CLINTON CREEK ASBESTOS MINE

REPORT

ON

1988 SITE INSPECTION

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1.0 INTRODUCTION

This report summarizes observations made during the 1988 inspection of the Clinton Creek mine area. The site visit was undertaken on June 7, 1988 in the company of Mr. H.F. McAlpine and included ground reconnaissance of the Clinton Creek and Porcupine Creek waste dumps and Wolverine Creek tailings pile. Specific attention was also paid to both the Clinton and the Wolverine Creek channels in areas influenced by previous mining activities.

Our assessment of movements and deformations which have continued on the waste and tailings piles since our last visit in 1987 is based on field observations and comparative evaluation of previously taken photographs. An attempt to take photographs from similar locations as during previous years was made to facilitate comparison of prominent terrain features. The photographs are contained in Appendix A and cross-referenced to pictures presented in last year's report.

Since no ground monitoring of survey stations has been undertaken since the summer of 1986, visual assessments of terrain and review of comparative photographs are the only methods available for the evaluation of ground movements.

Sketches schematically depicting the main surficial and instability features of the waste dumps and tailings piles, prepared on the basis of field observations in 1987, have been updated. The slide features plotted on these sketches indicate the type and direction of current movements.

Clinton Creek experienced a major flow event, likely on May 16, 1988 according to records from the stream gauge. The bridge on the access to the former townsite was destroyed and its right abutment eroded away during this event. High water level marks were found to be approximately 1.5 m, above the normal flow elevation at the bridge site. Our observations indicate that the flood was caused by a freshet, possibly combined with heavy precipitation.

2.0 CLINTON CREEK WASTE DUMP

The continuing instability of this waste dump is documented by the character of the slide scarps, cracks and fissures. Since there appears to be very little change in the general

terrain configuration and only a few slide features such as scarps and cracks have developed, it may be assumed that the mean rate of lateral movement is within the same range as previously determined by monitoring, i.e. 300 to 500 mm per year.

The main observations made during the site visit and our interpretation of the movements which have occurred since the 1987 site visit are summarized below:

- The uppermost section of the dump (Photo 1) exhibits a series of steep and fresh-looking scarps which appear to be very similar to those observed in 1987. The retrogressive character of the movement is indicated by ongoing vertical displacement and cracks beyond the dump boundary.

- Fissures caused by the sliding of the Porcupine pit north wall and the waste dump scarps are intersecting one another in the northeast sector of the dump (Photo 2).

