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KERR-AEX GRUM JOINT VENTURE

1975 BIOPHYSICAL AND SOCIO-ECONOMIC PROGRAM

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By

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SECTIONS :

PART 4 - LANDFORMS, SOILS AND VEGETATION

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4.1 GENERAL

The study area lies between the summit of Mount Mye and the Pelly River, and extends west from Blind Creek to a line running from the Cyprus Anvil Mine, south and west to the Pelly River. It is within the central Yukon Section of the Boreal Forest Region (Rowe, 1972). In this region the most productive forests occur in the lowlands of the Pelly River, and growth grades off as altitude increases, until timberline is reached at between 4500 and 5000 ft above sea level.

Five major types of surficial deposits have been identified; these are morainal, colluvial, glaciofluvial, alluvial, and organic. These have been further subdivided into landforms according to the modes of deposition and the resultant surface relief patterns (Plate 4-1).

The composition of the surface vegetation varies in response to the surficial deposits and the soils developed. It also reflects the predominating drainage conditions, slope, aspect, altitude and forest fire occurrence. Six vegetation zones have been mapped within the study area (Plate 4-2); these are flood plain forests, upland forests, bog forests, alpine tundra, subalpine transition and alluvial plain shrub.

The biophysical land classification, incorporating an inventory of wildlife, vegetation, landforms and soils, is designed to provide an overview of the wildland resources in the areas affected by the development and in the surrounding zones. It serves as the ecological basis for assessing the impact of the proposed mine and associated facilities and for suggesting mitigative measures.

As a first step, aerial photographic interpretation techniques were used in the preparation of a 1:50000 base map showing the five major groups of surficial deposits within which specific landforms were delineated (Plate 4-1).

During the summer of 1975, field investigations were made of vegetation, soils, surficial geology and wildlife of the area; wherever necessary, samples were taken for further analyses. The resulting information was superimposed on the base map in order to derive vegetation and wildlife maps. A preliminary classification of the sampled soils is presented in Appendix A, and all sites referred to in the following sections are shown here. The physical and chemical analyses of the soils are presented in Table A-1 in Appendix A.

The proposed mine and mill are located on these materials, which range in depth from 0-30 ft (Figure 4-1) and in which bedrock control is usually evident. The predominant textures are loam and sandy loam, but in several locations the till is capped by a layer of sandy volcanic ash. In places these inclusions are sufficiently extensive to be marked by the presence of lodgepole pine* denoting improved drainage conditions.

Parts of the surface are marked by deep grooves, indicating high pressure glaciation which suggests that much of the morainal material is likely to be quite compact.

The dominant soil of the proposed mine and mill site is a Gleyed Brunisolic Gray Luvisol (Sites 1 and 2) which merges in better drained locations to a Brunisolic Gray Luvisol (Sites 6 and 9). The dominant surface texture in both these soils is sandy loam, while slightly heavier textures (loam - silt loam) predominate in the subsurface. Other soils occupying smaller areas reflect local differences of soil parent material, slope, physiographic position, vegetation and drainage (Sites 4, 7 and 13).

The white spruce tends to predominate at the lower elevations, but is replaced by alpine fir at higher altitudes. In some better drained sandy sites or where the till material is overlain by a mantle of sandy volcanic ash, lodgepole pine replaces the other conifers (Site 4).

The exact species composition of these plant communities depends on factors such as moisture conditions, soil type, elevation and aspect, as well as on the fire history. A large part of the area studied was burned in 1969. This burn covered much of the terrain between the proposed mine site and the Pelly River, but did not reach as far as the site itself. During the course of this investigation, other earlier fires were discovered. An extensive fire burned in the vicinity of Vangorda Creek just east of the mine site about 40 years ago (Sites 4, 5 and 16). Another fire occurred in this region about 75 years ago (Site 6).

Although fires appear to be common and extensive within the Upland Forest zone, there are sites which do not appear to have been burned for considerable periods (Sites 2, 7 and 9); one such area is just west of the existing mine camp (Figure 4-2). This suggests that at least parts of the forest surrounding the site might have escaped the effects of fire.

Past fires in this region have reduced large parts of the forest to shrub or forest-shrub vegetation communities. This vegetation type is highly favoured as moose browse, and the apparent presence of a considerable number of these animals in the area may, therefore, be attributed to the effects of past fires.

