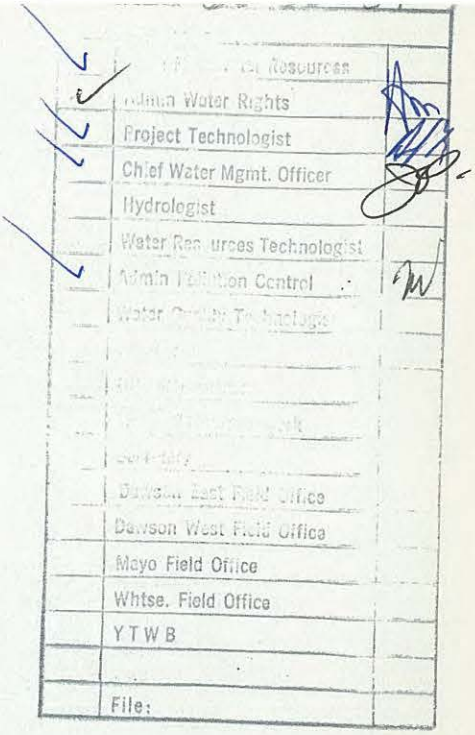
geo-engineering
(M.S.T.) LTD.
GEOTECHNICAL DESIGN & CONSULTING SERVICES



November 10, 1986

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

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

Dear Sir:

RE: Cassiar Asbestos Mine
Results of Annual Inspection

This letter-report summarizes observations made during the 1986 inspection of the above mine area. The site visit was undertaken on June 17 and 18, 1986 in the company of Mr. H.F. McAlpine and included both ground as well as helicopter assisted reconnaissance.

The inspection concentrated on the appearance of stream channels and behavior of both waste and tailings dumps. In addition, a tour of the Clinton Creek Valley downstream from the mine was undertaken in an attempt to evaluate the impacts (deposits) of the 1974 tailings dump failure.

Since no 1986 survey data of monitoring stations were available, our comments regarding the movements are based on comparing previously taken photographs with the current ground configuration and, as a result, are relative only. For the same reason, several photographs showing the key features of the dumps, are appended.

/...2

Clinton Creek Waste Dump

Most of the waste dump (Photo 1) is unstable and the rate of movement towards the creek channel appears to be in the same order of magnitude as previously determined by monitoring, i.e. 30 to 50 cm per year.

The aerial reconnaissance indicates that the dump segment descending towards the lake (Photos 2 and 3) is the most unstable and deformations (indicating movements) are clearly visible. Scarps and cracks in the lake facing portions of the dump are bigger and more prominent than those delineating movement towards the creek. The waste dump segment forming the south bank of the creek channel exhibits oversteepened slopes and freshly failed (scalloped) escarpments (Photo 4). The road paralleling the stream exhibits an uneven surface.

The north bank of the creek is also oversteepened (relative to the original slope). Slopes range from 48 to 50 degrees locally. Bedrock exposures (siltstone and shale) form the sideslope of the channel.

The creek channel (Photo 6) within the downstream dump segment appears to be somewhat narrower than during previous visits. There are several "steps" in the bottom of the channel, formed by large boulders. The retrogressive erosion, previously affecting primarily the creek segment within the downstream portion of the waste dump toe, has progressed further upstream, resulting in undercutting of the north, bedrock controlled, slope.

The channel weir, constructed in 1984, is gradually eroding and flow is cutting a new channel on the south side of the stream (Photo 5).

Deposition of eroded and transported material is evident in the area of the Wolverine Creek - Clinton Creek junction (Photo 7).

A specimen of waste has been secured from the toe area of the dump and the grain size analysis result is shown on Figure 1.

