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CONSULTING ENGINEERING & PROFESSIONAL SERVICES

Our Project No. CG-04946
Your Reference No.

July 13, 1982

Indian and Northern Affairs
200 Range Road
Whitehorse, Yukon
Y1A 3E1

ATTENTION: Mr. H.F. McAlpine, P.Eng.

Dear Sir:

Re: Cassiar Asbestos Mine,
Waste Dump and Tailings Pile Inspection

This letter summarizes observations made during an annual inspection of the above mine components. The site was visited on June 14, 1982 in the company of Mr. McAlpine, P.Eng. Some of the key features observed during the field reconnaissance are documented on attached photographs. It should be appreciated that the comments contained in this letter are based on visual evidence only, since no recent monitoring data regarding the actual movement of these dumps have been available.

Despite the lack of exact data on the deformation of the dumps, the surface characteristics of both dumps demonstrate sufficiently clearly the ongoing instability and continuing movement of the dumps.

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GEOTECHNICAL, MATERIALS & METALLURGICAL ENGINEERING — ENVIRONMENTAL, MATERIALS & CHEMICAL SCIENCES
CALGARY DAWSON CREEK EDMONTON ELKFORD FORT McMURRAY LETHBRIDGE MEDICINE HAT PRINCE GEORGE RED DEER SASKATOON VANCOUVER WINNIPEG

Clinton Creek channel weirs (constructed last fall) have been bypassed by the stream which is now undercutting and eroding the natural side slope. Retrogressive erosion would adversely affect the integrity of the lake. In my opinion, mitigative measures should be undertaken this summer season. Details regarding these aspects are contained in the following paragraphs.

1.0 CLINTON CREEK WASTE DUMP

Relatively fresh tension cracks (not effaced by runoff) have been observed within the main dump segment, i.e. uphill from the access road and across the old trail leading to the open pit. Some of these cracks are located within areas where fissures were observed the previous year. Vertical displacement along some of the cracks produced quite prominent steps. In addition, relatively recent movement is indicated for the portion of the dump descending into the lake and for the dump uphill from this area. Typical dump conditions are shown on Photos 1 and 2.

The downslope dump segment (adjacent to the creek channel) shows less disturbance than in 1981 and most of the previously observed fissures are effaced.

The banks of the creek channel show fresh sloughing and erosion scars (Photos 6 and 7). Despite the continuing erosion and undercutting, the slope made of waste material is steeper than the materials' angle of repose. This is indicative of a continuous movement of the dump into the creek channel.

It is my opinion that the entire waste dump is still unstable and that the movement will likely continue. There is enough evidence to believe that the instability is adversely affecting the geometry of the creek channel and contributing to the amount of fines which are transported by the stream.

While the appearance of fissures and cracks indicate continuous movement of the waste pile, the rate of movement apparently remains within the range previously monitored (i.e. 1 to 5 feet per year). It can be reiterated that a sudden and catastrophic movement of the waste dump is not expected.

2.0 CLINTON CREEK WEIR SYSTEM

The weirs controlling retrogressive erosion at the lake outfall have been reconstructed last fall. The reconstruction has been undertaken according to drawings prepared by Golder Associates (as per their letter of August 28, 1980). Our recommendation not to narrow the channel (as contained in the report of June 22, 1981) has been, in principle, accepted.

Notwithstanding well intended design measures and apparently careful construction of the weirs themselves, the freshet flow bypassed the weirs along the north valley wall (Photos 3 and 4) and cut a new channel outside of the weir system. This channel is seriously eroding the toe of the north valley wall at this location.

It appears that the flow followed the access road cut into the north bank. Field observations indicate that the elevation of the road has been about the same as the elevation of the top of the first weir. The bank armouring was apparently insufficient to control erosion. Mr. D. Acason reports that the failure of the north bank started due to piping. While this is difficult to confirm or reject, recent field evidence indicates that the bank was overtopped and that the flow followed the construction trail which was subsequently eroded. In this context, it is of interest to note undercutting of the south bank of the channel downstream of the weir system (Photo 5). This undercutting has obviously been caused by flow traversing the channel from the bypass route.

Observations from the south bank of the weir section show that insufficient rock channel lining exists on this slope. The rock lining does not extend appreciably above the top of the weirs. While the extent of the lining is not specified on the drawings, the intent of the design was to protect the side slopes against erosion.