* For vascular plants, the common and botanical names follow Hulten (1968).

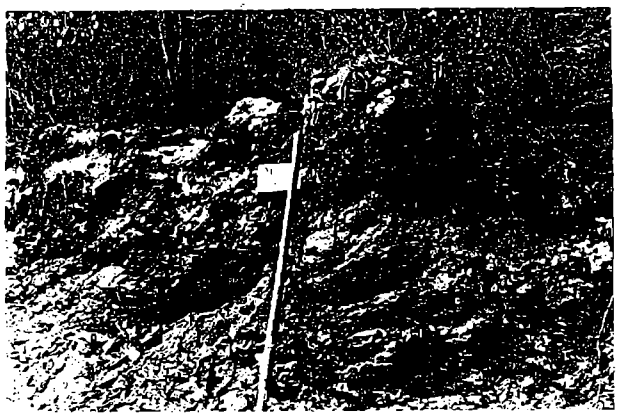

Figure 4-1 - Profile of Morainal landform. Only a thin veneer of till overlies the bedrock in many locations.

Figure 4-2 - Mature unburned Upland Forest in vicinity of existing mine site.

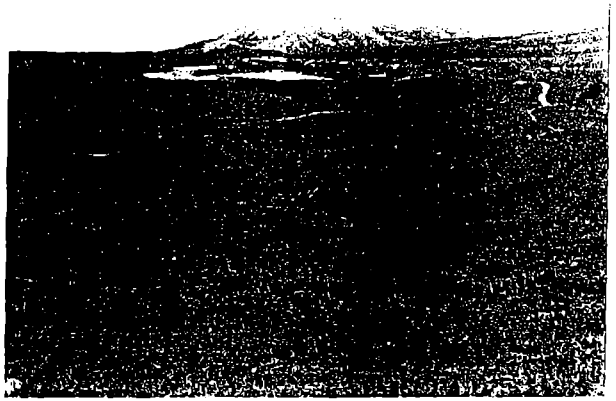

Figure 4-3 - View of existing mine site and arm of Vangorda Creek which drains this area.

4.3 COLLUVIAL LANDFORMS

The colluvial deposits are divided into Steepland Colluvial and Alpine Colluvial landforms. This is done in order to emphasize the influence of the harsh climatic regime and the periglacial processes that take place in the Alpine zone, which make this environment especially sensitive to disturbance.

431 STEEPLAND COLLUVIAL LANDFORMS

The Steepland Colluvial landform occurs on mountain slopes below the treeline where the gradients are between 20 and 60%. The soils are relatively shallow and bedrock outcrops are common, especially at the higher elevations. The parent material is a till-colluvium mixture. The soils that have developed

on the upper slopes are generally well drained (Site 14), while those on the lower slopes tend to be deeper and generally poorly drained (Sites 5 and 11). In some cases these poor drainage conditions lead to the build-up of organic layers and the development of permafrost conditions (Site 11).

The Steepland Colluvium is generally associated with the Subalpine Transition vegetative zone which occurs on the steep upper mountain slopes between the Upland Forest and the Alpine Tundra, and also at lower elevations, where there are steep slopes and shallow soils. The shallowness of the soils in this zone generally limits tree growth, and in the most adverse locations, at higher elevations, shrubs tend to predominate (Site 5 and 14). Only in relatively stable locations, at the base of some slopes, is deeper soil encountered, and consequently it is in these locations that better tree growth is encountered (Site 11).

Moose use the Subalpine Transition vegetation as summer range because of the high proportion of shrub cover, and signs of their browsing are commonly observed.

Grassy meadows (Figure 5-2) are encountered on a few steep, south facing slopes at elevations of 2500 to 3500 ft, and are usually associated with rocky outcrops in which draughty conditions predominate. Such areas were observed on the mountain just north of the Blind Creek bridge and on the left hand side of the road about one mile north of Faro. Such areas are typically used as winter range for sheep.

432 ALPINE COLLUVIAL LANDFORMS

This landform occurs above the treeline where the soils are formed on shallow colluvium and minor till deposits derived from the local bedrock (Sites 15 and 17). They are generally well drained with slopes of up to 40% and numerous rock outcrops. Periglacial features such as solifluction slopes, snow avalanches and minor cirques are evident, particularly on steep exposed sites.

