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ANNUAL REPORT OF THE MINISTER OF MINES

1938

Special Report
by

Roy J. Maconachie.

GOLDEN DREAM GROUP. This group, on the St. Eugene Mission road, 3 miles past the Mission, consists of the Golden Dream and Golden Dream No. 1 mineral claims, held on location by I.N. Campsall and A.N. Wallinger of Cranbrook. The road is in good condition and it is possible to drive directly to the showing which was exposed in the course of road-building.

The underlying rocks are fine-grained quartzites, probably of the Cranbrook formation. At this particular locality, bedding is fairly well-defined, strikes south 70 degrees east, and dips 30 degrees north-east. Within the quartzite there is no evidence of vein structure or of any other structural feature commonly associated with mineral deposits of commercial importance. In the hand specimen it is almost impossible to distinguish any mineralization, but an examination with the hand lens of selected pieces of rock proves the presence of very fine-grained pyrite. This mineralization occurs sparsely disseminated through the quartzite principally within one band of rose-colored quartzite.

Development has been limited to slight additional stripping of a 75 foot length of rock through which the road was cut. The fresh face of the bluff on the south-east side of the road has a maximum height of 11 feet, 6 feet of it above the road level, 5 feet dug below the road level in the ditch. In this 5 foot pit, the lower extension of the rose-colored band of quartzite is well exposed. From this pit the band rises diagonally across the face of the bluff to the south-west, defined on its upper limit by a narrow seam, gouge or silt filled, which ranges in width fom a quarters of an inch to 2 inches, and on its lower side by a 1 to 2 inch width of argillite. The width of the band itself ranges between 33 and 48 inches.

Even after careful examination, it was not possible for the writer to distinguish any feature of the showing which might lend encouragement to the owners, despite the fact that they exhibited small pieces of free gold claimed to have come from the bottom of the pit. The characteristics of this fee gold were strongly suggestive of placer origin but the owners would not allow admission of any such suggestion. In view of these facts, considerable trouble was taken in sampling the deposit in an effort to prove, primarily, whether or not there were any values present, and secondly, if so, whether or not they were derived from the gravel overhanging the rock face. Four samples were taken at 5 foot intervals across the width of the rose-colored quartzite; of these, 3 ran, Gold, nil; silver, nil. One ran, Gold, trace; silver, 0.2 oz. per ton. In addition, a block of fresh quartzite was taken from the location of each of these 4 samples, each block being washed clean before assaying. These samples ran: gold, nil; silver, nil. A select sample taken by Campsall from the bottom of the pit, fresher than common, containing visible fine grained pyrite, assayed: Gold, 0.05 oz. per ton; silver, trace. Eight samples were taken at 10 foot intervals from the silt and gravel at the base of the rock face; of these, 7 assayed: Gold, nil; silver, nil; one assayed: Gold, trace; silver, trace. One sample was taken of the argillite seam on the foot-wall of the rose-colored ledge of quartzite, this sample assayed: gold, 0.02 oz. per ton; silver, trace. One sample taken from the river silt from the opposite side of the road, assayed: Gold, nil; silver, nil.

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MEMORANDUM

TO Mr. K. B. Blakey.

DEPUTY MINISTER

FROM THE

DEPARTMENT OF MINES
AND PETROLEUM RESOURCES

VICTORIA, B.C., December 6th, 1968

WHEN REPLYING PLEASE REFER
TO FILE NO.

THE NATAL SLIDE OF NOVEMBER 24th 1968

Dr. Northcote's report on this slide shows clearly that it occurred after almost one million yards of stripped material had been dumped on a hillside covered with overburden. The slide penetrated into this overburden and it was the overburden that failed. To what degree the presence of water contributed to failure may be argued, but the failure was due to overloading. No matter how dry the hillside was originally, it would become wet, and, under such an extensive cover, it would not dry out again.

The exact nature of the overburden is not known at this time of writing. It is reported to be a mixture of all sizes including clay, and would simply be called glacial till were it not for the fact that there is some stratification, which is not usual in the case of material derived directly from glacial action. There is an added complexity, inasmuch as an ancient strand line lies at the 4,500-foot level, marking the shore of a glacial lake.