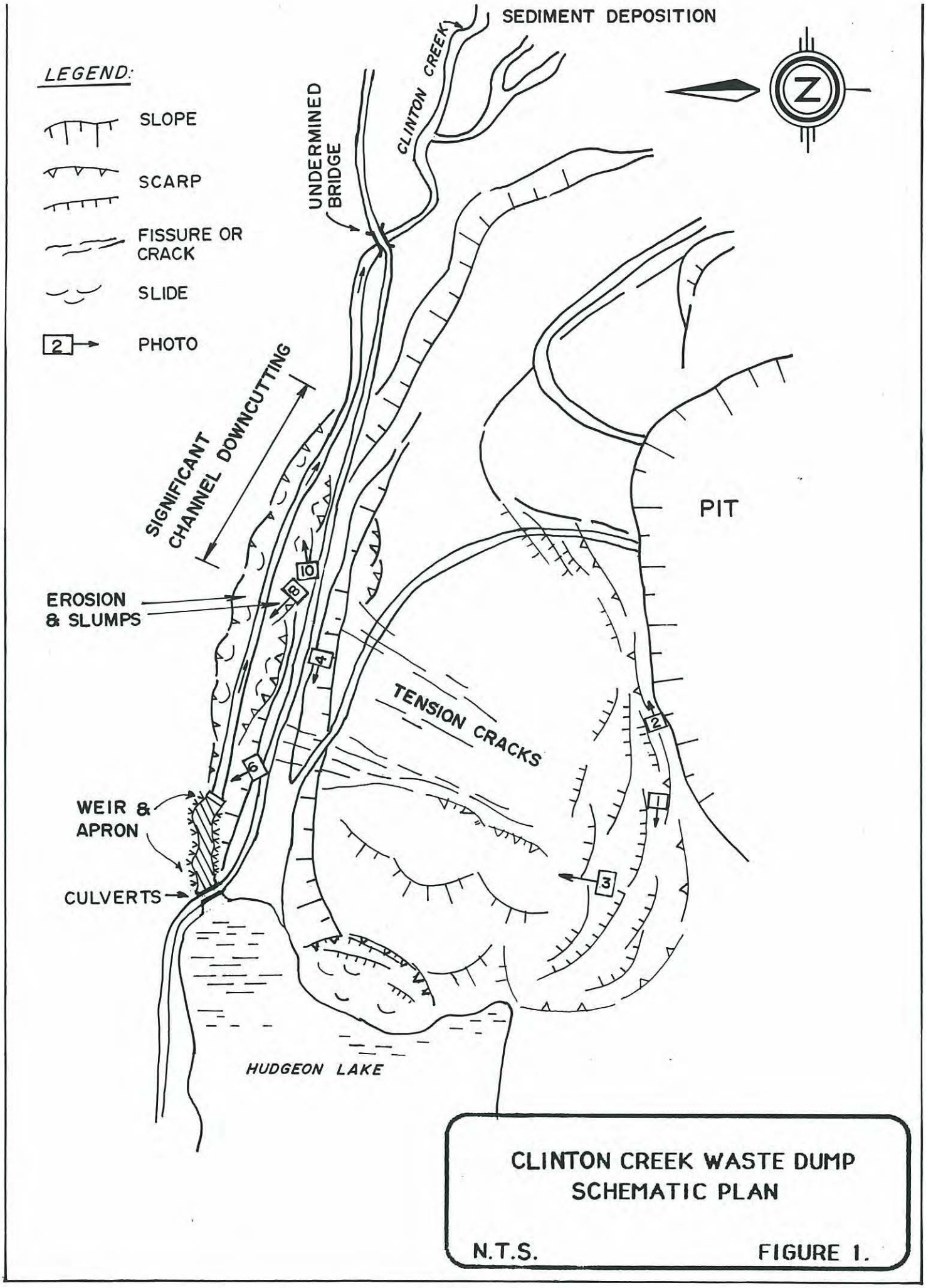
- A section of the dump forming the shore of Hudgeon Lake continues to move into the lake (Photo 3). The ground changes are discernible along the shore line. There is very little evidence suggesting significant displacement further upslope from the shore.

- Tension cracks running perpendicular to the Clinton Creek channel are fresh and indicative of recent movements.

- The south bank of the Clinton Creek channel, formed by the waste, is eroding downstream from the armoured channel section.

Our review of the main slide features schematically outlined on Figure 1 indicates that the dump movements recorded during the last two years are pervasive and that their rate remains approximately the same. The major areas of activity are listed below:

a) the uppermost dump sector moving into the valley,
b) the west toe of the dump moving into the lake, and



CLINTON CREEK WASTE DUMP
SCHEMATIC PLAN

N.T.S. FIGURE 1.

c) erosion of the north toe of the dump forming the south bank of the Clinton Creek channel.

The lake shore outside of the sector formed by the waste dump is locally disturbed by small slides, apparently triggered by wave induced erosion.

The high water level marks indicate that the water level in the lake was up to approximately 1.5 m above the water elevation at the time of the site visit.

3.0 CLINTON CREEK CHANNEL

There are no apparent terrain changes at the lake outlet area. The culvert inlets are partially obstructed by timber and other debris. The debris and possibly icing resulted in a significant rise of the lake level. The outlet dyke was not overflown, however.

The armoured section of the creek channel between the lake outlet and the drop weir (Photo Nos. 5 and 6) exhibits only minor changes since the 1987 site visit. The downcutting of an incised channel upstream from the weir continues. A gravel bar is being developed along the north bank (Photo 6). Erosion of the south abutment at the drop weir continues without major impact on the weir.