It is obvious that rehabilitation of the channel during this summer season is required to ensure structural integrity of repaired weirs as well as to prevent erosion of the lake outfall.

Culverts currently providing for the lake outfall have been found partly blocked by driftwood. It is considered prudent to remove the culverts once the road traversing the lake outfall is not in use anymore.

3.0 TAILINGS PILE

While monitoring data on the movement of the surface of the pile are not available the number of fresh cracks and scarps throughout the entire pile area is such that there is no doubt about a continuing and likely accelerating movement of main segments of the tailings pile (Photos 9 to 16 inclusive).

It appears that the north lobe experiences the greatest deformations. The differences and general configuration of the two key elements of the pile (i.e. the south and north lobes) is documented on Photos 9 and 10 which can be correlated with Photos 5 and 6 of our 1981 report. Visual observations indicate that the cracks, fissures and scarps became more pronounced during the last year. The cracking within the toe of the south lobe is more extensive. It is apparent that this area experiences spreading and heaving. The toe of the north slope continuous to override the natural terrain (Photo 16) and the toe itself has advanced further into the valley bottom.

The north portion of the tailings pile within the headscarp area has been displaced to such an extent that its subgrade (comprising wet silty and sandy material) is exposed. It is apparent that the slip surface traverses through the pile foundation.

In essence, the results of our recent visual inspection of the tailings pile lead to the same conclusions as presented after the last year's visit. In summary, the conclusions are as follows:

- Major segments of the tailings pile are unstable.

- The exposures indicate that failure occurs within the foundation of the pile.

- The deformations due to the slope movements are similar or greater than those observed last year.

- The movement rates appear to have remained about the same as during the previous year; although within certain slope segments the rates may be accelerating.

- While previous efforts to arrest the movement were not successful, there are no indications of a sudden and catastrophic slope movement.

It is my view that the slope movement will continue for a long time and that eventually the north slope of the tailings pile will come to rest at the bottom of the Wolverine Creek valley.

Visual inspection of the Wolverine Creek spillway system show that most of the weirs are in a good state of repair and that they are performing satisfactorily. In addition, several downstream weirs have been repaired and a rock apron placed below the lowermost weir.

4.0 CONCLUDING REMARKS

It is apparent that slope movements of both waste and tailing piles continue and will continue in the foreseeable future.

Consequently, the continuing maintenance of both Clinton and Wolverine Creek channels across valley segments affected by the waste and tailings piles movements is required.

At the present, this maintenance is required on a regular, yearly basis. In view of this, a more permanent arrangement regarding the responsibility for the maintenance of the stream channels than presently exists would be prudent.

Alternatively, major technical design measures, different from those currently adopted, are required to ensure the long-term integrity of both drainage courses relative to the possible future behaviour of both dumps.

Respectfully submitted,

HARDY ASSOCIATES (1978) LTD.

Per:

M. Stepanek, M.Sc., P.Eng.

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Photo 1: Clinton Creek Waste Dump.

Photo 2: Continuing subsidence within the central portion of the dump.

Photo 3: Clinton Creek weir system; stream bypassing the system and undercutting the bank.

