PHOTOGEOLOGICAL ANALYSIS

of

THE GRANDVIEW HILLS AREA, N.W.T.

Prepared For

SCURRY-RAINBOW OIL LIMITED

by HUNTING TECH. & EXPLOR. SERVICES LTD.

ON

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JUNE, 1959

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Geology By:

C. Wright-Broughton

CONTENTS

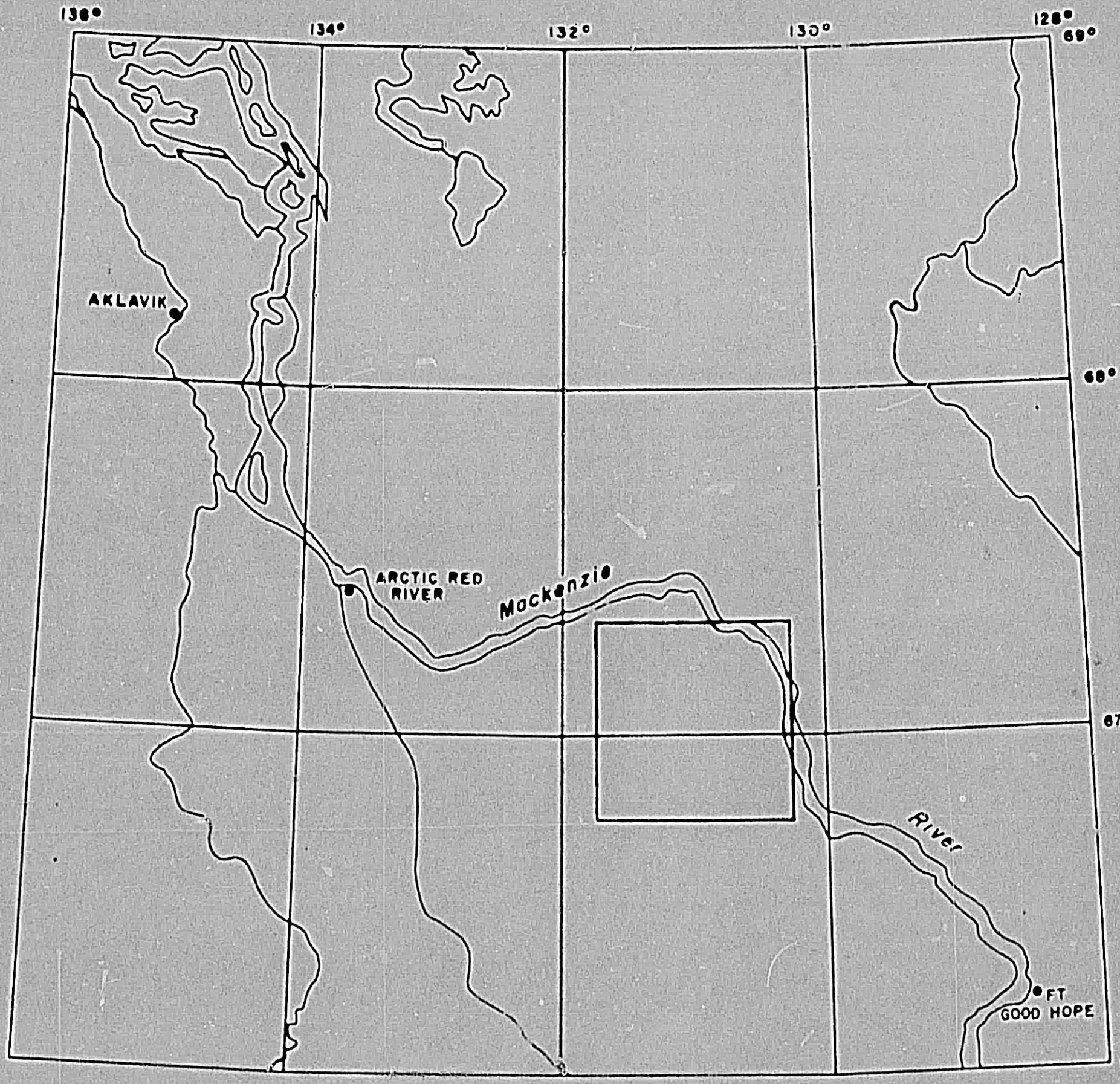
ILLUSTRATIONS

I. INTRODUCTION

The Grandview Hills project area is located in the Mackenzie Plain approximately sixty miles northwest of Fort Good Hope (Fig. 1). It is bounded by the following geographical coordinates:

