6.3.
Bm	10-22"	Brown (10YR 5/3) clay loam; prismatic to weak subangular blocky; pH 6.2.
Cca	at 22"	Light brownish gray (10YR 6/2) clay loam; weak prismatic to weak subangular blocky; pH 7.7.
Ck	at 30"	Light brownish gray (10YR 6/2) clay loam till; massive to weak subangular blocky; pH 7.8; strongly calcareous.

This Orthic Black soil developed on till. It is a well drained soil found on rolling to hilly topography. Stones may be found throughout the profile. The prismatic structure of the Bm horizon may extend into the lower Ah horizon. On the Reserve these soils are confined to the southwest half where the moisture regime is more favourable than that for the surrounding soils. The soil is rated as very good arable if on suitable topography. It is usually found, however, on rolling to hilly topography, and where this is the case its arability rating is only fair to fairly good. These soils support an excellent stand of grass for grazing purposes.

Profile Type: Orthic (thin) Black

2. Leavitt Loam or Clay Loam (Lv.L.CL.)

Ah	0- 6"	Very dark brown to very dark grayish brown (10YR 2/2-3/2) loam to clay loam; weak prismatic to granular; pH 6.4.
Bm	6-15"	Dark grayish brown (10YR 4/2) clay loam; prismatic to weak subangular blocky; pH 6.7.
Ck	at 15"	Light brownish gray (10YR 6/2) clay loam; massive appearance with some subangular structured till; often containing pink and green fragments of the Willowcreek geological formation; pH 7.6; Strongly calcareous.

This well drained Orthic (thin) Black soil developed on till. Stones may be found throughout the profile, but they occur most frequently in the C horizon. The soil structure is friable throughout the profile. There is very little increase in the clay content of the B horizon. These soils are usually located on gently rolling to hilly topography. On gently rolling topography they rate as fairly good to good arable. They support an excellent stand of grass for grazing.

3. Cardston Silt Loam or Silty Clay Loam (Ct. SiL.SiCL.)

Ah	0- 6"	Very dark grayish brown (10YR 3/1) silt loam to silty clay loam; loose prismatic to granular; pH 6.6.
Bt	6-16"	Dark grayish brown to dark brown (10YR 4/2-4/3) silty clay loam; prismatic to strong subangular blocky, quite hard; pH 6.4.
Ck	at 16"	Light brownish gray (10YR 6/2) silty clay; weak prismatic to weak subangular blocky; pH 7.8.
Cca	at 30"	Grayish brown to light brownish gray (10YR 5/2-6/2) silty clay; till; pH 7.8; moderately calcareous.

This well drained Orthic (thin) Black soil developed on sorted till. The Cardston Silty Clay Loam has a discernable transitional horizon between the A and B horizons, which usually has a prismatic to small subangular blocky structure, and a clay texture. In this type the fine clay content of the B horizon is enriched, and a salt layer occasionally occurs at 30 to 50 inches. In both types the Bt usually shows slight organic staining. Stones may be found throughout the profile. The topography is usually gently undulating to gently rolling with long smooth slopes. On undulating topography this soil rates as good to very good arable land.

4. Standoff Silt Loam or Silty Clay Loam (So. SiL.SiCL.)

Ah	0- 7"	Very dark grayish brown (10YR 3/2) silt loam to silty clay loam; prismatic to platy; pH 7.2.
Bm	7-16"	Dark brown (10YR 4/3) silt loam to silty clay loam; prismatic to small subangular blocky; pH 7.3.
Ck	at 16"	Light brownish gray (10YR 6/2) silt loam; massive appearance but breaking down into small weak subangular blocks; pH 7.8.
Ck	at 26 to 30"	Light gray (10YR 7/2) silt loam; massive to small subangular blocky; pH 8.0; strongly calcareous.

This Orthic (thin) Black soil developed on calcareous alluvial lacustrine material. Till may be found at 30 to 40 inches. It is stone free, and well drained. The largest area of this soil series lies south of Stand-Off on the slopes to the Belly River. The topography is level to undulating. Wind erosion is a problem, and the limey subsoil is often exposed. On gently undulating topography this soil would rate as good arable land.

5. Pincher Silty Clay Loam (Pn.SiCL.)

Ah	0- 7"	Very dark gray to very dark grayish brown (10YR 3/1-3/2) silty clay loam to silty clay; prismatic to granular, quite friable; pH 6.3.
Btj	7-20"	Very dark grayish brown (10YR 3/2) silty clay; prismatic to subangular blocky, firm to hard; pH 6.4.
Ck1	at 20"	Dark gray brown to gray brown (10YR 4/2 – 5/2) silty clay; weak prismatic to small subangular blocky; pH 7.8.
Ck2	at 24 -30"	Light brownish gray (10YR 6/2) silty clay; massive; pH 7.9; strongly calcareous.

This soil series is an Orthic (thin) Black soil developed on lacustrine material. Fairly large gravel stones may be found throughout the profile. It is well drained on a gently undulating topography. On this topography the arability rating is good to very good.

6. Ferintosh Loam or Sandy Loam (Fth.L.SL.)

This Orthic (thin) Black soil series developed on coarse outwash material. It resembles a very shallow Standoff loam, overlying gravel. This is a rapidly drained soil. Only small areas of these soils occur, mainly at the junction of the St. Mary River and Lee Creek. At present they are used as native pasture, and as a source for gravel.

Profile Type: Eluviated (thin) Black

7. Bullhorn Silty Clay Loam (Bu.SiCL.)

Ah	0- 3"	Very dark brown (10YR 2/2) silty clay loam; granular, soft; pH 6.3.
Ae	3- 5"	Dark gray (10YR 4/1) clay loam; coarse to fine platy, firm; pH 6.1.
Bt	5-20"	Very dark gray (10YR 3/1) clay; columnar to subangular blocky, stained with organic matter, very hard; pH 6.3.
Cca	at 20"	Very dark grayish brown (2.5Y 3/2) clay; massive to weak subangular blocky, firm; pH 8.0.
Ccas	at 24"	Dark grayish brown (2.5Y 4/2) clay, massive, friable; pH 8.1.
Cks	at 36"	Dark grayish brown (10YR 4/2) clay to silty clay; massive, firm: pH 7.8; moderately calcareous.

This soil series developed on lacustrine material. There may be gravel stones throughout the profile, and till may be found at depths of 30 to 40 inches. These soils are associated with eroded pits and Solonetzic soils. They are found on level to gently undulating topography, and are imperfectly to well drained. On gently undulating topography these soils have a fairly good arability rating.

Profile Type: Orthic Dark Brown

8. Lethbridge Loam or Silt Loam (Leth. L SiL.)

Ah	0- 5"	Very dark grayish brown to dark brown (10YR 3/2-3/3) loam to silt loam; weak prismatic to coarse platy, soft; pH 6.7.
Bm	5-10"	Brown (10YR 4/3) silt loam to clay loam; prismatic to weak subangular blocky; pH 6.9.
Cca	at 10"	Light brownish gray (10YR 6/2) clay loam; weak subangular blocky; pH 7.7.
Ck	at 20"	Light gray (10YR 7/2) clay loam; weak coarse blocky to massive; pH 8.1; strongly calcareous.

This well drained soil series is an Orthic Dark Brown soil developed on alluvial lacustrine material. It is usually stone free, but where till is within 30 to 36 inches of the surface some stones may be found. These soils occur on level to undulating topography and are well drained. They rate as good arable on gently undulating topography.

9. Readymade Loam or Silt Loam (Ry. L. SiL.)

Ah	0- 5"	Very dark grayish brown (10YR 3/2) loam to silt loam; loose platy to granular, soft; pH 6.7.
Bm	5-10"	Brown (10YR 4/3) clay loam; prismatic to subangular blocky, hard; pH 6.7.
Cca	at 10"	Light brownish gray (10YR 6/2) clay loam; blocky to subangular blocky, blotched appearance and some stones, till-like; pH 7.8.
Ck	at 20"	Light brownish gray (10YR 6/2) clay loam till; massive to subangular blocky, stones; pH 7.8. moderately calcareous.

This Orthic Dark Brown soil developed on sorted till. There are stones throughout the profile. This series is found on level to undulating topography. Drainage is good. Arability rating is fairly good to good if on gently undulating topography.

10. Coaldale Silty Clay Loam (Cdle. SiCL.)

Ah	0- 3"	Very dark grayish brown (10YR 3/2-4/2) silty clay loam; granular; pH 7.7.
$B\overline{tj}$	3- 9"	Dark grayish brown (10YR 4/2) silty clay; irregular prismatic, some organic staining on the cleavage faces; pH 7.7.
Bm	9-16"	Grayish brown (10YR 4/2-5/2) silty clay; coarse irregular prismatic; pH 7.8.
Cca	16-24"	Medium lime accumulation; pH 8.2.
Ck	at 36"	Light brownish gray (10YR 5/2-6/2) silty clay loam to silty clay; massive; occasional small inclusions of salt crystals; pH 8.3; moderately calcareous.

This moderately well-drained Orthic Dark Brown soil developed on lacustrine material. It occurs in old drainage ways, and between the Prairie Blood Coulee and its junction with the St. Mary River. The topography is level to gently undulating. On gently undulating topography the arability rating is good.

11. Carmangay Sandy Loam (Cm.SL.)

Ah	0- 8"	Very dark grayish brown (10YR 3/2) sandy loam; loose weak wide prismatic, pH 6.4.
Bm	8-30"	Dark yellowish brown (10YR 4/4) sandy loam; very coarse weak prismatic to single grain, pH 6.4.
Cca	at 30"	Pale brown (10YR 6/3) sandy loam; firm, massive; pH 7.8.
Ck	at 40"	Light brownish gray (10YR 6/2) loamy sand; single grain, structureless; pH 7.9.

This Orthic Dark Brown soil developed on alluvial aeolian material. It is found on undulating to rolling topography, and usually occurs as pockets. It is a well drained soil. On gently rolling topography the arability of this soil rates as fair.

12. Scollard Loam (Sc. L.)

This Orthic Dark Brown soil developed on coarse outwash material. The upper portion of the profile resembles a Lethbridge loam; it overlies, however, gravel or very stony material. It is a rapidly drained soil. Only small areas of this soil, mainly in old drainage ways, occur on the Reserve. These areas should be left in native pasture.

Profile Type: Calcareous Dark Brown

13. Brocket Clay Loam, Silt Loam or Silty Clay Loam (Bk.CL.SiL.SiCL.)

Ah	0-2.5"	Very dark gray (10YR 3/1) clay loam; weak prismatic to granular; pH 7.0.
Bt	2.5-7"	Very dark grayish brown (10YR 3/2) clay; prismatic to subangular blocky; pH 7.1.
Cca	at 7"	Light brownish gray (10YR 6/2) clay to clay loam; weak prismatic to granular; pH 7.8.
Ck	at 16"	Light brownish gray (10YR 6/2) clay to silty clay; large weak prismatic to massive; pH 8.1; strongly calcareous.

This well drained series is a Calcareous Dark Brown soil developed on calcareous lacustrine material. The Bt shows a higher clay content than the Ah and C horizons. These soils are usually stone free. Topography is usually level to undulating; drainage is good. On gently undulating topography this soil rates as fair to fairly good arable. Under cultivation the Cca horizon is often exposed which has a depressing effect on plant growth. The largest area of this soil occurs in the northern portion of the reserve where it supports a fair stand of grass.

ORDER: SOLONETZIC SOILS

Profile Type: Dark Brown Solodized Solonetz

The Solodized Solonetz soils are characterized by (1) a leached Ae horizon which is lighter in color than the underlying B horizon, and (2) a B horizon (Solonetzic) with a very hard, white capped columnar structure. There is usually a sharp break between the leached horizon and the B horizon. The surfaces of the structural aggregates of the B horizon are usually darker in color than the inside of the aggregates.

14. Keho Silt Loam (Kh.SiL.)

Ah	0- 8"	Dark grayish brown (10YR 4/2) silt loam; loose, granular; pH 7.1.
Ae	8- 9"	Light brownish gray (10YR 6/2) loam; platy; pH 6.8.
Bnt	9-20"	Grayish brown (10YR 5/2) clay; large columnar breaking down to subangular blocky, stained, very hard; pH 7.3.
Ccas	20-30"	Grayish brown (10YR 5/2) clay loam; massive; firm; pH 7.4.
Cks	at 36"	Light brownish gray (10YR 6/2) clay loam to silty clay loam; massive, firm; pH 8.3. moderately calcareous.

This series developed on alluvial lacustrine material. Most of these soils on the Reserve consist of pits where the A horizon has been eroded away. There may be a few stones, or none at all. Topography is level to undulating. It is an imperfectly to moderately well-drained soil. On the gently undulating topography the soil rates as fair arable.

15. Parr Loam (Pa.L.)

Ah	0-10"	Dark brown (10YR 4/3) loam; wide weak prismatic to granular, soft; pH 6.2. Depth of this horizon varies considerably.
Ae	10-12"	Pale brown (10YR 6/3) fine sandy loam to sandy loam; platy; pH 6.4.
Bnt	12-24"	Dark grayish brown (10YR 4/2) sandy clay loam; large columnar breaking down to blocky, stained, very hard; pH 7.6.
Ccas	at 24"	Brown (10YR 5/3) loam to sandy clay loam; weakly prismatic to weakly subangular blocky, firm; pH 8.3.

Cks at 30" Brown (10YR 5/3) loam; weakly prismatic to weakly subangular blocky sorted till; pH 8.3.

This series developed on sorted till. Most of these soils on the Reserve consist of eroded pits where most of the Ah has been removed. There are stones throughout the profile. Topography is level to undulating. It is an imperfectly to moderately well-drained soil. On gently undulating topography the arability is fair. The eroded phase supports a very poor stand of grass.

Profile Type: (thin) Black Solodized Solonetz

16. Ninastoko Clay Loam (Nn.CL.)

Ah	0- 5"	Very dark brown (10YR 2/2) clay loam; weak prismatic to single grain; pH 5.8.
Ae	5- 8"	Dark gray (10YR 4/1) loam to silt loam; platy; pH 6.6.
Bnt	8-14"	Very dark grayish brown (10YR 3/2) clay loam to clay; columnar to subangular blocky, very hard, stained with organic matter; pH 7.3.
Csa	at 14"	Dark brown (10YR 4/3) clay loam to clay; massive to weak subangular blocky, hard; pH 7.8.
Ccas	at 24"	Gray brown (10YR 5/2) clay loam; massive, firm; pH 7.9.
Cks	at 30"	Gray brown to light brownish gray (10YR 5/2-6/2) clay loam; massive to weak subangular blocky; till; pH 7.9,; strongly calcareous.

This series developed on till. It is an imperfectly to well drained soil on level to undulating topography. There are stones throughout the profile. Eroded pits are common. On gently undulating topography these soils rate as fair arable.

17. Twining Silt Loam (Tw.SiL.)

Ah	0- 5"	Very dark grayish brown (10YR 3/2) silt loam; weakly prismatic to granular, soft; pH 6.2.
Ae	7- 8"	Light brownish gray (10YR 6/2) loam to silt loam; platy; pH 6.4.
Bnt	8-24"	Dark grayish brown (10YR 5/2) clay; columnar, very hard, heavily stained; pH 7.4.
Ccas	at 24"	Dark grayish brown (10YR 5/2) clay loam; massive; pH 7.9.
Cksa	at 30"	Dark gray (10YR 4/1) clay loam; massive; pH 7.9.

This series developed on lacustrine material. Topography is gently sloping to undulating and the soils are moderately well to well drained. Arability is rated as fairly good to good.

Profile Type: (thin) Black Solonetz

18. Horn Silty Clay Loam (Hr.SiCL.)

Ah	0- 5"	Very dark brown (10YR 2/2) silty clay loam to clay loam; prismatic to granular; pH 5.9.
AB	5- 8"	Dark gray (10YR 4/1) clay loam; subangular blocky; pH 6.0.
Bnt	8-18"	Gray brown (10YR 5/2) clay loam; columnar to subangular blocky; pH 6.8.
Csk	18-21"	Light brownish gray (10YR 6/2) clay loam; massive to subangular blocky; pH 7.6.
Csca 1	21-25"	Light brownish gray (10YR 6/2) silty clay; massive, pH 8.0.
Csca 2	at 25"	Light brownish gray (10YR 6/2) silty clay; massive, pH 8.0. strongly calcareous.

This series developed on lacustrine material. Characteristic of these soils are eroded pits where the A horizon has been removed and the tough B horizon is exposed. Very little vegetation grows in these pits. The Horn series is an imperfectly to moderately well-drained soil. These soils are relatively stone free. On gently undulating topography these soils rate as poor to fair arable.

19. Mami Clay Loam (Mm.CL.)

Ah	0- 5"	Very dark brown (10YR 2/2) clay loam; prismatic to granular; pH 5.9.
AB	5- 8"	Dark gray (10YR 4/1) clay loam; subangular blocky to coarse platy; pH 6.0.
Bnt	8-18"	Gray brown (10YR 5/2) clay loam; columnar to blocky breaking down to subangular blocky, stained with organic matter, very hard; pH 6.6
Csa	at 18"	Light brownish gray (10YR 6/2) clay loam; massive to weak subangular blocky; pH 7.7.
Csk	at 21"	Light brownish gray (10YR 6/2) clay loam; massive; pH 7.9.
Csk	at 25"	Light brownish gray (10YR 6/2) clay loam; massive; till; pH 8.1. strongly calcareous.

This series developed on till, and stones may be found throughout the profile. Eroded pits are common. Topography is gently undulating to undulating. It is an

imperfectly to moderately well-drained soil. These soils are considered only fair arable if on gently undulating topography.

A profile description of an Eroded Mami Clay Loam (Er.Mm.CL.), taken from the center of an eroded pit, is as follows:

Ae 0- 1" Light brownish gray (10YR 6/2) silt loam; platy to single grain, vesicular; pH 6.7.

Bnt 1- 6" Dark grayish brown (10YR 4/2) silty clay loam; columnar to medium subangular blocky, very hard, stained with organic matter; pH 7.4.

Csa at 6-16" Dark brown (10YR 4/3) silty clay loam; subangular blocky, firm; pH 8.0.

Csca at 16" Light brownish gray (10YR 6/2) clay loam; massive to weak subangular blocky, till; pH 8.3. moderately calcareous.

Very little vegetation grows in the center of these pits. Stones are found throughout the profile. This soil is non-arable and only supports a poor stand of grass. About half of the 16,500 acres of Mami soils mapped occurred as eroded pits.

20. Oxley Loam (Ox.L.)

Ahēj 0- 1" Gray (10YR 5/1) sandy loam to loam; coarse weak blocky to weak platy; pH 8.3.

Bnt 1- 3" Dark grayish brown (10YR 4/2) loam to sandy clay loam; small hard blocky to columnar; pH 8.3.

Cca 3-10" Grayish brown (10YR 5/2) loam to clay loam; weak subangular blocky; pH 7.4.

Csak at 20" Light gray (10YR 7/1) loam; weak subangular blocky to massive; pH 8.3.

This series developed on modified residual material. It occurs in small acreages along hill slopes and in drainage ways, and is considered non-arable.

ORDER: GLEYSOLIC SOILS

Profile Type: Humic Eluviated Gleysol

21. Tempest Silt Loam (Te.SiL.)

Ah 0- 3" Dark gray (10YR 4/1) silt loam; weak prismatic to granular; pH 5.6.

Aeg 3- 6" Light brownish gray (10YR 6/2) loam; coarse platy to fine platy; pH 6.1.

ABg 6-10" Gray (10YR 6/1) loam; weak blocky to very platy; pH 6.3.

Btg1 10-16" Gray (10YR 5/1) clay; columnar to coarse blocky, very hard; pH 6.1.

Btg2 16+" Gray brown (10YR 5/2) clay; massive, very hard; pH 6.5.

This series developed on lacustrine material, and occupies depressions in the Coaldale silty clay loam area. Soils in this series are stone free. Arability of these soils is marginal and they should perhaps be left in native pasture.

ORDER: REGOSOLIC SOILS

Profile Type: Orthic Regosol (non-saline)

22. Mokowan Clay Loam (Mn.CL.)

Ahk 0- 2" Gray brown (10YR 5/2) silt loam; platy to single grain, pH 7.7. It contains lime carbonate.

Ck at 2" Brown (7.5YR 5/2) loam; weak irregular blocky to small subangular blocky, pH 7.8; moderately to strongly calcareous.

This series developed on calcareous residual material mainly of Willowcreek formation origin. It is typical on the Mokowan Butte. The subsoil may have the appearance of alluvial lacustrine material, or sometimes of sorted till. The colour of the Ck horizon which is due to highly coloured parent material varies considerably. These soils are found on hilly topography and are well drained; they should remain in native pasture.

23. Alluvium (Av.)

These soils are Orthic Regosols with a very thin Ah horizon and a subsoil which usually consists of stratified sand and silt. Gravel may be found at varying depths. Lime carbonate often extends to the surface. These soils are usually confined to river and creek valleys. The topography is gently undulating; some areas may be cut up by old stream courses and as a result cultivated fields are small and have irregular shape. Arability rating is fair to good, depending on texture, depth to gravel, and topography. The silt loams on gently undulating topography rate as good arable land.

Profile Type; Saline Regosol

Undifferentiated (B)

These soils have a high salt content, and lack profile development. Only small areas occur in incipient drainage ways. As a rule these soils are non-arable, and only salt grasses will grow on them.

B. CHEMICAL AND PHYSICAL ANALYSIS

The results of significant chemical and physical analyses of some of the soils mapped in this area are shown in Table 25. The Chernozemic Soils are generally neutral in reaction. The fine textured soils show an increase in the fine clay content in the $\overline{Btj}$ horizon. Calcium is the major exchangeable cation; and all these soils have a high to very high calcium carbonate content in the subsoil.

The Solonetzic soils have a Bnt horizon with a high percentage of exchangeable sodium and an accumulation of fine clay. Both characteristics are associated with the undesirable features of Solonetzic soils. Solonetzic soils range from neutral to slightly acid in the surface to somewhat alkaline in the subsoil.

