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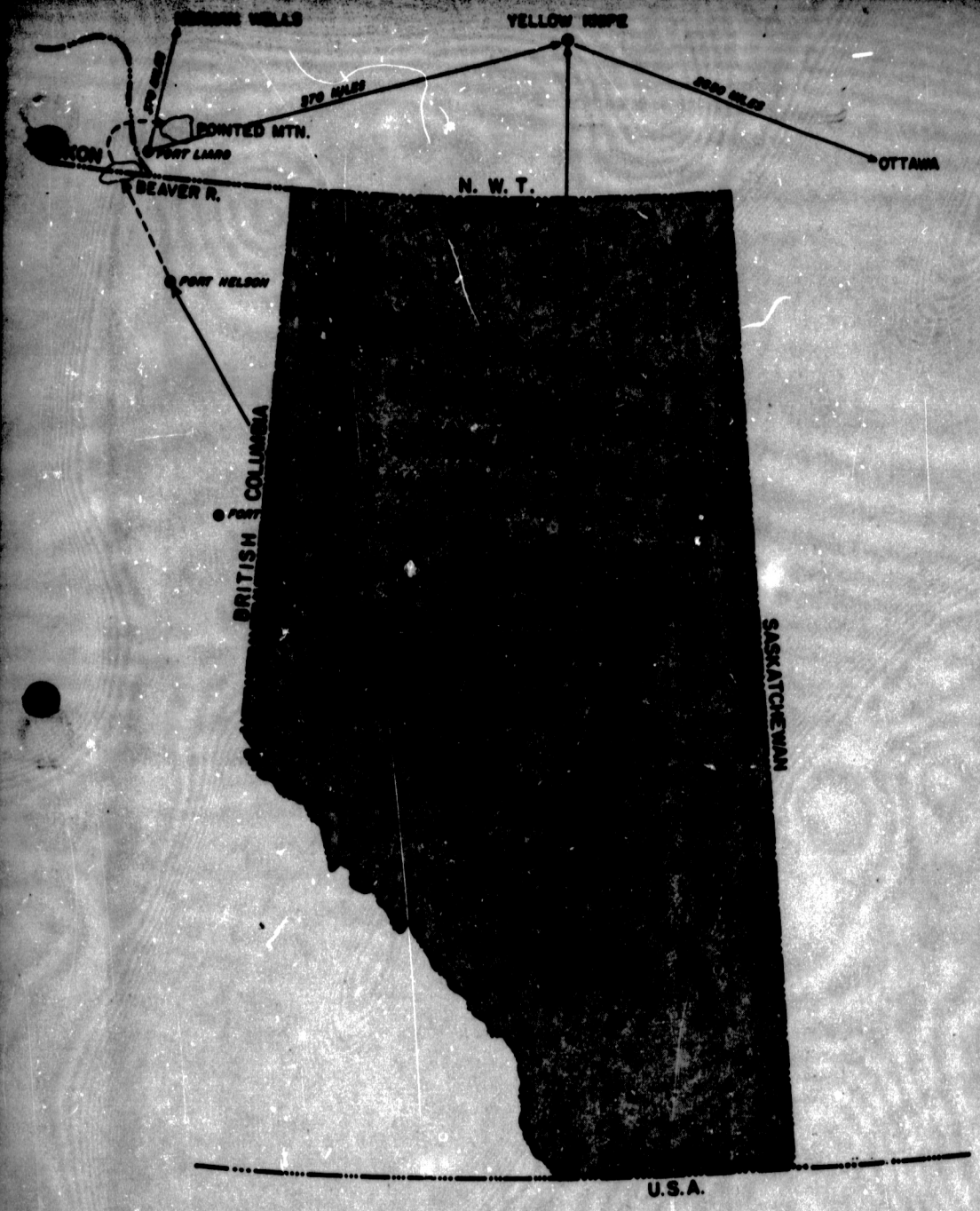
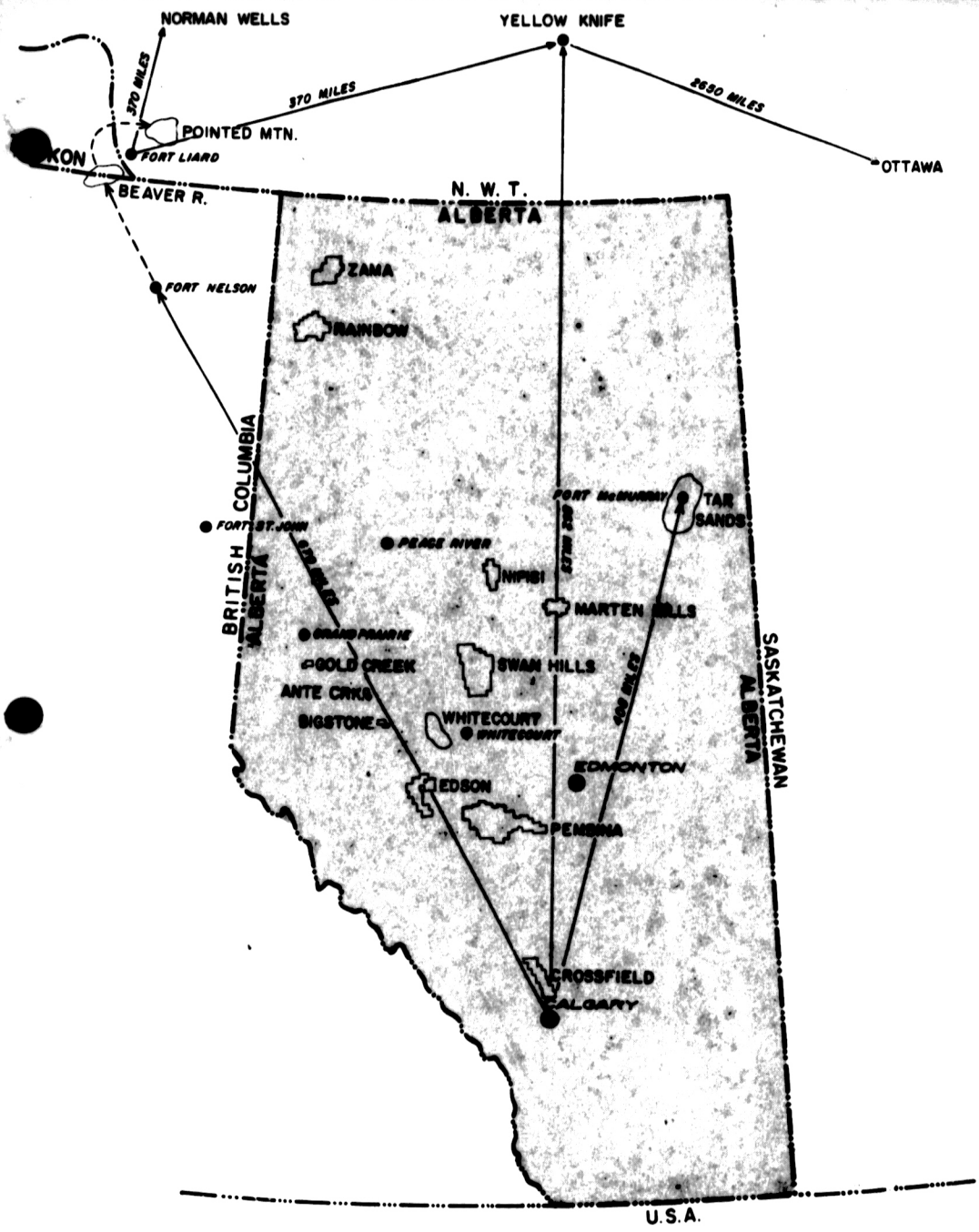