Much of this landform, with its associated Alpine Tundra vegetation, is located at higher elevations above the treeline which lies between 4500 and 5000 ft. The exact elevation depends on the interaction of factors such as fire history, slope, aspect and soil conditions.

The Tundra vegetation consists of various proportions of lichens, sedges and prostrate shrubs (Sites 15 and 17), whose exact species composition depends on the moisture and soil conditions. At lower elevations dwarfed white spruce are frequently encountered.

The Alpine Tundra forms summer range for caribou and Fannin sheep. The caribou congregate on and about snow patches which frequently persist throughout the summer, particularly on north facing slopes. Sheep prefer higher rocky areas and are commonly located at elevations of 6000 ft and more.

4.4 GLACIOFLUVIAL LANDFORMS

Extensive areas of various forms of Glaciofluvial deposits occur along Vangorda, Rose and Blind Creeks and their tributaries. The materials are generally coarse, consisting of well sorted, well rounded sands and gravels (Site 16). The soils of these landforms are generally excessively drained. The dominant soil types are Brunisols and Podzols. The vegetation is generally similar to the drier phases of the Upland Forests described previously.

4.5 ALLUVIAL LANDFORMS

Alluvial deposits occur in the valleys of Vangorda and Rose Creeks and their tributaries, as well as along the Pelly River. The slopes of this landform are gentle and generally less than 5°. The soils in the basins of Rose and Vangorda Creeks consist of Gleysols in the poorly drained locations (Sites 10, 18 and 19), or Brunisols and Podzols in locations having slightly better drainage (Sites 8 and 12). The Gleysolic soils are generally very wet and massive.

The Alluvial Plain shrub vegetation occurs at high elevations in the valleys of Vangorda and Rose Creeks and their tributaries. The vegetation consists of a dense, chest-high cover of shrubs, with few or no trees. In the upper reaches of these creeks (Sites 18 and 19), willow forms the major shrub species; at lower elevations (Sites 8, 10 and 12), shrub birch is the major species. In both locations the ground cover consists of a mixture of lichens, mosses and herbs, the species composition and abundance of these depending on the moisture conditions. At the lower elevations there is also a scattering of balsam fir and white spruce associated with this type of vegetation.

At lower elevations this vegetation zone is used to some extent as summer range by moose; the upper elevations are widely used by moose and caribou. An extensive network of trails through this zone was noted in the upper reaches of both Vangorda and Rose Creeks.

The flood plains along the Pelly River and the lower reaches of Blind Creek are flat, undulating and up to two miles wide in some places. They are composed of gravel, sand and silts which are generally better drained than the previously mentioned materials. Included in this complex are oxbow lakes, alluvial fans, slumped banks and organic backswamps. Only one stand (Site 3) was sampled in this landform, since the development would have only a minimum impact here.

The flood plains of the Pelly River and lower Blind Creek support the most luxurious forest stands in the area, with white spruce over 30 m high and diameters measured up to 43 cm. The average basal area of site 3 was 38 m^2/ha, the highest found in this survey.

Three major forest communities encountered on the flood plains are the white spruce-feathermoss community, the balsam fir-shrub community and the depressional backswamps. The white spruce-feathermoss forests are located in those sections where flooding is infrequent. They represent the best economic forests in this area, with many trees reaching saw-timber size.

The balsam fir-shrub forests occur in locations subject to more frequent flooding, where active deposition is still occurring. Stands of black spruce have developed in the depressional backswamps where organic soils predominate; pine, aspen, birch and spruce have infiltrated the areas above the flood level. These species may be used as indicators of drainage conditions.

These flood plain forests represent the major winter habitat for moose in this area.

4.6 ORGANIC LANDFORMS

Organic deposits occur as inclusions within other landforms. They are a result of poor drainage and the presence of a water table at or near the surface. These poor drainage conditions lead to the growth of mosses, which in time promote the accumulation of peat and eventually the development of permafrost.

This landform occurs rather extensively in the lowlands adjacent to the Pelly River and in flat depressional areas adjacent to stream beds and lacustrine depressions, such as that around Doal Lake. Apart from the organic terrain mapped, numerous other areas too small to map also occur.