TABLE 25.– Chemical and Physical Properties of Selected Chernozemic, Solonetzic, Gleysolic and Regosolic Soils on the Blood Indian Reserve

Soil Series[a]		pH	Percentage[b]		Exchangeable Cations (me./100 gms.)[c]					Mechanical Analyses[d]				Texture[e]
			N	$CaCO_3$ equivalent	H	Na	K	Ca	Mg	%S	%Si	%C	%FC	
2. Leavitt Clay Loam														
Ah	0- 6"	6.2	0.42	–	2.3	–	1.6	23.5	4.0	25	34	36	23	CL
Bm	6-18"	6.1	0.15	–	1.4	–	0.7	20.4	4.2	21	43	36	23	CL
Ck	18+"	6.7	–	22.8	–	–	–	–	–	27	43	30	15	CL
3. Cardston Silty Clay Loam														
Ah	0- 5"	7.1	0.36	–	–	0.3	2.2	35.0	6.5	23	31	46	27	C
AB	5-11"	6.7	0.16	–	0.8	0.6	2.0	31.5	8.0	12	32	56	20	C
Bt	11-20"	7.2	0.14	–	0.2	0.6	1.4	26.5	6.2	14	28	58	38	C
C	20-30"	7.8	–	8.0	–	–	–	–	–	12	40	48	24	SiC-C
Ck	30+"	7.5	–	15.6	–	–	–	–	–	23	42	35	12	CL
4. Standoff Silty Clay Loam														
Ah	0- 7"	7.0	0.26	–	0.6	0.6	1.4	25.0	4.5	20	48	32	20	SiCL-CL
Bm	7-16"	6.8	0.14	–	–	0.2	0.6	23.5	5.0	19	54	27	17	SiL-SiCL
C1	16-26"	7.8	–	21.5	–	–	–	–	–	20	57	23	7	SiL
C2	26+"	7.9	–	22.1	–	–	–	–	–	–	–	–	–	
5. Pincher Clay														
Ah	0- 8"	6.6	0.35	–	1.7	0.4	1.6	27.0	4.5	14	37	49	28	C
$B\overline{tj}$	8-18"	6.3	0.14	–	1.3	0.2	1.0	22.5	6.2	9	40	51	35	SiC-C
Ck	18-30"	7.8	–	16.1	–	–	–	–	–	9	50	41	18	SiC
C	30+"	7.9	–	17.7	–	–	–	–	–	4	40	56	21	SiC
7. Bullhorn Clay Loam														
Ah	0- 3"	6.7	0.37	–	0.2	0.5	1.2	30.0	5.0	22	41	37	19	CL
Ae	3- 5"	6.7	0.29	–	1.3	1.7	0.3	12.8	5.8	26	41	33	17	CL
Bt	5-12"	5.9	0.24	–	2.3	0.2	0.7	27.0	3.5	41	16	43	24	C
B	12-20"	8.0	–	5.9	–	–	–	–	–	9	33	58	17	C
Ccasa	20-36"	8.3	–	16.2	–	–	–	–	–	7	32	61	17	C
C	36+"	7.7	–	11.0	–	–	–	–	–	10	46	44	12	SiC
8. Lethbridge Silt Loam														
Ap	0- 7"	6.4	0.31	–	1.3	0.2	1.4	22.2	4.2	22	47	31	19	CL
Bm	7-18"	6.8	0.16	–	1.4	0.3	0.7	25.2	5.0	17	46	37	26	SiCL
C	18+"	7.8	–	23.5	–	–	–	–	–	27	44	29	8	CL

Table 25.– Continued

Soil Series[a]		pH	Percentage[b]		Exchangeable Cations (me./100 gms.)[c]					Mechanical Analyses[d]				Texture[e]
			N	$CaCO^3$ equivalent	H	Na	K	Ca	Mg	%S	%Si	%C	%FC	
9. Readymade Loam														
Ah	0- 5"	6.5	0.31	–	1.1	0.3	1.1	22.0	4.0	30	36	34	22	CL
Bm	5-13"	6.5	0.18	–	0.6	0.2	0.9	20.2	4.5	32	33	35	23	CL
Cca	13-24"	7.8	–	10.3	–	–	–	–	–	35	34	31	15	CL
C	24+"	7.8	–	9.8	–	–	–	–	–	30	37	33	15	CL
13. Brocket Silty Clay Loam														
Ah	0- 4"	6.5	0.23	–	1.0	–	1.0	29.5	3.5	16	49	35	–	SiCL
Bt	4-10"	6.8	0.13	–	0.2	–	1.2	22.4	6.8	26	30	44	27	C
Cca	10-16"	7.7	–	17.4	–	–	–	–	–	18	35	47	22	C
C	16-24"	7.9	–	16.3	–	–	–	–	–	–	–	–	–	C
16. Ninastoko Silt Loam														
Ah	0- 3"	5.7	0.31	–	4.6	1.5	1.5	10.5	6.0	24	51	25	11	SiL
Ae	3- 5"	6.9	0.16	–	0.6	2.2	0.7	6.5	6.2	26	56	18	4	SiL
Bnt1	5-12"	7.3	0.13	–	–	6.6	1.1	9.2	18.0	13	46	41	25	SiC
Bt2	12-22"	7.7	–	1.32	–	–	–	–	–	8	34	58	28	C
Ccasa	22-28"	7.8	–	19.30	–	–	–	–	–	5	48	47	14	SiC
C	28+"	7.9	–	16.93	–	–	–	–	–	18	55	27	6	SiCL-SiL
18. Horn Clay Loam														
Ah	0- 5"	5.9	0.40	–	3.6	0.9	1.0	21.6	3.9	25	45	30	18	CL
AB	5- 8"	6.0	0.24	–	2.5	2.2	0.9	14.5	4.4	25	42	33	19	CL
Bnt	8-18"	6.8	0.14	–	0.2	7.5	0.7	14.2	8.1	23	41	36	24	CL
Csk	18-21"	7.6	–	3.79	–	–	–	–	–	22	41	37	17	CL
C1	21-25"	8.0	–	17.58	–	–	–	–	–	14	39	47	19	SiC
C2	25+"	8.0	–	17.23	–	–	–	–	–	13	46	41	13	SiC
19. Mami Clay Loam														
Ah	0- 7"	7.2	0.42	–	–	0.5	1.1	37.8	4.5	30	31	39	22	CL
Bnt	7-18"	6.4	0.12	–	0.7	5.5	0.7	26.5	7.5	22	25	53	29	C
Ck	18-32"	7.8	–	15.8	–	–	–	–	–	6	52	42	13	SiC
C	32+"	8.2	–	17.0	–	–	–	–	–	14	40	46	15	SiC
19. Eroded Mami Silt Loam														
Ae	0- 1"	6.7	0.16	–	1.1	1.2	0.6	9.5	2.2	23	63	14	4	SiL
Bnt	1- 6"	7.4	0.12	–	–	4.2	0.7	20.8	6.2	16	51	33	22	SiCL
Cs	6-16"	7.7	–	0.8	–	–	–	–	–	18	51	31	19	SiCL
Csca	16+"	7.7	–	12.5	–	–	–	–	–	20	48	32	10	SiCL-CL

Table 25.– Concluded

Soil Series[a]		pH	Percentage[b]		Exchangeable Cations (me./100 gms.)[c]					Mechanical Analyses[d]				Texture[e]
			N	$CaCO^3$ equivalent	H	Na	K	Ca	Mg	%S	%Si	%C	%FC	
21. Tempest Silt Loam														
Ah	0- 3"	5.6	0.36	–	3.6	–	2.2	10.5	2.5	21	53	26	12	SiL
Aeg	3- 6"	6.1	0.10	–	1.2	0.2	1.0	5.7	1.5	35	45	20	5	L
ABg	6-10"	6.3	0.09	–	1.0	0.2	0.9	6.5	2.0	29	46	25	8	L
Btg1	10-16"	6.1	0.09	–	1.2	0.2	2.6	16.8	8.5	13	38	49	34	C
Btg2	16+"	6.5	0.07	–	0.5	0.4	2.9	17.3	10.0	12	31	57	38	C
22. Mokowan Loam														
Ahk	0- 2"	7.7	0.23	12.5	–	–	–	–	–	38	39	23	11	L
C	2-24+"	7.8	–	14.6	–	–	–	–	–	36	39	25	11	L

Notes:–

a. The numbers of the soil series in the table correspond with those in the text.

b. Meaning of chemical symbols; N=nitrogen; $CaCO_3$=calcium (lime) carbonate; H=hydrogen; Na=sodium; K=potash; Ca=calcium; Mg=magnesium.

c. Exchangeable cations are expressed in milliequivalents per 100 grams.

d. Meaning of symbols used in mechanical analyses: S=sand; Si=silt; C=clay; FC=fine clay.

e. For explanation of symbols used see Table 23. In the case of 3. Cardston Silty Clay Loam, 8. Lethbridge Silt Loam, and 9. Readymade Loam the texture of the sample analysed differs from the most common texture of the series.

GLOSSARY

Aeolian deposit	Material transported and deposited by the wind. It has a medium to coarse texture, is free of stones, and often occurs in dune-like topography.
Alluvial deposit	Material deposited in moving water. It has a medium to coarse texture (sometimes gravelly), and usually occurs on level to gently undulating topography.
Eluviated soil	A soil in which a significant amount of leaching has taken place. This kind of soil is characterized by a light coloured horizon immediately below the surface horizon which indicates that there has been removal of soluble material. The leached material is deposited in lower horizons.
Gleyed soil	A soil that has been modified by a high or fluctuating water table. Gleying is usually indicated by a blue grey colour and/or rusty mottles in the subsoil.
In situ	This term means "in its original place". It refers to bedrock or soil, and indicates that the material has been undisturbed and is in the same position as it was originally deposited.
Lacustrine deposit	In general a deposit in a lake. In soil surveys lacustrine deposits usually are beds of ancient post-glacial lakes. It has a fine texture, is free of stones, and is usually associated with level to gently sloping topography.
Mature and immature soils	Time is a factor in soil formation and, in general, the longer soil forming factors have been at work the more mature a soil is. Maturity is indicated by horizon development. Recent river deposits lack horizon development and are therefore immature soils.
Orthic soil	A soil that has formed on non-saline parent material in a moderately to well drained position. It might be thought of as the normal soil for its climatic zone.
Outwash deposits	Coarse textured materials, generally gravelly and stony. They are usually found on fairly level topography, and are in areas where the finer particles have been carried away by moving water.
Parent material	A surface geological deposit on which a soil profile has formed. Parent materials differ in chemical and physical composition, and in the way they were deposited over the land surface.
pH	A measure of relative acidity or alkalinity. In general, a soil with a pH greater than 8.0 is considered alkaline, one with a pH less than 6.0 is considered acid, and one between 6.0 and 8.0 is considered neutral.
Residual material	This term, as used in soil survey, refers to material in areas where the bedrock is at, or is very close to, the surface. Surface stones may occur if the fine particles in the original till mantle have been removed by erosion. The topography is usually gently undulating or sloping.
Soil horizon	A layer in the soil profile approximately parallel to the land surface with more or less well defined characteristics. On the Blood Indian Reserve the surface horizon is darker in colour and contains a greater amount of organic material than the underlying horizons.
Soil profile	A vertical section of a soil through all its horizons and extending into the underlying unaltered parent material. A deep road cut is usually a good place to view a soil profile.

Soil zone	A large area or region where the influence of climate and living organisms, chiefly vegetation, is fairly similar. In general, the soils within one zone have the same surface horizon colour. Part of the Blood Indian Reserve is in the Dark Brown zone and part is in the Thin Black zone.
Structure (soil)	This term refers to the type of aggregates (chunks) into which a soil mass will naturally break. These aggregates may be blocky, columnar, granular, or platy.
Texture (soil)	This term refers to the percentages of sand, silt and clay particles that make up a soil. Sand particles are larger than 0.05 millimeters in diameter, silt particles are between 0.05 and 0.002 millimeters in diameter, and clay particles are smaller than 0.002 millimeters in diameter.
Till	A heterogeneous mixture of stones, sand, silt, and clay. It is material that was pushed by the glacier and then left when the ice sheet melted. The topography is usually undulating to hilly.
10 YR 2/2	Symbols such as this one, used in the description of soils series, are colour codes of the Munsell colour charts.

VIII. RANGE

The grazing lands of the Reserve are among the finest in Western Canada. Not only are they a most productive native grassland type, but also the area has some excellent natural water provided by the rivers surrounding the Reserve and an irrigation canal cutting through its southern half. There are also springs and wells which can be developed together with the construction of dams and dugouts. Additional stock watering places are required, however, particularly in the northern part of the Reserve.

GRASSLAND TYPES

There are many different plants on the Reserve, which is a good feature in grazing lands. A botanical survey revealed 53 grass species, 11 species belonging to sedges and rushes, 14 different forage herbs, 18 shrubs, and 126 species of weeds (see Appendix to this Chapter). The latter have no grazing value and in some cases may become a pest.

Grasslands have been classified according to the dominance of some species. There are two major grassland types on the Reserve. One is the Fescue Prairie which covers the southern half of the Reserve, and most of the remaining grassland belongs to the Mixed Grass Prairie type.

Grazing lands of the Fescue Prairie type are also found in the Porcupine Hills, the benchlands of the Cypress Hills in southeastern Alberta, the Buffalo, Wintering and Hand Hills of southcentral Alberta and in certain areas of the Parkland region of the northcentral part of the Province. The dominant grass of this type is Rough Fescue, a productive long bunchgrass with an extensive root system; other associated grasses are much less prevalent. Over the years Rough Fescue has added much organic matter to the soil, and thus played an important role in the formation of the Black, Thin Black and Dark Brown soils of the prairie provinces. Although much less prevalent, some of the associated species, such as Idaho Fescue, wheatgrasses, bluegrasses, and some sedges and forage plants of the broad-leaved type, also have a high grazing value.

Forage production is greatest in the southwest corner as a result of more favourable rainfall, but otherwise the vegetative composition and density is markedly uniform.

In the northern portion of the Reserve one finds a Mixed Grass type of grazing land in which spear grasses, blue grama grass and bluejoint are dominant species. These short grasses reflect a rainfall lower than in the southern portion, and are associated with soils of high lime content. Although the nutritive value of some of these grasses is quite high, the productivity of this grassland type is much less than that of the Fescue Prairie type.

WEEDS AND POISONOUS PLANTS

Weeds do not pose a serious problem on the range but do occur in great abundance on some summer fallow land (mostly Canada Thistle) and road sides, particularly where the soil has been disturbed. There are a few pockets of Leafy Spurge. One was seen, for instance, near the west bank of the St. Mary's River. If such infestations are not eradicated they can spread rapidly and take over extensive areas of grazing lands, as has happened in Montana and elsewhere. There is also a widespread invasion of weeds in the Mixed Grass Prairie which indicates over-grazing in most of the area, particularly the northern end of the Reserve.

There are a few poisonous plants on the Reserve, notably Loco Weed and Death Camas. Loco Weed can be found on most parts of the range and appears to be spreading. The poison in Loco Weed is cumulative, and if eaten repeatedly the nervous system becomes badly affected (or locoed). Fortunately cattle avoid this plant, but horses seem to develop a taste for it, or become addicted to it. Death Camas occurs in moist draws and coulees where its green succulent onion-like leaves can attract attention of grazing animals, particularly in spring when new growth of grasses is limited. Severe losses among cattle and sheep may occur if it is eaten in quantity. The best way to prevent losses is to keep the range in good condition. With ample supply of good forage the chances of consuming lethal amounts of Death Camas are remote.

GRAZING CAPACITY OF RANGE[1]

The Reserve can be divided into three grazing zones (see Range Carrying Capacity Map). In the north half of the Reserve 35 acres are required for one animal unit for a 12-month grazing period. In the Rough Fescue Prairie, 16 acres are required per animal unit a year, except in the southwest corner where 14 acres are sufficient.

Under appropriate range and livestock management cattle grazing in these lands can gain around 300 pounds per year. It has been experienced that cattle grazing in the northern part of the Reserve as a rule put on more weight than cattle grazing elsewhere on the Reserve. This experience reflects the nutritious value of the short grass species, especially Blue Grama.

NOTES

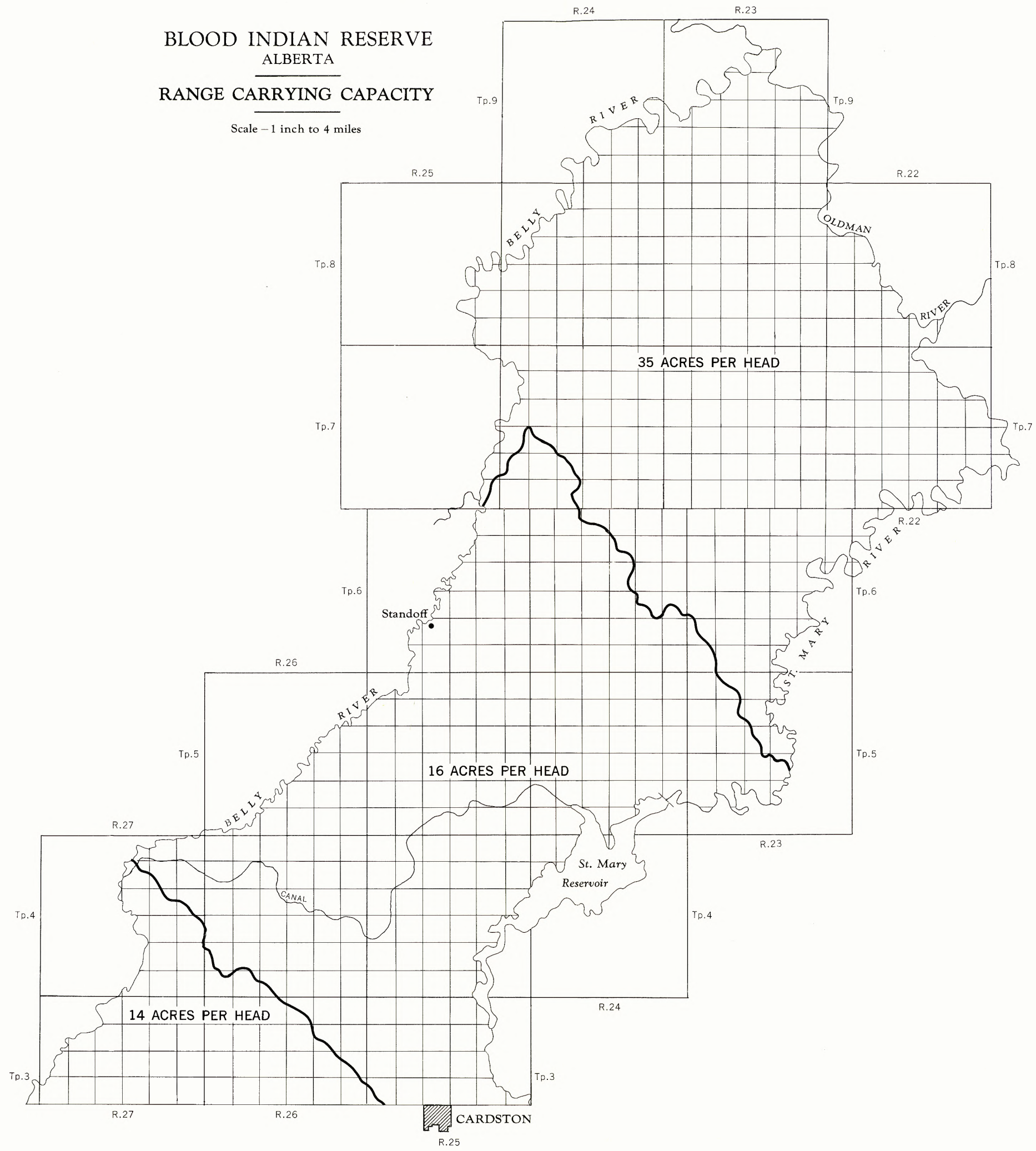
1. Grazing capacity refers to the number of acres required to keep one animal unit (or equivalent) for a twelve-month period under good range management conditions. The unit of capacity used is a 1000 pound cow with calf under six months. Other animals can be converted to this unit by using the following equivalents:

1 yearling steer or heifer = 2/3 or 3/4 animal unit
1 two-year old steer or heifer = 1 animal unit
1 bull = 1 1/2 animal units
1 horse = 1 1/2 animal units
1 sheep = 1/5 animal unit

BLOOD INDIAN RESERVE
ALBERTA

RANGE CARRYING CAPACITY

Scale – 1 inch to 4 miles



APPENDIX

Plants on Blood Indian Reserve, July 1961

Common Name	*Botanical Name*
Grasses	
Crested wheat-grass	Agropyron cristatum (L.) Gaertn.
Thick-spike wheat-grass	Agropyron dasystachyum (Hook.) Scribn.
Griffith's wheat-grass	Agropyron griffithsii Scribn. & Smith
Slender wheat-grass	Agropyron pauciflorum (Schwein.) Hitchc.
Streambank wheat-grass	Agropyron riparium Scribn. & Smith
Western wheat-grass	Agropyron smithii Rydb.
Bearded wheat-grass	Agropyron subsecundum (Link) Hitchc.
Red-top	Agrostis alba L.
Spike red-top	Agrostis exarata Trin.
Tickle-grass	Agrostis scabra Willd.
Slough-grass	Beckmannia syzigachne (Steud.) Fern.
Blue grama	Bouteloua gracilis (HBK) Lag.
Fringed brome	Bromus ciliatus L.
Smooth brome	Bromus inermis Leyss.
Japanese chess	Bromus japonicus Thunb.
Downy chess	Bromus tectorum L.
Canada reed-grass	Calamagrostis canadensis (Michx.) Beauv.
Northern reed-grass	Calamagrostis inexpansa A. Gray.
Plains reed-grass	Calamagrostis montanensis Scribn.
California oat-grass	Danthonia californica Boland.
	var. americana (Scribn.) Hitchc.
Timber oat-grass	Danthonia intermedia Vasey
Parry's oat-grass	Danthonia parryi Scribn.
Tufted hair-grass	Deschampsia caespitosa (L.) Beauv.
Salt-grass	Distichlis stricta (Torr.) Rydb.
Canada wild-rye	Elymus canadensis L.
Giant wild-rye	Elymus condensatus Presl
Idaho fescue	Festuca idahoensis Elmer
Six-weeks fescue	Festuca octoflora Walt.
Rough fescue	Festuca scabrella Torr.
Tall manna-grass	Glyceria grandis S. Wats.
Fowl manna-grass	Glyceria striata (Lam.) Hitchc.
	var. stricta Fern.
Wild barley	Hordeum jubatum L.
Meadow barley	Hordeum jubatum L.
	var. caespitosum (Scribn.) Hitchc.
June-grass	Koeleria cristata (L.) Pers.
Mat muhly	Muhlenbergia richardsonis (Trin.) Rydb.
Indian rice-grass	Oryzopsis hymenoides (R. & S.) Ricker
Reed canary-grass	Phalaris arundinacea L.
Alpine timothy	Phleum alpinum L.
Timothy	Phleum pratense L.
Big blue-grass	Poa ampla Merr.
Plains blue-grass	Poa arida Vasey
Canby's blue-grass	Poa canbyi (Scribn.) Piper
Canada blue-grass	Poa compressa L.
Early blue-grass	Poa cusickii Vasey

Common Name	*Botanical Name*
Inland blue-grass	Poa interior Rydb.
Kentucky blue-grass	Poa pratensis L.
Sandberg's blue-grass	Poa secunda Presl
Nuttall's alkali-grass	Puccinellia nuttalliana (Schult.) Hitchc.
Prairie wedge-grass	Sphenopholis obtusata (Michx.) Scribn.
Columbia needle-grass	Stipa columbiana Macoun
Needle-and-thread	Stipa comata Trin. & Rupr.
Short-awn porcupine-grass	Stipa spartea Trin. var. curtiseta Hitchc.
Green needle-grass	Stipa viridula Trin.
Forage Herbs	
False dandelion	Agoseris glauca (Pursh) Raf.
Salt sage	Atriplex nuttallii S. Wats.
Asters	Aster spp.
Winter fat	Eurotia lanata (Pursh) Moq.
Sticky purple geranium	Geranium viscosissimum Fisch. & Mey.
Milk vetch	Hedysarum mackenzii Richards.
Perennial lupine	Lupinus argenteus Pursh
Black medick	Medicago lupulina L.
Alfalfa	Medicago sativa L.
White sweet clover	Melilotus alba Desr.
Yellow sweet clover	Melilotus officinalis (L.) Lam.
White dutch clover	Trifolium repens L.
Vetch	Vicia americana Muhl.
Sedges and Rushes	
Water sedge	Carex aquatilis Wahlenb.
Involute-leaved sedge	Carex eleocharis Bailey
Dark-fruited sedge	Carex festivella Mack.
Thread-leaved sedge	Carex filifolia Nutt.
Graceful sedge	Carex praegracilis W. Boott
Spike rush	Eleocharis palustris (L.) R. & S.
Baltic rush	Juncus balticus Willd.
Toad rush	Juncus bufonis L.
Long-styled rush	Juncus longistylis Torr.
Three-square rush	Scirpus paludosus A. Nels.
Bulrush	Typha latifolia L.
Shrubs	
Saskatoon-berry	Amelanchier alnifolia Nutt.
Red osier dogwood	Cornus stolonifera Michx.
Wolf willow	Elaeagnus commutata Bernh.
Lance-leaf cottonwood	Populus acuminata Rydb.
Balsam poplar	Populus balsamifera L.
Aspen	Populus tremuloides Michx.
Chokecherry	Prunus virginiana L. var. melanocarap (A. Nels.) Sarg.
Shrubby cinquefoil	Potentilla fruticosa L.
Gooseberry	Ribes sp.
Skunk-bush	Rhus trilobata Nutt.
Wild rose	Rosa woodsii Lindl.
Peach-leaf willow	Salix amygdaloides Anderss.
Beaked willow	Salix bebbiana Sarg.

Common Name	*Botanical Name*
Sandbar willow	Salix interior Rowlee
Snowberry	Symphoricarpos albus (L.) Blake
Western Snowberry	Symphoricarpos occidentalis Hook.
Poisonous Plants	
Early yellow loco-weed	Oxytropis sericea Nutt. var. spicata (Hook.) Barneby
Showy loco-weed	Oxytropis splendens Dougl.
Death camas	Zigadenus gramineus Rydb.
Weeds	
Yarrow	Achillea lanulosa Nutt.
Pink-flowered onion	Allium stellatum Fras. ex Ker-Gawl.
Prairie onion	Allium textile Nels. & Macbr.
Pygmy flower	Androsace septentrionalis L.
Long-fruited anemone	Androsace cylindrica DC.
Cut-leaved anemone	Anemone multifida Poir.
Prairie crocus	Anemone patens L. var. wolfgangiana (Bess.) Koch
Pussy-paws	Antennaria nitida Greene
Spreading dogbane	Apocynum androsaemifolium L.
Tower mustard	Arabis glabra (L.) Bernh.
Burdock	Arctium minus (Hill) Bernh.
Plains wormwood	Artemisia compestris L.
Pasture sage	Artemisia frigida Willd.
Prairie sagewort	Artemisia ludoviciana Nutt. var. gnaphalodes (Nutt.) T. & G.
Showy milkweed	Asclepias speciosa Torr.
Many-flowered aster	Aster pansus (Blake) Cronq.
Two-grooved milk vetch	Astragalus bisulcatus (Hook.) A. Gray.
Ground plum	Astragalus crassicarpus Nutt.
Milk vetch	Astragalus flexuosus Dougl.
Purple milk vetch	Astragalus goniatus Nutt.
Narrow-leaved milk vetch	Astragalus pectinatus Dougl. (Hook.)
Loose-flowered milk vetch	Astragalus tenellus Pursh
Balsam root	Balsamorhiza sagittata (Pursh) Nutt.
Blue bell	Campanula rotundifolia L.
Hoary cress	Cardaria draba (L.) Desv.
Yellow Indian paintbrush	Castilleja septentrionalis Lindl.
Field chickweed	Cerastium arvense L.
Lamb's quarters	Chenopodium album L.
Oak-leaved goosefoot	Chenopodium glaucum L.
Lance-leaved goosefoot	Chenopodium leptophyllum Nutt.
Golden aster	Chrysopsis villosa (Pursh) Nutt.
Canada Thistle	Cirsium arvense (L.) Scop.
Short-stemmed thistle	Cirsium foliosum (Hook.) DC.
Pale comandra	Comandra pallida A. DC.
Hound's tongue	Cynoglossum officinale L.
Flixweed	Descurainia sophia (L.) Webb
Fireweed	Epilobium angustifolium L.
Common horsetail	Equisetum arvense L.
Swamp horsetail	Equisetum fluviatile L.
Philadelphia fleabane	Erigeron philadelphicus L.
Umbrella plant	Eriogonum flavum Nutt.