TRIP TO NORTHERN OPERATIONS

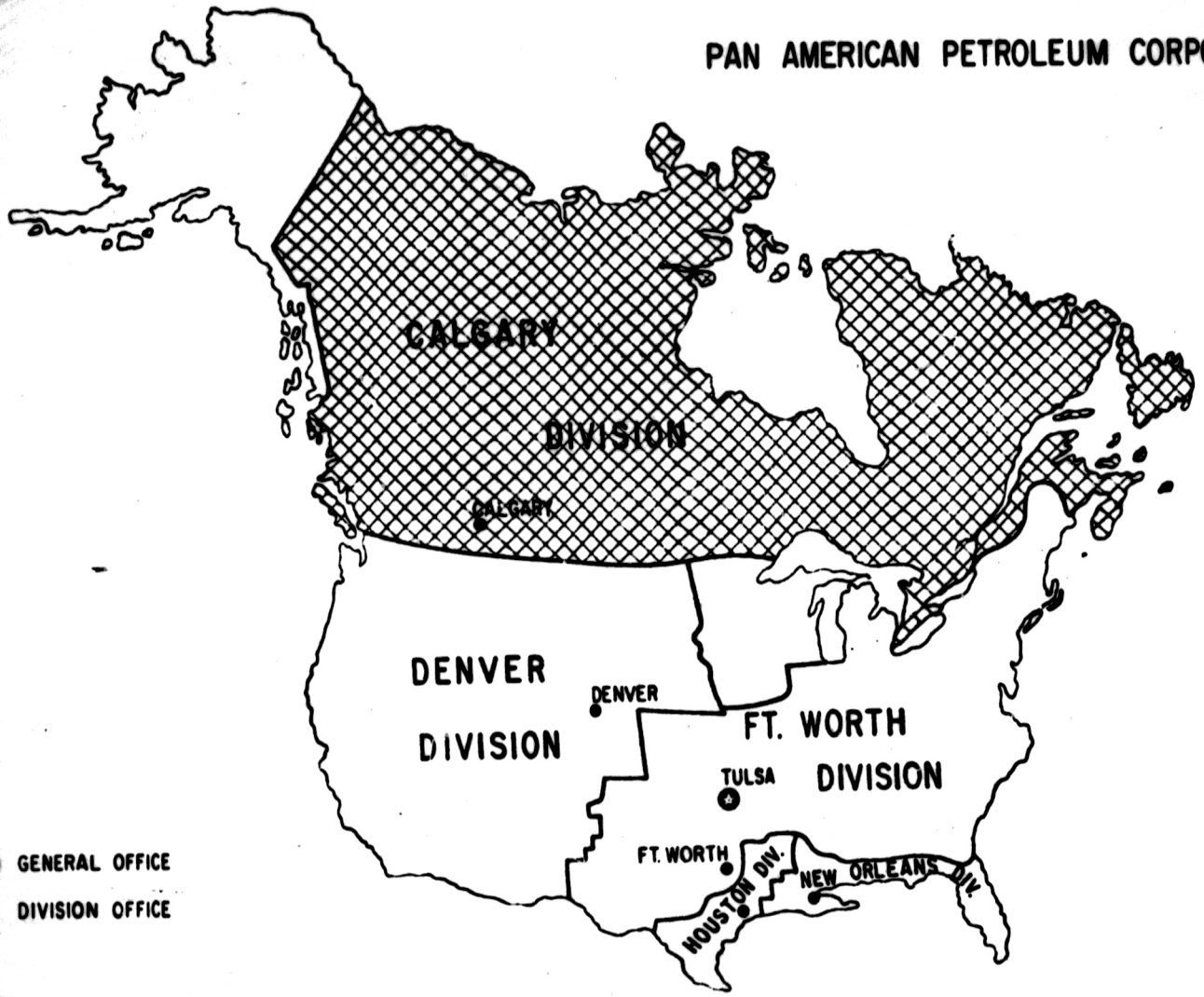
CALGARY DIVISION



TRIP TO NORTHERN OPERATIONS

CALGARY DIVISION

PAN AMERICAN PETROLEUM CORPORATION



THIRD NORTHERN RESOURCE CONFERENCE
WHITEHORSE, YUKON TERRITORY

April 8 - 11, 1969

DEVELOPMENT OF THE BEAVER RIVER AND POINTED MOUNTAIN GAS FIELDS

J. D. Burns
Pan American Petroleum Corporation
Calgary, Alberta

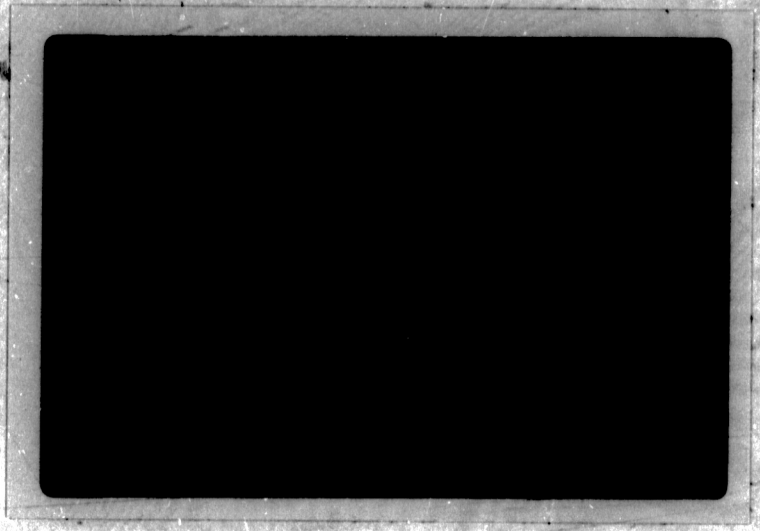
On January 25, 1967, Pan American Petroleum Corporation announced the signing of a natural gas sales contract covering 1.5 trillion cubic feet of reserves in Northeast British Columbia, Northwest Territories and the Yukon. The purchaser, Westcoast Transmission Co. Ltd., agreed to purchase these reserves at daily rates which could reach 205 MMCF/D and transport them to Fort Nelson B.C. for processing and further distribution through their mainline facilities. This stream of gas will be sufficient to provide all the residential heating requirements for roughly four cities the size of Calgary. The signing of the contract was particularly significant for Pan American because it represented not only one of our largest gas sales, but also the completion of a very important step in the development and marketing of the large gas reserve discovered eight years earlier (1959) in the Beaver River Field. Today the Beaver River-Pointed Mountain Fields stand as the most northerly active and commercial gas project in Canada. As such they are herald of better things to follow for the North. With this as a background I would like to review with you the success story which is "Beaver River - Pointed Mountain".

It all started for Pan American in 1956 when we became interested in the Liard Fold Belt - a geological area located in the mountain ranges of the three-border area which covers the lands west of the Liard River and south of the Nahanni River to the Rocky Mountains. At that time we began purchasing land permits as a result of conducting field geologic surveys around Beaver River in northeastern British Columbia. The first drilling in the area was on the Beaver River structure where a thick gas pay section was found in 1959.