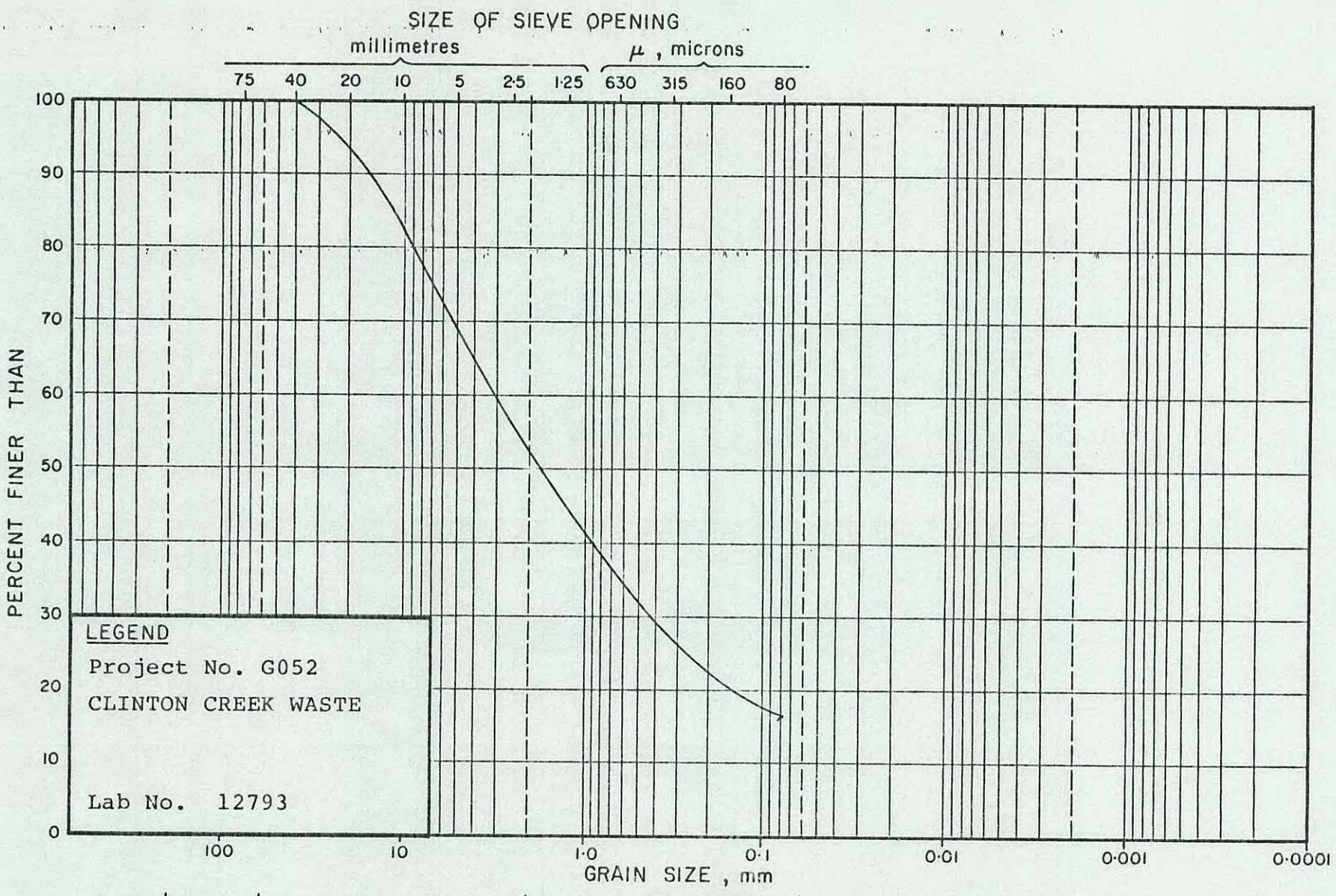
Wolverine Creek Tailings Pile

The north tailings lobe has reached the valley bottom (Photo 8) and is assuming a similar configuration to that of the south lobe. The toe of the dump rests against the east valley slope and the material is piling up. It will eventually block the valley, likely forming a new lake or modifying the existing one.