Weeds (Cont'd)	
Prairie Rocket	Erysimum asperum (Nutt.) DC.
Wallflower	Erysimum inconspicuum (S. Wats.) MacM.
Wild strawberry	Fragaria virginiana Duchesne var. glauca S. Wats.
Brown-eyed susan	Gaillardia aristata Pursh
Northern bedstraw	Galium boreale L.
Butterfly weed	Gaura coccinea Pursh
Three-flowered avens	Geum triflorum Pursh
Wild licorice	Glycyrrhiza lepidota (Nutt.) Pursh
Gumweed	Grindelia squarrosa (Pursh) Dunal
Broom weed	Gutierrezia sarothrae (Pursh) Britt. & Rusby
Iron weed	Haplopappus spinulosus (Pursh) DC.
Toothed iron plant	Haplopappus nuttallii T. & G.
Annual sunflower	Helianthus annuus L.
Sunflower	Helianthus sp.
Black henbane	Hyoscyamus niger L.
Poverty weed	Iva axillaris Pursh
Prickly lettuce	Lactuca scariola L.
Beggar ticks	Lappula echinata Gilib.
Pepper-grass	Lepidium densiflorum Schrad.
Blazing star	Liatris punctata Hook.
Stoneseed	Lithospermum ruderale Lehm.
Skeleton weed	Lygodesmia juncea (Pursh) D. Don
Fringed loosestrife	Lysimachia ciliata L.
Tar weed	Madia glomerata Hook.
Pincushion cactus	Mamillaria vivipara (Nutt.) Haw.
Wild mint	Mentha arvensis L. var. villosa (Benth.) S. R. Stewart
Horse mint	Monarda fistulosa L. var. menthaefolia (Graham) Fern.
Yellow cactus	Opuntia fragilis (Nutt.) Haw.
Prickly pear	Opuntia polyacantha Haw.
Evening primrose	Oenothera Flava (A. Nels.) Garrett
White evening primrose	Oenothera nuttallii Sweet
False gromwell	Onosmodium occidentale Mackenz.
Owl's clover	Orthocarpus luteus Nutt.
Blue beard-tongue	Pentstemon nitidus Dougl.
Slender blue beard tongue	Pentstemon procerus Dougl.
Squaw root	Perideridia gairdneri (Hook. & Arn.) Mathias
White prairie clover	Petalostemon candidum (Willd.) Michx.
Purple prairie clover	Petalostemon purpureum (Vent.) Rydb.
Prairie phlox	Phlox hoodii Richards.
Plantain	Plantago major L.
Common knotweed	Polygonum aviculare L.
Rough cinquefoil	Potentilla norvegica L.
Heart-leaved buttercup	Ranunculus cardiophyllus Hook.
Prairie coneflower	Ratibida columnifera (Nutt.) Woot. & Standl.
Sheep sorrel	Rumex acetosella L.
Narrow-leaved dock	Rumex mexicanus Meisn.
Russian thistle	Salsola kali L. var. tenuifolia Tausch.

Little club moss	Selaginella densa Rydb.
Prairie groundsel	Senecio canus Hook.
Night flowering catchfly	Silene noctiflora L.
Tumbling mustard	Sisymbrium altissimum L.
Blue-eyed grass	Sisyrinchium angustifolium Mill.
False solomon's seal	Smilacina stellata (L.) Desf.
Low goldenrod	Solidago missouriensis Nutt.
Goldenrod	Solidago mollis Bartl.
Scarlet mallow	Sphaeralcea coccinea (Pursh) Rydb.
Sow thistle	Sonchus arvensis L.
Bronze-bells	Stenanthium occidentale A. Gray
Dandelion	Taraxacum officinale Weber
Buffalo bean	Thermopsis rhombifolia (Nutt.) Richards.
Stinkweed	Thlaspi arvense L.
Goatsbeard	Tragopogon dubius Scop.
Common nettle	Urtica gracilis Ait.
Vervain	Verbena bracteosa Michx.
Cockle bur	Xanthium strumarium L.

IX. TIMBER LIMIT[1]

GENERAL DESCRIPTION

The Timber Limit is relatively small, and covers 4,795 acres (7.49 sq. mi.). It is located in the most easterly part of Waterton Lakes National Park along the west side of the Belly River. A provincial highway (Chief Mountain Road) passes through the northern half of the Limit after crossing the Belly River at a point about 135 chains, as the crow flies, from the north boundary. The main Reserve of the Band lies about 25 miles to the northeast.

Most of the Limit is rolling country but there are some fairly steep slopes in the southern half where extensions of Sofa Mountain and Sentinel Mountain reach into the Limit. These slopes are to some extent broadside to Chief Mountain Road and provide attractive scenery for the passing motorist. In the extreme northwest corner of the Limit is a low ridge which slopes rather gently to the east. Due mainly to the dominance of a plateau in the southwest corner and its lower continuation parallel to the Belly River the general aspect of the area is north and east.

The North Fork Belly River enters the Limit close to the middle of the south boundary and joins the Belly River about 90 chains up stream from the highway bridge. The North Fork branch drains a rather small part of the Limit. Most of the drainage is done by Indian Creek and an unnamed stream, both of which enter into the Belly River. The general drainage direction is to the east. In some places drainage is insufficient and a number of swamps and intermittent marshes are located northwest of the center of the Limit towards the highway, and low lying lands close to the confluence of the North Fork and the Belly Rivers.

Accessibility is good in most parts of the Limit, and existing survey lines, trails, and rights of way will facilitate hauling. The only area not readily accessible is the plateau in the southwest corner but no exceptional difficulties or high costs are foreseen when tree cutting is extended to this area.

FOREST DESCRIPTION

The Limit lies on the eastern edge of the M.5 – Douglas Fir and Lodgepole Pine Section of the Montane Forest Region[2]. The climate is fairly dry, and as a result small differences in soil texture, aspect and exposure have a noticeable effect on the number and distribution of the tree species. The dominant species at present is lodgepole pine (Pinus contorta, var. latifolia).

The pine occurs mainly in pure stands, but to some extent is found also in mixtures of spruce (Picea spp.) and poplar (Populus spp.). The average number of trees (one inch and over at d.b.h.) per acre varies greatly in stands of any age, and ranges from 250 to 2,500. In the north half of the Limit the pine stands are generally open and the trees limby, whereas the stands on the southwestern plateau are usually overstocked.

Aspen (Populus tremuloides) is the dominant species in most mixedwood stands. Other species in these stands are black cottonwood (Populus trichocarpa), willow (Salix spp.), balsam fir (Abies balsamea) and brush. None of these trees produce wood of present merchantable value.

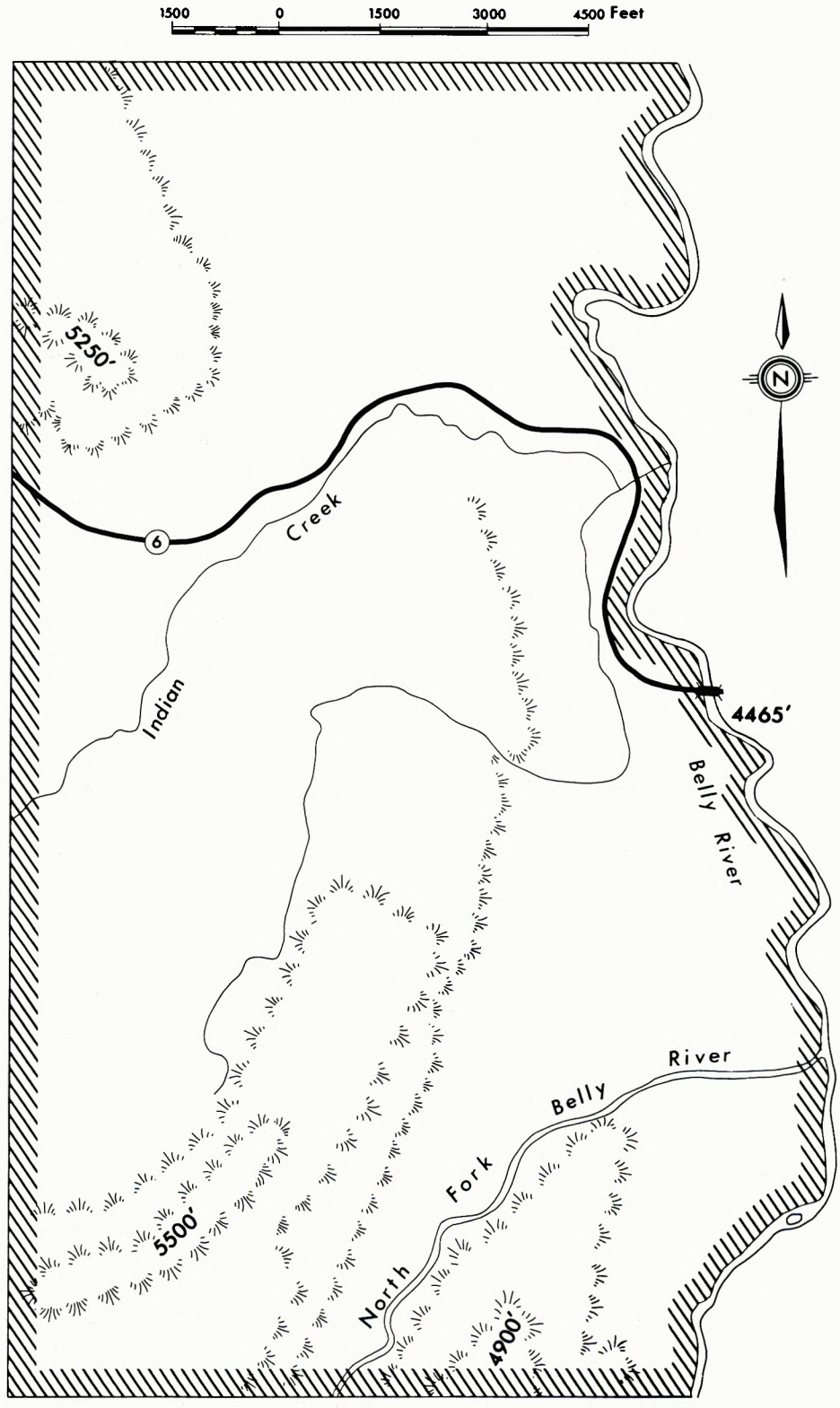
The area occupied by softwood stands is about 1,940 acres, or 40 per cent of the total Limit area (Table 1). The non-commercial mixedwood and hardwood stands comprise 1,659 acres, or 35 per cent of the Limit area. These stands are not included in the estimates. The remainder is non-forested land consisting of grassland (953 acres) swamps and water (161 acres), and rights of way (83 acres).

Table 26 – Land Use, Blood Indian Timber Limit, 1962[3]

Land Class	Acres		Percentages	
Forested land	3,598		75	
Softwood		1,939		40
Mixedwood and hardwood (non-commercial)		1,659		35
Non-forested land	1,197		25	
Grassland		953		20
Swamp, marsh, water		161		3
Rights of way		83		2
Total area	4,795		100	100

For the purposes of estimating the amount of timber, and also to facilitate the management of cutting operations, the softwood stands have been subdivided into mature and immature forest types (see Forest Inventory Map). There are 885 acres (25 per cent of the forest land) of mature timber, which contain a considerable merchantable volume of lodgepole pine. The growth of the trees is now stagnant

Main Topographic Features of the BLOOD INDIAN RESERVE TIMBER LIMIT ALBERTA



and these stands should be harvested first because they are beginning to decline. The immature stands comprise 1,054 acres of lodgepole pine and spruce which have not yet reached their maximum growth.

The mature and immature stands were further broken down into forest subtypes and stocking classes. The forest subtypes are (a) stands consisting predominantly of lodgepole pine, (b) mixed stands of lodgepole pine and spruce where lodgepole pine is the major species, and (c) mixed stands of spruce and lodgepole pine where spruce is the major species.

Table 27 – Forest Areas in Acres by Subtypes and Maturity Classes

Subtype	Maturity Class I	Maturity Class II	Unclassified	Total
P	885	453	–	1,338
PS	–	562	–	362
SP	–	39	–	39
Total Softwood	885	1,054	–	1,939
Non-commercial	–	–	1,659	1,659
Total	885	1,054	1,659	3,598
Per Cent of Total	25%	29%	46%	100%

Within the subtypes a differentiation is made with regard to the average stocking of trees. The four stocking classes used are:

1. open, understocked (less than about 300 trees per acre)
2. average, moderately stocked (about 300 to 750 trees per acre)
3. better than average, fully stocked (about 750 to 1,500 trees per acre)
4. dense, overstocked (more than 1,500 trees per acre).

The area distribution by forest subtypes and stocking classes (Table 28 shows that almost 70 per cent of the area supporting softwoods consist of stands with better than average and dense stocking.

THE ESTIMATE

The data in Table 29 which follows, shows that at present the Timber Limit cannot produce any marketable wood other than fence posts and corral rails. The sale of these products offers the only possibility for economic management of the Timber Limit, and it is fortunate therefore that the adjacent range country of southern Alberta provides a ready market.

Table 28 – Softwood Area Distribution by Forest Subtypes and Stocking Classes, Blood Indian Timber Limit, 1962

Areas in Acres

Forest Subtypes	Stocking Class 1	2	3	4	Total	Per Cent of Total
Lodgepole pine	45	527	86	680	1,338	69
Lodgepole pine-spruce		6	556		562	29
Spruce-lodgepole pine		39			39	2
Total acres	45	572	642	680	1,939	100
Per cent of total	2	30	33	35	100	

Table 29 – Average height, Diometer, and Age of Forest Subtypes by Moturity and Stocking Classes Blood Indion Timber Limit, 1962

Subtypes	Maturity Class	Stocking Class	Average Height	Average d. b. h.	Average Age
			Feet	Inches	Years
Lodgepole pine	mature	1	55	7	75
"	"	2	45	6	87
"	"	4	35	4	83
"	immature	2	40	6	50
"	"	3	30	4	40
Lodgepole pine-spruce	"	3	35	4	45
Spruce-lodgepole pine	"	2	60	8	85

The mature lodgepole pine stands contain at present about 340 corral rails and about 860 fence posts per acre (Table 30). In comparing the mature and immature subtypes with similar stocking, i.e. stocking class 2, it appears that the available supply per acre of corral rails from the mature stand is about three times higher than that from the immature stand, but the number of available fence posts is about the same for both stands.

The total number of corral rails that is at present available for harvest is about 361,000, and the number of available fence posts amounts to about 1,049,000 or a total of 1,410,000 pieces (Table 31). The mature stands account for 66 per cent of this total, and the immature stands account for the remaining 34 per cent.

Table 30 – Available Supply Per Acre of Carral Rails and Fence Posts by Forest Subtypes, Maturity and Stacking Classes, Blood Indian Timber Limit, 1962[a]

	Corral Rails ($d_0b_0h_0$)			Fence Posts ($d_0b_0h_0$)						Total of Rails and Posts
	2	3	Total	4	5	6	7	8	Total	
	Pieces									
Mature Stands										
P 1	10	10	20	20	20	30	30	30	130	150
P 2	10	50	60	75	75	100	75	75	400	460
P 4	100	320	420	600	200	170	30	–	1 000	1,420
Averages	80	260	340	483	171	152	38	14	858	1,198
Immature Stands										
P 2	–	20	20	35	120	170	40	20	385	405
P 3	150	150	300	200	120	50	–	–	370	670
PS 3	50	80	130	200	170	50	35	–	455	585
Averages	41	65	106	142	148	92	34	7	423	529
Over all Average	60	156	216	301	158	120	36	10	625	841
	Percentages									
Av. Mature Stands	7	22	29	40	14	13	3	1	71	100
Av. Immature Stands	8	12	20	27	28	18	6	1	80	100
Over all Average	7	19	26	36	19	14	4	1	74	100

a. P 1 means forest subtype lodgepole pine stocking class 1; similarly for P 2 P 3 and P 4; PS 3 means forest subtype lodgepole pine spruce stocking class 3.

Table 31 – Available Supply of Carral Rails and Fence Posts by Maturity and Stacking Classes, Blood Indian Timber Limit, 1962

	Corral Rails 2–3"$d_0b_0h_0$	Fence Posts 4–8"$d_0b_0h_0$	Total
	Pieces		
Mature Stands			
P 1	640	4,160	4,800
P 2	8,280	55,200	63,480
P 4	256,620	611,000	867,620
Total	265,540	670,360	935,900
Immature Stands			
P 2	6,340	122,045	128,385
P 3	24,600	30,340	54,940
PS 3	64,610	226,135	290,745
Total	95,550	378,520	474,070
Total of Mature and Immature Stands	361,090	1,048,880	1,409,970
Per Cent of Total	26	74	100

The wood utilization and management of the Timber Limit will be discussed in Chapter XII.

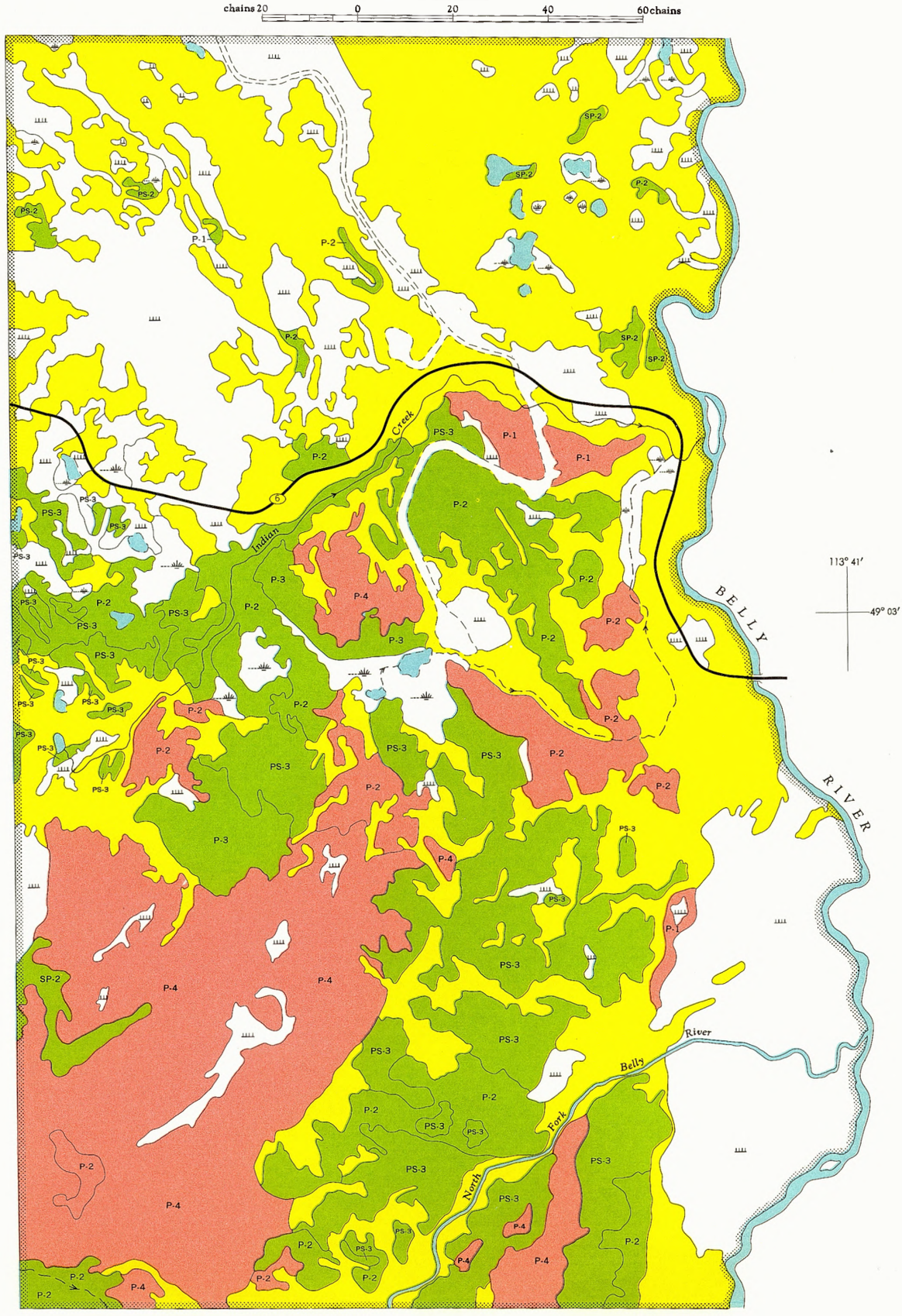
NOTES AND REFERENCES

1. Existing forest survey data and other relevant information were reviewed and adapted for publication in the present form (Chapters IX and XII) by Mr. A. A. Buys, Forestry Officer, Department of Forestry and Rural Development, at the request of the Indian Affairs Branch.
2. Rowe, J.S., Forest Regions of Canada, Bull. 123, Queen's Printer, Ottawa, 1959.
3. Inventory data, contained in the reports on the Timber Limit by Messrs. C.P. Brett and A.M. Marsh, have been adjusted to conform with the total area of the Limit as provided by the Indian Affairs Branch and shown on the accompanying maps.

BLOOD INDIAN RESERVE TIMBER LIMIT

ALBERTA

FOREST INVENTORY MAP - 1962



REFERENCE

Colour Legend

- Mature types
- Immature types
- Non-commercial types
- Non-forest land
- Water

Stocking (Mature and Immature)

- Understocked, open.....1.
- Moderately stocked, average.....2.
- Fully stocked, better than average.....3.
- Overstocked, dense.....4.

Species

- Lodgepole pine....P
- Spruce.....S

Example of Symbol

PS-3 .. Lodgepole pine and spruce — Fully stocked

- Swamp
- Grassland, meadow
- Lake, intermittent
- Stream, intermittent
- Main highway — 6
- Right of way
- Forest type line
- Boundary, Timber Limit

FOREST CLASSIFICATIONS

Mature

Lodgepole pine stands which contain considerable merchantable volumes but have become stagnant, and begin to decline. Such stands should have priority in cutting.

Immature

Lodgepole pine and spruce stands with merchantable volumes but which have not reached their maximum rate of growth could be deferred until maturity.

Non-commercial

Stands consisting of aspen, black cottonwood, willow, scattered spruce, pine, and balsam fir. Though regarded as non-commercial under present market conditions, these stands could supply fuelwood.

Utilization of Natural Resources

X. MINERAL RESOURCES

The term "mineral resources" is used here in its broadest sense, and includes oil and gas, coal, oyster shell, gravel and sand, and even groundwater. The oil and gas resources on the Reserve (including the Timber Limit) are by far the most important ones in terms of providing revenues to the Band, and fuel for industrial, business and domestic use. Coal, on the other hand, has been the mineral of greatest value during the early history of the Reserve. This resource was exposed in river banks, and could be mined easily with primitive tools. It is unlikely that the mining of coal will ever reach the importance of past years. Gravel and sand, although of minor importance, will be increasingly used in the future. The oyster shell deposits may also be utilized, and the need for groundwater will become more and more evident as time goes on. The utilization and economic significance of the various resources will be discussed in the approximate order of their importance.

OIL AND GAS

Main Reserve

There are still good prospects for the development of crude oil and gas on a commercial basis on the main Reserve. The drilling of the 19 wells shown on page 63 amounts to only about one well per township, and some of these are grouped in two's and three's. There are large areas which have not been tested.

A study of the cross section (p. 65) reveals that there was some oil and gas in most of the wells shown. Similar shows were observed in most of the wells not included in the section. These encounters indicate a widespread occurrence of hydrocarbons on the Reserve, particularly in the Rundle Group of the Mississippian Period.

Drilling on the Spring Coulee Arch also indicated prospects of commercial production. Following the drilling of their two wells in section 23-6-24, Pan American Petroleum Corporation persisted in attempting to achieve a sustained profitable production through various well stimulation programs, but without success. One of the reasons offered for the drying up of the flow of oil is that the drilling operation introduced water into the oil reservoir rock, causing certain clay minerals to swell and thereby sealing off the minute channels and reducing the permeability of the rock. In subsequent drilling (Pan American K-1 Blood Indian Reserve 12-20-5-23W3 well, 1960) an oil-base mud, rather than the usual water-base mud, was used to exclude water from the reservoir. Unfortunately the reservoir rock was encountered in a place where it was saturated with salt water rather than oil, leaving unanswered the question why the initial flow of oil has dried up in the earlier wells.