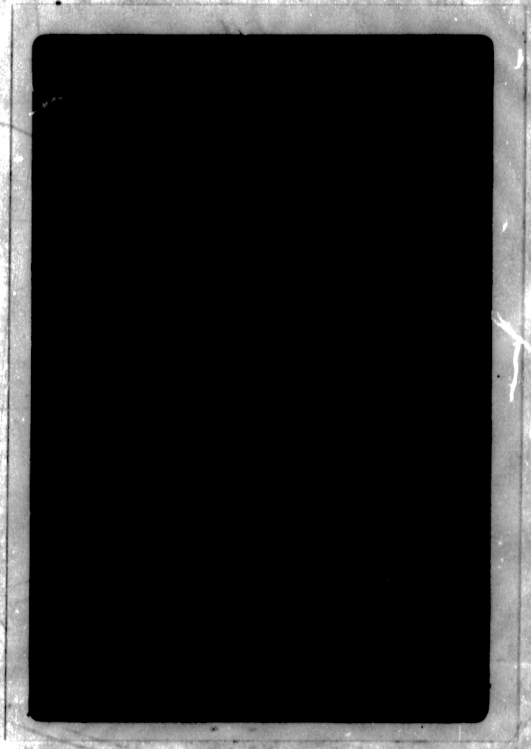
Picture No.1

My first picture shows the general outline of area referred to as the Liard Fold Belt - so named because the mountain ranges in this area are the result of severe folding and faulting of the sedimentary rocks. Within the black outline is the area which I refer to as the Beaver River-Pointed Mountain Area - this is also the area covered by our gas sales contract with Westcoast. Within this area lie 575 square miles. The nearest populous area to the southeast is Fort Nelson, roughly 110 miles away. By comparison Whitehorse lies some 380 miles to the northwest.

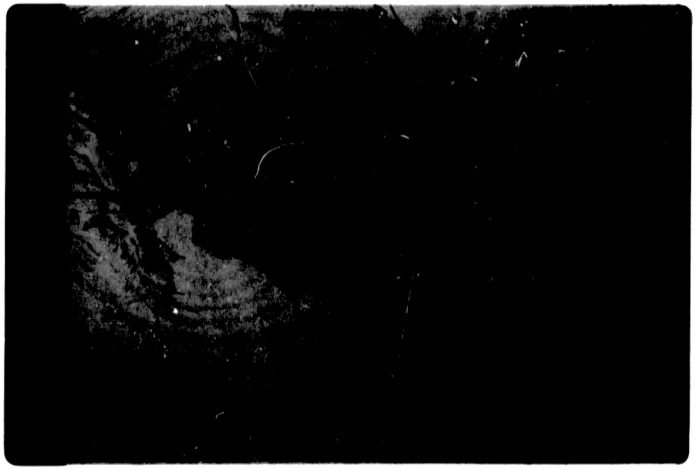
Encouraged by the Beaver River discovery a seismic program was launched in other parts of the area. Seismic exploration verified the geology and a series of drilling operations was begun first on the North Beaver structure. It was here and at Beaver River that one of our major problems was encountered. The trouble is that subsurface conditions may bear little relationship to the simple surface geology. Structures mapped at the surface cannot always be accurately projected down to the producing formation because of the folding and faulting in the area. To aid the geologist in picking the right drilling location, seismic exploration over possible producing structures was and is of prime importance. Following an unsuccessful try on the North Beaver structure - our well on this structure was called Kotaneelee A-1, a



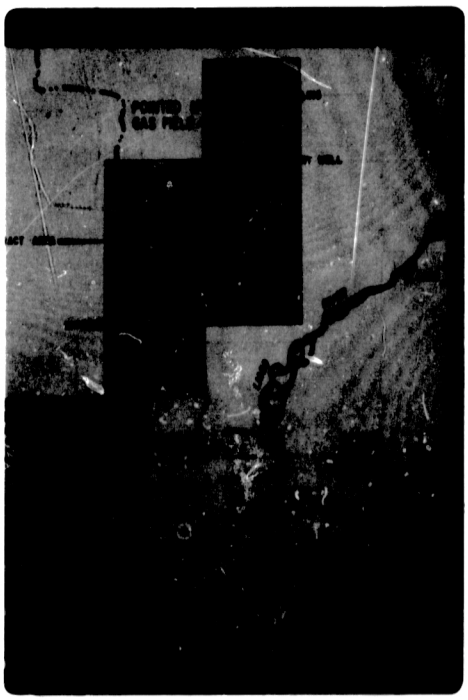
Picture 1



Picture 2



Picture 1



Picture 2

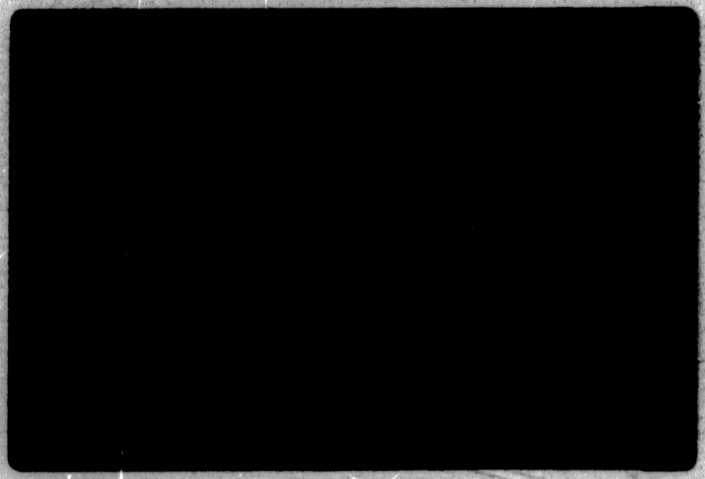
geologic study of the Pointed Mountain structure was made in 1964. Finally after considerable review, on February 8, 1966 after nearly two years of geological and geophysical work our first Pointed Mountain well was spudded. Nearly a year later on December 17, 1966, the well was completed as a successful discovery - having drilled to a depth of 14,339 feet. Almost coincident with the discovery of the Pointed Mountain Field we signed our gas sales agreement with Westcoast. Pan American's confidence in the area was most certainly proved by this second major field discovery.

Picture No.2

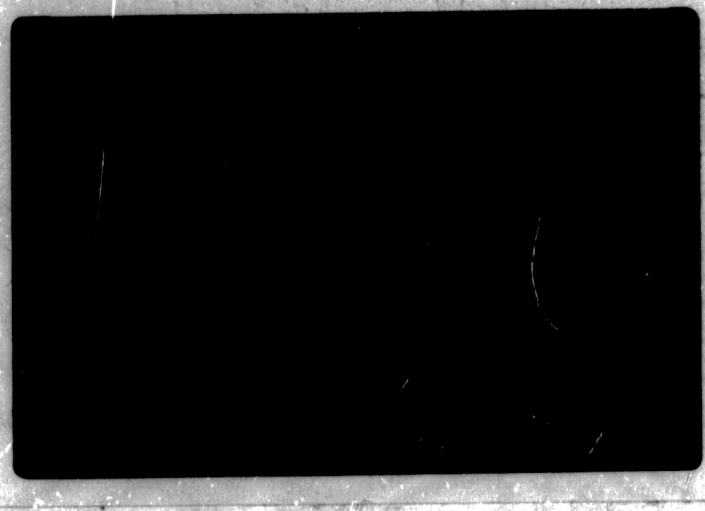
My next picture shows in slightly more detail the location of these two major gas fields. Beaver River lies straddling the B.C. - Yukon border - although we have not yet proved the existence of commercial gas reserves in the Yukon. Our drilling well Beaver River C-1 will hopefully prove these reserves early this summer. Pointed Mountain lying some 30 miles to the northeast is wholly within the N.W.T.