The nature of the overburden was not known before dumping occurred, and consequently the amount of permissible loading was not known. It is plain that had a full study been made, such a heavy loading probably would not have been carried out. This, of course, may be said in any situation where failure has occurred as a result of loading, but it is a fact that in the present circumstance some study of the material under the dump should have been made. As far as I can ascertain, no study was made.

Study of the slide and its causes is rendered difficult by the lack of proper knowledge of the underlying material. Reference is made in reports to gulleys, and the air photos do show some depressions. However, these do not show adequately on the existing topographic map of the hillside that was made without due regard to detail, and consequently the original ground surface was poorly known at the start of operations and cannot be studied effectively now.

I believe that this slide points to the necessity for prior investigation of any ground upon which a major quantity of material is to

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be dumped, particularly if there is the faintest possibility of people being within the range of sliding. As a minimum, the following should be done:

(a) Prepare an accurate topographic map of the entire dump area, so that all minor topographic features may be shown, and so that accurate profiles may be drawn. This, as a rule, requires considerable ground survey control.

(b) Study and plot all areas of rock outcrop and all known planes of weakness in the rock, such as bedding, cleavage, joints, faults etc.,

(c) Study overburden to determine its character and the possible occurrence within it of stratification that might present planes of weakness, and to assess the probable effect of changing moisture content.

(d) Estimate, and, in situations near highways and habitations determine depths of overburden in order that profiles showing overburden depths may be drawn with reasonable accuracy.

(e) In the general case the advice of a competent soil mechanics specialist should be sought, because very few mining engineers have adequate training or experience

The foregoing outlines the recommended procedure only, and does not consider the matter of responsibility for seeing that it is done.

M. S. Hedley

M. S. HEDLEY
Chief, Mineralogical Branch

MSH:bg

THE NATAL SLIDE

By K. E. Northcote

A slide occurred at about 11:30 A.M., Sunday, November 24, 1968, on the south side of Michel Creek valley between Sparwood and Natal. At least two persons were killed. The slide originated within and beneath waste rock dumped at elevation 4,800 feet on the north end of Sparwood Ridge (see Fig. 1 and Plates I to III and V to VII). The waste material was being removed from one of Kaiser Coal Ltd.'s open-pit mining operations. A consulting engineer, C. O. Brawner, is investigating the slide for Kaiser.

The slide area extends from 4,700 feet to 3,700 feet elevation, is 3,200 feet long, and averages 600 feet wide. Highway No. 3 was covered for a length of 900 feet by slide debris said to be from 5 to 40 feet deep. Surface material on the hillside, a marshy area above the highway, and several hundred feet of pavement were torn up. A car containing the bodies of two people was found under slide debris about 100 feet from the west side of the slide.

The slide material consists mostly of blocks of cobble and boulder-size bedrock stripped off Balmer No. 10 coal seam at 4,900 feet elevation on the north end of Sparwood Ridge (see Fig. 1). A small part of the slide material consists of overburden stripped off the Kootenay Formation during mining, material underlying the dump, and surface material torn from the hillside by the slide. The slide debris originating from the Kootenay Formation is composed of siltstone, sandstone, shale, and a minor amount of coal and carbonaceous shale. Overburden visible in the slide debris is largely stratified till-like material containing rounded cobbles and boulders in a clayey or sandy matrix. Muddy material, believed to have been torn from a marsh above the highway, is found near the bottom of the slide.

Most of the surface material on the slide consists of cobbles and boulders from 4 inches to about 1 foot in largest dimension. Finer material occurs in a trough at about 4,400 feet elevation and mucky material near the road at the bottom of the slide. Blocks of frozen surface material from the dump are scattered over the slide and are composed of aggregates of small angular rock fragments an inch to several inches in diameter cemented by a frozen matrix of clay-like and silty material. Near the top of the slide these blocks were only slightly separated and rotated during slumping. About 800 feet from the bottom of the slide there are stratified but otherwise till-like blocks of rounded cobbles and boulders in a dark clayey matrix (see Plate IV). The origin of these blocks is uncertain but they probably formed part of the original ground surface underlying the waste dump.