Maximum movements of the north lobe are apparently of the same order of magnitude as during previous years. Some decrease in the rate of movement will occur due to the support provided to the toe of the north lobe since it reached the valley bottom. The dump surface is highly distorted (Photo 9). Headscarp positions show that the movement is in the direction of the original slope fall lines, i.e. not only into the Wolverine Creek Valley, but also in the northerly and westerly directions. It is of interest to note that sliding occurs also towards the mill site, located on a relatively flat ground.

The south tailings lobe has deformed considerably since the 1984 site visit. Major deformations (and probably the highest rates of movement) exist in the lower portions of the dump. However, significant deformations exist at upper dump segments as well. The creek channel is practically blocked (Photo 11) by advancing the toe of the pile. Some flow occurs underground and is discharged at the bottom and east of the rock lined outfall channel. The channel, for its major length, is dry.

PROJECT No. 862-2000 DRAWN D.M. REVIEWED _____ DATE 26 June 86



GRAIN SIZE DISTRIBUTION

Figure 1

Golder Associates

Inspection of the Clinton Creek Valley

The Clinton Creek Valley downstream from its junction with Wolverine Creek was examined to determine the extent of sediment transport after the 1974 tailings pile failure (south lobe) and breach of the valley blockage. Inspection sites are shown on Figure 2.

The Wolverine Creek Valley bottom up to its confluence with Clinton Creek has been covered with tailings (Photo 13) and the creek is currently downcutting through the sediment.

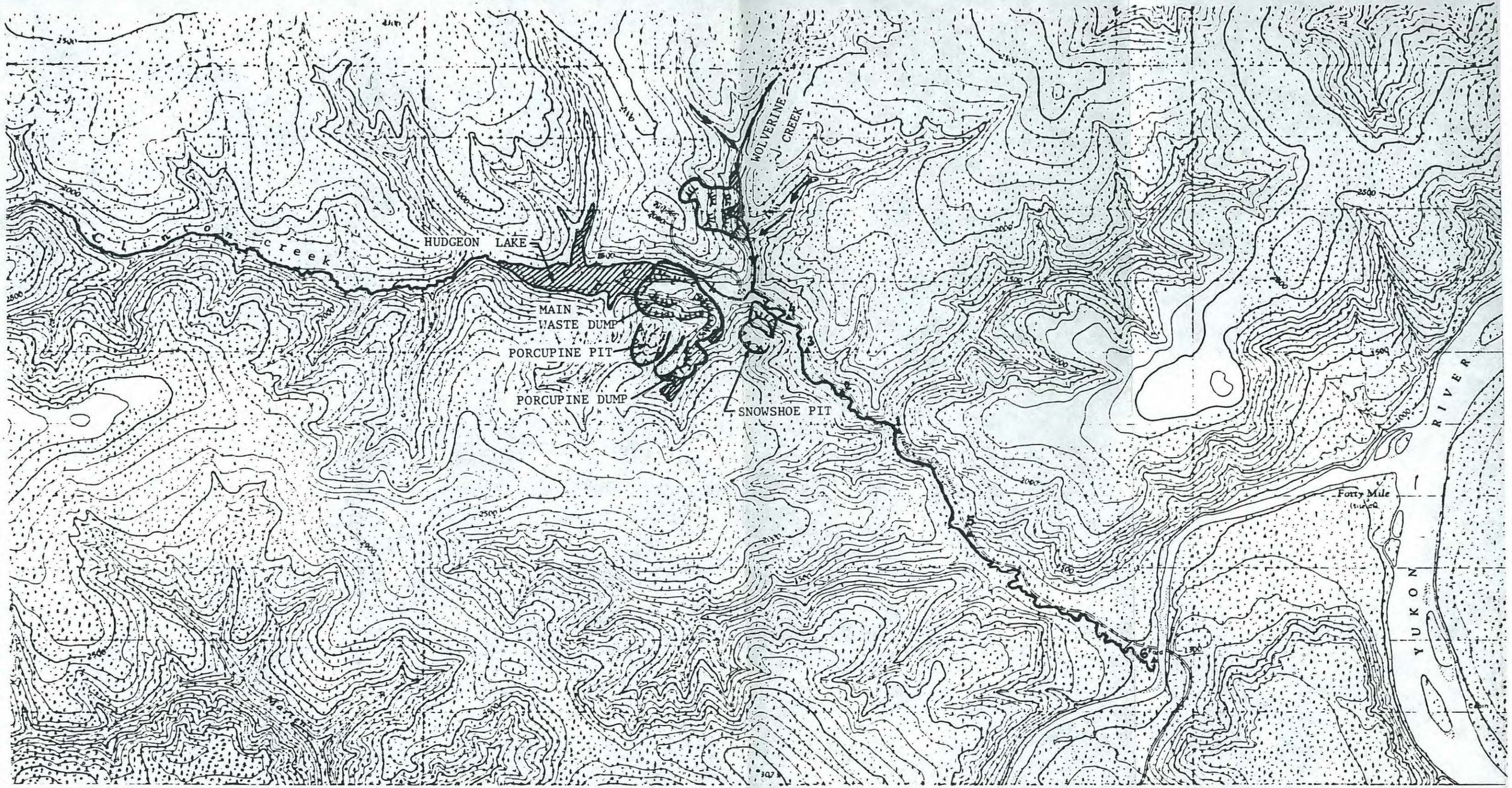
Extensive deposits of asbestos fibres and sand-sized tailings are encountered in the area located 0.5 km downstream from the creeks' confluence (Photos 14 and 15). The tailings deposits are several centimetres to 50 cm thick. The fibres on trees are approximately 2 to 3 m above the creek channel, indicating an unprecedented flood.