67°20'	N. Lat.	130°15'	W. Long.
66°45'	" "	130°15'	" "
66°45'	" "	131°45'	" "
67°20'	" "	131°45'	" "

This report has been prepared to accompany the photogeological maps and represents a summary of the findings of the photo-analysis. The procedures followed during the study are discussed briefly. This is followed by a general description of the topography encountered in the area. The nature of the terrain and lack of accurate stratigraphic information have restricted the mapping of stratigraphy to a few isolated Cretaceous and Devonian outcrops and the Quaternary deposits. Several geomorphological features present in the area are believed to be of considerable importance. These features are discussed in detail and their possible structural implications assessed. The conclusions presented in this report are based almost entirely on the photogeomorphological analysis and should be carefully assessed in view of field information and other data.



REGIONAL LOCATION MAP
of the
GRANDVIEW HILLS AREA
N.W.T.

prepared by

HUNTING TECHNICAL & EXPLORATION SERVICES LTD.

CALGARY, ALBERTA

FIGURE 1

MAP LEGEND

TO ACCOMPANY PLATES 1,2,3&4

MAP SYMBOLS

River & stream
Dots denote intermittent stream

Lake

Swamp

Slump

Esker

Dip component less than 3°

Topographic slope which may reflect gentle dip

Topographic slope which may reflect horizontal strata

Geological boundary

Axis of postulated syncline
Arrow denotes plunge

Axis of postulated anticline
Arrow denotes plunge

f——f Postulated fault

(A) Feature discussed in report

Outcrop area

SL——— Shore line

A———A Alignment not defined

V———V Vegetation alignment

DSA——— Distinct stream alignment

DTA—u— Distinct topographic alignment
U signifies side of higher elevation

——-—— Old meander belt

Terrace

Gentle scarp slope

Steep scarp slope

Gentle regional topographic slope

Medium regional topographic slope

Steep regional topographic slope

Glacial lineation

K———K Key bed

ROCK UNITS

QUATERNARY	Qal	River and stream alluvium
	Q	Alluvial and colluvial deposits, undifferentiated
	Qf	Alluvial fan deposits
	Qk	Kame deposits
	Qm	Moraine deposits
	Qmm	Marginal moraine ridge
CRETACEOUS	K	Area of good Cretaceous outcrop
DEVONIAN	D	Area of good Devonian outcrop

FIGURE 2

II. METHODS AND PROCEDURES

Royal Canadian Airforce photography at a scale of 1:40,000 was supplied by Scurry-Rainbow Oil Limited. This photography was used to construct uncontrolled mosaics at a scale of one inch to half a mile.

The photographs were studied stereoscopically and all the pertinent hydrological, geomorphological and geological data noted. These data were then transferred to mosaic acetate overlays. Reproduction linens of these overlays (Plates 1, 2, 3 and 4) were obtained, and ozalid prints of these linens compose the final photogeological maps. A legend (Fig. 2) which refers to these maps is included with this report. A photogeological sketch map at a scale of one inch to one and a half miles was also prepared. Three uncoloured prints of Plates 1, 2, 3 and 4, and three coloured prints of the sketch map constitute the final maps submitted to Scurry-Rainbow Oil Limited.

III. GEOGRAPHY AND TOPOGRAPHY

The project area is located in the tundra region of the Mackenzie Plain, and for the most part consists of a topographic high partially bounded on two sides by the Mackenzie River.