Small scarps from 10 to 30 feet high were formed at the head of the slide and on its east and west sides at elevation 4,400 to 4,500 feet (see Fig. 1). The scarp on the west side of the slide is composed of oxidized till-like material with an abundantly sandy matrix containing scattered angular rock fragments of pebble to boulder size. This till-like material forms surface material of the original hillside on which the stripping waste was dumped. A close inspection was not made of the scarps on the east side and near the head of the slide for reasons of personal safety as loose material was still falling from the head of the slide. However, through field glasses from a point more than half way across the slide, the scarp at the head of the slide appeared to be composed of fine-grained material containing scattered subangular boulders and cobbles. The impermeable nature of this material is shown by a small spring and four or five water trickles emerging near the top of the scarp and flowing over its face. This scarp is probably composed of original overburden. A photograph (see Plate III) shows stratification of the upper part of the east scarp and indicates that at least this part is waste dump material. The lower part of the east scarp may be original ground surface material but this is not definitely known.

The waste dumps on the north end of Sparwood Ridge were started late in 1967. The amount of material dumped there is estimated to be slightly less than one million cubic yards. The thickness of the dump was not accurately known at the time of the slide. Dumping of stripping waste would be expected to result in a crude sorting of material and differences in permeability in different parts of the dump. Fine material would be expected to remain high on the slope; coarse material would roll farther down hill. Water passing down through the dump and agitation resulting from successive dumpings would tend to concentrate fine material along the dump-ground surface contact. Permeability would therefore be lowest near the upper end of the dump close to the contact between dump and ground surface.

Causes of the Slide

(1) Water presently flowing over the scarp at the head of the slide probably contributed to the slide.

Stripping waste filled three or more water courses and spread across the end of the ridge in two large overlapping lobes. A northerly trending fault, folding, and steep jointing in bedding in the area above the water courses suggest they may be structurally controlled. If so additional water may be added to water derived from surface catchment areas of these water courses. Seasonal variations in amount of water would be expected. Water reaching dry, relatively impermeable material near the base of the slide would cause lubrication, an increase in pore pressure, and loss of cohesion which might be sufficient to cause a slide.

(2) Overburden underlying the waste dumps may have been overloaded resulting in failure. C. O. Brawner suggested that dump material was too porous for water to be the sole cause of the Natal slide. He suggests the slide originated by failure of underlying till-like material as a result of overloading by the waste dumps. In addition a build-up of pore pressure and loss of cohesion in this material would contribute to failure. Dry till-like material with a clayey matrix when moistened would act as a lubricated surface and the material with a sandy matrix when saturated would have little strength to withstand load pressure.

A number of features which suggest possible recurrence of slides are evident. Fortunately there was an opportunity to examine the slide with C. O. Brawner and to discuss potential causes of additional slides and the possibility of them occurring. The features causing concern are as follows:

(a) Wide cracks are visible in dump material at the top of the slide. The edge of the dump above the slide is unstable and will probably break away when it becomes water saturated or undergoes a number of freeze-thaw cycles. An unsuccessful attempt was made to dislodge this material by setting off heavy dynamite charges on the upper surface. It is thought that too little material is likely to break away to endanger the highway but berms are being constructed for additional protection.

(b) The east half of the waste dump which was unaffected by the slide is underlain by a water course. Although this part of the waste dump is stable now, it is possible that underlying till-like material and greater amounts of water in the spring would result in the same conditions that existed in the west side of the waste dump at the time of the slide. C. O. Brawner pointed out that a slide in the east half of the dump would also depend upon the thickness of waste material there.

While this hazard is being investigated a continuously monitored warning system is being established whereby movements of one-eighth inch or greater can be detected at a number of points across the dump. If a slide appears imminent a signal can be given and the highway closed.