Since completion of Chapter VI another wildcat well was drilled by Royal American Petroleums Limited along the Spring Coulee Arch at Legal subdivision 10 of section 23-6-24. This company is attempting also to obtain continuous commercial production by excluding water from the formation. Oil was recovered during a test of the interval from 6,332 to 6,388 feet in depth within the Rundle Group of the Mississippian, which gave promise of commercial production. At the time of writing (September 1964), production tests have not been completed to confirm this promise, but if this company is successful it would confirm Pan American Petroleum Corporation's explanation that water used during drilling causes clay mineral to swell and seal off the channels through which the oil flows.

Should an oil field be developed on the Blood Indian Reserve it will not provide significant employment opportunities for the Indian people. With modern oil production equipment, one man is sufficient to operate and maintain the equipment for a small oil field. Transportation charges on crude oil are low, considering its value, so refineries and industries using refined products are usually situated distant from the place of production. The main benefit to the Indian Band would be revenues from bonus payments for leases and from royalties for production.

There is also a possibility of developing wet gas in the southwest corner of the main Reserve which is located in the Disturbed Belt. The highly productive Pincher Creek gas field is only five miles west of the reserve boundary and conditions for the entrapment of wet gas, similar to those in the Pincher Creek structure, could exist on the Reserve.

Timber Limit

The physical development of the Lookout Butte wet gas field on the Timber Limit has been described in Chapter VI. It is important to have this field exploited as a unit, that is to say the drilling and production of wells should be planned and carried out in a manner which assures the greatest recovery of the hydrocarbon resource and maximum benefits to the participating interests. At a time when there is no market for gas it becomes necessary to proceed in two stages. The first stage is a cycling operation in

which condensate is removed from the wet gas and sold, while the residue gas is injected back into the gas reservoir for future use. The second stage will commence when there is a market for the residue gas, and will require plant facilities for the recovery of sulphur and liquid fractions.

Unit Agreement. – The cycling operation requires the gas field to be operated as a unit in which one well is chosen for injection of gas produced from the remaining wells. For an efficient operation the choice of the injection well must be based on engineering considerations and without regard to ownership.

British American Oil Company Limited and Shell Canada Limited (assignee of Shell Oil Company) started negotiations in early 1962 for operating the gas field as a unit. It was necessary to reach agreement first on the engineering interpretation of results from the drilling of each well; and second, on the projection of results for these wells to the entire area (see map p. 67) believed to be underlain by the gas reservoir. Following agreement, participating interests could then be calculated.[1] Negotiations were completed and an agreement was accepted by all interested parties in August 1963. Subsequently the Shell Chief Mountain 12-16 was included in the unit area and the tract participations were adjusted to increase the interest of the Blood Band in the field. The new agreement became effective May 1, 1964.

At present field gas is gathered from the 11-31, 3-29, 7-20 and 12-16 wells and delivered to the cycling plant near the 4-13 well.[2] The condensate moves automatically to the Rangeland Pipeline and is transported to a market in the Rocky Mountain area of the United States.

Blood Indian Band Share. – Under the revised agreement of May 1964 the portion of production credited to land of the Blood Indian Band was raised from 38.049861 per cent to 46.00 per cent. Fifteen per cent of this amount, or 6.9 per cent of the wellhead value, goes to the Band as royalties.

Cash revenue to the Band from the sale of condensate alone is already considerable. After the cycling plant was tuned up to operate at nearly full capacity, royalties averaged almost $9,000 per month. Since enlargement of the unit in May 1964, revenue from this source has increased to over $11,000 monthly. As production continues the condensate content of the produced gas stream will constantly decrease so that, if cycling were continued for ten years, the revenue in the tenth year would be scarcely half of that in the first year.

Prospects for Future Use. – There is good prospect that a market will develop in the near future for gas from the Lookout Butte field. This field is located favourably within a few miles of both the pipeline transmitting gas for export to Montana and California and the pipeline for gas to the market in eastern Canada. Another factor is that a nearby field has not supplied gas in the quantity originally estimated, which leaves some pipeline capacity unused. There is also the prospect of new industrial plants being established in the area because in addition to a moderately priced gas fuel, such industries would be close to railway transportation and have access to large supplies of water.

COAL

History of Coal Mining

In 1890 John McKenzie of Lethbridge was employed by the Indian Department to open up the first mine on the Reserve. Shortly afterwards, an Indian by the name of Heavy Gun began mining coal, and in 1892 an agreement was made with the Band which gave him the right to mine coal on the St. Mary River. In 1894 another Blood Indian, Black Horse, started mining coal and continued with his sons until the early 1920's when a fatal accident to Black Horse brought the operations to a halt. Although records for this period are incomplete, annual production appeared to range from 100 to 600 tons. Most of this coal was freighted in horse-drawn wagons by Indians from the St. Mary River occurrences.

Later, and for a short period only, experienced miners from the Blackfoot Reserve mined a seam on the Belly River a short distance downstream from the highway bridge east of Hillspring. It is reported also that coal was mined from the Bullhorn Coulee area west of St. Paul's Anglican School. These localities in the southern part of the Reserve were favoured because they were close to the more populous part of the Reserve. But production was soon discontinued because the amount of mineable coal was limited and the quality poor.

As coal was mined from a river or coulee bank crude timbers were placed for support to render some measure of safety to the workers. With the passing years entries to the underground working areas became longer, timbers began to decay and collapse, and finally the underground workings were abandoned. At no time was the quantity of coal mined very large, and it would not have exceeded 20 tons a day. The coal was used not only on the Reserve but also was sold to nearby farmers and in towns.

The last period of coal mining extended from 1948 to 1956. Following a referendum by the Band in 1948, coal mining rights in section 7-7-21 were leased to McClain and Meldrum of Magrath. In this section suitable coal was found in the flood plains of the St. Mary River. As strip mining proceeded down the dip of the seam, river water seeped in and made mining operations difficult. The operations had to be abandoned in 1956. The amount of coal produced from this lease was only 4,179 tons, all of which was marketed in the Magrath area outside the Reserve. For each ton produced the Band received 50 cents in royalties.

Prospects for Future Mining

At present coal is not mined but there is prospect of mining deposits by the strip method. Strip mining requires that a seam of mineable thickness occurs close enough to the surface so that the overburden can be easily removed and disposed of. The occurrences on the Belly River and Bullhorn Creek are not worth further investigation as the steeply dipping seam makes strip mining impossible. There is prospect, however, of small strip mining in localities 1 and 5 (see p. 73) on the St. Mary River.[3]

Locality 1. – Here the No. 1 coal seam has a mineable thickness of 3 feet 6 inches. A small amount of shale parting (4 inches) could be separated easily from the coal at the time of mining. The overburden, consisting of soft shales and river deposits, is about 10 feet or more thick and could be disposed of readily by bulldozing it over the steep river bank.

On the basis of a volume-weight relationship of 4.32 tons per hundred cubic feet and an average seam thickness of 3.5 feet, a pit measuring 200 by 50 feet would contain 1400 tons of coal. Present information is insufficient to state with certainty to what length the pit could be extended. The 200 feet in the example could certainly be achieved, however, and it is probable that it could be extended beyond this length. The width is limited by the northward rise of the land surface and a thickening of the overburden. It is unlikely, therefore, that the width could exceed 50 feet.

Locality 5. – At this locality No. 2 seam presents possibilities for a strip mining operation. This seam contains 3 feet 6 inches of coal and a 4 inch parting of shale that could be separated during mining.

Where the seam is exposed in the steep bank the overburden is about 10 feet thick. West of this point and of the line of outcrop the overburden increases in thickness, and also here the mineable width would probably not exceed 50 feet. The length of a pit along the line of outcrop may well exceed that of a pit at locality 1.

Conclusion

In view of increasing use of coal for thermal power plants consideration was given to the possibility of finding sufficient coal on the Reserve for such a plant. A thermal power plant would require a coal reserve of at least 25 million tons with an overburden depth of less than 50 feet. The mineable coal on the Reserve, however, falls far short of these requirements. Deposits of coal in the St. Mary River area may be strip mined only for a small local market.

OYSTER SHELL

In recent years several parties have shown interest in leasing the mining rights to the fossil oyster shell. In 1957 a company in Cardston applied for the rights with the intention of providing the limestone ingredient for a proposed portland cement plant. The plan was abandoned, which is not surprising because the steeply dipping beds are too small to justify the capital expenditure required for such a plant. In 1960 another party applied for the rights and wanted to use the shell for producing a calcium feed for poultry. The party lost interest when it became apparent that distributors and poultrymen prefer apparently the white flaky product of imported shell to the ground and washed fossil oyster shell which happens to be granular and grey-buff. Another group, also wanting to use the shell for the poultry market, proposed in 1963 the construction of a $35,000 plant on the Reserve. The shell was to have been quarried on the Reserve and also on land across the Belly River just north of the highway bridge to Hillspring. Although there has been delay in submitting a formal application for the rights of mining the oyster shell the group has indicated its continued interest.

The usefulness of ground oyster shell as a calcium feed for poultry was demonstrated in a feed experiment at the Lethbridge Research Station of the Canada Department of Agriculture (see p. 75). According to this experiment, it may be recalled, the local oyster shell is just as good as the imported shell. The results of this experiment should be brought to the attention of poultry feedmen who discriminate in favour of the white flaky imported shell, and who have to pay $40.00 to $42.00 a ton for this product. The fossil oyster shell deposits could be crushed and washed well below that price, and still leave a good margin of profit.

GRAVEL AND SAND

The use of gravel and sand is restricted largely to requirements for the construction of roads and buildings, within a short trucking distance of the deposits. As the quantity of these materials is plentiful and well-distributed in southwestern Alberta, very little of the supply located on the Reserve has been sold. It is expected that future utilization will be confined largely to needs on the Reserve.

GROUNDWATER[4]

The development of groundwater resources requires, in addition to the location of potential aquifers, a preliminary test drilling program to determine the yield and quality of water within the aquifer. As will be recalled from the ground water discussion in Chapter VI the sandstone within the lower part of the St. Mary River Formation and the entire Blood Reserve Formation are considered good potential bedrock aquifers, and three locations are indicated for test holes (see maps p. 61 and p. 77). Additional bore-holes will be required to test the groundwater potential of these formations in other parts of the Reserve. If test drilling indicates that a satisfactory supply of water can be obtained, it is then necessary to construct a well designed for the geological and hydrologic characteristics of the aquifer.

The best results from test drilling and subsequent well installation will be obtained if the work is done by a competent well drilling contractor.[5] No assurance can be given that all holes drilled during the testing program will encounter adequate water supplies from the potential aquifers. All drilling, however, will give valuable information for future groundwater exploration, provided a record of the drilling is retained including the log and location of each hole.

In addition to a groundwater development program, improvements to existing water supplies on the Reserve, such as concrete enclosures over springs and the fencing of stock ponds should also be undertaken.[6]

NOTES

1. Engineering values required for the calculation of reserves of gas include net pay thickness and average porosity of the gas reservoir rock for each well. The hydrocarbon pore volume contours (see map p. 67) are drawn from these well data, allowing for all known geological considerations. From the pore volume map are estimated tract participations and participations of individual working interest owners and royalty owners in the total field production.
2. Shell Canada Limited has provided the following details of the operation of the plant:

   "The cycling plant consists of a separator, condensate stabilization unit, condensate storage and shipping facilities, and compressors. The raw gas enters the plant at the inlet separator where the condensate is removed from the raw gas at a pressure of 1,110 pounds per square inch and a temperature of 75°F. The residue gas passes from the separator to the compressor units where it is compressed to approximately 5,000 pounds per square inch and reinjected to the reservoir through the 4-13 well. The compressor capacity of 36 million cubic feet per day at an inlet pressure of 1,150 pounds per square inch and discharge pressure of 5,000 pounds per square inch is made up of three 1,100 horsepower compressors."

   "The condensate upon leaving the separator is flashed to 500 pounds per square inch and then passed through the stabilizer where the condensate is further stripped of gas to yield a product containing less than 2% butane. Gas released from the stabilizer is compressed and injected into the flash tank. The gas liberated in the flash tank is further compressed and readmitted to the inlet separator. The stabilized condensate passes on to the storage tanks located at the plant. Sufficient storage capacity has been installed to hold 2 days production. However, this is not normally used as Automatic Custody Transfer equipment delivers the condensate directly to the pipeline."
3. The following descriptions of localities 1 and 5 were prepared by B. A. Latour (see note 1, Chapter VI).
4. This section was prepared by J. S. Scott (see note 1, Chapter VI, and *Groundwater Potential, Blood Indian Reserve, Alberta*, Paper 63-15, Geological Survey of Canada, Department of Energy, Mines and Resources Ottawa, 1963).
5. Information on competent water well drillers in the Blood Reserve area may be obtained from the Alberta Water Well Drilling Association, P.O. Box 505, Edmonton, Alberta.
6. The Prairie Rural Housing Committee has published two excellent booklets: *Farm Water Systems and Sewerage* and *Treatment of Farm Water Supplies* (available from the Extension Department, University of Alberta, Edmonton). Both booklets could be used to advantage on the Reserve.

XI. AGRICULTURE

This chapter deals with dry-land farming practices and range management, and contains an appraisal of potential income from these two sources. First it will be well, however, to take a look at how the land has been used lately.[1]

LAND USE

In 1961 there were about 86,450 acres under cultivation, and just under 100,000 acres were used as grazing land (Table 32). These acreages amount to 25 and 29 per cent, respectively, of the total Reserve area. The 1963 estimates show an increase in the amount of grazing land which took place as a result of extending the grazing area for the Band's herd on what had been open range.

Table 32.– Averages of Major Land Use Categories, Blood Indian Reserve, 1961 and 1963

	1961	1963	1961	1963
	acres		percentages	
Cultivated land[a]	86,450	84,900	25	24
Grazing land[b]	99,250	116,600	29	34
Open range[c]	135,600	119,800	39	35
Other land (bad-lands, sloughs, etc.)[d]	23,200	23,200	7	7
Total Reserve[e]	344,500	344,500	100	100

Sources.–
a. 1961: land use survey; 1963: Blood Indian Agency.
b. 1961 and 1963: Blood Indian Agency.
c. 1961 and 1963: residuals.
d. 1961 and 1963: soil survey (Chapter VII).
e. 1961 and 1963: Indian Affairs Branch, Ottawa.

According to the 1961 data individual Indians held 48 per cent of the cultivated land and 50 per cent of the grazing land (Table 33). The entire open range was (and is) available to them and they used this land primarily for cutting hay. Nearly all of the remaining cultivated land was leased to non-Indians. In 1961 and 1962 the leased cultivated land was increased by about 12,000 acres under short-term lease agreements for the liquidation of farming debts incurred by Indians who had been using that land (see Chapter XIII). The grazing leases to non-Indians were not renewed when they expired in 1963 and 1964. As a result Indian grazing lands increased in 1963 by about 1,945 acres, and in 1964 by 19,910 acres. This shift decreased the proportion of grazing land used by non-Indians to only 2 per cent.

TABLE 33.– Utilization of Cultivated and Grazing Land by Groups of Users, Blood Indian Reserve, 1961

Users	Cultivated Land		Grazing Land	
	acres	percentages	acres	percentages
Individual Indians	41,300	48	50,000	50
Blood Indian Band	250	0.3	27,200	27
Non-Indians (leases)	43,480	50	22,050	23
Residential schools:				
St. Mary	1,000	1.2		
St. Paul	420	.5		
Total	1,420	1.7	–	–
Total	86,450	100.0	99,250	100

Indian and non-Indian farmers follow about the same crop rotation (Table 34). In 1961 a somewhat higher percentage of the leased land was kept in

TABLE 34.– Acreages and Percentage Distribution of Field Crops (and Summer Fallow) for All Cultivated Land, Agricultural Lease Area and Indian Operated Farms, Blood Indian Reserve, 1961

	All Cultivated Land		Indian Operated Farms[a]		Agricultural Leases	
	acres	%	acres	%	acres	%
Spring Wheat	31,139	36.0	15,132	35.2	16,007	36.9
Winter Wheat	3,991	4.7	3,191	7.4	800	1.8
Durum Wheat	2,047	2.3	162	0.4	1,885	4.3
All Wheat	37,177	43.0	18,485	43.0	18,692	43.0
Coarse Grains	5,118	5.9	3,325	7.7	1,793	4.1
Forage	1,805	2.1	1,290	3.0	515	1.2
Oil Seeds	2,862	3.3	952	2.2	1,910	4.4
Other Crops	9,785	11.3	5,567	12.9	4,218	9.7
Summer fallow	39,482	45.7	18,914	44.1	20,568	47.3
Total	86,444	100.0	42,966	100.0	43,478	100.0

a. Includes Band and Residential School farms.
Source.–Land use survey.

summer fallow (47 per cent, as against 44 per cent on Indian operated farms), and the difference may be ascribed to a somewhat lower precipitation in most of the lease area than in the area where most Indian farms are located. The land is predominantly used for grain growing. Spring wheat occupies about 35 per cent of all the cultivated land, and winter wheat is only slowly gaining ground. Indian operated farms have a slightly larger proportion of their land in use for coarse grains and forage crops. A small acreage of lease land, most of which is located in Township 7, Range 23, and Township 5, Range 24, has been used for the production of tame grass seed.

Most of the land cultivated by Indian farmers lies in the southwestern half of the Reserve where the soils belong to the Thin Black Soil Group (Soils and Topography Map, p. 85). The largest single piece of land leased for crop production lies in the northeastern part of the Reserve. The soils in that part belong to the Dark Brown Group. With a few exceptions all of the cultivated land is located in areas that have been mapped as good to very good arable, and fairly good to good arable.

DRY-LAND FARMING

This section constitutes a general assessment of the actual cropping and cultivation practices used on the Reserve, without consideration of related economic factors.

Indian Operated Farms

Much of the cultivated land was broken from the native grassland using mouldboard or breaker-bottom ploughs. In some instances ploughs were not operated effectively with the result that sods were turned incompletely. Regrowth of grass and forbs occurred readily in years when moisture conditions were favourable and so necessitated a partial re-breaking of the land. Wherever poor sod breaking occurred, the preparation of good seed beds was hampered for 2 to 4 years, and during that time poor grain crops were produced.

Although exceptions have occurred, much land used for cereal grain production has been seeded without adequate seed bed preparation. A lack of dependable implements has been partially responsible for this condition, but some blame must be laid on the operator for failing to begin seed bed preparation in early spring when weed growth is small and repeating it once or twice if necessary before seeding.

There is little, if any, evidence of any appreciable tillage after harvest on stubble fields for weed control. Under the relatively good moisture conditions that prevail in the Thin Black Soil Zone, growth of annual and perennial weeds has usually been well advanced by the time initial tillage for fallowing has been completed. There has been a tendency in past years to neglect or delay initial tillage on fallow until late spring or early summer.

Disk-type implements such as the one way and the wide level disk-harrow have been popular for fallow tillage. Only in recent years have Indian farmers begun to use subsurface tillage implements. Through repeated use of disk-type tillage implements, often improperly adjusted and operated, one usually buried a large proportion of the crop residue and weed growth (trash cover), and left fallow fields in an unprotected and vulnerable condition against wind erosion. On fine-textured or heavy soils located in Township 5, Ranges 25 and 26, some serious soil drifting has occurred on fallow fields. Generally, these fields have been inadequately protected by trash cover and strip cropping against wind damage.

Strip cropping, a recommended practice in areas where soil drifting occurs, has been conspicuous by its absence on all but a few farms. Where strips have been employed, they have generally been wider (20 to 40 rods) than is normally recommended (8 to 20 rods) for maximum protection. Recognized emergency control measures to stop soil drifting when it occurs have been used on only a limited scale. Some soil erosion by water has occurred on cultivated land located on sloping terrain, but this has not yet been as serious as the erosion caused by wind elsewhere on the Reserve.

With minor exceptions, most of the grain has been produced on fallow land, and very little sowing on stubble ("stubbling in") has been practised. Almost one half (44 per cent in 1961) of the total cultivated acreage on Indian operated farms has been fallowed each year. Because of their greater moisture content the Thin Black soils permit the use of more intensive cropping systems than are at present being used on the Reserve. These soils lend themselves well to mixed farming and the use of longer rotations involving the growth of more coarse grains and some forage crops rather than to wheat production alone.

The length of rotation and the proportion of grain, forage, and fallow will depend on the operator's need for livestock feed and upon local soil conditions. A full year of summer fallow every other year is costly and of doubtful value on most soils in the Thin Black Soil Zone. One year of fallow in a 4 to 6 year rotation will be adequate for weed control. Where such a rotation is used, winter wheat acreages could profitably be increased. This crop should be seeded strictly in

accordance with the recommendations supplied by the Lethbridge Research Station of the Canada Department of Agriculture. Stubbling in coarse grain or wheat whenever moisture conditions permit should be done on a much larger scale than has so far been practised.

Where fallowing is done, a real effort must be made to maintain adequate trash covers on all fields through an appropriate choice of crops and tillage implements. Cereal grains usually provide more trash cover than flax or other oilseed crops. Disk-type tillage implements ordinarily bury more trash cover than subsurface-type tillage implements.

Weed growth in a growing crop constitutes a problem on many farms operated by Indian farmers. Canada thistle, sowthistle, wild mustard, flixweed, and wild oats are common in grain fields. Selective herbicides have not been used to best advantage on most farms. Where herbicides have been used, they have often been applied too late to obtain optimum weed control consistent with minimum crop damage. It is noticeable, however, that a gradual and marked improvement in this valuable practice has occurred during the past 2 or 3 years.

Little or no commercial fertilizer has been applied at any time, although fertilization is recommended throughout the Thin Black Soil Zone of Alberta and is recognized as a necessity for sustained high production on such soils.

A few Indian operators have attempted to farm the Solonetzic soils located in Township 4, Range 25, but have had only a moderate amount of success in producing satisfactory grain crops. Sweet clover for hay has been grown with some success on these soils.

Recommendations:

1. Closer attention should be paid to timing and method of tillage for seed bed preparation. Firm seed beds, free of weeds and adequately protected from wind by a moderately heavy mantle of well anchored trash cover, help to ensure uniformity in crop growth.[2]

2. Strip cropping should be followed on all farms to reduce the danger of soil drifting. Strips 8 to 16 rods wide are recommended on the heavier clay soils. On loam soils, strips 16 to 20 rods wide could be used effectively.[3]

3. The acreage now cultivated could be utilized to much better advantage by stubbling in, thereby stabilizing the farming program. Usually, when there is over 27 inches of moist soil under the stubble at seeding time, such land should be re-cropped rather than fallowed. A reduction in fallow acreage on almost all farms would not only materially increase the average yield per acre of rotation, but also decrease the incidence of soil drifting.

4. Selective herbicides, applied as recommended by the manufacturers, would help to reduce weed growth on most farms.

5. Without exception, phosphate and nitrogen fertilizers should be used according to the recommendations issued by the Alberta Department of Agriculture or the Lethbridge Research Station.[4]

Agricultural Leases

Most land cultivated under lease agreements by non-Indian farmers was broken from native grassland between 1949 and 1954. Farmers or farming companies, equipped with large scale heavy duty machinery, did much of the initial sod breaking. Subsurface blade cultivators and chisel ploughs, followed by heavy duty, offset disk-harrows or one way tillers, were used for breaking. Because soil moisture conditions were not always favourable, only a mediocre job of sod turning resulted the first time on much of the land. Soddy seed beds did not provide optimum growing conditions for newly seeded grain, and many grain stands lacked uniformity. Grain yields during the initial years of operation were not always as good as might be expected. Subsequent tillage of the grain stubble after harvest, along with cultivation the following spring, usually completed the sod breaking job, and fields with good tilth and soil structure resulted. Grain stands have generally been satisfactory after the initial years, and yields have compared favourably with those from surrounding districts. Lease land has generally been farmed in big block areas with fields ranging in size from about 80 to 640 acres. With minor exceptions, non-Indian operators have farmed their lease land on a crop-fallow basis. Fallows have generally been prepared with subsurface blade cultivators, heavy duty cultivators, or wide level disk tillage implements. Where blade or heavy duty cultivators have been used consistently, reasonably good trash cover has remained on the soil surface as protection against wind erosion. Some operators, however, have used disk-type tillage implements repeatedly on fields where stubble was sometimes thin and light, and thereby reduced the amount of protective trash cover. Furthermore, in an effort to cover large acreages in a limited amount of time, tillage implements have often been operated at excessively high ground speeds, an action that tends to pulverize useful soil aggregates and break down valuable soil structure. On many of these fields, serious soil drifting has occurred.

Since 1958 there has been evidence of serious soil drifting on several fields in the midwestern and northeastern portions of Township 7, Range 23, and the southwestern corner of Township 8, Range 22. Some soil drifting has also occurred on lease land located in Township 5, Range 24. From 2 to 4 inches of soil have been eroded from the surface of areas 5 to 20 acres in size on many fallow fields. Insidious soil drifting, where less than 1 inch of soil has been moved from the surface of the fields, has occurred over even larger areas. Recognized emergency control measures to stop soil drifting have seldom been used as readily or as extensively as the seriousness of the problem warranted. Absenteeism from the land by the lessee may be partially responsible for this condition, but absenteeism can seldom be accepted as an excuse for failing to implement control measures. Strip farming, in its true sense, has not been practised on these farm lands, although it is a recommended practice for the control of soil drifting in this area.