The Bog Forest vegetation zone is characterized by an accumulation of peat and the growth of stunted black spruce. Other vegetation includes bog birch, sedges, willow and mosses.

4.7 SENSITIVITY, IMPACT AND MITIGATIVE MEASURES

The sensitivity of the major landforms to the impact of the proposed development, and the mitigative measures that are required for their conservation, are discussed briefly in the following sections.

MORAINAL LANDFORMS

The sensitivity to disturbance of the Morainal landforms depends upon the soil and drainage situation. Those areas having good surface drainage and high infiltration rates can be expected to have a low erosion hazard. Thus, the best sites for construction are generally those dominated by pine forests, which indicate better drained and more stable soils.

In areas such as that around the proposed mine site, the gleyed soils (Sites 1 and 2) indicate a high water table with low permeability. Under such conditions, spring snowmelt and summer precipitation are less likely to infiltrate the soils, and extensive clearing of these areas could result in increased surface runoff and subsequent erosion. It is therefore suggested that in the future development of the mine and mill, the amount of forest cleared be kept to a minimum.

A number of proposed buried pipelines run through the Morainal landform. These require the clearing of only small areas, and because the terrain is fairly level they are not generally expected to cause significant problems. However, in any location where steep slopes are encountered there would be a potential erosion hazard.

It is therefore recommended that on any moderately steep sections, a system of cross ditching and berms be used to minimize this problem. Such procedures are outlined in the Guides For Controlling Erosion published by the Alberta Department of Lands and Forests, 1975.

STEEPLAND COLLUVIAL LANDFORMS

These Steepland Colluvial landforms are associated with shallow soils and very steep slopes. They are thus generally unsuitable for development of any kind because of the rapid erosion which can occur if the vegetation is cleared. A good example of this occurs on the existing road running southeast from the airstrip through a colluvial valley, which is severely eroded and nearly impassible.

Two of the proposed tailings ponds and one proposed pipeline could be sited in this landform. The proposed tailings ponds are located in the valley of Shrimp Lake and in the valley to the east of the end of the Kerr-AEX airstrip. It is unlikely that either of these tailings ponds would cause any adverse environmental effect through erosion or loss of wildlife habitat. However, great care must be taken in constructing the roads and pipelines leading to these developments. They should be constructed utilizing cross ditching and berming to ensure adequate drainage and to prevent erosion. Seeding of the pipeline right-of-way should be done as soon as possible to minimize environmental impact. Methods of construction are outlined in the previously mentioned Guides for Controlling Erosion.

473 ALPINE COLLUVIAL LANDFORMS

The slow growth of vegetation and the shallow nature of the soils in the Alpine Colluvium cause the alpine areas to be very sensitive to disturbance. The proposed development should, however, have no direct impact on these high altitude areas. The upper elevations of Mount Mye would be made more accessible as a result of the proposed Rose Creek or Upper Vangorda Creek tailings areas, and the sensitive ecology of these areas could be influenced accordingly.

474 GLACIOFLUVIAL LANDFORMS

The Glaciofluvial landforms are very favourable for construction and development of all types. This is mainly due to the stable and non-erodable nature of the well drained coarse soils. For example, the town of Faro is located on a glaciofluvial fan. In the proposed Kerr-AEX development several of the proposed pipelines cross glaciofluvial landforms, and no erosion or other environmental problems are anticipated. It is suggested that, where possible, pipelines, roads and other developments be located on these landforms.

475 ALLUVIAL LANDFORMS

The upper valleys of both the Vangorda (Figure 4-4) and Rose Creeks are possible locations for tailings ponds. Gleysolic soils and a willow-shrub type of vegetation community (Sites 18 and 19) occur at both sites. The deep, heavy textured impermeable till material that underlies both sites makes them well suited for the location of tailings ponds. However, care must be exercised in clearing large areas, since runoff is likely to increase by at least the amount of water previously lost by transpiration. Such an increase in runoff and the resulting erosion could adversely affect the waters of adjacent creeks by increasing siltation.

The flood plains of the Pelly River and Blind Creek would not be affected by the proposed development. However, many of the spruce stands on the Pelly River contain trees of saw-timber size, and it is suggested that these may serve as a local source of lumber for the development if this should prove desirable.