Formation of a gravel bar (Photo 16) and cutting of a new channel at this location indicates the impact of the additional bed load. The old channel is abandoned in favour of the new one located behind the gravel bar.

At locations depicted on Photos 17 and 18, the fibres mark the high flood elevation, which is about 2.0 m above the creek level.

Another sign of flooding associated with the 1974 tailings pile failure was found approximately 3 km downstream from the Wolverine Creek - Clinton Creek junction. The valley bottom, at this location, is approximately 10 m wide and the slopes have about a 40° gradient. The fibres were observed approximately 4.2 m above the normal level of the creek.

We did not locate any definite evidence of this flood event further downstream from this location. However, serpentinite and argillite



LEGEND:

- OPEN PIT
- WASTE OR TAILINGS DUMP
- LAKE
- SEDIMENT TRANSPORT INSPECTION SITE

CLIENT
NORTHERN AFFAIRS PROGRAM

geo-engineering (M.S.T.) LTD.

CASSIAR ASBESTOS MINE

TITLE
LOCATION PLAN

SCALE 1: 50 000

PROJECT No G 052-2

FIGURE 2.

fragments exist in the alluvial fan at the creek's confluence with 40 Mile River. The sources of these fragments are uncertain.

Closure

The results of the inspection confirm that both waste and tailings dumpsremain unstable. The movement of the waste dump is apparently relatively constant. The movement of the tailings pile varies locally and with time. It has been previously classified as a "caterpiller-like."

Clinton Creek continues to erode the valley blockage and changes in the rate of erosion are probable. This could result in a partial breach of the dump and increased sediment transport.

Major deformations and modifications of dump configuration have occurred on the tailings pile. A breach of the currently formed valley blockage is possible during the 1987 spring break-up. This could be associated with a flood event similar to that of 1974.

Yours truly,

GEO-ENGINEERING (M.S.T.) LTD.

Milos Stepanek, M.Sc., P. Eng.
Principal Consultant

MS/jlw#7

GO52-2

Enclosures

PHOTO DOCUMENTATION

Photo 1: Clinton Creek valley, looking west.

Photo 2: Upstream face of the dump and outfall from the lake.

Photo 3: Fresh cracks in the headscarp of the waste dump confirm recent movements.