Selective herbicides have been used for weed control in most grain crops each year. An abnormally heavy and unsightly infestation of wild oats has appeared, nevertheless, in grain crops on land located in the midwestern portion of Township 7, Range 23. It would appear that a concerted effort at eradication or control during the formative years of this wild oat infestation would have prevented the present problem.

The application of commercial fertilizers on land seeded to grain has been well below the recommended levels. Only on land where tame grass seed is produced have substantial amounts of fertilizer been used.

Recommendations:

1. Most land leased is located in the Dark Brown Soil Zone. This Zone is primarily a grain producing area, and every effort should be made to maintain its productivity at a high level through appropriate cropping practices.

2. All cultivated land, except that seeded permanently to grass, should be strip farmed in accordance with the latest recommendations from the Lethbridge Research Station.

3. Emergency control measures to stop soil drifting must be adopted more readily in the future than has been the case in the past.

4. Serious consideration should be given to reducing fallow acreages by increasing the length of the rotation employed. Reduced fallow acreages would decrease the incidence of soil drifting and tend to increase the average yield of grain per acre of rotation. Re-cropping or stubbling in a crop as an alternative to fallowing has generally been most profitable in the Dark Brown Soil Zone when soil moisture reserves were adequate in the spring. Re-cropping should always be considered on lands located in the Thin Black Soil Zone.

5. Stubble must never be burned in preparing land for re-cropping. If there is evidence of abnormally heavy straw growth at harvest time, or if the straw is of such a nature (for instance, flax straw) as to present a serious tillage problem the following spring, the use of straw cutters on the combine should be considered.

6. Where fallowing is done, a real effort must be made to maintain adequate trash covers on all fields through the proper choice of crops and tillage implements. Cereal grains usually provide more trash cover than flax or other oilseed crops. Disk-type tillage implements ordinarily bury more trash than subsurface-type tillage implements.

7. Non-Indian operators farming lease land must make a genuine effort to maintain all cultivated land free of serious weed growth, particularly weeds such as wild oats, Canada thistle, bindweed and buckwheat.

8. All crops should be fertilized in accordance with the recommendations issued by the Alberta Department of Agriculture and the Lethbridge Research Station. It would seem appropriate that an agreement between lessee and the Blood Band be reached regarding an equitable distribution of fertilizer costs.[5]

Summary

Much progress has been made by some farmers in adopting sound farming practices during the past 5 to 10 years and these men have developed successful farming enterprises. It must also be recognized that there are many operators who have enjoyed only a limited amount of success as dry-land farmers. It would be advantageous and highly profitable to the latter, and to the Blood Band as a whole, if the agricultural information that is available from district agriculturalists, research personnel, and trustworthy commercial firms were sought more often, adopted more readily, and followed more diligently.

RANGE MANAGEMENT

Grazing, Water Supplies and Weeds

The range is unevenly utilized. In some ar over-grazing has been (and still is) serious an other areas grass is not fully utilized from ye year.

The Mixed Grass type in the northern part e Reserve gives every impression of having been zed

constantly without sufficient rest. The wooded bottom lands along the northeastern boundary of the Reserve which provide good shelter during the winter, explain the temptation to keep cattle in that area. There is no doubt, however, that continuous overgrazing with concomitant invasion of weeds has reduced the value of these grazing lands. This situation may be corrected by fencing and development of water sources so cattle can be distributed over the more lightly grazed areas. Some areas are so badly overgrazed that they should be allowed to rest for several years.

There are extensive areas of grazing land in need of additional stock watering places so that livestock will be guided away from the river valleys and into areas which are lightly grazed or undergrazed.

All weeds have the habit of spreading, and steps should be taken to control them as soon as possible. One should start the control on neglected summer fallow and along roadsides. Range weeds are almost impossible to eradicate, and any attempt to do so is costly and time consuming.

Haying

Most hay produced is from the Fescue Prairie, of which Rough Fescue is the main constituent. Although this grass is productive, one can only cut it profitably after an accumulation of two or three years' growth. Periods longer than three years are wasteful because cured or dry grass, when still attached to the growing plant, soon disintegrates and loses nutritive value.

At present, hay is cut in a haphazard manner involving many patches scattered over a wide area. It is detrimental to the range to turn livestock intc these areas because cattle have a tendency to concentrate on the mowed areas which are producing first year's growth. These areas are easily overgrazed thus bringing about retrogressive changes. has been demonstrated that the productivity of land reserved for haying alone is about three times as high as the same land used for grazing. The loss under grazing is due to tramping, bedding down, and livestock excretions which make much of the forage unpalatable and unusable.

It is estimated that in an extensive area of the Fescue Prairie, considerable revenue could be secured from appropriate cutting and handling of this native hay which finds ready sale in feed markets. There is no doubt that improved haying methods would make possible an increase in the amount of native hay produced. One should be careful not to cut the grass too short; if that is done, the crowns of Rough Fescue dry out and die. It is important, therefore, that a stubble of at least three inches be left on the field.

Irrigated Pasture and Re-Seeding

If in future a real need arises for livestock feed, consideration should be given to irrigated alfalfa pastures, particularly along the banks of the rivers bordering grazing lands. The costs of preparing such lands for growing alfalfa hay depend on the amount of levelling required, cultivation practices necessary, seeding, and type of irrigation used (for instance, open ditch or sprinkler). Preparation costs may amount to 40 dollars an acre, and further expenses would be incurred for sowing, irrigating and harvesting. With an average annual yield of two tons an acre, it will certainly be cheaper at present to make full use of the native hay.

Should it appear advisable to re-grass land now under cultivation, it might be possible to raise the productivity two and a half times the native prairie yield by sowing an appropriate grass-legume mixture. The Forage Crop Division of the Lethbridge Experimental Station should be consulted about the mixture to be used, and the rate and manner of seeding.

Feed Lot Operations

With thousands of acres of choice native grassland and a large area of arable land for cereal production, there appears to be an excellent opportunity for feed lot operations, provided, of course, the Canadian and United States cattle markets remain reasonably buoyant and economical feeding methods are employed.

Such an enterprise would involve a good breeding herd of cows, and the feeding of calves and yearlings other than replacement heifers. Much employment would be provided for members of the Band, as well as considerable revenue from the production of feeder calves and yearlings, or well-finished two year olds ready for market.

In view of the size of a feed lot operation that could be set up on the Reserve, a competent range manager would be required to organize and manage the enterprise. Cattle finishing today is a highly skilled occupation with profit margins often narrow enough to demand the most efficient and economic methods of feeding. Without an experienced and competent manager, it is almost certain that a feed lot operation will be a failure.

Summary of Recommendations

1. Consideration should be given to fencing and to the development of water resources, particularly in the northern part of the Reserve.

2. Instead of the present haphazard hay cutting, it is recommended that an area which has proven to give the best yields of good quality hay be reserved for haying.

3. In cutting Rough Fescue, one should be careful to leave a stubble of at least three inches high.

4. Consideration should be given to feed lot operations under competent management.

POTENTIAL INCOME

The Reserve is located in what is primarily a wheat and beef producing area. Although a cropping system of wheat and summer fallow is quite common, oats or barley are sometimes grown as a second crop after summer fallow. Some farmers have a rather intensive cropping system, and produce also crops such as durum wheat, flaxseed, rapeseed, and mustard. The market, however, is limited for these crops. The beef raising is typically a ranch-type operation in which large areas of land are used as grazing land for cattle. Feeder calves and cull cows form the largest proportion of beef sold from most ranches.

In this section estimates of potential incomes from agriculture are provided for: (1) the Reserve as a whole under two different land use arrangements, and (2) grain farms of one section and half a section of land with different productivity rating, as well as a beef farm with a basic herd of 100 head.

Agricultural Income from the Reserve

For the purpose of comparison income estimates have been made for two land use arrangements. In Plan A all land cultivated in 1961, except that in the poor to fair arability class, is used for field crops. All other land is used for the production of beef. In Plan B all land considered suitable for crop production except that in the poor to fair arability class, is used for field crops, and the remaining land for beef production.

For both plans the income estimates are made under the assumption that wheat, oats, barley, flax, and beef cattle will continue to be the main products. The income from these field crops is based on a cropping system of 35 per cent summer fallow, 35 per cent wheat, 15 per cent barley, 10 per cent oats, and 5 per cent flax. The percentage of cultivated land in summer fallow is less than that on the Reserve in recent years but is about the same as that in farming areas around the Reserve, and in line with the recommendations made earlier in this chapter. As far as the beef cattle enterprise is concerned it is assumed to be a cow-calf type of operation with the calves sold as feeders in the fall. Farming skill (management) is of course an important factor determining income. The data used in arriving at potential incomes for the Reserve are based on average managerial skill comparable with that for three-quarter and one section farms on similar soils in other parts of the prairies.

An outline of the steps followed in arriving at net returns from field crops and beef production is given in sections B and C of the appendix to this chapter. From the summary in Table 35 it follows that efficient utilization of the land under a plan that corresponds fairly well to the present land use would provide a (rounded) net return of $995,000, whereas under a plan in which the agricultural potential is more fully utilized the (rounded) net return is $1,625,900.

TABLE 35.– Estimates of Receipts, Expenses, and Net Returns under two Land Use Plans, Blood Indian Reserve

	Plan A	Plan B
Acreage for field crops	82,250	252,400
Acreage for beef production	257,250	87,100
Field crops		
Receipts	$1,363,082	$3,802,003
Expenses	$ 761,451	$2,316,233
Net returns	$ 601,631	$1,485,770
Beef		
Receipts	$ 753,063	$ 268,217
Expenses	$ 359,650	$ 128,096
Net returns	$ 393,413	$ 140,121
Both field crops and beef		
Receipts	$2,116,145	$4,070,220
Expenses	$1,121,101	$2,444,329
Net returns	$ 995,044	$1,625,891

Source.– Appendix, Sections B and C.

Income from Grain Farms and Beef Farms

The returns from a farm will depend to a large extent on its size, productivity of the land, and the managerial ability of the farm operator. These three factors are taken into account in determining the potential income of a farm on the Reserve. For grain farms the returns have been estimated for a one-section and a half-section farm on three different land productivity classes. The income from a cattle farm is based on a basic herd of 100 beef cows, with the calves being sold in the fall as feeders. The size of such a cattle farm depends on the carrying capacity of the range, and would be about 2.25 sections in the

grazing zone of 14 acres per animal unit, about 2.5 sections in the zone of 16 acres per animal unit, and about 5.5 sections in the zone of 35 acres per animal unit. For both grain and cattle farms the assumption regarding management ability is the same as that used in the preceding section.

The incomes from a farm are based on the same crop rotation, yields, costs, and product prices, as those used in estimating the agricultural income for the Reserve as a whole. Higher incomes are obtainable when crops, such as rapeseed, mustard, and durum wheat are grown in addition to the regular grain crops, or when a feedlot is operated to fatten the cattle raised on the ranges. It is not likely, however, that markets and management ability will allow more than a few farmers to deviate from the typical farm operation in this area.

The per acre cost of producing grains is only slightly affected by the number of bushels produced. The cost per acre of producing grain on the fair to fairly good class of land is estimated at $9.00 and on the good to very good land at $9.47, a difference of only 47 cents (appendix, section B). The net returns are, therefore, almost directly related to the number of bushels of grain produced per acre.

A comparison of incomes from farms of equal size on three successive land productivity classes shows that the net returns on good to very good land are about 3 times as large as on land rated fair to fairly good (Table 36). A one-section farm on the fair to fairly good soil provides about the same income as a half-section farm on the fairly good to good soil. If the Indian farmers were required to pay a levy to the Band fund for the use of the land these incomes would be lowered by the amount of the levy. The net returns from a cattle farm with a basic herd of 100 animal units is about the same as that from a half-section grain farm, on soil classed as good to very good, but requires about 5 times as much land.

Table 36.– Operating Statement for One-Section and a Half-Section Grain Farm by Land Classes, and for a Cattle Farm of 100 Animal Units, Blood Indian Reserve[a]

	Land Class		
	Good to Very Good	Fairly Good to Good	Fair to Fairly Good
	dollars		
Grain Farm			
One-Section[b]			
Receipts	12,850	9,681	7,488
Expenses	5,919	5,750	5,625
Net returns	6,931	3,931	1,863
Half-Section[c]			
Receipts	6,168	4,647	3,594
Expenses	2,841	2,760	2,700
Net returns	3,327	1,887	894
Cattle Farm (100 animal units)			
Receipts	$6,156		
Expenses[d]	$2,940		
Net returns	$3,216		

a. Based on per acre and per animal unit data estimated in the appendix to this chapter.
b. 625 acres of arable land is assumed.
c. 300 acres of arable land is assumed.
d. The costs may vary for land with different grazing capacity, but no information is available to take these differences into account.

. . .

Under the conditions of land use, prices, costs and management ability assumed here, the income from agricultural operations on the Reserve could be increased by reducing the acreage used for raising beef cattle and increasing the acreage used for grain production. This conclusion should not be interpreted, however, as a recommendation for a shift towards grain farming, for if a Blood farmer prefers cattle raising it no doubt would be preferable for him to do so.

APPENDIX

A. TABLE 37.– Acreages for (1) Reserve, (2) Cultivated Land (1961), and (3) Range Land (1961), by Soil Classes and Zones of Carrying Capacity, Blood Indian Reserve

Soil Classes	14 Acres Per A.U.[a]	16 Acres Per A.U.	35 Acres Per A.U.	Total
		acres		
1. Reserve				
Good to very good arable	2,300	38,100	–	40,400
Fairly good to good arable	10,700	43,900	68,500	123,100
Fair to fairly good arable	12,900	20,300	55,700	88,900
Poor to fair arable	5,900	26,700	11,800	44,400
Pasture	3,300	8,200	11,400	22,900
Very poor pasture	500	10,900	13,400	24,800
Total for Reserve	35,600	148,100	160,800	344,500
2. Cultivated Land, 1961				
Good to very good arable	450	25,300	–	25,750
Fairly good to good arable	200	15,800	28,700	44,700
Fair to fairly good arable	100	4,100	7,600	11,800
Poor to fair arable	–	3,400	800	4,200
Pasture	–	–	–	–
Very poor pasture	–	–	–	–
Total for Reserve	750	48,600	37,100	86,450
3. Range Land, 1961[b]				
Good to very good arable	1,850	12,800	–	14,650
Fairly good to good arable	10,500	28,100	39,800	78,400
Fair to fairly good arable	12,800	16,200	48,100	77,100
Poor to fair arable	5,900	23,300	11,000	40,200
Pasture	3,300	8,200	11,400	22,900
Very poor pasture	500	7,900	11,400	19,800
Total for Reserve	34,850	96,500	121,700	253,050

a. Animal unit of cow and calf under six months of age.

b. Difference between figures in section 1 and corresponding figures in section 2; "Very poor pasture" was reduced in zone "16 Acres Per A.U." by 3,000 acres, and in zone "35 Acres Per A.U." by 2,000 acres as an adjustment for nonproductive land.

B. Estimation of Net Returns from Dry-land Grain Forming under Plon A and Plan B, Blood Indian Reserve

		Land Class (Arability) Good to Very Good	Fairly Good to Good	Fair to Fairly Good	Total
			acres		
Acreages[a]					
Plan A	Fallow (35%)	9,012	15,645	4,130	28,787
	Wheat (35%)	9,012	15,645	4,130	28,787
	Oats (10%)	2,575	4,470	1,180	8,225
	Barley (15%)	3,863	6,705	1,770	12,338
	Flax (5%)	1,288	2,235	590	4,113
	Total	25,750	44,700	11,800	82,250
Plan B	Fallow (35%)	14,140	43,085	31,115	88,340
	Wheat (35%)	14,140	43,085	31,115	88,340
	Oats (10%)	4,040	12,310	8,890	25,240
	Barley (15%)	6,060	18,465	13,335	37,860
	Flax (5%)	2,020	6,155	4,445	12,620
	Total	40,400	123,100	88,900	252,400
Yields			bushels per acre[b]		
	Wheat	24	18	14	
	Oats	41	31	24	
	Barley	38	29	22	
	Flax	12	9	7	
Production			bushels		
Plan A	Wheat	216,288	281,610	57,820	555,718
	Oats	105,575	138,570	28,320	272,465
	Barley	146,794	194,445	38,940	380,179
	Flax	15,456	20,115	4,130	39,701
Plan B	Wheat	339,360	775,530	435,610	1,550,500
	Oats	165,640	381,610	213,360	760,610
	Barley	230,280	535,485	293,370	1,059,135
	Flax	24,240	55,395	31,115	110,750
Price per bushel:[c] Wheat $1.41; oats $0.58; barley $0.81; flax $2.86					
Receipts			dollars		
Plan A	Wheat	304,966	397,070	81,526	783,562
	Oats	61,233	80,371	16,426	158,030
	Barley	118,903	157,501	31,541	307,945
	Flax	44,204	57,529	11,812	113,545
	Total	529,306	692,471	141,305	1,363,082
Plan B	Wheat	478,498	1,093,497	614,210	2,186,205
	Oats	96,071	221,334	123,749	441,154
	Barley	186,527	433,743	237,629	857,899
	Flax	69,326	158,430	88,989	316,745
	Total	830,422	1,907,004	1,064,577	3,802,003

a. Plan A: see (2) Cultivated Land, 1961, part A of this Appendix; Plan B; see (1) Reserve, part A of this Appendix.
b. Wheat yield: see Table 24, Ch. VII, Soils; yields of other crops are estimates of Economics Division, Canada Department of Agriculture.
c. Average price of 1957–61 period; *Quarterly Bulletin of Agricultural Statistics*, Jan.-March 1963.

B–Cont.

Expenses (per acre)[d]					
	Fallow	4.76	4.76	4.76	
	Wheat	11.41	11.06	10.81	
	Oats	12.56	12.01	11.61	
	Barley	12.86	12.36	11.96	
	Flax	12.43	12.23	12.08	
Total Expenses					
Plan A	Fallow	42,897	74,470	19,659	137,026
	Wheat	102,827	173,034	44,645	320,506
	Oats	32,342	53,685	13,700	99,727
	Barley	49,678	82,874	21,169	153,721
	Flax	16,010	27,334	7,127	50,471
	Total	243,754	411,397	106,300	761,451
Plan B	Fallow	67,306	205,085	148,107	420,498
	Wheat	161,337	476,520	336,353	974,210
	Oats	50,742	147,843	103,213	301,798
	Barley	77,932	228,227	159,487	465,646
	Flax	25,109	75,276	53,696	154,081
	Total	382,426	1,132,951	800,856	2,316,233
Net returns (total)[e]					
Plan A		285,552	281,074	35,005	601,631
Plan B		447,996	774,053	263,721	1,485,770
Net returns per acre of grain land (Plan A and Plan B)					
	Receipts	20.56	15.49	11.98	
	Expenses	9.47	9.20	9.00	
	Net returns	11.09	6.29	2.98	

d. Based on relevant farm management studies, Economics Division, Canada Department of Agriculture. Costs included are for tillage, seed, seed cleaning, seeding, spraying, hail insurance, hired labor, harvesting, hauling grain, and a share of the telephone and hydro bills. The land is considered tax and interest free.

e. Receipts less expenses. The net returns are the returns to the farm operator for his labour, management, and capital invested in the farm.

C. Estimation of Net Returns from Beef Production under Plan A and Plan B, Blood Indian Reserve

	Carrying Capacity	Acres in Grass	Number of Animal Units	Lbs. of Beef Produced[a]
Plan A	14 acres per A.U.	34,850	2,489	746,700
	16 acres per A.U.	99,900	6,244	1,873,200
	35 acres per A.U.	122,500	3,500	1,050,000
	Total	257,250	12,233	3,669,900
Plan B	14 acres per A.U.	9,700	693	207,900
	16 acres per A.U.	42,800	2,675	802,500
	35 acres per A.U.	34,600	989	296,700
	Total	87,100	4,357	1,307,100

Price

Average cattle price, all grades for the months of September and October, basis Calgary stockyards, 1958–62: $20.52 per cwt.[b]

	Plan A	Plan B
	dollars	
Receipts	753,063	268,217

C–Cont.

Expenses[c]			
Overhead:[d] $18.00 per animal unit		220,194	78,426
Hay: 1½ ton per animal unit at $6.50 per ton		119,272	42,481
Trucking live cattle to Calgary: $0.55 per cwt.		20,184	7,189
Total costs		359,650	128,096
Net returns[e]		393,413	140,121
Net returns per animal unit (Plan A and Plan B)			
Receipts	$61.56		
Expenses	$29.40		
Net returns	$32.16		

a. Production of 300 lbs. per animal unit is assumed.

b. Source: *Livestock Market Reports*, Market Information Section, Production and Marketing Branch, Canada Department of Agriculture.

c. Costs are based on comparable farm management studies, Economic Division, Canada Department of Agriculture.

d. Includes breeding, veterinary, insurance, minerals, salt, fencing, and interest in cattle investment.

e. See note e, Section B.

NOTES AND REFERENCES

1. Mr. U.J. Pitman (Dry-land Farming Specialist, Agricultural Research Station, Canada Department of Agriculture, Lethbridge) wrote the section on dry-land farming; Mr. J.A. Campbell (chief grazing appraiser, Alberta Department of Lands and Forests, Edmonton) wrote the section on range management; Mr. S. W. Garland (agricultural economist, Canada Department of Agriculture, Ottawa) contributed the assessments of potential incomes; Mr. K. Elgaard (agricultural economist, Canada Department of Agriculture, Edmonton) provided land use data.

2. *Alberta Farm Guide*, prepared by the University of Alberta, Canada Department of Agriculture, and Alberta Department of Agriculture, pp. 30 and 31.

3. *Ibid.*, pp. 17-19.

4. *Ibid.*, pp. 9-16.

5. Some of the lessees have applied fertilizer in lieu of cash bonus payments.

XII. FOREST MANAGEMENT

Objectives

The objectives of forest management on the Limit may be summed up as: (a) to make the most of what is available now, and (b) to invest part of the proceeds to increase productivity on the area. The relatively slow growth of trees compared to other agricultural crops, requires long term planning but with due regard to continuously changing economic conditions. For this reason planning should be limited to a trial period of say 10 years and then be revised.

The 1959 "Census of Indians in Canada" lists 2,850 persons belonging to the band, and the labour force is estimated to be close to 600 men. This means that there is slightly more than one acre of forest per band member and about 5 acres per wage earner. It cannot be recommended therefore that any income from the communal property be realized on an individual area allotment basis. A more practical method would be to have a group of band members perform the necessary woods operations for a fair remuneration while the band fund would receive dues on the wood products sold from the Limit.

Local processing of finished wood products instead of simple roadside timber sales will increase forest-based income and provide more employment opportunities. The acquisition of fence post manufacturing and chemical treatment equipment by the band, and opening of a plant for this type of product may enhance the value of the Timber Limit considerably. The market price for any wood products sold should at least equal the total amount of wages, dues, and administration costs. All efforts should be made to keep the new enterprise solvent, or at least to amortize the investment within a reasonable time. Industrial requirements and the preponderance of poor quality timber will have a decisive bearing on the size of the annual cut during the first management period.

The fairly extensive areas of grassland along the Belly River are suitable for cattle ranging and may raise the total revenue from the Limit. No conflict between the two land-uses, forestry and grazing, is foreseen for some time provided the grazing lands are properly fenced if used as such. Scattered, small grass areas completely enclosed by forest should not be regarded as potential range land but as natural enclaves in the forest land and often constitute moreover a scenic attraction.

Forest Aspects

Close to 2,000 acres on the Limit support softwood forest, predominantly (67 per cent) Lodgepole pine. The area occupied by pine stands classified as mature amounts to 885 acres, of which about 77 per cent are overstocked. The immature pine types cover 453 acres, but only 19 per cent of these stands are fully stocked while the remaining area supports an average stocking. In other words, there is a 2:1 ratio between the areas occupied by mature and immature pine stands.

It can be seen from Table 29 (Chapter IX) that the overstocked (stocking class 4) mature pine stands have an average diameter of 4 inches, average height of 35 feet, and average age of 83 years. Stands of this nature reflect poor conditions and are of marginal value as a renewable resource basis. This unfavourable situation may not justify large expenditures, but does point to the necessity of experimenting with reforestation methods, particularly when a good market for small trees exists. Appropriate silvicultural practices for various stand and site conditions on the Limit will have to be decided by a competent forester on the spot. However, judging from the stand data available for the overstocked mature pine stands it would appear that these sites are poor, and reforestation may be difficult.

The moderately stocked immature pine stands which show an average diameter of 6 inches, average height of 40 feet, and an age of about 50 years, appear to be the only stands which might benefit from thinning to induce diameter growth. These types occupy 367 acres.