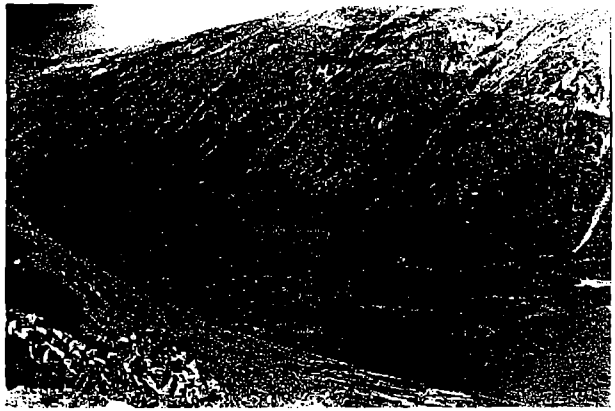

Figure 4-4 - Valley of Upper Vangorda Creek at site of proposed tailings pond. Alluvial shrub vegetation zone dominates valley floor. Stunted forests occur on Glaciofluvial terraces at lower end of valley.

ORGANIC LANDFORMS

Doal Lake and the surrounding organic deposits represent the only example of this landform which is likely to be affected by the development. This lake does not have an extensive drainage area, and the surrounding organic areas appear to have been developed because of the proximity of the water table to the surface. It is also likely that permafrost occurs under the organic deposits which surround this water body. Disturbances of soil and tree removal where these conditions persist could be expected to produce problems of soil movement and rising water tables. These conditions should be taken into account before any development is undertaken which would affect Doal Lake or its immediate surroundings.

LANDFORM DETAILS

Morphologic Expression	M-Morainal	A-Alluvial	C-Colluvial	A^G-glacial Fluvial	O-Organic
p-plain	Mp-Morainal plain	Ap-Alluvial plain Af-Alluvial fan		A^G_p-glaciofluvial plain	Op-Organic plain
r-rolling plain	Mr-morainal rolling plain				
h-hummocky	Mh-hummocky moraine		Ch-hummocky colluvium	A^G_h-hummocky glaciofluvial	Oh-hummocky organic
r-ridged	Mr-ridged moraine		Cr-ridged colluvium	A^G_r-ridged glaciofluvial	Or-ridged organic
t-terraced				A^G_t-glaciofluvial terrace A_t-alluvial terrace	
f-fan			Cf-colluvial fan	A^G_f-glaciofluvial fan	
v-veneer	Mv-moraine veneer		Cv-colluvial veneer	Av-alluvial veneer	Ov-organic veneer
b-blanket	Mb-morainal blanket		Cb-colluvial blanket		Ob-organic blanket

Modifiers: V=gullied; S=soliflucted; N=nivated

M/R = morainal veneer overlying bedrock R = bedrock

C/M = a complex unit of colluvium and moraine in equal proportions (50% each)
C/M = 60%C + 40%M; C/M = 80%C + 20%M; M:O = 90%M + 10%O
C/G = gravel bar

TABLE 2.1. Temperature and Precipitation on the Ross River Lands (from Canada, 1982)

	Lat.	Long.	Elev. (m)	TEMP (oC) Annual	Jan.	July	Extreme Min. (Month)	PRECIPITATION (mm) Annual	June-Aug.	Ann. Snowfall (precip. mm)	Days With Snow
ROSS RIVER	62 59'	132 27'	698	-5.7	-28.6	12.8	-59.4 (Jan.&Feb.)	263.5	105.8	105.8	41
ANVIL	62 22'	133 23'	1158	-3.4	-19.8	11.5	-46.1 (Jan.)	367.7	179.9	179.2	68
[redacted]ARD	62 14'	133 21'	694	-2.8	-24.5	14.9	-55.0 (Jan.)	287.7	104.3	125.9	62
DRURY CREEK	62 12'	134 23'	609	-2.5	-23.7	14.3	-54.4 (Jan.)	349.4	102.9	175.7	90
[redacted]IET LAKE	61 09'	133 04'	812	M	M	13.0	-52.2 (Feb.)	M	110.6	M	M
SHELDON LAKE	62 37'	131 17'	884	M	M	11.7	M	M	163.5	M	M
[redacted]ITEHORSE	60 43'	135 04'	703	-1.2	-20.7	14.1	-52.2 (Jan.)	261.2	102.5	136.6	73

NOTE: M= information is not available for these records.