The channel downstream from the weir to a point approximately half way across the waste dump area has also been relatively stable since 1986. This channel section has a constant gradient (upstream from point A on Photo Nos. 7 and 8) and contains a series of small steps across the channel bottom. Erosion of the south bank continues at a relatively slow rate.

Relatively significant changes have taken place in the channel downstream from point A. The north bank is eroding, exposing thinly to medium-bedded, jointed shale and calcareous sandstone (Photo 8). While these strata will slow the erosion process, they are not competent enough to retard it entirely.

The south bank, comprised of mine waste, is eroding and the steep bank is sliding.

The downstream channel segment is downcutting and both banks are eroding. The changes which occurred since 1986 are apparent (Photo Nos. 9 and 10). The channel has shifted towards the north bank and material covering the channel bottom has been redistributed. Boulder pavement of the channel bottom is more consistent in this sector than further upstream.

Similarly to the upstream channel segment, both banks are undermined by the creek and are unstable. The bedrock forming the north side of the channel is comprised of thinly-bedded and jointed shale and calcareous sandstone, and the bank face ravels. The south bank, comprised of waste material, has not exhibited major changes since 1986.

4.0 PORCUPINE CREEK WASTE DUMP

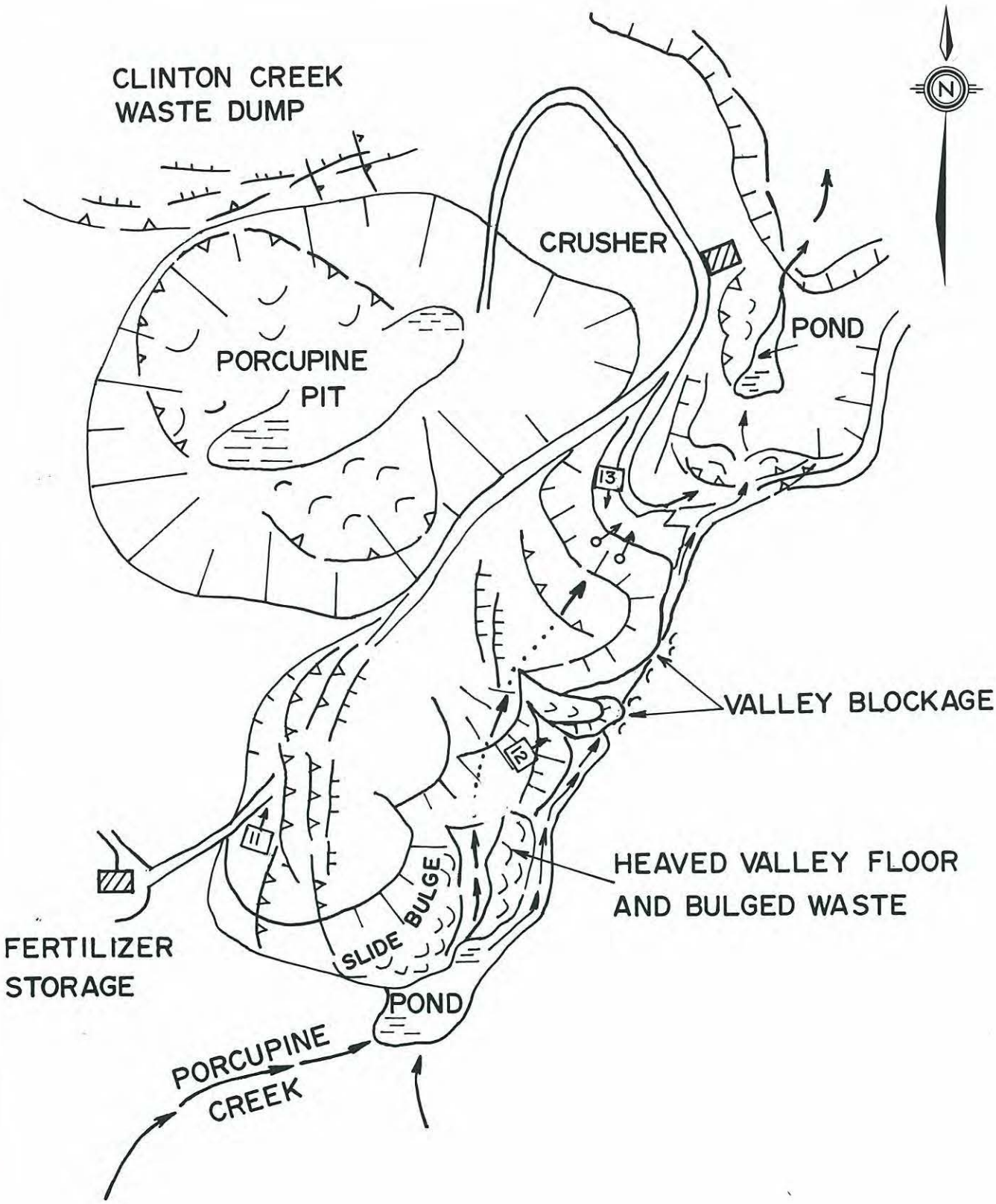
The displacement of the mine waste deposited into the Porcupine Creek valley continues. The main instability features and drainage conditions are schematically shown on Figure 2.