The differential relief in the area is in the order of 1500 feet. The upland which dominates the project area consists of a plateau with a series of bench-like escarpments indicative of nearly flat lying strata. The lowland exhibits an undulating topography. which becomes subdued to the southwest and merges into the almost featureless lowland occupied by the Ontaratue River system.

Present within the area are both glacial and post-glacial valleys. Some of the former are very large and occupied by lakes. The normal processes of weathering and erosion have been influenced by the unusual climatic conditions prevalent in the Arctic region. Solifluction and permafrost are widespread and these have intensely modified the landforms present. The effects of Pliestocene glaciations are shown by the presence of moraines, drumlins, glacial spillways and glacial fluting. These features have greatly influenced the present day drainage.

The vegetation in the area is sparse and typical of tundra areas. Large areas of muskeg together with the permafrost conditions may make access to the area difficult during the summer months.

IV. STRATIGRAPHY

It was not possible to map on the photographs the geological contacts of any of the formations present within the area. On the large scale maps only the Quaternary deposits and occasional good outcrop areas of Cretaceous or Devonian strata have been indicated.

Both the Cretaceous and Devonian strata in the area consist dominantly of shales with occasional thin sandstone beds. Thin sandstones in the upper part of the Cretaceous form prominent benches in the central part of the project area. Elsewhere the stratigraphic units give rise to an undulating terrain. The outcrop areas of these stratigraphic units have been greatly modified by the processes of weathering, glaciation, and solifluction resulting in an overall similarity of topography. It is not possible to identify the Devonian Fort Creek or Imperial formations; or separate any of the Cretaceous formations. However, on the sketch map an attempt has been made to indicate the approximate contact between the Cretaceous and Devonian strata.

The following Quaternary deposits have been mapped in the area:

Q: <u>Alluvial and Colluvial Deposits, undifferentiated</u>

Coarse to fine deposits of pediment gravel, hillwash, outwash, small areas of moraine, and unsorted glacial debris of variable thickness.

STRATIGRAPHY: (Cont'd)

Qal: Quaternary Alluvium

Recent flood plain deposits of alluvium and valley gravels.

Qm: Moraine

Hummocky deposits of till with some sand and gravel. These deposits are characterised on the photographs by a hummocky terrain of knobs and kettles.

Qmm: Marginal Morainal Ridge

Sinuous ridge deposit of till. The photographic characteristics of this deposit might easily be mistaken for those of bedrock.

Qk: Kame

Stratified gravel having a hummocky appearance.

Qf: Alluvial Fan Deposits

Fan-shaped deposits of gravel and sand.

Slump: Shown symbolically

Slump and landslide colluvial deposits.

V. GEOMORPHOLOGY

Certain features which are believed to be of geological and/or geomorphological significance are labelled alphabetically on the accompanying sketch map (Plate 5). These will each be discussed.

Feature A is a northeast plunging syncline. The exact position of the axis as shown is based on rather unreliable dips. However, on the basis of the general landforms in the area a syncline is definitely suspected south of Marion Lake.

Feature B is comprised of a northeast trending "alignment" and a northeast trending drainage segment. The former probably represents a fault and the latter may also be the result of fault control. The presence of additional northeast trending faults is suspected in this vicinity.

Feature C is a series of individual drainage segments having an annular pattern. These streams show a deviation from the more rectangular pattern normal to the area and could be controlled by two flanks of a "dome-type" structure.

Feature D indicates two areas in which low topographic ridges may be controlled by bedrock. The asymmetry of the ridges indicates a gentle southwest dip in the region. The topography however is very subdued and the dips are questionable.

Feature E refers to the high plateau area in the central part of the project. On this upland weathering has produced a series of topographic

GEOMORPHOLOGY: (Cont'd)

benches believed to correspond to more resistant strata of Cretaceous age. The beds in this area are thought to be almost horizontal.

Feature F is a questioned anticlinal axis. The mapped topographic reflections of dip in the project area indicate a reversal between the extreme northwest and southeast corners of the project area. Feature F is an attempt to locate the axis of this reversal, but its existence and position are doubtful.