Photo 4: Clinton Creek channel cut into the north valley wall and eroding the waste dump toe.

Photo 5: Rock weir constructed in 1984 shows deterioration and erosion along the south bank.

Photo 6: Oversteepened channel banks.

Photo 7: Deposition of eroded material downstream of the dump. Note braided channel.

Photo 8: Tailings piles, looking south.

Photo 9: Scarps within the upper portion of north lobe.

Photo 10: Toe of the north lobe resting against the east valley wall.

Photo 11: Wolverine Creek channel blocked by the southern lobe of the tailings pile.

Photo 12: Rock lined outfall channel is dry. A new channel is developing along the east side of the valley fill.

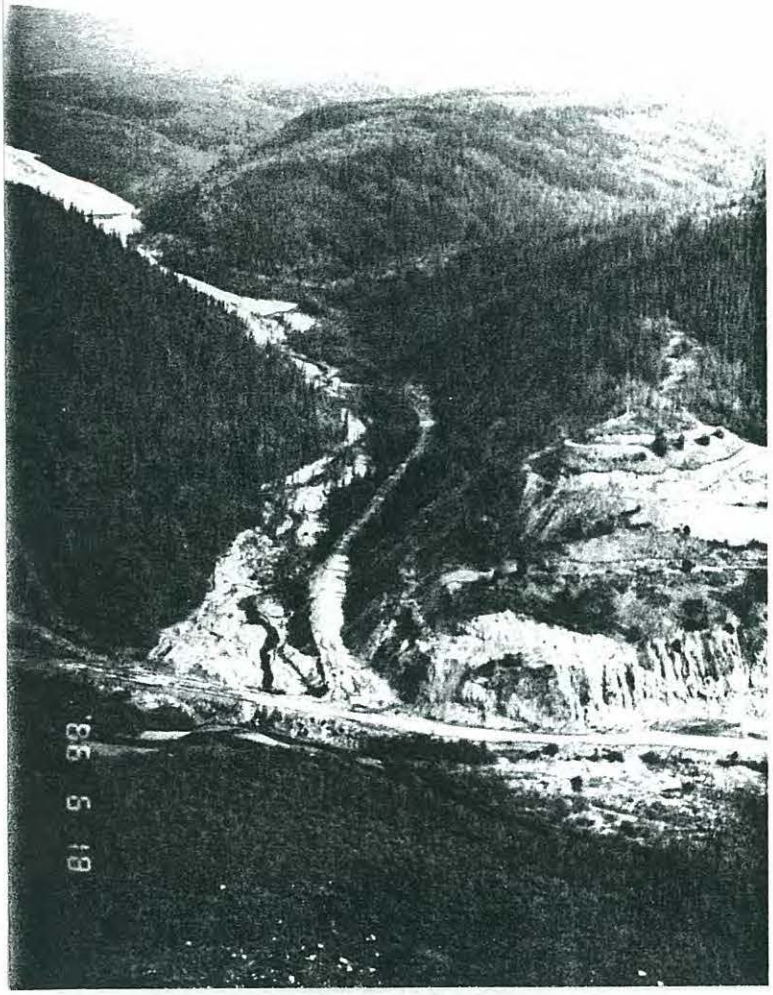


Photo 13: Tailings deposits cover the bottom of the Wolverine Creek valley upstream from its junction with the Clinton Creek.

Photo 14: Clinton Creek valley, approximately 500 m downstream from the Wolverine Creek confluence. Note deposits covering the terrain between meanders.

Photo 15: The same area, detailed view of asbestos fibre on trees.

Photo 16: Clinton Creek, approximately 600 m downstream from the Wolverine Creek junction, changing its channel because of gravel bar.

Photo 17: Location some 1.2 km downstream from the Clinton and Wolverine Creeks' confluence.

Photo 18: Clinton Creek, approximately 2 km downstream of the Wolverine Creek confluence. Asbestos fibre is some 3.5 m high above the current flow level (approximately 2.0 m above the floodplain elevation).