Steep, fresh-looking scarps outlining the upper limit of the slide area encompass the entire waste dump (Photo 11). The toe area also exhibits fresh cracks confirming the overall instability of this dump.

The valley blockage caused by a relatively narrow slump, combined with ground heave, did not significantly change since last year (Photo 12). However, the outflow from this pond is now mainly underground since more heaving occurred on the east side of the blockage.

The outlet from the lake has been abandoned because of ground heave. This notwithstanding, a significant amount of seepage occurs at the north end of the dump. The seepage is dispersed over a relatively wide zone and does not have any adverse impact on this dump sector (Photo 13).

The flow from the dump and surface drainage paralleling the east side of the dump traverses a small dump and descends into the valley bottom. This dump is progressively failing.



NOTE: LEGEND ON FIG. 1

PORCUPINE CREEK WASTE DUMP
SCHEMATIC PLAN

N.T.S. FIGURE 2.

5.0 WOLVERINE CREEK TAILINGS PILE

The general appearance of both south and north lobes of the tailings pile is quite similar to that observed last year (Figure 3). The displacement of material continues, possibly at a somewhat slower rate.

The most active areas are presently along the toe of the south pile and the valley bottom in front of the north pile. The rate of horizontal movement of the south lobe is estimated to be in the range of 5 to 10 m per year. There are no major changes in the slide headscarps of both piles since last year (Photo 14).