Picture No.3

This picture shows a geologist's conception of the gas bearing structure at the Beaver River Field. The structure as presently mapped is about six miles long and 2 miles wide. Surface terrain in this field is not particularly rugged when compared to that in Pointed Mountain. Although the wells shown here appear perfectly straight - nothing could be further from the truth. In actual fact the steepness of formation overlying the producing horizon causes the drill bit to vary as much as 15° from the vertical. Hard drilling and deviations are but two of the many problems experienced in drilling. High water flows and high pressure gas pockets are also a continual source of trouble. In fact our Beaver River A-1 well had to be abandoned in 1959 when a high pressure gas zone in the Mississippian caused a blowout and fire which destroyed the rig.



Picture 3



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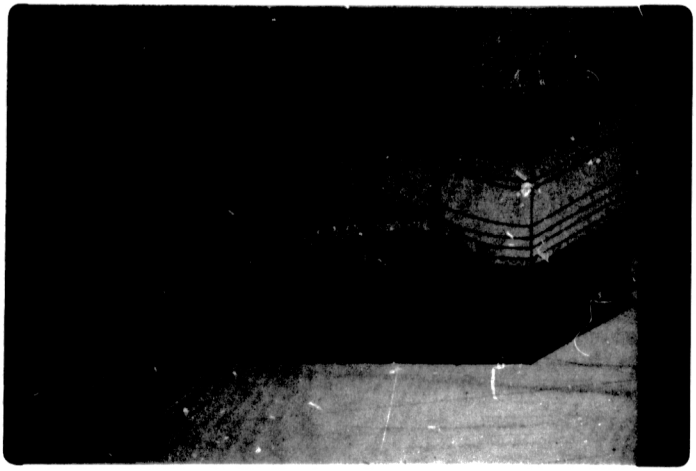


Picture 3

Picture 4

Picture No.4

This slide shows a plan view of the Beaver River Field as we presently map it. To date four wells have been drilled, three are capable of production and one is now drilling at a depth of about 8000 feet.

Picture No.5

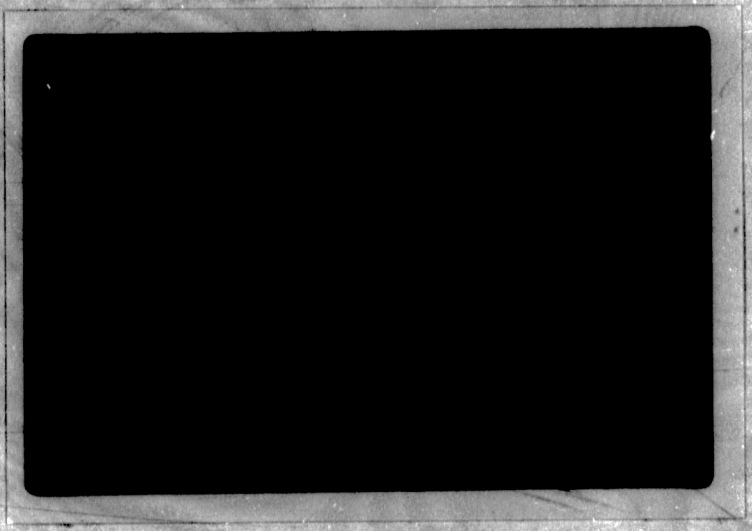
This picture shows a cut away three dimensional view of the Pointed Mountain Field. Faulting and folding are more severe in this field and the surface terrain is very rugged. The difference in surface elevation between the two wells shown is some 2700 feet although they are only about one mile apart.

Picture No.6

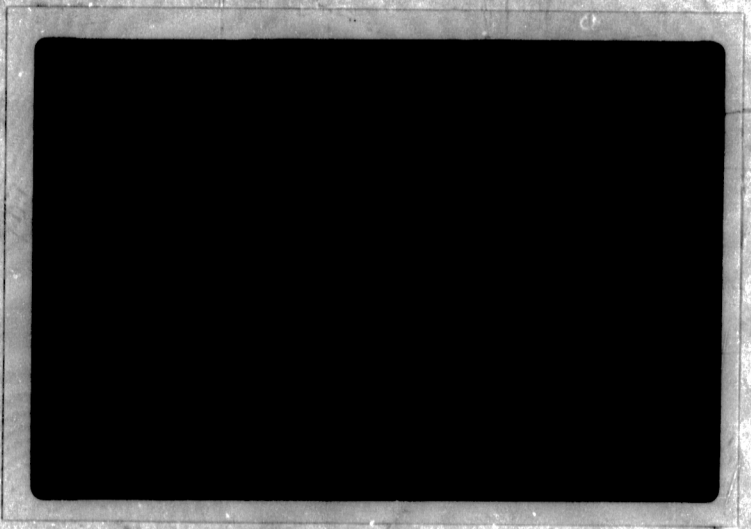
This surface plan of the Pointed Mountain Field will certainly require additional drilling to prove its validity, however, with two capable gas wells, a third now drilling and evaluating the reservoir and a fourth well ready to begin drilling soon, we feel confident our geologists and engineers will be proved correct in their interpretations.

In both Beaver River and Pointed Mountain the reservoir rock is a Middle Devonian carbonate referred to by the geologists as the Nahanni. Penetrated gas pay sections ranging from a minimum of 800 feet to a maximum of 2146 feet, however, allow the wells to flow at very high rates. It is estimated that the gross pay section in our Beaver River A-1 discovery well is in excess of 3000 feet. A recently tested well, Beaver River B-1 has recently been tested at flow rates of nearly 34 MMCF/D with surface pressures in excess of 3000 psi. These high flow rates are one of the major factors which will make the entire venture commercial. When considering wells that cost in excess of $2,000,000 each, the fewer required the better.

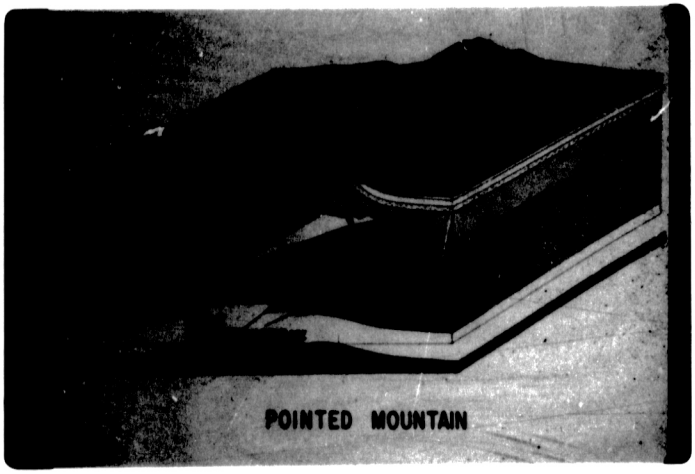
You may find the following facts interesting:



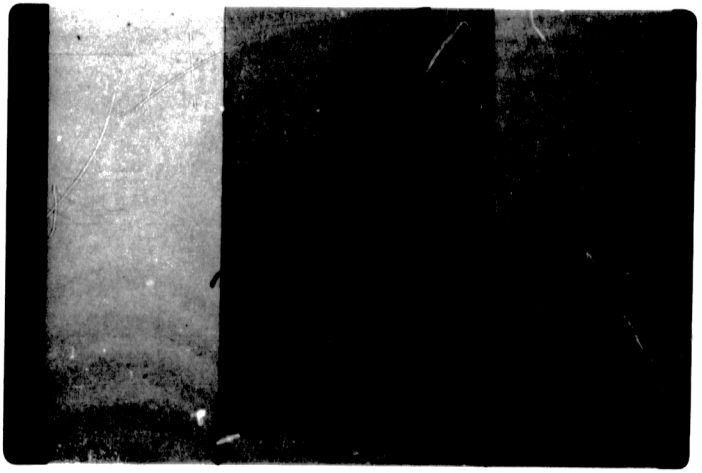
Picture 5



Picture 6



Picture 5



Picture 6

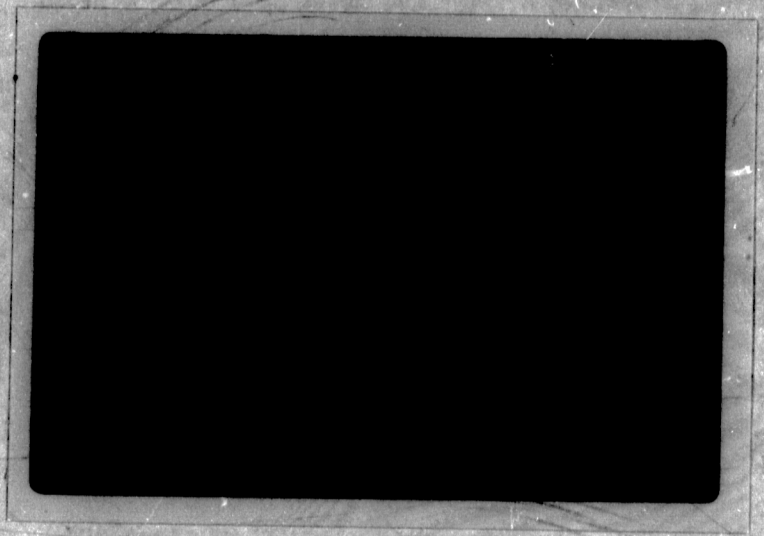
1. Wells in these fields vary from 12,500' to 14,300' in depth.
2. Reservoir pressures range from 5300 - 5800 psia.
3. Reservoir temperatures are more than 100°over the boiling point of water - at about 320°- 340°F.
4. The Absolute Open Flow Capacity of the average well is about 100 MMCF/D.
5. Drilling time for wells, now that we are familiar with the area is approximately six to seven months. Initially a well took about one year to drill.
6. The total cost of drilling an average well is over $2,000,000.

One of the greatest problems in an operation as remote as this is getting the drilling rig in and out. For the most part drilling equipment and supplies are trucked in from Fort Nelson during the winter months. More and more equipment is being transported by barge, however. Last year our biggest and most successful barging season saw some 8000 tons of equipment and supplies transported by barge from Fort Nelson.

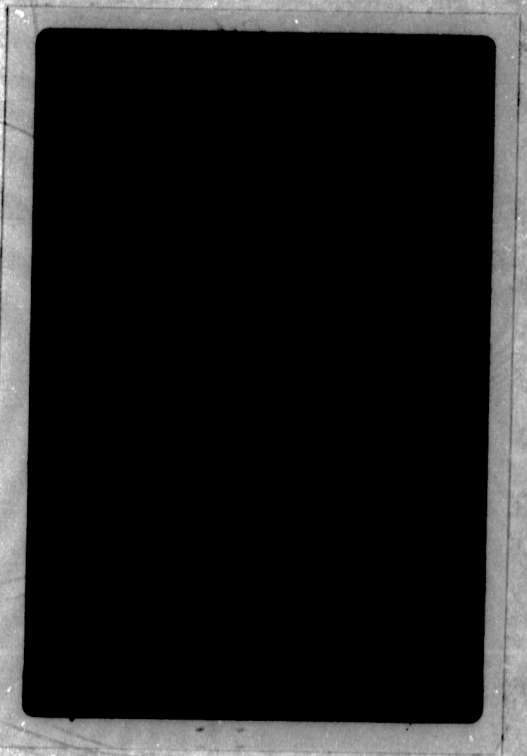
Picture No.7

This slide shows the route of our winter hauling - over the Simpson Trail and the summer barging route which utilizes the Fort Nelson River to its junction with the Liard River. At each field Pan American has constructed barge landing facilities on the Liard and Equipment moves over high grade company roads into each of the field wells.

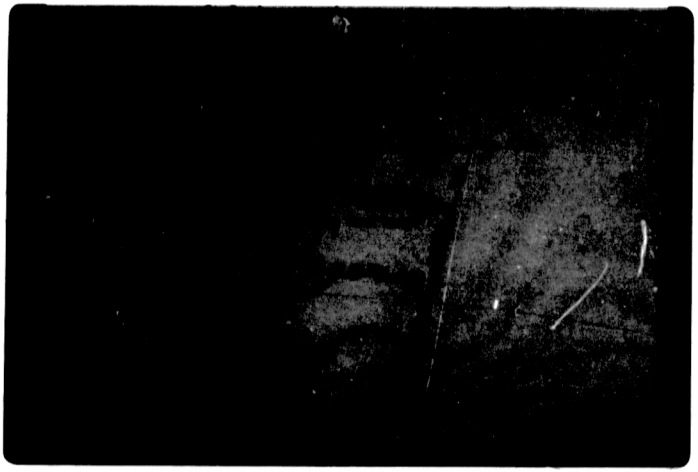
In addition, an all-weather air strip located centrally at our old Kotaneelee A-1 well has also come in handy when weather problems are encountered at either of the other two strips. Since both the barging and winter trucking season last about 3 - 4 months each, we are very dependent on aircraft. Both helicopters and fixed wing aircraft are a must in this operation. At present Pan American utilizes a Fairchild F-27 and a Caribou to provide these vital links with these fields. All drilling rig



Picture 7



Picture 8



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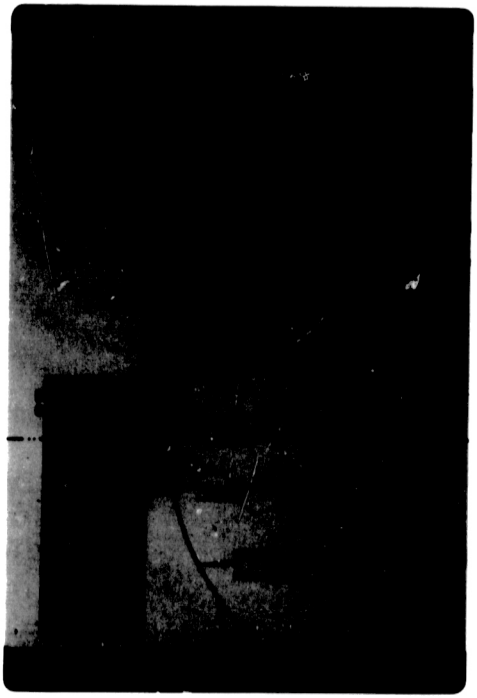


Picture 8

crew changes, minor equipment supplies and groceries are regularly laid into these fields by our aircraft.

With most of the drilling and transportation problems well in hand we are now moving forward to complete the drilling required to provide sufficient wells to meet the delivery rates called for under our gas contract. Presently we are shooting for a November 1, 1970 sales commencement date. This means that by that date Westcoast will have to construct some 110 miles of pipeline from Fort Nelson to the Beaver River Field to take delivery of the unprocessed gas and Pan American will have to install the necessary field gathering lines and field processing facilities to dehydrate the gas before delivering it to Westcoast. At present our engineers are busily involved in working out plans for this phase of the operations. If all goes well we would expect to be starting field construction in early 1970 and completing the facilities coincident with gas sales on November 1, 1970.