Feature G is an "alignment" on the edge of the Ontaratue River Lowland which is possibly the reflection of a fault zone.

Feature H is the Ontaratue River Lowland. The project area includes only a small portion of this very extensive northwest trending lowland that separates the Grandview Hills from the Peel Plateau.

Feature I is a series of north trending drainage and topographic "alignments" which may be the result of fault control.

Feature J comprises three arcuate stream courses which are anomalous and may have structural significance. These streams may possibly indicate a local north trending structural high.

Feature K is a series of "alignments" which may reflect fault control.

Feature L is a ridge of marginal moraine which was probably formed at the edge of an ice sheet.

GEOMORPHOLOGY: (Cont'd)

Feature M is a ridge of marginal moraine similar in origin to Feature L. This ridge shows consistent asymmetry and could easily be mistaken for bedrock.

Feature N is an extensive remnant of a former high level meander belt now occupied by a series of lakes. The exact origin of this impressive feature is subject to doubt but it is believed to have no structural significance.

Feature O is a glacial spillway. This feature conforms with the annular pattern shown by Feature C. However, the origin of the feature is glacial and not structural.

Feature P refers to a northeast trending ridge which represents the highest elevations attained within the project area. It has no structural significance.

The project area is largely composed of a topographic high that rises to elevations of 1500 feet above the Mackenzie Plain. Southwest of the project area lies the extensive lowland of the Ontaratue River system. This lowland rises southwestward to the Peel Plateau which is overlooked by the Mackenzie Mountains. It may be of some structural significance that the Peel Plateau forms a generally north facing escarpment throughout its length, except for the area between the Arctic Red and Ramparts rivers which is immediately south of the Grandview Hills. To the northwest of the project

GEOMORPHOLOGY: (Cont'd)

area lie the Mackenzie Plain and the Arctic Coastal Plain. The regional geological map of Canada shows the Peel Plateau and Arctic Coastal Plain to be underlain by rocks of Cretaceous age and the Mackenzie Plain to be underlain by rocks of Devonian age. If the Grandview Hills area consists of a partial outlier of very flat lying Cretaceous strata, as suggested by Feature E, then it would appear to be a small outlier situated on the flank of a regional structural high suggested by the Devonian strata of the Mackenzie Plain. If this is the case, the Grandview Hills should be composed of horizontal or synclinal strata. However, such an explanation makes the very striking circular appearance of the topographic high unusual. Even after considerable ice action horizontal or synclinal strata would not be expected to form such a circular feature.

The regional drainage of the Mackenzie Plain, in the vicinity of the project area, shows that local segments of both the Mackenzie and Iroquois rivers have acutely arcuate courses around a northeast trending salient. These arcuate courses may be controlled by a structural high. The project area is situated at the southwestern end of this postulated structural high. The local drainage within the project area shows a rectangular pattern in the northwest and southeast. In the centre the pattern is more dendritic, with the drainage segments indicated by Feature C seeming to be annular. The annular drainage of Feature C, and the questioned dips of Feature B suggest the presence

GEOMORPHOLOGY: (Cont'd)

of gently southwest dipping strata in the southwestern part of the project. In the northwest part of the project some gentle northwest dips have been postulated. The postulated northwest and southwest dips, coupled with the southeast dip in the Marion Lake area, suggest the presence of a very broad gentle anticlinal or domal structure. However, no evidence of a north or northeast flank can be seen.

Feature J is possibly the reflection of structural control. The drainage in this region is well incised and these arcuate drainage segments may be the result of a local structural high. Features B, I and K are postulated faults. In the extreme southwest corner of the project area Feature G is believed to be a fault separating the Grandview Hills from the Ontaratue River Lowland.