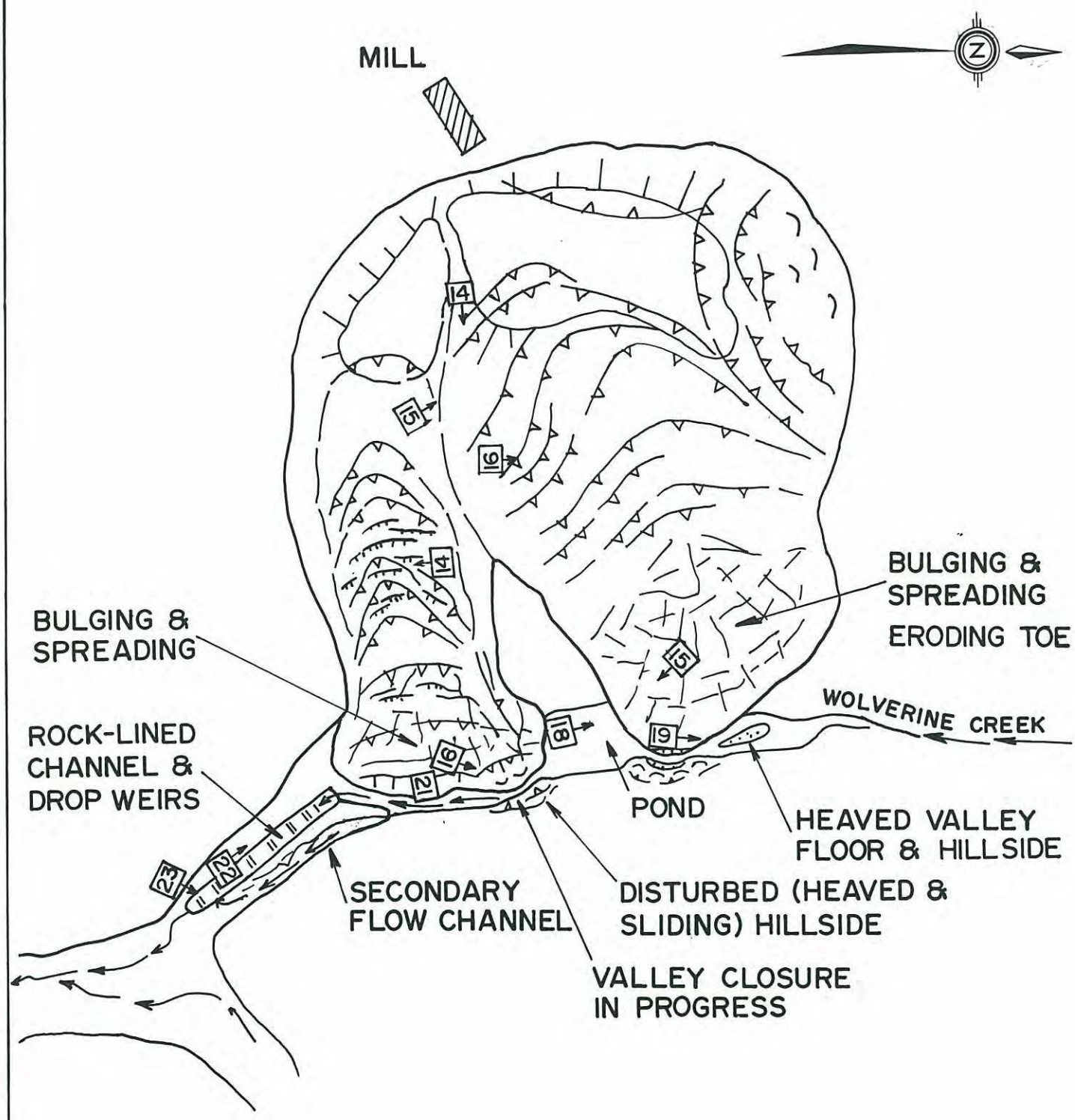
The south lobe (Photo 15) temporarily blocked the outlet channel which resulted in an approximate 0.5 m rise of the lake level. This blockage has been breached and the flow continues through the previously established channel (Photo 16).

The toe area of the south lobe is traversed by two main sets of cracks - parallel and perpendicular to the stream. The cracks are fresh and wide. Their appearance indicates recent movements. The toe area is spreading into the lake.

On the upstream side of the south pile, the heaving of the original valley floor continues. The opposite hillside shows less extensive sliding than in 1987.

The downslope sector of the north pile is badly disturbed (Photo 16) and it is very difficult to evaluate the relative rate of movement. The toe area did not change significantly since 1987 (Photo Nos. 17 and 18), except that the toe at sometime this spring had completely blocked the valley. The blockage was breached and a channel cut through the tailings (Photo 19).

The displacement rate of the toe area has decreased because of the support provided by the east valley wall. The toe bulge has approximately the same slope gradient as in 1987. The heaving of the valley bottom in front of this toe continues.



NOTE: LEGEND ON FIG.1

WOLVERINE CREEK
TAILINGS PILES
SCHEMATIC PLAN

N.T.S. FIGURE 3.