Picture No.8

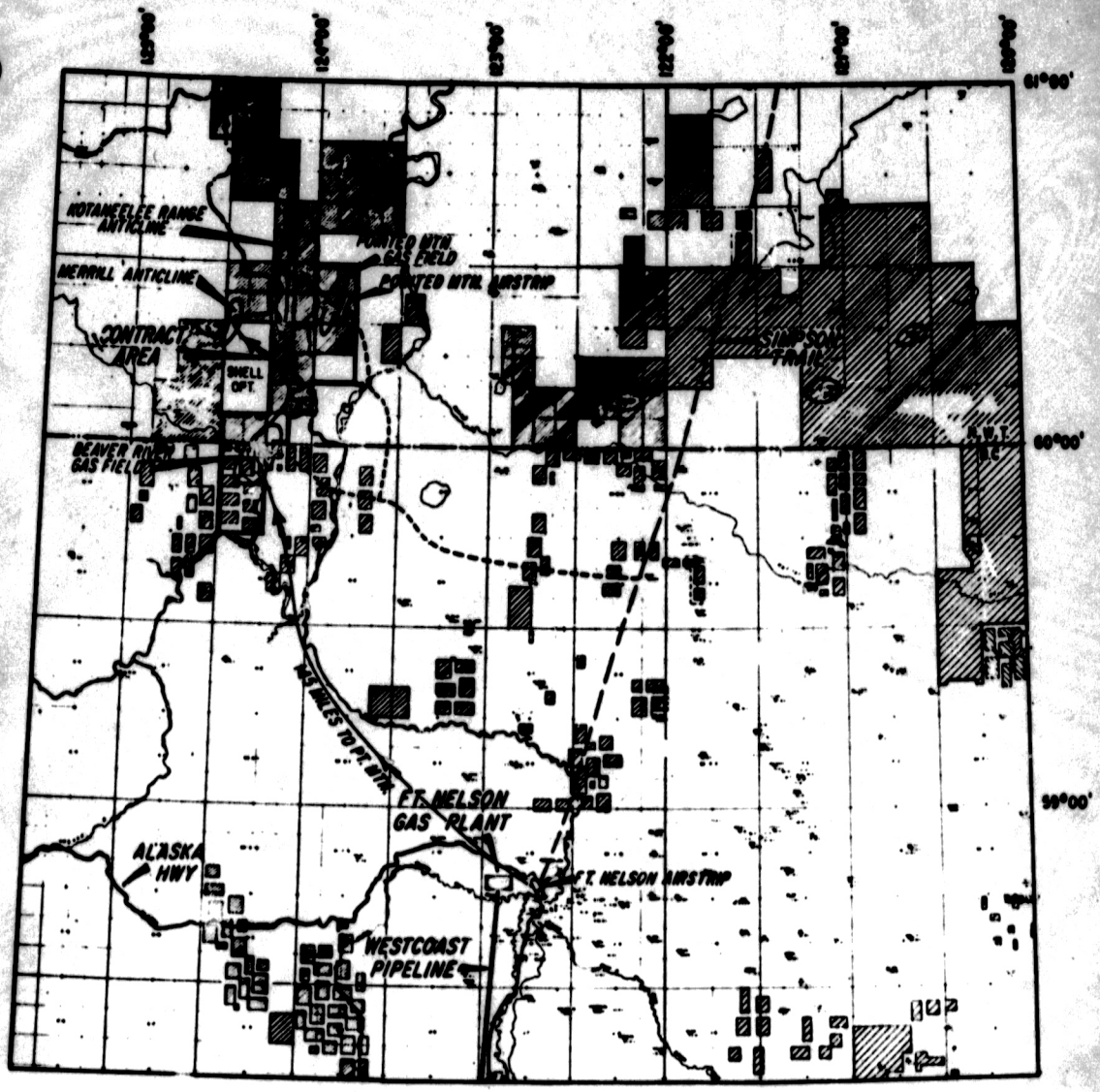
This slide, although only representative of the conceptual engineering plans of gathering and processing the gas will give you some idea of the magnitude of the project. Central dehydrator facilities in both fields will strip away the water of condensation which occurs naturally with the raw well stream, this is necessary to ensure freezing does not occur in the Westcoast Transmission line to Fort Nelson. A certain amount of gas cooling will also be reauired as the gas temperature leaving the wellheads will be better than 200°F. Cooling is necessary to provide good measurement and protect transmission line coatings.

In general, the facilities will be relatively simple as far as gas processing is concerned. In fact, it is our hope that with proper design, and the use of automatic equipment, the number of operating people required to stay on the site will be limited.

Remoteness of the area and lack of adequate all-weather roads are the major reasons of course for making such a mode of operation desirable. Final processing of the gas in Fort Nelson also allows us to minimize the facilities required to operate fields of this size.

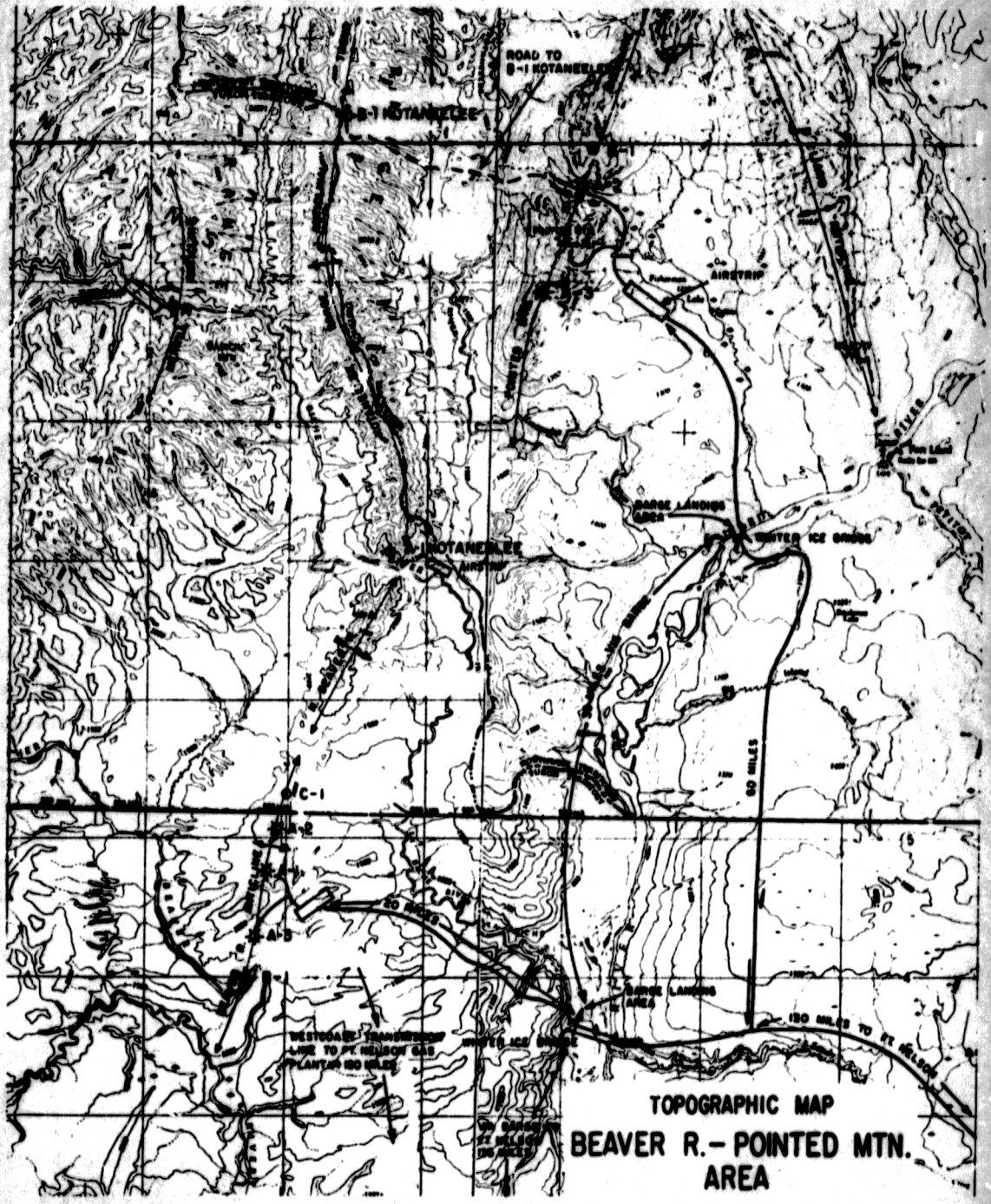
At this time much thought and study is being given by our engineers as to how to reduce the extremely high costs of meeting our contract commitments. Some of these plans include the strategic location of new wells to ensure proper drainage of the reservoir, stimulations to improve the productivity of wells now drilled, sizing of well equipment to take advantage of the high delivery rates and the many facets of automating and operating a remote gas field. Also included in our planning is the thought that additional discoveries are bound to be made, in fact, we are presently preparing a drilling site on the Flett anticline some 15 miles north of Pointed Mountain. This well should spud late this summer.