The pine-spruce and the small spruce-pine stands, all classified as immature at present, occupy 600 acres. They also may warrant some silvicultural attention particularly the fully stocked stands which are 40 years old, and still could benefit from thinning.

The mixedwood and hardwood stands, occupying about 1,660 acres and classified as non-commercial, could perhaps be upgraded by underplanting with white spruce. This would lead to an increase of spruce on the moist and better sites. Underplanting in these types should be considered a sound practice because the existing productive potential may thus be better realized.

Accessibility and logging conditions on most of the area are favourable, but a distinct disadvantage to forest management is the lack of technical supervisory personnel among the band members and the diverse duties of the District Supervisor which already fully occupy him and his staff. Considerable knowledge, initiative, and continual supervision during the forest

operations are required for the proper development of the Limit.[1]

Equally important as competent supervision and technical assistance is the maintenance of minimum forest management records. These consist of cut reports and scale returns, showing the number of trees cut by species, where they were cut, and also the number, length, and diameter of the posts and poles, or other products obtained.

Industrial Aspects

Information available on the band-sponsored fence post industry has been studied in order to estimate the demand for rough posts, revenue, and the possible supply from the Timber Limit.

The following production capacity, costs, and sale price data were supplied by Mr. J. R. Tully, District Supervisor of the Blood/Peigan District.

Capacity of fence post pointer (sharpener)
In an 8-hour shift ..... 8-900 posts

Chemical treatment given
In an 8-hour shift ..... 1,000 posts

One, 8-hour shift is operated per day,

There are 120 working days in a year.

Operating costs per post:

Gas, oil, maintenance, etc.	0.02
Handling	0.04
Purchase of posts (including cutting and transportation)	0.14
Peeling and sharpening	0.04
Treatment	0.04
Total cost per post	0.28

Investment for equipment,
buildings, fences ..... $18,600.

The average life of a post pointer is 10 years.

1963 selling prices for posts:

3'' diameter – $0.42	5'' diameter – $0.48
4'' diameter – $0.45	6'' diameter – $0.50

Percentages of posts by size class of total posts produced were:

3'' – 10%, 4'' – 60%, 5'' – 20%, and 6'' – 10%

Posts are peeled, sharpened, and dry piled. They are treated and made ready for sale when there is a demand.

The limiting factor in the above production data appears to be the operation of the pointer which permits an output of little more than 100 posts per hour. This is in the neighbourhood of 15% less than the number of posts which can be chemically treated within the same time. Full annual production may thus amount to 96,000 posts of various sizes with a possible value f.o.b. the treating plant of close to $44,000. About 61 per cent of this amount covers production cost, leaving approximately $17,000, or 18 cents per post, for administrative costs, stumpage dues, and net profit. It appears that the investment was well worth-while and might be paid off in the near future.

The cost of silvicultural treatment and planting tests on the Limit cannot be accurately estimated at this time, but scarification would probably cost $15 per acre. If natural regeneration fails, planting may have to be done, at a cost of at least $20 – $25 per acre. The total cost of restocking the area could thus amount to $40 per acre, roughly 4 cents per fence post, or 10 per cent of the gross value.

It may not be desirable from a strictly economic point of view to finance restocking efforts from the proceeds of the fence post project, because of the uncertainties related to a long term investment of this nature. Not always, however, need one consider the economic aspects of an investment and the band may give priority to having trees on the Limit. Such a decision pertains to values (would one rather have trees than something else, e.g. from a short term investment) and is for the band to decide. Other chargeable costs include supervision, and operational cruising.

The Annual Cut

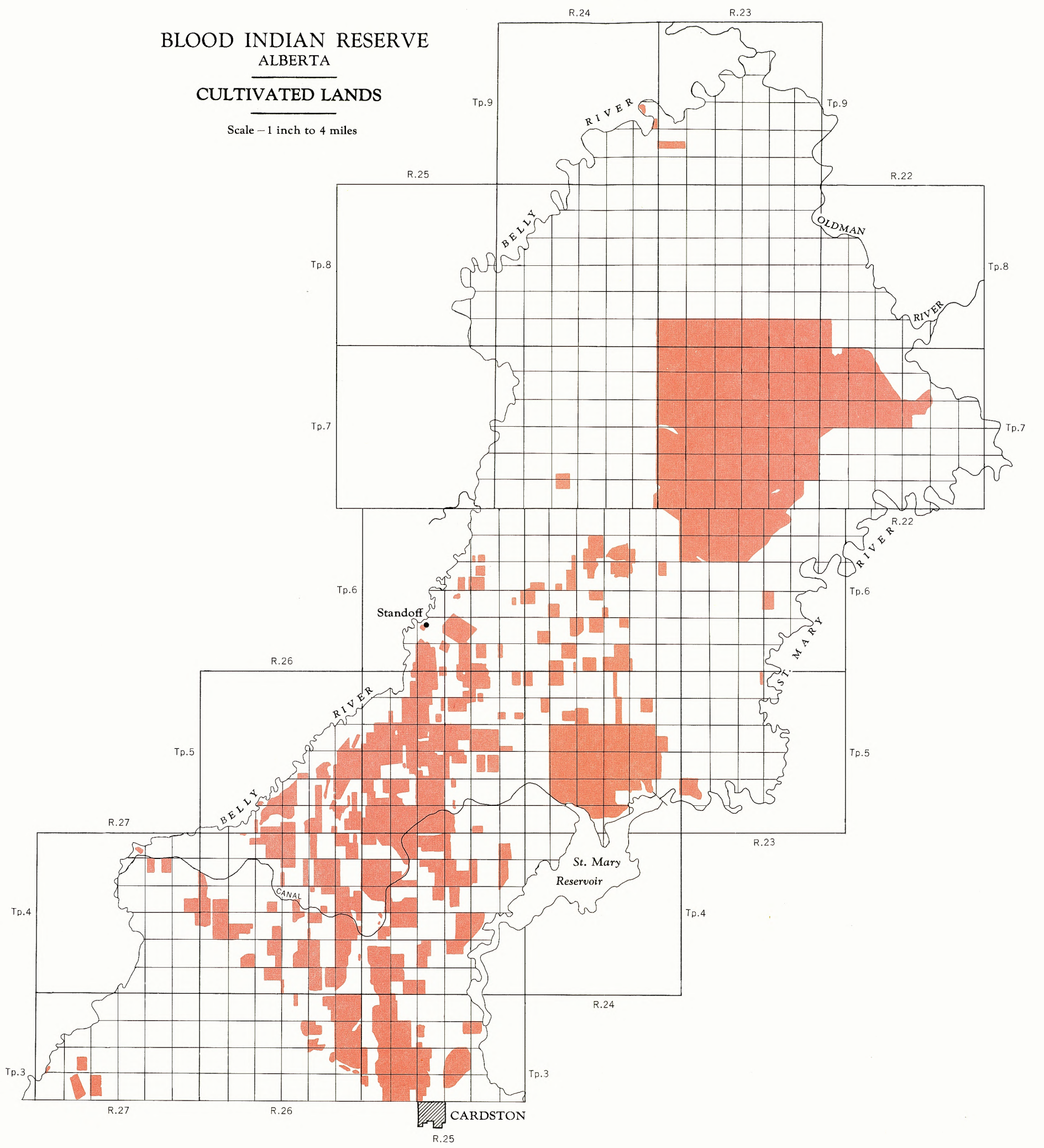
The annual cut will, provided the demand for fence material continues, be taken from lodgepole pine stands, and it is recommended that the fully stocked and overstocked mature stands be removed during the first 10-year period. An annual cut of about 94,000 posts (Table 30–Chapter IX) may thus be available for utilization. Any growth which might accumulate, will no doubt be offset by mortality occuring in these stands. Excluded from this program should be those stands, mature or otherwise, which serve as a protective cover on steep slopes.

The remaining 2,000 posts needed to meet the fence post requirement of 96,000 posts, might be obtained from thinnings in the immature stands. The average number of corral rails and fence posts per acre in the immature types is estimated to be 529, of which 80 per cent is fence post material of 4 inches and up (Table 30–Chapter IX). Such thinning operations may also stimulate the production of larger sized material, as outlined before.

BLOOD INDIAN RESERVE
ALBERTA

CULTIVATED LANDS

Scale – 1 inch to 4 miles



Scattered mature patches could be clear cut, but at least an effort should be made to induce natural regeneration when cutting the larger stands. This may be done by progressively clear cutting strips not more than 2 chains wide against the prevailing southwest and westerly winds. The proposed short total cutting time (10 years) makes it essential that the slash-borne seed source be fully utilized by lopping and scattering of tops and branches. Stump height should be kept at a maximum of one foot or less in order to allow scarification by running a bulldozer over the cut area. This should be done as soon as possible after cutting, but before summer.

The lodgepole pine stands of about 40–50 years may respond favourably to crop tree release, often referred to as low thinning. Smithers[2] states that the intensity of thinning should result in not less than 250 well distributed dominant trees per acre while at least 50 per cent of the original basal area before thinning should remain. These two factors have to be determined for each forest type, or perhaps stand, before a definite estimate of the wood volume which will be cut can be made. Application of this procedure will necessitate technical assistance, but is highly desirable to increase the productivity in the present immature stands where possible.

Protection

Fire, insects and disease, abnormally strong wind, and grazing are major hazards in the management of forest land.

Fire destroys the reproduction and advanced growth, and kills or injures the larger trees. The location of the Limit within the Waterton Lakes National park will certainly be of help in the detection, and if necessary, suppression of fire. Fire prevention on the other hand is entirely a local matter depending to a large extent on the behaviour of people on the area and the avoidance of unnecessary risks. Almost all lodgepole pine forests in Alberta originated after fire, and are highly susceptible to further outbreaks. The stands on the Limit are no exception and the following measures are, therefore recommended:

1. Keep open all existing roads and seismic lines to serve as firebreaks and facilitate the movement of fire crews.
2. Separate grassland from forest by ploughed fireguards at least 10 feet wide.
3. Remove patches of windfallen, dead and diseased trees.

Insect and disease damage has not been reported and may indeed be of minor importance. Some control could be carried out by removal of any affected trees in order to minimize the danger.

Abnormally strong winds do occur. The risk of damage can, however, be reduced by care in the layout of cutting operations, e.g. adjustments to prevailing winds on high, vulnerable operations.

Grazing ofcattle in the forest should be prevented by proper fencing as mentioned previously.

REFERENCES

1. A forestry officer has been appointed to the Indian Affairs Alberta Regional staff, since this chapter was written.

2. Smithers, L. A. "Fence Posts and Poles from Lodgepole Pine Stands" (unpublished), January 1958.

XIII. LAND ALLOTMENT, CREDIT AND INDEBTEDNESS[1]

Land is made available to Band members for agricultural purposes but without financial aid most Band members could not put their allotted land to such use. The allotment of land and extension of credit are therefore discussed together.

Land Allotment

The Reserve was established for the use and benefit of all Band members, and there has always been a strong sentiment among the Blood Indians favouring the keeping intact of the Reserve for future as well as present generations. Whereas other Bands sold land originally set aside for them under treaty,[2] the Blood Band leaders successfully resisted any tempting offer to sell part of their Reserve, and only reluctantly gave in to the sale of land required for public purposes, such as highways, diversion canal and St. Mary's reservoir.

The Blood Band never accepted the land allotment system as prescribed in the Indian Act.[3] "Certificates of Possession" and whatever they entail were looked upon as a step towards private ownership which could eventually lead to the disintegration of the Reserve and even the Band. The Councillors voted against adopting the official system, and instead continued a procedure of land allotment of their own.

The land allotment procedure on the Blood Indian Reserve is quite simple, and has excellent features providing it is consistently pursued When an Indian residing on the Reserve desires land to start farming or ranching, he looks around for land not yet allotted that seems to meet his needs Having decided on the land he would like to use, he must then appear before the Band Council and request that the land of his choice be allotted to him. If this land is still free for allotment and the applicant appears serious about putting the land to good use, the Council will as a rule grant the request up to half a section.

The Council also has adopted the view that certain improvements, such as fencing or plowing, must be made within two years after land has been allotted. When the required improvements are made, the Council may decide to allot the Indian another half section. Should, on the other hand, the Indian fail to make improvements or should the council feel that the improvements are inadequate, not only will the Indian not be granted another half section, but also will run the risk of having the allotment of the half section already granted to him cancelled and re-alloted to another Indian applying for that land.

In allotting land, the Band Council has foremost in mind the active involvement of Band members in utilizing the land. A member is not allowed to employ custom help to carry out field operations. Except for a temporary arrangement (discussed later in this chapter) a member cannot lease his cropland to another member or non-Indian and be entitled to the rent in cash or kind, or even a portion of the rent. In the past some members were given permission to lease their allotted land to non-Indian farmers with the view to having the land broken and fenced. Whenever it becomes evident, however, that the member has no intention of taking over the farming himself, such lease arrangements have been declared illegal "(buckshee leases"), and the usual one-third share of the crop reverted to Band funds.

Until recently the Council took a somewhat more lenient attitude with respect to leasing range land. An Indian who wished to lease his allotted grazing land to a rancher, either Band member or non-Indian, had to appear before the Council with the prospective tenant and request approval for such a lease. Under recent leases approved by the Council the tenant paid $3.50 per head of cattle for each month of grazing. Of this amount, $2.50 went to the revenue fund of the Band and $1.00 to the Indian whose allotted land was leased. By Band referendum, it was decided that all grazing leases, including the ones arranged for individual Indians, would not be renewed when they expired. As a result, practically all land used for grazing was back in Indian hands by 1964. At the same time 64 Indians started in the ranching business, and the chances are that another 40 will follow. These people favour the cancellation of the grazing leases because it provides them with an opportunity for building up their own herd. Those, however, who depended to a large extent on the cash received from leases would naturally like to see the grazing leases reinstated.

The concern of the Blood Band to keep the Reserve intact as Band property is also reflected in the fact that allotted land cannot be transferred among Indians or bequeathed without Band Council approval. When approval is obtained, the Indian taking over allotted land, will as a rule, pay compensation for improvements to the Indian relinquishing the land. Upon death of the person to whom the land was allotted, the land officially reverts to the Band but

usually the Council agrees to a division of this land among the next-of-kin.

Other reservations and restrictions on the allotted land are largely those imposed by the Indian Act pertaining to all Indian lands. Because allotted land remains Reserve land, an Indian, for instance, cannot transfer land either by gift or by sale, except to the Band for whom the Reserve was set aside or a member of that Band.[4] Also, allotted land is not "subject to seizure under legal process",[5] and cannot be mortgaged, except in a restricted manner to the Band or another Band member.[6] Furthermore, liquor is not permitted on Reserve land whether allotted or not,[7] and an allotment applies only to the surface use and does not include mineral and timber rights.

The procedure of land allotment on the Reserve is not laid down in Band by-laws, or even as resolutions in minutes of Band Council meetings. The allotment of land and the enforcement of the unwritten rules about allotted land thus become matters that are largely at the discretion of the Councillors. Such a system may work well as long as sufficient land is available to meet demands. As time goes on, population growth will no doubt put pressure on the economic utilization of land, and when the point is approached where little or no land is left for allotment, the Council may find it increasingly difficult to decide on matters of land allotment and management without becoming suspect of patronization and favouritism. The Council, realizing that this day may not be far off (see population estimates, Chapter IV), recently set up a Land Committee whose main function is to review all land allotments over the past 10 years. In addition a land register has been introduced, and allotted land will be entered in this register after review and approval by the Council. As pressure on land increases, land disputes may arise more frequently than is now the case, and the register will prove helpful in settling such disputes.

Although lack of annual data makes it impossible to show the trend in the amount of land allotted, figures are available for 1961. By that year individual Band members had been allotted about 41,000 acres for crop farming and 50,000 acres for ranching (Chapter XI, Table 33). The average size of an Indian operated farm was about 170 acres, and 80 per cent of all Indian farms were less than 240 acres (Table 38). By comparison 64 per cent of the farms in Census District No. 3, in which the Reserve is situated, are larger than 240 acres.

Indebtedness

Most Band members who had been allotted land were not in a position to utilize their land without further assistance. They needed capital to build fences, buy farm machinery and equipment, or cattle,

Table 38. – Comparison of Size Distribution of Indian Farms on Blood Indian Reserve and Farms in Census Division No. 3, Alberta, 1961.

Size of Farm	Number of Farms		Per Cent Distribution	
	Census Div. No. 3[a]	Blood Indian Reserve[b]	Census Div. No. 3	Blood Indian Reserve
Under 3 acres	111	–	4.2	–
3–9 "	34	–	1.3	–
10–69 "	156	39	5.9	17.0
70–129 "	205	59	7.7	25.8
130–179 "	244	46	9.2	20.1
180–239 "	200	39	7.6	17.0
240–399 "	535	34	20.2	14.8
400–559 "	379	8	14.3	3.5
560–759 "	319	2	12.1	0.9
760–1,119 "	289	2	10.9	0.9
1,120–1,599 "	103	–	3.9	–
1,600 acres and over	71	–	2.7	–
Total	2,646	229	100.0	100.0

Sources.–

a. 1961 Census of Canada, Agriculture (Farms by Size and Use of Farm Land).

b. List of names of Indian farmers with location of their allotments and acreages for fall wheat, stubble, summer fallow, and total, Indian Affairs Branch. Ottawa.

and cover operating expenses. The main source of credit open to Blood Band members has been their own Band fund.[8]

Loans for operating expenses such as those for gasoline, seed, insurance and wire can be obtained from the Band revenue fund. On the basis of total assistance requested by Indian farmers and guided by expenditures in the past, an item for farm assistance is included each year in the Band budget. When the budget is approved at Indian Affairs Branch headquarters (where Indian funds are held in trust), the Council determines the amounts to be made available to those in need of farming assistance, and also whether it is provided in full at the beginning of the crop year or in instalments during the crop year.

Annual expenditures on farm assistance to individual farmers has risen from a few thousand dollars in the early 40's to an average of almost $167,000 for the 5-year period from 1957 to 1961. The average total agricultural expenditures from Band fund over the same period amounted to about $200,000 (Table 39).

Farm assistance is considered an interest-free advance on anticipated income and should be repaid at the end of the crop year. For one reason or another Indian farmers have fallen short in making repayments of their short-term farming debts. Total Indian indebtedness due to farming rose, therefore, from somewhat less than $94,000 at the end of May 1954 to an average of about $380,000 for the two fiscal years 1960-61 and 1961-62 (Table 40). This indebtedness was in-

Table 39. – Agricultural Expenditures from Blood Indian Band Fund, 1954 to 1961

Fiscal Year	Farm Assistance	Other Farming Expenditures	Total
	$	$	$
1954–55	–	–	268,056
1955–56	–	–	190,869
1956–57	–	–	108,235
1957–58	140,331	53,622	193,953
1958–59	125,235	37,278	162,513
1959–60	148,925	35,114	184,039
1960–61	273,275	23,866	297,141
1961–62	145,572	55,622	201,194

Source. – Annual Band Fund Statements of Accounts (1954 to 1956) and Annual Machine Statements of Trust Fund Account, Treasury Office (1957 to 1961), Indian Affairs Branch, Ottawa.

Table 40. – Indian Indebtedness to Blood Indian Band Fund, 1954 to 1961

Year[a]	Farming	Housing[b]	Miscellaneous[c]	Total
	$	$	$	$
1954	93,613	101,601	2,013	197,227
1955	173,093	112,355	1,567	287,015
1956	179,761	121,215	5,527	306,503
1957	175,177	116,105	18,464	309,746
1958	190,901	172,842	16,106	379,849
1959	260,158	219,117	25,853	505,128
1960	322,897	227,029	9,206	559,132
1961	397,567	456,519	17,155	871,241
1962	372,555	705,745	15,217	1,093,517

a. As of May 31 for 1954 (first date for which complete data are available); as of March 31 for other years.

b. New construction and repairs.

c. Includes equipment and vehicles, band well (1954-60), flour (1954-56) and labour placement assistance (1962). Band loans under section 64 (h) of the Indian Act for which interest is charged are included.

Source. – "Statements of Current Indian Indebtedness as at March 31", Treasury Office, Indian Affairs Branch, Ottawa.

curred by 252 Indians, and just over half of them owed less than $1,500. Only 42 farmers had debts between $3,000 and $6,000.[9]

In recent years the indebtedness incurred for the provision of homes has exceeded that for farming. It rose from about $100,000 to slightly over $700,000 in eight years (Table 40). Loans for other capital items such as farm machinery and equipment have been made on an interest-free basis, and also as Band fund loans under section 64 (h) of the Indian Act. In the latter case, a formal application must be made, security offered and a five per cent interest charge is levied.

Liquidation of Farming Debt

Naturally the Band Council has been greatly concerned about the drain on funds which belong to all members of the Band, present and future ones. In an attempt to liquidate some of the debts, the Credit Committee of the Band decided in 1960 that the land of some 80 farmers who were heavily indebted to the Band and who had a low credit rating would be farmed as Band projects.[10] Any proceeds would be applied against the debt of the individual farmer, and the land would be returned to him as soon as his debt was cleared. The plan did not work. The Band had to complete most farming operations on a contract basis, and with high prevailing custom rates it was difficult to farm profitably. Besides there were problems in getting contractors when needed, and in overseeing work which was scattered over a large area.

Instead of risking further Band funds, arrangements were made to lease about 12,000 acres of land allotted to marginal Indian farmers. The first leases were taken up in 1961 for a five-year period, and additional leases were granted in 1962 for a four-year period. As had been customary on the Reserve, one-third of the crop went to the lessor and the lessee paid in addition a cash bonus per acre of land leased. The Council agreed that the cash bonus was to be paid to the Indian farmer whose land was involved in compensation for any improvements he had made so that he had at least some income while his land was under lease. The revenue from the one-third crop would be applied against the farming debt,[11] and any amount accumulating in excess of the individual's debt would be kept in trust for him. When the lease expires, the Indian farmer may therefore have some farming capital available, and sufficient additional land of his allotment may have been broken to give him a unit of minimum economic size.

The lease scheme may be expedient as far as elimination of internal debt is concerned but it obviously does not go down to the root of the problem. If no steps are taken at the same time to improve the managerial ability of Indian farmers, they will not be in a position to take advantage of a new opportunity. Chances are that in most cases the leasing of the land will continue after the present contracts expire, and the Indian locatee will eventually claim the one-third share of the crop grown on his land in addition to the cash bonus he is receiving already. The Council would be well advised to deliberate without delay on policy and programs concerning the utilization of its agricultural land. A few comments pertaining to both aspects will be appropriate in this report.

First there is the matter of policy. In the past the Band as a whole has been strong in its stand that all Reserve land is Band land. Individual members are entitled to land revenues only if they participate actively in putting the land to use. Their participation may be confined to management only, but when land is leased to non-members, the Band as proprietor is to receive the lessor's share of the rent. Apart from the legal justification of this stand on the grounds that the Reserve was set aside for the Band as a whole, there is the practical value of stimulating members to participate themselves. By accepting responsibilities that go with farming, or any other business, a social environment is created that is sound and enduring, and without which it would be difficult, if not impossible, for the Band to maintain its identity, and for members to succeed in competition outside the Reserve. As time goes on and population pressure mounts, it will become increasingly apparent that involvement in economic activities both on and outside the Reserve will be unavoidable.

Assuming that sentiments of the Band have not changed with respect to their identity, of which the Reserve itself is a symbol, and if they recognize that both may disintegrate if members do not develop their innate skills and aptitudes through active development of the resources available to them, one then faces the question of settling on the right course of action.

As far as farming is concerned, it may at this stage be necessary to set up some sort of an incentive program which would make it possible to pay Indian farmers from Band funds for specific farm activities, such as plowing and seeding, as soon as the work has been completed.[12] The total of these amounts, which should remain below a percentage (say 75 per cent) of the assessed gross revenue based on long-term yield average, are repayable and can be deducted from the gross returns at the end of the crop year. Such a scheme would assist Indian farmers who need intermediate payments to tide them over, and provide incentive for those who are unaccustomed to long delays in rewards inherent in farming. As the financial

position of the Indian farmers improve, the advance payment may gradually be eliminated.

Guidance and supervision will naturally be required, and these tasks will be a full-time job for a competentagricultural manager or extension specialist. In addition to extensive practical experience and ability to deal effectively with farm and range management problems, such a person must have a keen awareness of market conditions, be familiar with community development principles of selfhelp, and have a sympathetic interest in the Indians' welfare. How to get the right man for the job may not be an easy task. There are, however, qualified agriculturalists serving non-Indian farmers in managerial capacities or as extension specialists with provincial governments, and it would be surprising if some of these would not possess the zeal to work among Indian farmers.