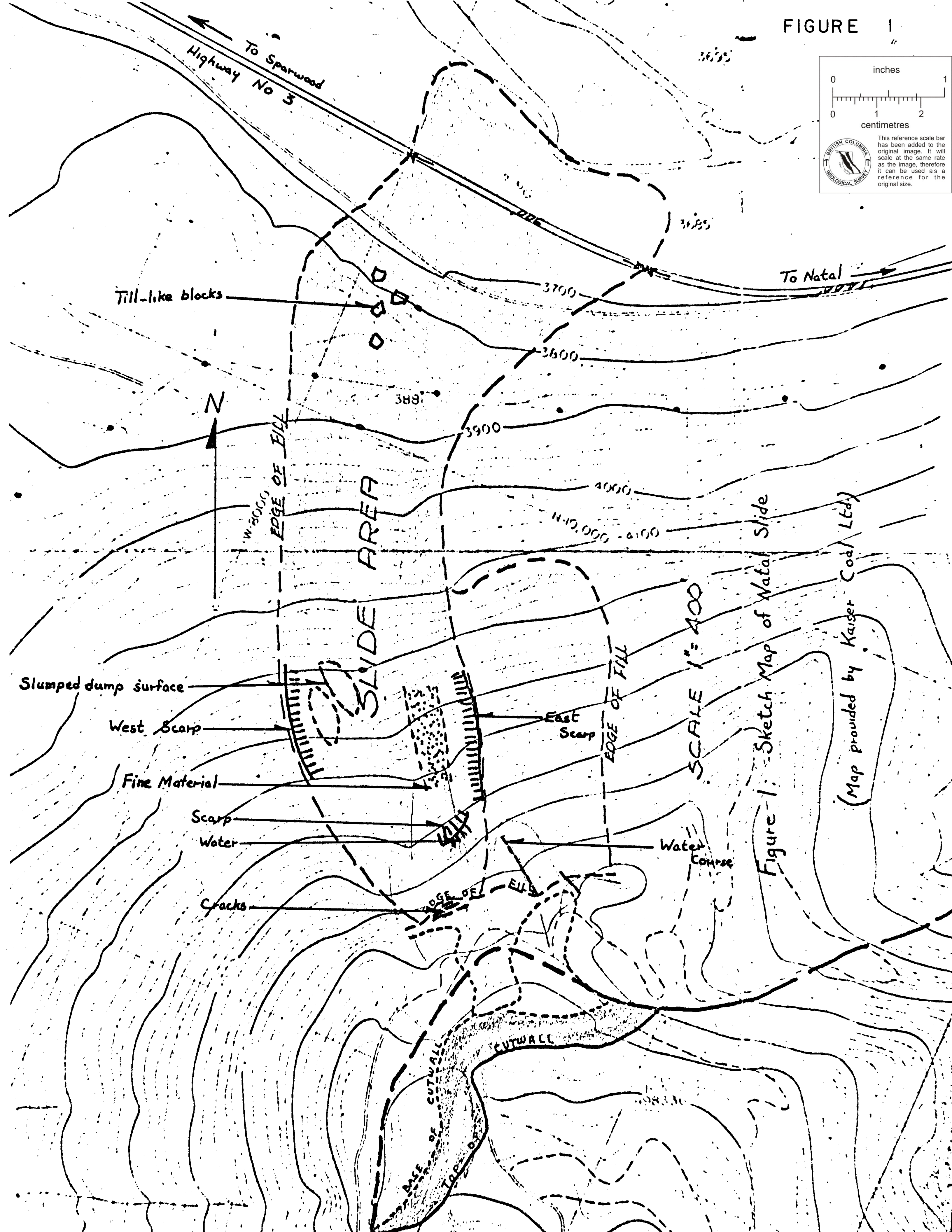
(c) The air crew photographing the slide noted two inverted V-shaped cracks on the surface of the east dump. These cracks are visible on photographs (see Plates V to VII). C. O. Brawner considered these cracks to present no hazard.

Conclusions

Open-pit mining methods which produce large volumes of waste materials will undoubtedly increase in British Columbia in the near future, and disposal of waste will become more and more a problem. Disposal of waste materials is as much part of a mining operation as extraction of material from the ground. Just as safety of conditions of removal of material from the ground is supervised by the Department of Mines and Petroleum Resources so should disposal of waste materials.

Mineralogical Branch,
Department of Mines and Petroleum Resources,
Victoria, B.C.
December 5, 1968.

FIGURE 1



inches
0
1
0
1
2
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
BRITISH COLUMBIA
GEOLOGICAL SURVEY
To Sparwood
Highway No 3
To Natal
3695
3685
3700
3600
3881
3900
4000
4100
W 8000
N 10,000
Till-like blocks
EDGE OF FILL
SLIDE AREA
Slumped dump surface
West Scarp
East Scarp
Fine Material
Scarp
Water
Water Course
Cracks
EDGE OF FILL
CUTWALL
BASE OF CUTWALL
TOP OF
SCALE 1" = 400'
Figure 1. Sketch Map of Natal Slide
(Map provided by Kaiser Coal Ltd)

PLATE I.--Natal Slide, Sunday, November 24, 1968.

PLATE II.--Natal Slide; town of Michel in Michel Creek valley on left.