6.0 WOLVERINE CREEK CHANNEL

The channel blockage which probably occurred prior to the freshet at the upstream end of the south pile has been breached and the channel restored. However, significant erosion of the west bank (comprised of tailings) has occurred at this location, as documented on Photo Nos. 20 and 21. While this bank appears to be approximately at the same location, the failed marker indicates the horizontal movement of the bank to be in excess of 5 m since June 1987.

In 1987, the flow was similarly to the previous year, divided into two channels at the downstream end of the south pile. A majority of the flow this year is through the armoured channel with drop weirs (Photo 22). The secondary channel, eroded along the east side of the valley, appeared to carry less flow than in 1987 (Photo 23).

Despite the temporary blockage of the channel inlet and obvious subsequent surge of water, the channel performance was good during the 1987-1988 period.

7.0 CLOSURE

The results of the 1988 inspection confirm the continuing instability of the waste dumps and tailings pile.

The movements, in general, appear to be similar to those observed in 1987 or somewhat smaller.

The Clinton Creek channel exhibits major changes since 1987 in the middle sector where erosion uncovered bedrock strata in the channel bottom and the toe of the north bank. The material eroded from the upper channel and its banks has been deposited in the downstream channel sector and within the flat area downstream from the dump. The west abutment of the bridge across Clinton Creek, which was severely undermined in 1987, has been rehabilitated. It is our opinion that the flood which probably occurred on May 16, 1988, has been caused by a combination of spring runoff and precipitation. While there is evidence of fluctuations of the water levels in the lakes formed by the waste and tailings materials, there does not appear to be any indication of a significant channel or valley

blockage. Our inspection of the terrain downstream from the Clinton Creek junction did not encounter any signs of flash flood events.

The waste dumps in the Porcupine Creek valley experience ongoing deformation, similar to that observed in 1987.

Porcupine Creek flows mainly through the waste dump as well as through the valley blockage.

Major deformations continue within the downstream section of the south tailings pile. So far, these deformations have not had a significant impact on the creek channel. The north tailings pile will likely block the valley bottom. This blockage would be again eroded away.

Since the monitoring of unstable dumps has been discontinued, it is recommended to acquire low level air photos and conduct a comparative evaluation of deformations on that basis.

It would also be prudent to monitor water levels in both lakes and downstream from the Wolverine and Clinton Creeks junction.

Respectfully submitted,

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GEO-ENGINEERING (M.S.T.) LTD.
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The Association of Professional Engineers, Geologists and Geophysicists of Alberta

APPENDIX A

PHOTOGRAPHS

Photo 1: The uppermost segment of the Clinton Creek waste dump is traversed with fresh scarps. The failure is retrogressive.

Photo 2: The sliding waste dump and unstable north wall of the pit are in contact in the NE sector of the dump.

Photo 3: View of the N.W. sector of the Clinton Creek waste dump and Hudgeon Lake outlet. This dump segment continues to move into the lake and the surface expressions of the movement remain very similiar to those observed in 1987.

Photo 4: Access road paralleling the Clinton Creek channel is traversed by tension cracks. Cracks along the crest of the channel bank are fresh, but about the same locations as last year (refer to Photo 3 in the 1987 report).

Photo 5: Basin between the lake outlet and drop weir; photo taken in June 1987.

Photo 6: Channelization and localized downcutting of the basin bottom continues.