NOTES

1. Thanks are due to Messrs. A. Many Fingers and A. Tail Feathers of the Blood Indian Band, and Messrs. J. R. Tully and A. R. Turner of the Blood Indian Agency, for comments on a draft of this chapter.
2. Within the Canadian Blackfoot group, for instance, 115,000 acres of the Blackfoot Reserve were surrendered in 1910, and 23,500 acres of Peigan Reserve in 1909.
3. According to the Indian Act reserve land is "... held by Her Majesty for the use and benefit of the respective bands for which they were set apart..." (S. 18:1). For all practical purposes it is Band property, but when the Band Council has allotted land to an individual member "the Minister" may issue a "Certificate of Possession" ("... as evidence of his right to possession of the land described therein..." (S. 20.2). Should "the Minister" withhold approval of the allotment by Council, he "... may prescribe the conditions as to use and settlement that are to be fulfilled by the Indian...", and will issue for such land a "Certificate of Occupation" which will entitle the Indian to occupy the land for two years (S. 20:4 and 5). At the end of this period "The Minister may extend the term of a Certificate of Possession for a further period not exceeding two years..." (S. 20:6). When the "Certificate of Occupation" expires, the land will either be alloted to the Indian under a "Certificate of Possession", or will be available for re-allotment by the Band Council.
4. The Indian Act, Sections 24 and 37.
5. Ibid., Section 29.
6. Ibid., Section 88.
7. Ibid., Sections 93 and 94.
8. Blood Indian farmers have not made much use of the Government Revolving Loan Fund. A few well-established Indian farmers are securing loans from local banks, and as of 1962, a Blood Indian Credit Union (the first on a Canadian Indian reserve) was set up.
9. From "Annual Reports of Indian Indebtedness", Indian Affairs Banch, Ottawa.
10. Indian Affairs Branch file 103/32-1, memorandum dated December 1, 1960.
11. During the 1961-62 crop year the total one-third crop share amounted to $58,136. The debt of four Indian farmers was eliminated, and even exceeded by a total of $1,845.
12. Such a scheme was applied on the Reserve at one time and apparently with marked success. Similar advance payments on anticipated returns are made to some Indian trappers (from appropriation) and Indians working in the logging industry (from Band funds).

XIV. SUMMARY AND RECOMMENDATIONS

The report, as the title indicates, deals with the economic potential of the resources of the Blood Indian Reserve. The most important of these is, of course, the human resource for whose benefits economic development is to be undertaken and who occupy a vital role in the developmental process. Next come the natural resources with which the Reserve is richly endowed and which are a source of capital funds.

Because the natural resources are there, and also because the Band members prefer to work outdoors, it is only obvious that efforts to raise the standard of living among them should begin by putting these resources to their fullest possible use. The members themselves can undertake the development of agricultural land which is now being used for growing field crops, as natural range for raising feeder cattle, or cutting hay which is sold for cash. They also can continue the exploitation of the Timber Limit, about 25 miles southwest of the main Reserve, for the production of fence posts. The exploration for and development of oil and gas resources requires special technical knowledge and much capital, and has to be done by private corporations from outside the Reserve. Other geological deposits, such as coal, oyster shell and gravel, although of limited economic significance, could be put to use by Band members. Groundwater is a resource of considerable importance, and should be developed by the Band in conjunction with an intensified livestock program.

In the following pages the discussions of the preceding chapters pertaining to the Blood Indian Band and the natural resources available to them have been summarized. This summary is followed by some guidelines for setting up an economic development program. Finally, the recommendations contained in the report are listed together and added as an appendix.

Human Factor

Almost 90 years have passed since the Blood relinquished most of their traditional hunting grounds, and decided to accept -- albeit with mixed feelings -- an area for their exclusive use. Nobody, knew what was going to happen after the treaty was signed in 1877 and the Blood Indian tribe finally settled on what is called the Blood Indian Reserve. For the Indian the events of that time were full of ill omen. Yet his hope must have been survival and preservation of his tribe in an area which had been a favourite camping ground for generations. The term "reserve", although now possibly an affront to free men, was fitting under those unfortunate circumstances.

Tribal societies are known to be stable. Stability provides continuity and security on one hand, but on the other it offers resistance to change which hinders people in adapting to an ever-changing world around them. Much of the early hope of the Blood to keep the tribe intact has come true, in spite of the odds; the question which is becoming increasingly crucial is how well will the Band accommodate itself in the world around them when isolation becomes less and less possible and participation in the wider Canadian community becomes more and more desirable. Although it may appear that keeping the tribe intact and preserving cultural traditions will unavoidably conflict with participation in a world whose cultural norms are basically different, there is plenty of evidence that successful participation in such a world is not attained by denying one's own cultural heritage but rather by believing in it. There is no good reason why people of different cultures cannot participate and cooperate in the same environment. This co-existence is particularly true in Canada where citizenry is based on cultural pluralism; and of all cultures represented in the country is not the Indian culture a treasure to guard?

In view of what three or four generations of Blood Indians saw changing outside their reserve, the forces that these changes put to bear on them, and the alien efforts through schools and churches that have persistently operated among them, it is little short of amazing that the traditional Blood culture and basic Blood Indian personality have remained intact so well. The most obvious aspects are the survival of the Blackfoot language and the extent to which the Sun Dance activities have been preserved. The way in which participation in the Sun Dances takes place creates an atmosphere of sincerity, reverence and dedication which can only come from deep innerfelt needs and their fulfillment. The activities of the Age Grade Societies, the popularity of the Hand Game, the continued though modified belief in the medicine-man, the still irresistible urge to characterize individuals with second names, and the nomadic attitude with regard to homes, are other manifestations of traditional Blood Indian culture. They are for an outsider less obvious than the use of language and Sun Dance celebrations, but for the Blood they are no doubt equally meaningful in terms of tribal identity and belonging.

Changes have taken place, of course. The harsh aspects of self-inflicted pain in proving manhood and in expressing sorrow for a lost husband belong to a

past era and are naturally gone. The age-grade societies no longer perform policing duties, and are primarily social clubs. The belief in the power of the medicine-man is no longer what it used to be, and the wandering of nomadic life has modified to frequent visiting among relatives living on the same or other reserves, and attending rodeos from one town to another. As Spindler sums it up: "the Blood culture of to-day combines aspects of Blood Indian culture, other Indian cultures, old-time cowboy and fontier traditions, and contemporary culture". The importance of each of these aspects varies from person to person.

Changes have taken place and continue to take place as can be sensed by different attitudes in the various age groups. Without such changes and adaptations a culture would surely disintegrate quickly because there would be severe discontinuity among the generations. The chances would be that whatever was preserved would be remnants only to which the old timers would cling and would disappear with their passing. It is fortunate, therefore, that the Blood have been able to adapt and thus, judging from past to present keep in their traditions enough vitality to continue and maintain their own. It is fortunate because a people without a cultural base is like a ship without a rudder. There would be no sense of tribal or Band loyalty, no sense of belonging which is so important in facing the future with confidence. There would be no base for maintaining a structure of values, i.e., beliefs in what is good and desirable and what is bad and undesirable, on which to draw for guidance in setting future goals and deciding on ways to obtain them.

Yet one should be careful not to be exaggerate and be misled by the overt manifestations of Blood culture. A closer look at the values, attitudes, aspirations, and goals among the Blood reveals that not all is well. In the early days the Blood were a self-confident people who were proud of their independance and freedom. The Blood family was individualistically oriented; so much so that the tribe became known as the Tribe of Many Chiefs or Kainai. At the same time there was a strong tribal identity and loyalty, and the autonomy of the individual became subordinate to the good of all when co-operation was required during wars and buffalo hunts. The Blood valued cleanliness, health and a strong body. He admired courage, accepted challenge, and met competition. He had a strong desire to excel, and gained prestige through performance. The Blood refrained from ordering others, and resented being ordered. He valued generosity and hospitality. All these qualities can still be found among the Blood but only in fragmental forms and to varying degrees.

In many ways these values, and the attitudes they engender, correspond to those of the white man, but there are also characteristic differences. Whereas the white man's world is future oriented, and the white man is accustomed to making sacrifices now for future rewards, the Blood is still primarily concerned with satisfying his current needs, unaccustomed to projecting his goals into the future. The white man's urge to accumulate wealth is strong, but for the Blood the ability to give is more important than the ability to acquire.

In contact with Indian and Western cultures and as a result, no doubt, of both their similarities and differences, the Blood has become ambivalent in his feelings. He may express admiration and at the same time disgust for the white man's culture as well as his own. He may express a dislike for abilities he admires in the white man, and express admiration for qualities he dislikes among his own. He wants to be independent, yet does little to change his dependency. This sort of ambivalence within an individual is a severe handicap. It causes confusion and indecision, and thus has a paralyzing effect in adjusting to one's environment and making the best of it. Basically the problem is one of having to cope with conflicting values which exert opposing tendencies, attitudes and objectives.

Differences in these attributes can be healthy and conducive to development when they exist among people instead of within the same person. Available evidence, based mostly on occupational preferences, suggests, however, that the Blood Band as a whole lacks diversity. True, the juveniles appear less concerned with maintaining Indian traditions and put more emphasis on material needs than the older generations, and there certainly are vast differences in behaviour between the two age groups, but equally striking and more perplexing are the similarities. Both groups show in their preferences for occupations that they are still strongly reserve-oriented. The only group that seems more outward looking are the women, who more often than men chose occupations obtainable outside the reserve as their favourites. Apart from these generalizations there are many variations. Some, particularly some old-timers, cling tenaciously to Indian tradition and reject white values without examining them, others, mostly juveniles, are valueless in that they have given up, or never had Indian values and nothing took their place, and there are a few who have been able to reconcile Indian values and an economic world that is white in origin. The latter are crucial models in economic development but are exceptions.

Generalizations are risky, particularly in such fields as values where problems are complicated and

knowledge is scanty. It would be true to state, however, that among the Blood there is a problem of unbalance in the whole complex of values, attitudes, aspirations, and goals. Such problems are not the fate of Indians alone; as part of the growing-up process most of us come to face it at one time or another. As long as it is of a passing nature there need not be concern. But when the problem becomes chronic and continuously saps the energy, conscious efforts should be made to overcome it. No economic development program can be sensibly undertaken as long as people are hamstrung by indecision and lack of self-confidence.

Solving such a problem is largely a matter for the individual Blood, and each must find his own solution. It may be helpful, however, to suggest some collective action. As one Indian said "If I can't make it as an Indian I'll never make it". These words are simple and forceful, and in them lies a remedy. The question is not how can the Blood adopt white man's norms but how can they strengthen their belief in their own culture and make it meaningful to the point where they can cope and live with another culture. It would be fruitful if the Blood would consider teaching the Blackfoot language and Indian history, particularly Blackfoot history, in their schools. This suggestion is not made as an attempt to revive the past, or to preserve for the sake of preserving (although it seems infinitely more sensible to preserve a culture among its people than in a museum), but with the hope that through intensified cultural awareness and identity a justifiable pride will emerge. Not the pride of snobbishness or arrogance, but pride as a hidden source of inner strength, self-reliance, and determination in a responsible, meaningful life for these qualities are indispensable if economic development is to succeed.

Economic development cannot take place in isolation. Even if initial efforts were limited to putting available resources within the Reserve boundaries to greater use, these efforts would inevitably intensify dealings with people outside the Reserve through the marketing of products and purchasing of equipment and supplies. And as time goes on it will become increasingly difficult for all Blood to make a livelihood on the Reserve. Whether the Blood has only occasional dealings outside the Reserve or lives there to earn a living, he must have pride that gives him dignity, humility and not hatred in his heart if he is to see the opportunities that are open to him. All obstacles that hinder this process must be removed.

One such obstacle seems to be the connotation of dependency and second class citizenry associated with the term "Reserve". It would be helpful if a better term could be used to denote the land resource.

The urgency is apparent. Even since the middle of the 1920's the Blood population has been growing at a rate well above the Canadian average and among the highest in the world. Young dependents of the ages 0-14 now comprise slightly more than half the Blood population compared with about 30 per cent for the Canadian population as a whole. The average "crude" annual birth rate, i.e., number of births for every 1,000 people, for the Blood Band during the 4-year period from 1960 to '63 was 51, and the more meaningful fertility birth rate, which indicates the number of births for every 1,000 women of 15 to 44 years of age, is 254. For the Canadian population as a whole these rates were about half: 26 and 126, respectively. More significant even is the fact that over this period the Canadian fertility birth rate declined by about 2.5 per cent a year, whereas the Blood Indian birth rate has remained fairly stable, and has been stable over the last 50 years. Moreover there is no reason to anticipate a sudden decline in the future. The death rate, in contrast, has in recent years declined sharply, and is now at about the same low level as that for the Canadian population as a whole (6 to 7 deaths for every thousand of population). The consequences are clear: for some years to come the Blood Indian population will continue growing at a high rate. If the present high fertility birth rate of 250 were maintained the population will expand from about 3,100 in 1961 to 3,800 in 1966, to about 7,550 in 1981. On the basis of an average fertility birth rate of 250 till 1971, and 225 in the following ten years, the population would be close to 7,300 in 1981. Under the first birth rate assumption the growth between 1966 and '81 amounts to 4.7 per cent a year, under the second 4.4 per cent a year.

In terms of employment needs these rates of growth mean that the number of youngsters reaching the age of 16 each year, when they could enter the labour market, will be about 80 by 1966, 140 by 1976, and by 1981 the annual addition will amount to almost 160. About half of these numbers are girls, who will ease the employment problem when they get married, but the problem of finding employment for married men becomes more urgent.

It is doubtful whether sufficient work opportunities can be created on the Reserve to absorb all employable Blood Band members. A population of 7,550 by 1981 would give the Reserve about 13 persons per square mile. By then the density would be about that of the surrounding area at present, but this area includes the city of Lethbridge.

It would be folly to ignore the problem ahead and action should be taken now to meet it. Those who will depend on employment outside the Reserve should be

fully prepared, not only in terms of schooling and training for trades and professions, but also in terms of attitudes, convictions, goals and values. With the right attitudes the opportunities are unlimited and it becomes a matter of pointing them out. To this end great stress should be placed on counselling and field trip tours through which Indian students can acquaint themselves with what is going on outside the Reserve and identify the role they can play in it.

The human factor is a crucial one, because development can take place only when there is a will to develop together with the right attitude to secure success. Next in importance come natural resources ready for development or to be further developed, and capital to make it possible. The Blood are fortunate in being well-endowed with the former, and through them are in possession of sizeable capital funds.

Land

The Reserve area is about 344,500 acres. Almost 75 per cent of this land, or 252,400 acres, is suitable for cultivation: 40,400 acres are rated as good to very good arable, 123,100 acres as fairly good to good arable, and 88,900 acres as fair to fairly good arable. There are also 44,400 acres of poor to fair arable land which is marginal for growing field crops, and should unless there is urgent need for it, be kept in grass, together with the remaining 57,700 acres of the Reserve.

Field Crops

Most soils on the Reserve have a medium or finer texture which means that they have on the whole a good moisture holding capacity. Wheat crops of 20 to 28 bushels are obtainable on the better soils under average management and average weather conditions.

In 1961 only 86,450 acres were under cultivation and in 1963 this area was reduced to less than 85,000 acres. Nearly all this land lies in areas which have been rated fairly good to very good arable. The few exceptions where farming is practised on soils not or barely suitable for cultivation can be located with the help of the soil map.

The Blood Band members farm slightly less than half the cultivated land, which amounts to about 17 per cent of all arable land on the Reserve. Their holdings are located mostly in the southwestern half of the Reserve where soil and weather conditions are more favourable than in the northern half. The remaining cultivated land is used by farmers from the surrounding area.

Indian and non-Indian farmers follow about the same crop rotation. The main staple is wheat (around 40 per cent of the cultivated land); a fair amount of coarse grain (almost 8 per cent of Indian land and about 4 per cent of the leased land) is grown, and there are small acreages of special crops, such as oil seeds.

On the whole Indian farmers have not been able to make a success of dry-land farming. The reasons are partly technical, partly a matter of attitude and preferences, and partly a matter of farm size. Seed bed preparation in spring and after-harvest tillage are important to keep weeds under control, but these operations are, with some notable exceptions, neglected, and as a result Canada thistle, sowthistle, wild mustard, flixweed, and wild oats are common in grain fields. Insufficient use of weed-killing chemicals, and poor timing when used, have further aggravated this problem.

Inappropriate tillage practices have also caused a problem of soil erosion. The repeated use of disc type implements, which have the danger of burying much of the crop residue, instead of subsurface tillage implements has left the land unprotected and vulnerable to the wind. If in addition farmers either ignore strip cropping or make strips too wide to be effective, there is little or nothing that will prevent soil dirfting on fallow fields. This problem is serious in some sections of the Reserve, particularly where soils are fine textured, such as in Township 5, Ranges 25 and 26.

According to the land use survey about 45 per cent of the cultivated land is kept in summer fallow, which means that land is left idle about every other year. The soils in the Thin Black Soil Zone (south of the soil zone boundary, starting from Section 4, Township 7, Range 24 on Soils Map and extending in southeasterly direction) have a moisture content good enough to permit fairly intensive cropping, and a year fallow in a 4 to 6 year rotation will be adequate. With such a rotation the crop acreage would be increased by 45 per cent and high production can be sustained with the use of commercial fertilizers.

Indian-operated farms are on the whole too small to be sufficiently remunerative. The average size of these farms in 1961 was about 170 acres, and 80 per cent of them were less than 240 acres. Even on land rated as good to very good a farmer requires at least half a section to clear about $3,000, and to realize this income on fairly good to good arable land he needs about a section, and 2 sections of fair to fairly good arable land. The larger units also permit, of course, more economic use of farm implements and machinery.

The leased land is cultivated in large blocks. Most of this land is located in the Dark Brown Soil Zone where moisture conditions are somewhat less favourable than in the Thin Black Soil Zone, but when these conditions are good in spring, following at less frequent intervals than is practiced at present, would be advisable. Also on these lands the danger of soil erosion has been insufficiently recognized. Inadequate trash cover, tillage implements operating at high speeds and thus pulverizing soil aggregates, and lack of adequate strip cropping, have caused serious soil drifting, notably in Township 7, Range 23, Township 8, Range 22, Township 5, Range 24. Although the farmers of these lands use selective weed killers in most grain crops, there nevertheless are some infestations (wild oats) that have gone out of control. All these observations indicate the kind of improvements that will have to be made before full use is made of the cultivated land.

There are four fairly extensive areas where irrigation farming is feasible. The ideal location is near Standoff (see Irrigable Areas Map) where the soils are free from salts and have a good texture. In addition the topography is ideal, the irrigation diversion canal nearby, and ready drainage of excess water is no problem. Under these circumstances the Band should consider taking up its water rights granted upon selling reserve land for the construction of the irrigation diversion canal, and organize a pilot irrigation farm. On this farm essential experience can be gained, the appropriate irrigation methods demonstrated, crops most suitable for irrigation determined, and profitability compared with that of dryland farming. If after some years the project demonstrates that irrigation can be successful, it may then be possible to extend irrigation to Indian farmers who have shown their skills and management ability.

Range

Almost 70 per cent of the Reserve (236,400 acres in 1961) is still in native grass. About half of this land is fenced and used as grazing land, the remainder is open range and available to Band members for cutting hay. A few years ago large tracts of grazing land (still 22,000 acres in 1961) were leased to non-members, but when the leases expired in 1963 and '64 they were not renewed.

The range of the Reserve is among the finest in Western Canada. There are two major grassland types: the Fescue Prairie in an area which largely corresponds to the Thin Black Soil Zone, and the Mixed Grass Prairie in the remaining part of the Reserve. The grazing capacity varies from 14 acres a head in the southwestern corner, to 12 acres a head in the middle portion of the Reserve, to 35 acres a head in the area north of a line that corresponds to the boundary between the two soil zones. Water is plentiful in the south and along the rivers, but additional stock watering places are needed in the interior, particularly in the area where 35 acres are required for one head of cattle. Cattle grazing on the Reserve can gain around 300 pounds a year under good management.

The range has been unevenly utilized. In some areas, particularly the Mixed Grass Prairie in the northern part of the Reserve, over-grazing has been serious, whereas in others the range in under-utilized. The over-grazed areas should be allowed to rehabilitate, which might be accomplished by fencing and development of sufficent water sources so that cattle will be more evenly distributed over the range.

When the range is used for haying its productivity is much higher than under grazing, but only if haying is organized and carried out properly. At present cutting takes place haphazardly, rakes often travel too fast wasting much grass by leaving it on the land, and by cutting the grass too close the crowns dry out and the grass dies. Haying on the Reserve is socially as well as economically important. It is done by small groups, usually relatives, and can be carried on as long as weather permits and the land is free of snow. For many Indian families haying is part of their life and it is a steady source of ready cash.

The combination of excellent grazing land, a good supply of hay, and a large area of arable land where coarse grains can be grown is ideal for feedlot operations. Such an operation can be quite profitable but it requires competent management covering marketing as well as production.

. . .

The income from the land depends of course on how it is used. Let us assume, however, the following land use plan: (1) all land classed as "fair to fairly good arable" and better is used for fieldcrops, (2) the remainder of the land is used for raising cattle, (3) a cropping system of 35 per cent fallow, 35 per cent wheat, 15 per cent barley, 10 per cent oats, and 5 per cent flax, and (4) calves are sold as feeders in the fall. Such a plan would, under average farm management (comparable to that on three-quarter and one section farms with similar soils and climate in other parts of the prairies), give a net return of about $1,625,000 a year. Assuming further that a net annual family income between $3,000 and $4,000 would be a reasonable objective, agriculture on the Reserve could support about 450 Blood families, of which 400 would be cultivating field crops and 50 would be raising cattle.

There are, of course, many land use alternatives and in choosing an appropriate plan the preferences and aptitudes of the Band members must be taken into account if a plan is to be successful. Raising cattle may well come easier for the Blood than dry-land farming, and it may be necessary to emphasize this aspect initially in a development program. It should be realized, however, that the number of ranches beyond the minimum necessitated by physical conditions of the land will either reduce the total number of families that can live from the land or reduce the average family income. Intensification of land use by introducing irrigation farming and feedlot operations would provide further employment and raise the average level of income, but only when managed competently.

A word should be added about the land allotment system because it is a key factor in the success or failure of Indian farming. So far it has been easy for a Band member to obtain Reserve land and use it for dryland farming or ranching: the land was there for the asking. Even with the land free of charge, as well as financial assistance in the form of interest-free Band loans to cover operating expenses, most Indian-operated farms failed to be successful. Farming debts to the Band increased every year, and by 1962 the combined indebtedness of Indian farmers was getting close to $300,000. In addition to these debts, members had accumulated substantial housing debts (over $700,000 by 1962) and it became imperative that such a drain on Band funds could not be permitted to continue. The Band, in an effort to liquidate these debts, has now leased the land of indebted Indian farmers to non-Indian farmers, and any proceeds thus obtained will be applied against their debts. Although this arrangement may be successful in eliminating the Indian debts it does not change poor or marginal Indian farmers into capable ones. Such a change requires an educational process, and here again the problem is one of attitudes and preferences.

As long as land was plentiful the problem of efficient land use was not pressing. As the population grows and the number of applicants for land increases, while the acreage of unallotted land declines, it will become more and more difficult for new generations to obtain land sufficient in area to enable them to make a living on it. It would seem unfair to them to have other members waste or make inadequate use of land, and continue to use the land simply because they happened to be born earlier. The Reserve was set aside for the Band as a whole, and allotments to individual members were granted on the condition that these members put the land to good economic use. If it turns out that Indian farmers do not have the required managerial ability, and there is little likelihood of their acquiring, it, and particularly if other members are keen on starting a farm, then the Band should implement its ruling that allotments to incompetent farmers be cancelled. It would, furthermore, be only reasonable if established Indian farmers on the Reserve were to contribute to a fund from which grants could be made available, in the form of scholarships for education or down payments on land outside the Reserve for members of Blood generations to come.

Timber

The Timber Limit consists of almost 2,000 acres of softwood stands (40 per cent of total area), and 1,660 acres of non-commercial mixed wood and hardwood stands (35 per cent of total area). The remaining land is either grassland or unproductive. Thirty-five per cent of the softwood stands, which consist mostly of lodgepole pine, are overstocked, and another 33 per cent is fully stocked.

The available timber can be used for fence posts and corral rails, for which there is fortunately a ready market in the ranch country of southern Alberta. The Band has already a fence post treatment plant in operation, and judging from the results after one year, it is a profitable undertaking. The project can be kept operating at the present annual rate of 96,000 posts, (120 working days a year) for about 10 years from the available lodgepole pine. On this basis the potential gross value of annual sales amounts to almost $44,000. Operating costs are somewhat less than $27,000, and after allowing for amortization of capital invested and administrative costs the profit should come to about $12,000 a year. The Band took a wise decision indeed in operating the Limit as a Band project to obtain a satisfactory revenue and to gain business experience.

Harvesting of the trees should be done in the mature pine stands by clear cutting strips no more than 2 chains wide against the prevailing southwestern and westerly winds. At the same time thinning operations can take place in overstocked immature pine stands to supply additional posts, poles and corral rails. All forest operations should be carried out under competent supervision to ensure protection against fire, wind, disease, and insect damage, and to facilitate regeneration efforts. It is important that cutting operations be carried out systematically and that a record be kept of the number of trees cut, where they were cut, and the number of posts and poles yielded.

The Limit also includes an extensive area of grassland along the Belly River. This area could be leased or used by the Band for grazing cattle, but

only after it has been fenced. Grazing at large in the forested areas should not be allowed.