PLATE III.--View showing stratified scarp on east side of slide.

PLATE IV.--Stratified till-like material.

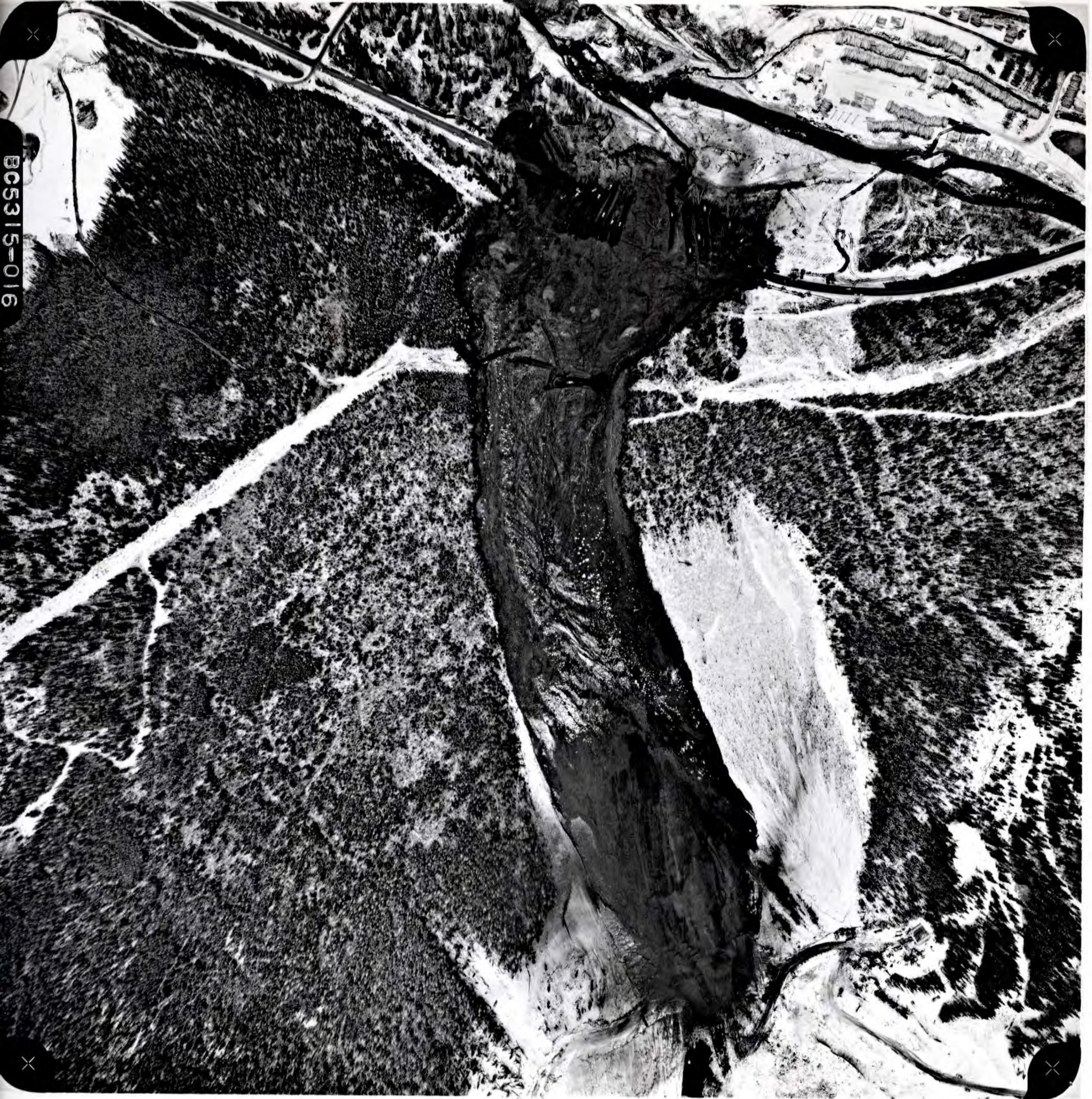

BC5315-017

B.C. GOVERNMENT AIR PHOTOGRAPH

Date of Exposure

NOV 25 1968

Obtain Reprints & Tech. Data From
Air Division
Dept. of Lands, Forests & Water
Resources Victoria, B.C.


BC5315-016

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