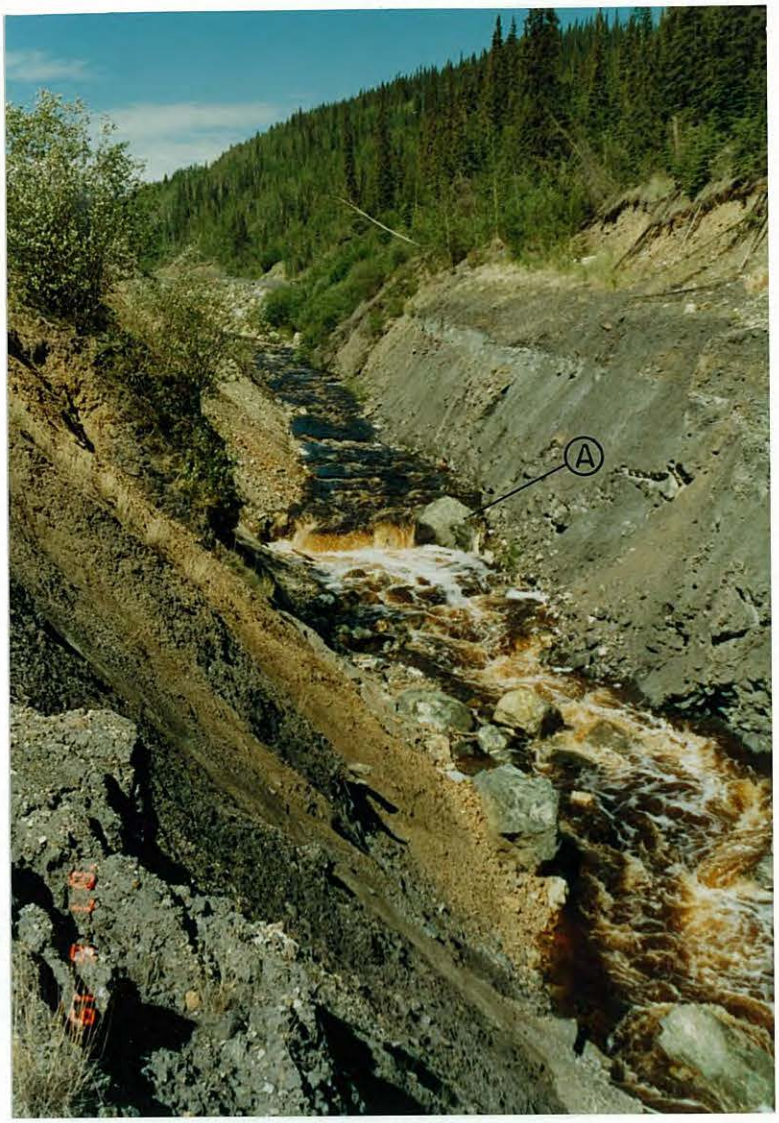

Photo 7: Clinton Creek channel upstream from the drop weir; June 1987.

Photo 8: The same segment of the channel in June 1988. Note eroding banks and bedrock exposures in the channel bottom.

Photo 9: Downstream segment of the Clinton Creek channel in June 1986.

Photo 10: The same creek segment in June 1988. There is evidence of creek downcutting and bank erosion despite bedrock exposures.

Photo 11: Oblique view of the Porcupine Creek dump looking north. Note fresh-looking cracks in the slide headscarp area and continuing bulging of the toe.

Photo 12: Surface appearance of the Porcupine Creek valley blockage did not change significantly since 1987 (Refer to Photo 8 in the 1987 report).

Photo 13: The north toe of the Porcupine Creek dump and the discharge of the underflow (Compare with Photo 10 of the 1987 report).

Photo 14: View of the north and south lobes (left and right, respectively) of the Wolverine valley tailings piles. there is a small elevation difference between the impondment upstream of the north lobe and the pond upstream from the south lobe.

Photo 15: View of the lower slope segment of the north lobe and toe of the south lobe.

Photo 16: Breached blockage at the upstream side of the south lobe. Note tailings on the east side of the channel.

Photo 17: The toe of the north lobe in 1987.

Photo 18: The same area in June 1988. Note breached blockage of the valley.

Photo 19: Detailed view of the eroding toe of the north lobe. Tailings temporarily blocked this valley segment and the valley which bottom has been bulged due to the pile movement.

Photo 20: Channel through the south lobe in June 1987. Note the marker on the top of the west bank.

Photo 21: The same channel in June 1988. The bank advance is indicated by the failed marker now resting in the channel bottom.

Photo 22: View of the armoured channel and the tailings pile in the background.

Photo 23: The creek flows mainly through the armoured channel, rather than through the secondary one (Compare with Photo 19 of the 1987 report).