Geological Deposits

There are several geological deposits on the Reserve. Most important is the presence of natural gas and oil. Coal deposits have been used locally in the past but no longer have economic significance. Oyster shell could be exploited on a limited scale and used as a mineral feed for poultry. Small amounts of gravel are available which will be useful for construction purposes. Groundwater is a resource of great economic importance, and its development is essential for the full utilization of the range in a livestock program.

Gas and Oil

The gas and oil resources are primarily a source of revenue, and offer few, if any, employment opportunities for the Band. Rents and cash bonuses during exploration work have added substantial amounts of money to Band funds, and since the exploitation of the Lookout Butte Gas Field on the Timber Limit royalties now averaging about $11,000 a month for condensate alone have been flowing in. As the concentration of the condensate gets weaker these royalties will decline, but new and no doubt substantial revenues will accrue to the Band as soon as the available gas can be marketed. That day may not be far off. Although earlier attempts to find oil and gas on the main Reserve in marketable quantities were unsuccessful, recent efforts have produced encouraging results.

Coal, Oyster Shell and Gravel

Only some small strip mining operations of coal in localities 1 and 5 on the St. Mary River (see Coal Occurrences Map) might be feasible. The total amount of coal that can be mined economically is in the neighbourhood of 3,000 tons, which could be used locally as fuel. The Band Council might give consideration to having at least the overburden of about 10 feet removed with their road building equipment. The excavation of the coal could take place in several ways. The Band could undertake the excavation as a Band project, lease the rights to do so to one or some of its members, or simply leave it to the residents to help themselves.

The fossil oyster shell deposits on the Reserve do not occur in sufficiently large quantities that are easily accessible, to facilitate cement production but they could be used as a mineral feed for poultry. The only drawback is that poultry feedmen seem to prefer a white flaky product which is imported. Tests have shown, however, that the grey and granular crushed shell from the Reserve is equally palatable and effective as a calcium feed. Besides the fossil shell could be crushed and washed, if necessary, at a cost well below the price range of $40-$42 a ton for the imported product. As in the case of the mineable coal, various ways are open to the Band in which the oyster shell deposits may be exploited. The scale of operation would be fairly small and possibly no more than 6 to 8 Band members may be employed.

Surface deposits of gravel of any significance are located in the southwestern part of the Reserve. These deposits will be needed by the Band for road construction.

Groundwater

There is a real need for a sound groundwater development program, particularly for the northern part of the Reserve. Not only are additional stock watering places required to promote even distribution of cattle over the range, but there is also a need for drinking water for domestic use.

As a first step a water development program should be approved by the Band Council. Such a program would entail the drilling of test holes (three initial locations are recommended; see Bedrock Geology and Groundwater Maps) to assess the goundwater potential of sandstone beds in both the Blood Reserve and the St. Mary River Formations. Appropriate wells should be installed wherever adequate water supplies are encountered. Other sources of water may be found in sand and gravel layers within unconsolidated material, particularly those at the base of glacial drift (see Groundwater Map). Surface deposits of gravel and sand in the valleys of the Belly and the St. Mary Rivers contain water supplies, and the construction of wells in these deposits has advantages over the intake of river water by pipe. A well has less contamination hazard, for instance, and eliminates worries of ice damage to which an intake pipe is exposed.

In setting up a groundwater development program technical assistance of groundwater specialists is required, and all drilling -- including well installations --must be carried out by competent drilling contractors. There is no guarantee that good water supplies will be discovered with every test hole drilled, but each hole will yield valuable information that can be used in guiding the drilling program. It is important that accurate and complete drilling records be kept of all test holes drilled on the Reserve, and the Band should insist on receiving a copy of these records.

A water development program should also include the improvement of existing water supplies, such as the protection of springs by way of concrete enclosures, and fencing ponds.

Economic Development

Although the idea of progress has concerned philosophers and political economists in the past, a serious interest in the factors governing economic development did not manifest itself until after the second world war. Suddenly, with the emergence of new nations, economic development became a magic term. Everybody felt it was good and desirable: the poor wanted to get rich, and the rich wanted to get richer. Soon the suject was adopted as a special field of study in the teaching of economics, political science, sociology and anthropology, each discipline concentrating on phases that fell within its sphere. For the technical sciences, such as engineering. agriculture and forestry, development was nothing new. There it had been going on for years, and the application of new techniques became only more intensified as society stepped up its demands, and research expenditures were increased. The interest in economic development as reflected in the various fields of learning pinpoints two aspects: one deals with the promotion of technical inventions and innovations; the other deals with the question of how economic development can be maintained, stimulated or introduced, by utilizing available techniques and knowledge. Most emerging nations are primarily concerned with the latter aspect, and this concern also applies to the Blood Indian Reserve.

Much has been written about problems of creating and maintaining economic growth and how to overcome them, but our knowledge in this field is still scanty and fragmentary. Considering the multitude of factors that interplay in economic development, including those of human nature, it is unlikely that the state of knowledge will ever reach the point where detailed programs for economic development outlining step by step the procedures to be followed can be designed, and offered with a guarantee that the objectives will be achieved at a predetermined future date. This realization does not mean that setting up a development program is pointless. It means only that at present economic development requires constant assessment of past and current actions so that future intentions can be revised and kept realistic. Such feed-back is particularly important where it involves a society such as the Blood for whom developmental programs are a new experience. It has been argued that in view of a multitude of uncertainties in economic development the organization of a development program makes little sense. One can also argue, and as experience has shown with more justification, that these uncertainties emphasize the need for an organized approach. But it is essential that in planning a program and in its execution there should remain sufficient flexibility so that it is possible to determine quickly changes that must be made, to co-ordinate and integrate these changes in the program, and to communicate these changes to all participants.

In setting up a development program there are roughly three phases: a preliminary phase, a fact finding phase, and an analysis phase. It may be helpful to discuss each briefly.

Preliminary Phase

It will be necessary to ascertain whether the efforts and expenditures entailed in economic development are justified. The primary criterion is the preparedness of Band members to co-operate and participate to the full extent of their ability in the whole program. Without their active participation in the economic development process lasting results will be doubtful. There is always the danger that outsiders who know, or think they know, will program ahead of the people concerned and in so doing jeopardize the whole program. Paternalism should be consciously avoided. This phase is concluded with recommendations, such as: "Carry on, prepare plans", or "Go slow with planning, provide for community development worker".

Fact Finding Phase

During the fact finding or inventory phase all essential information will be gathered. The scope of these activities depends of course upon the objectives set. As a rule, however, it will be necessary to organize surveys to determine the economic potential of the natural resources available to the people concerned. These resources may include land (used as range, for growing field crops or trees, and other purposes), mineral deposits (including oil and gas), and water, as well as capital and human resources (particularly the labour force). Other important field surveys and studies are those dealing with management practices in the current utilization of the resources, with values, attitudes and preferences of Band members, with institutional factors (such as Band government and land tenure) affecting economic development, and those providing population projections.

The need to enquire into the values and attitudes of the people concerned, and how these are changing, must be stressed. Many examples could be cited of foreign aid programs faltering because those who

brought assistance leaned heavily on introspection in anticipating the needs of other people, often belonging to a different culture, and in seeking ways to meet those needs. The same risks are run by non-Indians working for Indians in economic development.

It is obvious that many specialists in the various disciplines involved will have to be engaged to complete this phase. These people will have to be made available from other government departments (federal and provincial) and agencies, or contracted from Universities and consulting firms. In addition to these specialists a generalist is required to co-ordinate the various activities. This function might be assumed by the Indian Affairs Branch, particularly if it assists in financing the field work. But it can also be contracted, possibly to a competent consulting firm which may in fact undertake the whole program, including the writing and printing of a final report.

Analysis Phase

The results of the fact finding phase must be analysed in terms of economic potential, capital requirements, employment opportunities, and marketability of products. In this phase the number of people that can be supported by effective utilization of the available resources, must be made explicit. Practical objectives with regard, for instance, to the utilization of resources, establishment of commercial or industrial enterprises, and educational programs, must be decided. These objectives should be defined as fully as is reasonably feasible in terms of quantity and time, that is to say a Band should commit itself to obtain a certain production volume (in agriculture, for instance) or have projects of a predetermined minimum scale in operation (a feedlot operation, for instance, selling 500 head of cattle annually) at a predetermined future date. All projects must be economically sound, in accordance with the interests of Band members, and co-ordinated with the economy of the region of which a Reserve is a part. For the Blood Band close co-operation with the Oldman River District Planning Commission in Lethbridge is highly desirable.

In the course of the analysis it may become apparent that population growth exceeds the development of employment opportunities. Ways and means must be found to facilitate employment outside the Reserve by providing training in skills and professions so that Band members will qualify for work either within commuting distance of the Reserve, or elsewhere in the province or country. At the same time needs for more road construction, development of communities with recreational facilities and other amenities, may be envisaged. This report does not deal with these aspects of economic development, and it may well be necessary to instigate further fieldwork to assess community problems (such as those pertaining to health, hygiene, delinquency, school drop-outs), and to provide recommendations for their solution. Further study may also be advisable to determine whether some form of manufacturing could be introduced. Assembly type of manufacturing requiring manual dexterity may be well suited and turn out to be beneficial to both the Band and the firm. Under a suitable rental agreement the Band may provide even buildings and other services, such as water and electricity. As soon as these recommendations are made their incorporation into the development program should be considered.

Apart from outlining feasible projects, the interrelationships between and hence the sequencing of these projects should also be determined. Otherwise the chances are that time and effort will be lost because the completion of some projects will be delayed as a result of incompletion of others. For the same reason development problems, such as those pertaining to financing, procuring technical assistance, and appropriate training, should be anticipated, and dealt with before they materialize. Responsibilities as far as the execution of individual projects is concerned and over-all management should be determined and delegated.

In executing this critical phase of economic development the assistance of the various specialists, who prepared the resources inventory, and no doubt others, will be indispensable. Above all, the co-operation and participation of Band members themselves will be required. The Blood Indian Band Council is already assisted in its work by various committees and there would be no point in creating another if it would not serve a real need. When the Band is ready for economic development and decides to proceed along its path, then consideration should be given to a planning committee whose members are chosen from committees already in existence. In this way knowledgeable people in a variety of fields (roads, schools, credit, agriculture) would be pooled together, and the planning committee would be assured of being kept up to date on developments in these fields.

As has been mentioned earlier, the emphasis in this report lies with the assessment of the natural resources, their utilization and economic potential. The planning of an economic development program still has to be undertaken. It will be up to the Band to initiate this phase. It would be somewhat unrealistic, however, to assume that the initiative for setting up an economic development program may be sparked from within a community where under-development and low incomes are prevalent. Encouragement

through appropriate community development may well be required.

Economic development has faltered in the past not only because of inadequate planning of programs, but also because of faulty organization and management. Planning techniques are largely matters of common sense but it may be useful to state briefly the essential requirements that must be met.

First, the planning techniques used should be a learning device. When a Band has decided to deal with the low income problem on the Reserve through economic development it is coming to face a task that is enormous and complex. The scope and complexities are bound to hide many problems, some of which may be avoided, others may not. Even a modest program will take several years to complete, may involve fairly large capital expenditures, and will require resource specialists. All requirements, whether capital or human, must be kept to a minimum to keep costs down.

An undertaking of this kind requires a conceptual framework that forces one to think in a systematic manner through all essential activities involved in the whole economic development process. In so doing insights are gained into developmental complexities, and problems can be anticipated. When essential activities are identified an attempt can be made to assess the time it will take to complete each of these activities, and also the amount of labour and capital that will be required.

Second, the planning technique should be an explanotory device. Many activities in a developmental program are dependent on each other in the sense that an activity often cannot be started before the completion of another. The timing of starting and completing projects is therefore important, and each individual in the development process should be able to relate his work to that of others and the over-all objective. Also Band members and Indian Affairs Branch administrators, if involved, should know the significance of the various projects. The local people should know because their co-operation and participation will be required. The administrators should know because their approval for a planning budget and the hiring of staff may be required. The planning technique should, therefore, provide a model that makes it possible to show the essential activities involved in economic development, and how these activities are related to one another, and to the over-all objective.

Third, a planning technique should be a managerial device. An economic development plan must first be prepared, and then executed. In both phases a manager or co-ordinator is needed to direct activities so as to economize on time, expenditures and personnel, and to ensure that the economic development objectives are in harmony with general economic trends outside the Reserve. Throughout the developmental activities the manager will need to know whether developments progress smoothly. If they are not according to plan, he should be able to assess quickly the source or sources of the delay, and to consider alternatives to minimize the effects of the delay. Adjustments and revisions are unavoidable: some projects will have to be replaced by others; the sequence between projects may have to be changed; the responsbility for some projects may have to be enlarged to overcome the breakdown of responsibility in others. All such changes will have to be co-ordinated and integrated, and communicated to all involved. It is essential that the planning technique makes it possible to have these changes made quickly and effectively.

Management techniques that meet these requirements are used in other areas, such as in large scale manufacturing and construction where timing of subcontracts, delivery of materials, allocation of labour, and delegation of responsibilities to get the job done in time, are equally important as in carrying out an economic development program. Well established techniques are the Critical Path Method (CPM), the Program Evaluation and Review Technique (PERT), and the Resource Allocation and Manpower Scheduling (RAMPS). These techniques have been described in books and articles, and need not be dealt with here, except to say that they are basically simple but become quickly complicated as the number of projects or activities in the over-all program increases. Those responsible for economic development should at least be familiar with the principles of these techniques, and even if not adopted to the full extent using certain aspects will prove most helpful (consider, for instance, the network diagrams in which projects are indicated by arrows, and junctions of arrows indicate inter-relationships between projects).

Before closing, and hopefully in anticipation of the forthcoming planning and implementation of a development program for the Blood Indian Reserve, a word of caution may be appropriate. It is clear that economic welfare cannot be raised without conscious efforts on the part of the people concerned, and at times fairly heavy capital expenditures. In addition, it usually happens that another price, which is much less obvious and cannot be expressed in monetary terms, is being paid. It is a price of adjustment to a new mode of living and often involves changes in cultural values. A few examples may illustrate the point. The gain of economic independence is often at the expense of personal freedoms, such as starting

work and quitting whenever one feels like it. Wage employment may also entail monotonous routine work, and may take place in buildings where the fresh prairie air is missing. Furthermore social customs are bound to change. There is a real danger, for instance, that the Blood traditional values of hospitality and generosity will suffer when appetite for material possession increases, and the urge to satisfy them becomes stronger.

Higher incomes will undoubtedly add to the standard of living in eliminating disease, malnutrition, and other discomforts, but when the basic needs are filled it becomes exceedingly important not to allow acquisitiveness to dominate other values that add so much to human well-being. In all likelihood an over-emphasis on material needs at the expense of the traditional Blood ways might eventually reduce happiness among Band members. May the Blood be guided by fortitude and foresight in their quest for economic development, and may they avoid the pitfalls along its path.

APPENDIX

RECOMMENDATIONS

The Band Council should:

1. Consider arranging for studies dealing with community problems, such as crowded living conditions, delinquency, school drop-outs and health.
2. Encourage cultural activities among the residents.
3. Request appropriate authorities to introduce in the school curriculum on the Reserve the teaching of the history of North American Indians, with emphasis on the history of the Blackfoot tribe.
4. Continue to emphasize the importance of education for Blood Indian students.
5. Give serious consideration to having established Indian farmers, and ranchers, contribute to an educational and development fund to assist future Blood generations.
6. Consider cancellation of land allotments to residents who do not put land to good use within a stated time limit.
7. Explore ways and means by which Indian farmers will utilize agricultural extension services available to them.
8. Ensure that dry-land farmers adhere to farming practices as recommended by the Alberta Department of Agriculture and the Federal Lethbridge Agricultural Research Station. Particular emphasis should be given to control of over-grazing and noxious weeds.
9. Endeavour to consolidate farm lands into units of economic size.
10. Negotiate an agreement with the lessees for an equitable distribution of fertilizer costs.
11. Make plans for a feed lot operation and herd improvement program.
12. Consider the organization of a pilot irrigation unit under competent direction.
13. Organize a groundwater development program with the assistance of technical specialists.
14. Ensure that copies of records pertaining to drill holes for water are received from drilling contractors and that these records are kept for future reference.
15. Continue operating the Timber Limit and the fence post treatment plant as a Band project.
16. Keep a record of the number of trees cut on the Timber Limit, where they are cut, and the number of posts and poles yielded.
17. Give serious consideration to enabling the utilization of some coal deposits on the St. Mary River (locatities 1 and 5) by having the overburden removed.
18. Investigate possible uses and market opportunities for fossil oyster shell deposits.

SOIL AND TOPOGRAPHY MAP
OF THE
BLOOD INDIAN RESERVE
ALBERTA

Scale – 1 inch to 2 miles or 1:126720

Miles 2 1 0 2 4 6 8 Miles

All Elevations in Feet above Mean Sea Level.

LEGEND

CHERNOZEMIC SOILS

ORTHIC DARK BROWN

- Leth.L.SiL — Lethbridge Loam or Silt Loam developed on alluvial lacustrine material.
- Cdle.SiCL — Coaldale Silty Clay Loam developed on lacustrine material.
- Cm.SL — Carmangay Sandy Laam developed on alluvial aeolian material.
- Sc.L — Scollard Loam developed on coarse outwash material.
- Ry.L.SiL — Readymade Loam or Silt Loam developed on resorted till.

CALCAREOUS DARK BROWN

- Bk.CL.SiL SiCL — Brocket Clay Loam Silt Loam or Silty Clay Loam developed on Calcareous lacustrine material.

ORTHIC BLACK

- Dr.L.CL — Dunvargan Loam or Clay Loam developed on till.
- So.SiL.SiCL — Standoff Silt Loam or Silty Clay Loam developed on alluvial lacustrine material.
- Pn.SiCL — Pincher Silty Clay Loam developed on lacustrine material.
- Fth.L.SL — Ferintosh Loam or Sandy Loam developed on coarse outwash material.
- Lv.L.CL — Leavitt Loam or Clay Loam developed on till.
- Ct.SiL.SiCL — Cardston Silt Loam or Silty Clay Loam developed on resorted till.

ELUVIATED BLACK

- Bu.SiCL — Bullhorn Silty Clay Loam developed on lacustrine material.

SOLONETZIC SOILS

BLACK SOLONETZ

- Hr.SiCL — Horn Silty Clay Loam developed on lacustrine material.
- Mm.CL — Mami Clay Loam developed on till.
- Ox.L — Oxley Loam developed on residual material.

DARK BROWN SOLODIZED SOLONETZ

- Kh.SiL — Keho Silt Loam developed on alluvial lacustrine material.
- Pa.L — Parr Loam developed on till.

BLACK SOLODIZED SOLONETZ

- Tw.SiL — Twining Silt Loam developed on lacustrine material.
- Nn.CL — Ninastoko Clay Loam developed on till.

GLEYSOLIC SOILS

HUMIC ELUVIATED GLEYSOL

- Te.SiL — Tempest Silt Loam developed on lacustrine material.

REGOSOLIC SOILS

ORTHIC REGOSOL

- Av. — Alluvium recently deposited by rivers. Texture varies from loam to sandy loam.
- Mn.CL — Mokowan Clay Loam developed on calcareous residual material.

SALINE REGOSOL

- B — Unnamed undifferentiated saline material. Salts on surface.

St. This prefix denotes stony phase.

Er. This prefix denotes that most of the A horizon has been removed.

Gr. Gravel

Soil information by the Canada Department of Agriculture with the co-operation of the Research Council of Alberta and the University of Alberta.

DIAGRAM OF TOWNSHIP

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

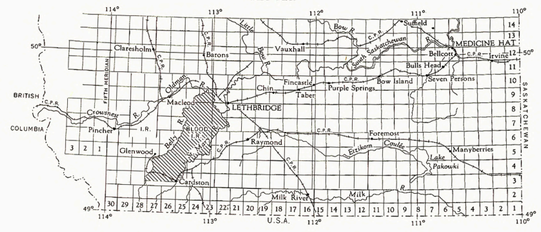
TOPOGRAPHY

- Level to undulating
- Gently rolling
- Rolling
- Hilly
- Rough broken land adjacent to stream courses

REFERENCE

- Roads — paved
- — gravel and elevated
- — dirt road or bladed car trail
- — car trail
- Railway
- Bench mark — B.M.3234→
- Elevation — 3886
- Topography boundary
- Soil boundary
- Soil zone boundary

KEY MAP



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BLOOD INDIAN RESERVE
ALBERTA

TOPOGRAPHIC MAP

Scale 1 inch to 1 mile or 1:63,360

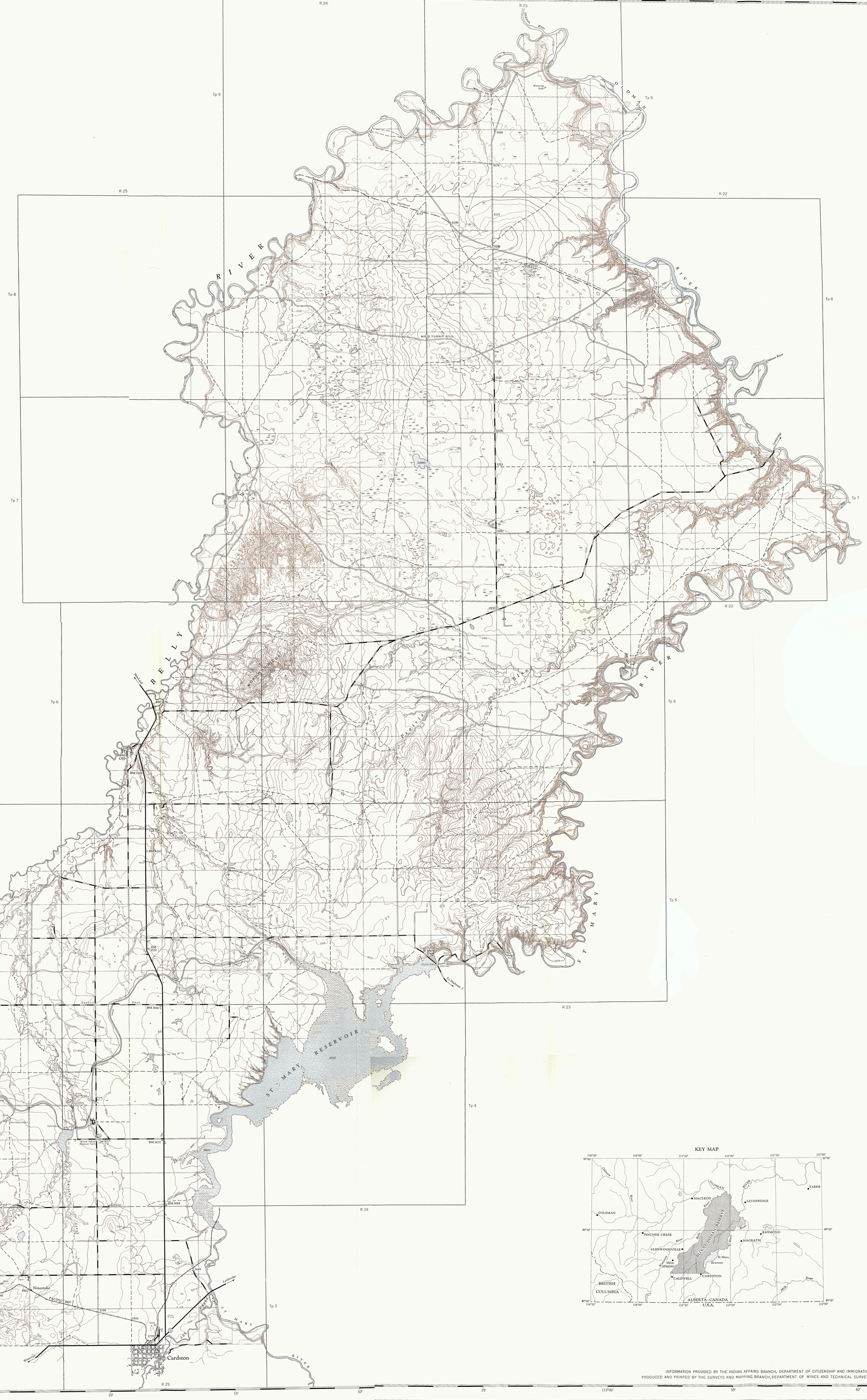
1 ½ 0 1 2 3 4

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

NOTE—CONTOUR INTERVAL IN TP. 3, R. 25, 26, 27 AND TP. 4, R. 27 IS 50 FEET. CONTOUR INTERVAL ON REMAINDER OF SHEET IS 25 FEET

REFERENCE

- Roads — paved
- — gravel and elevated
- — dirt,or bladed car trail
- — car trail
- Railway
- Bridges: road; railway
- Cutting; Embankment
- Township boundary
- Section line
- Bench mark with elevation — BM 157
- Building; Barn
- Church; School
- Cemetery
- Stream; intermittent or dry
- Lake intermittent
- Inundated land, seasonal
- Marsh or Swamp
- Foreshore flats; Sand or gravel
- Contours — elevation — 1225
- — depression
- — cliff



KEY MAP

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