VI. STRUCTURE

The dominant rock in the area is shale, and the dips are believed to be very gentle. The landforms etched from these gently dipping shales have been greatly modified by solifluction, which has made it impossible to map accurate dip in the region. The structures here postulated are based on 1) topography believed to be reflecting dip, 2) the analysis of drainage, and 3) regional topography.

The most striking feature of the project area is the circular topographic high. The evidence on the photographs and topographic maps, despite the regional geology, suggests that this topographic high is coincident with a northeast trending structural high of considerable magnitude. There is some evidence on the flanks of the topographic high to suggest that it is a broad gentle anticlinal or domal structure, terminated to the southwest by the down-faulted graben of the Ontaratue River Lowland. The presence of a northeast plunging syncline in the vicinity of Marion Lake is postulated. Three fault trends represented by Features B, I and K are also thought to cross the project area. In the north, Feature J is of particular interest. The arcuate drainage in this area is anomalous and may be reflecting a local structural high.

The Mackenzie Mountains lie about 100 miles to the south of the project area. These mountains, unlike the Rocky Mountains, do not have a foothills belt. However, they do have a foreland belt which is

STRUCTURE: (Cont'd)

in part represented by the Franklin Mountains. The area around Norman Wells is directly northeast of the prominent trend change evident in the Mackenzie Mountains, and it is in this vicinity that the Franklin Mountains are believed to show the surface reflection of basement fault control. The surface structural expression of the Franklin Mountains ends south of Fort Good Hope, but it seems reasonable to suppose that the foreland belt and associated basement blocks should continue westwards in front of the Mackenzie Mountains. It is also thought probable that the structural influence of the foreland extends northwards beneath the Grandview Hills area. Therefore the postulated northeast trending structural high may be controlled by basement faulting and the Ontaratue River Lowland may be a graben controlled by similar basement faults, which may be reflected in the Cretaceous strata as gentle monoclines.

VII. CONCLUSIONS

The photogeomorphic analysis of the Grandview Hills project area suggests that the circular topographic high which dominates the region may be an anticlinal of domal structure which is crossed by several large faults. However, neither a north or northeast flank of this postulated structure can be seen on the photographs. The structure also appears to coincide with a postulated northeast trending structural high possibly controlled by basement faulting. It is probably terminated to the southwest by the down-faulted Ontaratue River Lowland. The northwest trending fault, on the north flank of the Ontaratue River Lowland, may be of considerable magnitude. It may be controlled by basement faults which are reflected in the Cretaceous strata as monoclines.

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This, the final report, "Photogeological Analysis of Grandview Hills Area, N.W.T.", is signed and respectfully submitted.

HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED

July 3, 1959.

R.D. Johnson
Chief Petroleum Geologist

C.F. Miller
Senior Photogeologist

PLATE 5

131°45' 67°20' — 130°15' 67°20' — 131°45' 66°45' — 130°15' 66°45'

MACKENZIE RIVER

GOSSAGE RIVER

MARION LAKE

ONTARATUE RIVER LOWLAND

NO PHOTO COVERAGE

PHOTOGEOLOGICAL SKETCH MAP
of the
GRANDVIEW HILLS AREA
N.W.T.

15-2-L-2

prepared for
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JUNE, 1959

Approximate scale: 1 inch to 1½ miles

LEGEND

MAP SYMBOLS

- River and stream
- Lake
- Swamp
- Slump
- Esker
- Dip component less than 3°
- Topographic slope which may reflect gentle dip
- Topographic slope which may reflect horizontal strata
- Geological boundary
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- Axis of postulated anticline — Arrow denotes plunge
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- V——V Vegetation alignment
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- Old meander belt
- Terrace
- Gentle scarp slope
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- Gentle regional topographic slope
- Medium regional topographic slope
- Steep regional topographic slope
- Glacial lineation

ROCK UNITS

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CRETACEOUS	K	Postulated Cretaceous strata
	K	Area of good Cretaceous outcrop
DEVONIAN	D	Postulated Devonian strata
	D	Area of good Devonian outcrop

PROJECT AREA LOCATION MAP

Geology by C. Wright-Broughton

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