We are confident this play is still in its infant stages. Costs are high, terrain is rough, weather is a problem, but we consider the promise to be great.



GENERAL AREA

NE BRITISH COLUMBIA and NORTHWEST TERRITORIES



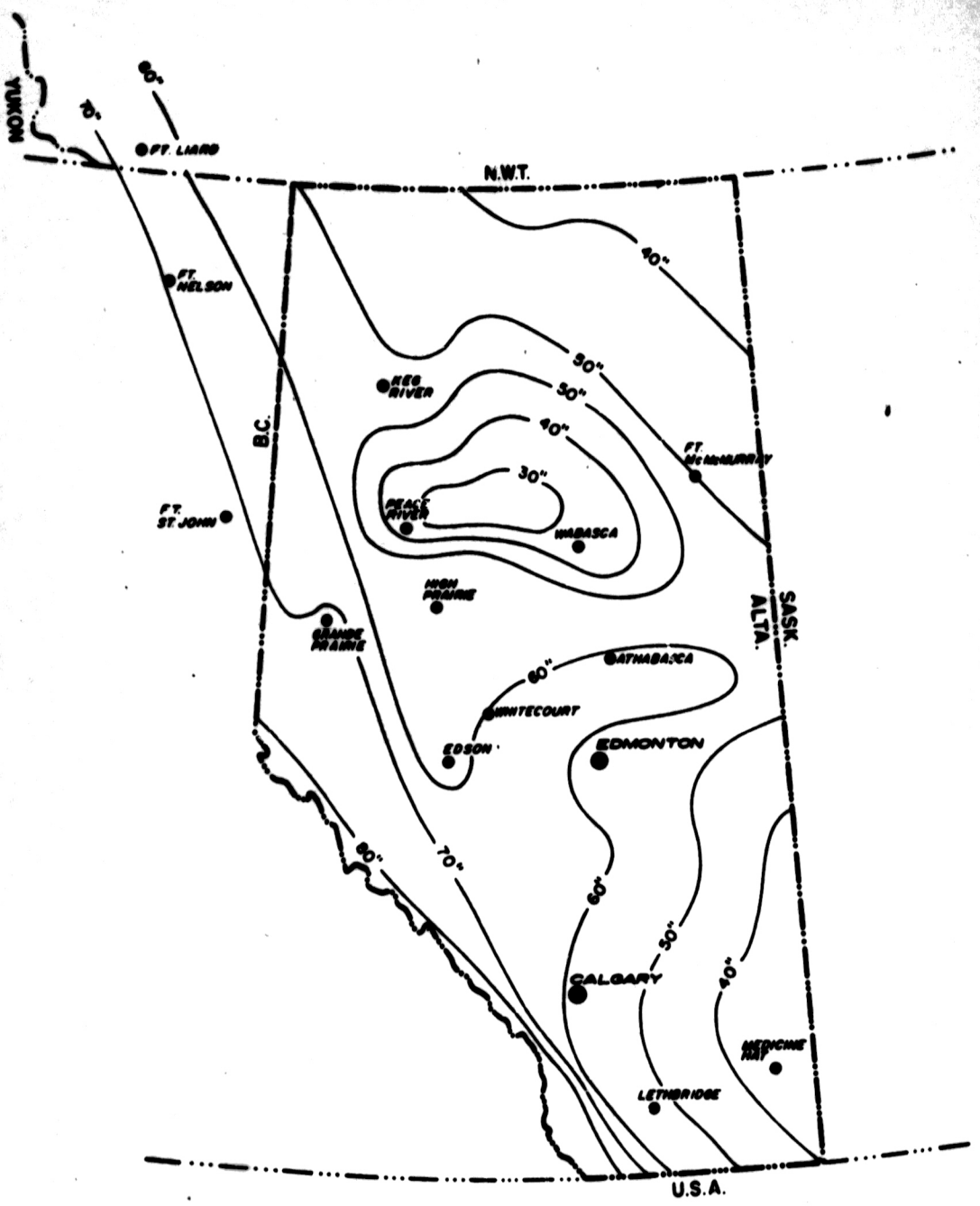
TOPOGRAPHIC MAP

BEAVER R.– POINTED MTN. AREA

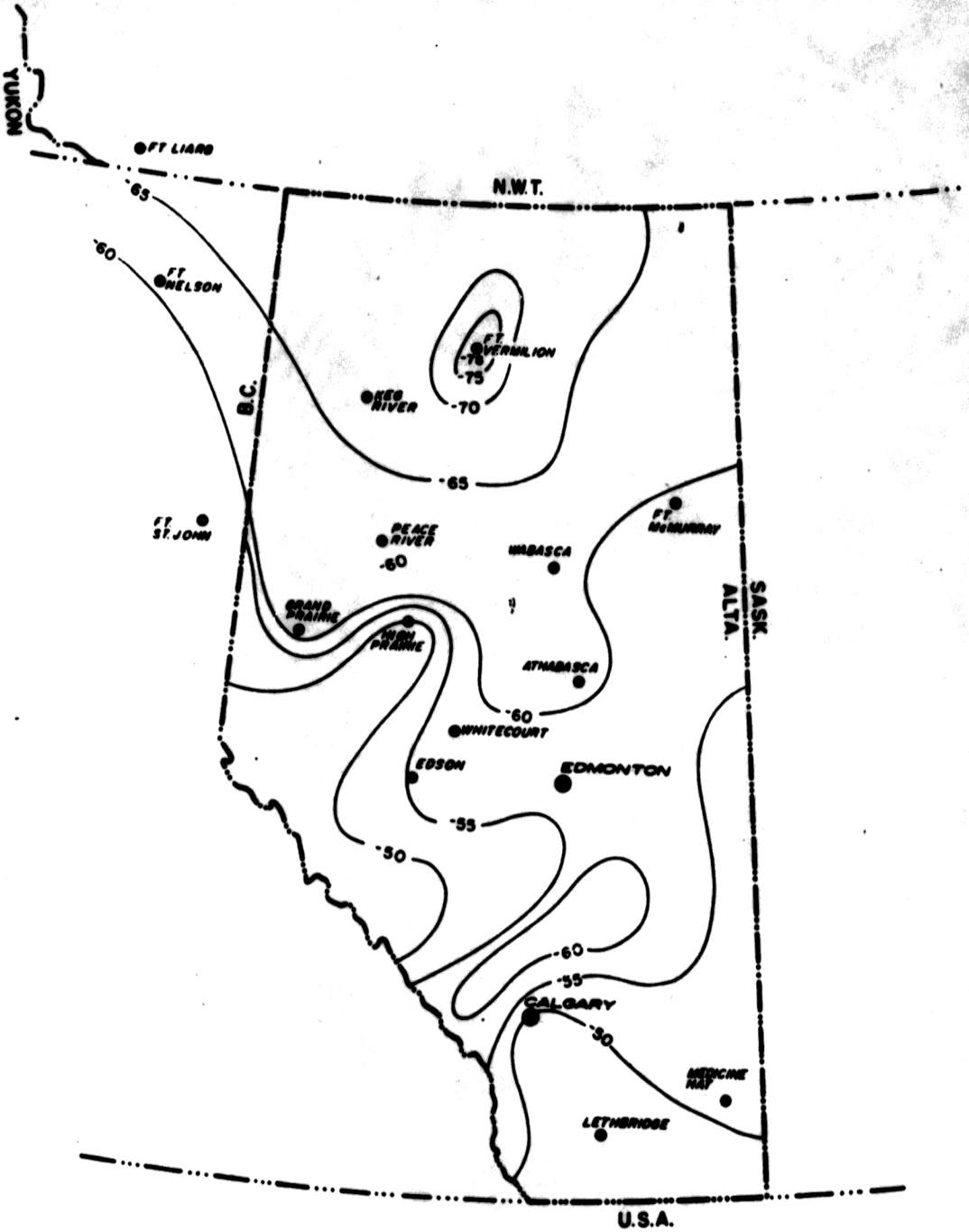
CLIMATIC CONDITIONS

The enclosed maps of Alberta and northeastern British Columbia depict average annual snowfall, extreme low temperatures and mean annual temperatures recorded throughout this area. It is significant to note that we must combat an average annual snowfall of 50 - 60 inches, extreme below zero temperatures of -60°F, and average yearly temperatures of approximately 34°F, throughout the major portion of our Calgary Division Exploration and Production operations.

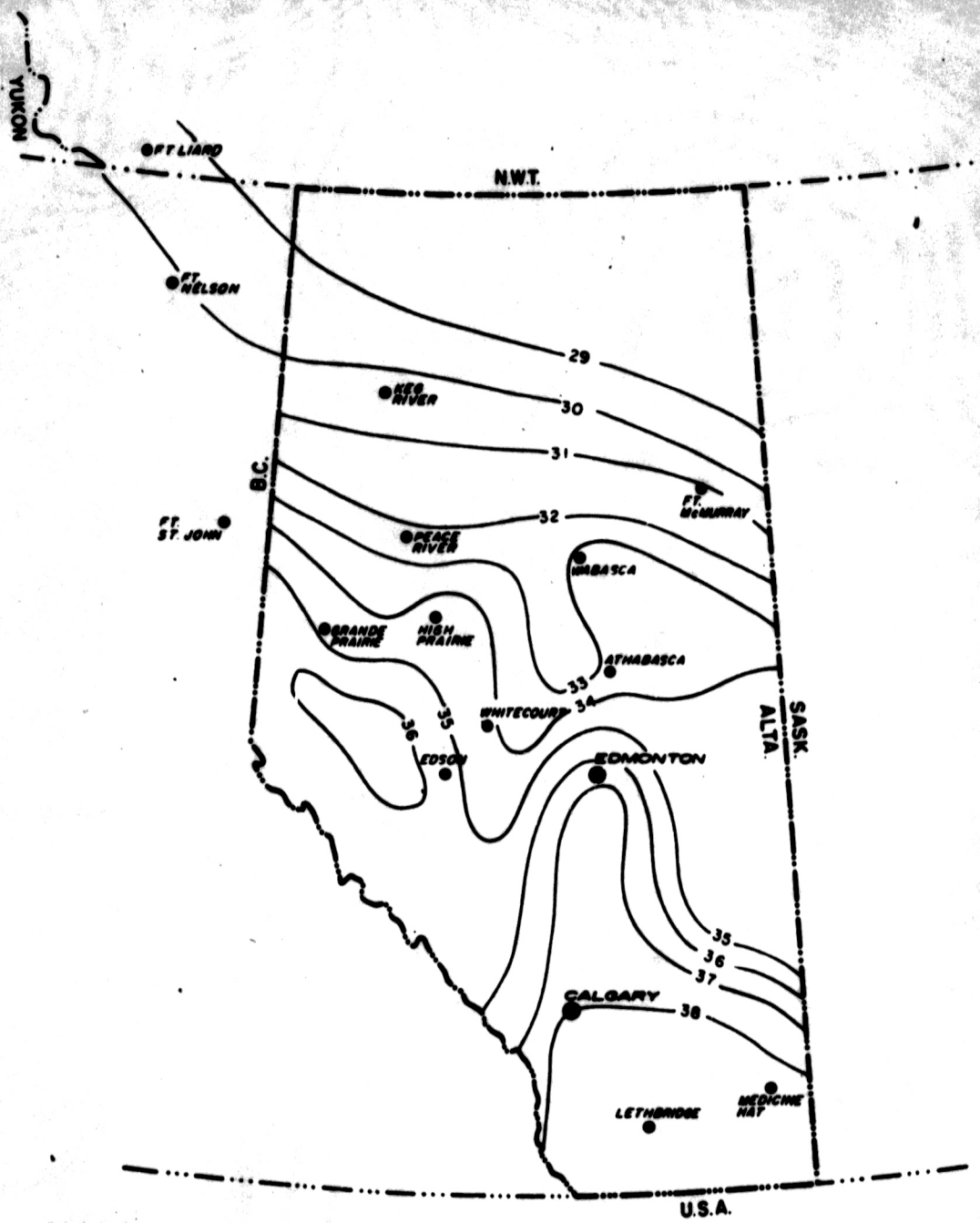
The enclosed chill factor chart illustrates what is a much talked about and valid representation of effective temperature by combining the effects of wind velocity and actual temperature. The shaded portion varying all the way from temperatures of 16°F to -5°F and wind velocities of 0 to 40 miles per hour illustrates those effective temperatures at which exposed skin will freeze.