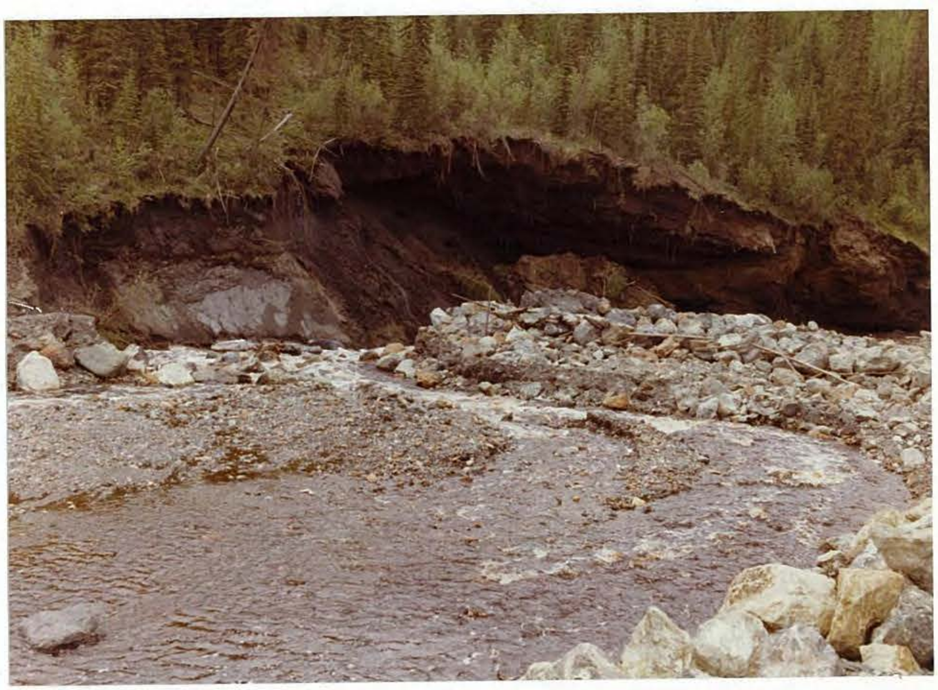

Photo 4: Detailed view of upstream weir section; note the height of breached bank relative the weir height and driftwood position.

Photo 5: Sloughing of the undercut dump at the weir section.

Photo 6: Clinton Creek downstream of weirs - comparable to Photo 1 of 1981 report.

Photo 7: Downstream segment of Clinton Creek channel cut through waste dump and into the bedrock.

Photo 8: Wolverine Creek weir system and tailings pond.

Photo 9: Tailings pile, south lake. Photo taken from similar location as selected for Photo 5 of 1981 report.

Photo 10: North lobe of the pile, photo comparable to No. 6 of 1981 report.

Photo 11: View of disturbances affecting the upper section of the south lobe.

Photo 12: Extensive cracks within the toe area of the south lobe indicate bulging of toe material.

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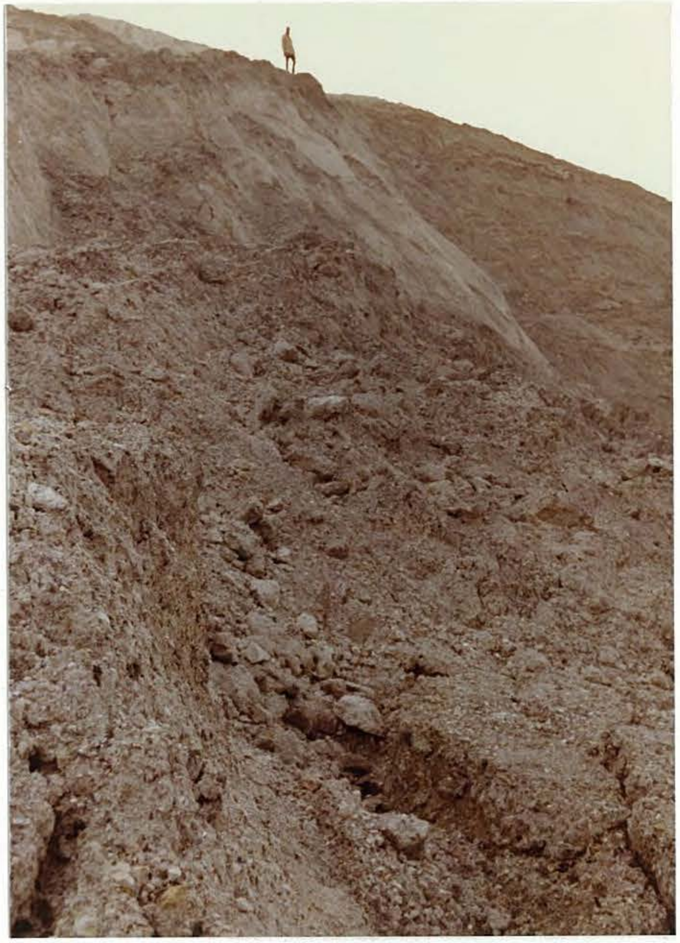

Photo 13: Uppermost section of the north lobe shows significant vertical displacement.

Photo 14: General view of the headscarp of the north slide lobe.

Photo 15: Destroyed terraces in the middle portion of the north lobe.

Photo 16: Toe of the north lobe bulldozing vegetation and soil cover.

Photo 17: Wolverine Creek upstream of weir spillway.

Photo 18: Reconstructed bottom weirs and rock apron below the weir floodway.