AVERAGE ANNUAL SNOW FALL – INCHES



EXTREME LOW TEMPERATURES °F



MEAN ANNUAL TEMPERATURES °F

CHILL FACTOR

TEMPERATURE IN °F

WIND VELOCITY IN M.P.H.	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
10	20	14	8	2	-4	-10	-15									
15	13	7	0	-6	-12											
20	9	2	-5	-12												
25	5	-2	-9													
30	3	-5	-12													
35	0	-7	-14													
40	-1	-9	-16													

SHADED AREA INDICATES READING AT WHICH EXPOSED SKIN WILL FREEZE

CHILL FACTOR

TEMPERATURE IN °F

WIND VELOCITY IN M.P.H.	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
10	20	14	8	2	-4	-10	-15	-21	-27	-33	-39	-45	-50	-56	-62	-68
15	13	7	0	-6	-12	-18	-25	-31	-38	-44	-50	-57	-63	-69	-75	-81
20	9	2	-5	-12	-19	-25	-32	-39	-45	-52	-59	-66	-72	-79	-85	-92
25	5	-2	-9	-17	-24	-30	-37	-44	-51	-58	-65	-72	-78	-86	-93	-99
30	3	-5	-12	-20	-27	-33	-41	-48	-55	-63	-70	-77	-83	-91	-98	-104
35	0	-7	-14	-22	-29	-36	-44	-51	-58	-66	-73	-81	-87	-95	-102	-109
40	-1	-9	-16	-24	-31	-38	-46	-53	-61	-69	-76	-84	-91	-98	-105	-112

SHADED AREA INDICATES READING AT WHICH EXPOSED SKIN WILL FREEZE.