ABANDONED CLINTON CREEK ASBESTOS MINE

REPORT
ON
SITE INSPECTION

Prepared for:
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G052

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1.0 INTRODUCTION

The abandoned Clinton Creek area was visited between August 24 and 26, 1992, in the company of Mr. H.F. McAlpine. The previous geotechnical inspection was undertaken in September 1990 and the observations made are contained in our report dated June 1991. Detailed documentation of main geotechnical aspects of this area and a brief review of the historical behaviour of mine pits and dumps is presented in our Review Report dated December 1986.

Relics of past mining activities, such as underground conduits, crusher, storage tanks, foundations of a power plant and sewage treatment plant are still evident despite an effort to partially cover some of them with random fill. Degradation of permafrost in the former village area has produced irregular ridges and kettle holes in former roads.

Ground surveys and monitoring of previously installed benchmarks on waste and tailings dumps was discontinued in 1986. Similarly to the 1988 and 1990 inspections, the rating of deformations and movements observed during the current site visit is qualitative only. Some of the photographs included in this report were taken from locations similar to those selected for photographing during previous visits. This allows for comparison of current terrain features with previous documentation.

We have also included previously compiled sketches of main surficial features of the waste dump and highlighted the areas of the apparent greatest activity.

2.0 CLINTON CREEK WASTE DUMP

Clinton Creek waste dump is comprised of overburden rock from the Porcupine open pit. With the exception of occasional more durable blocks, weak overburden shale and sandstone materials are disintegrated. The overall configuration of this dump has not significantly changed since the mid-80's.

The uppermost segments of the valley wall have gradients up to some 30 degrees. The mid and lowermost segments are comprised of several slightly inclined terraces and a bulge slowly advancing into Hudgeon Lake. Discharge from the lake currently passes through two 1.5 m diameter culverts into the Clinton Creek channel which flows across the waste dump along the north side of the valley. Two other culverts have been removed to allow

overflow if the remaining culverts are plugged. The channel, with an overall gradient of about 4.5 percent, has incised a trough bounded by waste material on the south side while the north bank is mostly bedrock-controlled.

2.1 WASTE DUMP

Fresh cracks, scarps and fissures were observed, similar to those noted during previous inspections, in the upper and middle segments of the waste dump. The waste dump toe, forming the valley plug, appears to be similar to its configuration in 1990 (Photo 1). The headscarp area has retrogressed further upslope from the waste dump limit and additional localized segments of natural ground have become unstable. While difficult to assess visually, it is obvious that the dump toe had to advance into the creek channel. However, because of creek erosion, the position of the toe of the dump relative to the creek channel appears to be the same as before.

The main observations made during the site visit and our interpretation of the movements which have occurred since the 1990 site visit are summarized below:

- The uppermost section of the dump exhibits a series of steep and fresh-looking scarps, ranging in height from 0.1 to 1.0 m. The uppermost slope gradient ranges from 40 to 45 degrees.

- The retrogressive character of the movement is indicated by ongoing vertical displacement and cracks extending beyond the upslope dump boundary (Photo 2). One scarp is about 2 m high.

- Fissures caused by the sliding of the Porcupine pit north wall extend into the waste dump and vice versa (Photo 3). The rate of dump segment affected by the pit wall instability has possibly increased.

- A step in the former access road to the Porcupine pit (Photo 4) indicates that the total vertical dump displacement at this location exceeded 3 m.

- The west segment of the dump, forming the valley plug, does not show significant changes in the ground configuration (Photo 5). The dump toe forming the lake shoreline appears to be somewhat flatter than before. No visually discernible terrain changes were observed along the Clinton Creek channel and the access road.

Fresh cracks in the middle and uppermost waste dump areas and the retrogressive character of the movement indicate that the dump continues to be unstable. The rate of movement is expected to vary; it is apparently slow in the toe area and more rapid in the dump upper reaches. Very little movement, if any, apparently occurs at the lake outlet area.

Water level marks indicate that the water level in the lake, at the time of our visit, was down by approximately 1.0 m from the maximum lake elevation.

It is of interest to note that the water level in the Porcupine open pit is approximately 25 m below the water level in Hudgeon Lake. Because there is a limited drainage area and no apparent springs above the pit water level, it appears that this level is indicative of the regional water table at this location.

2.2 CREEK CHANNEL

The lake outlet has been modified in the fall of 1991. Two culverts were removed from the north side of the outlet and an overflow section was excavated (Photo 6). The resulting "spillway" (approximately 6 m wide) was not armoured. While the channel gradient between this location and the armoured section is gentle, some erosion is likely to occur. Timber and other debris partially plug the remaining two culverts.

No significant changes of the armoured section of the creek channel between the lake outlet and the drop weir were visually discernible in 1992. A notch has developed in the rock plug at the downstream end of the armoured section (Photo 7). However, the overall stability of the weir foundation and the performance of the armoured channel upstream from the weir appears to be, at this time, satisfactory.

The channel downstream from the weir to a point approximately half way across the waste dump area has also been relatively stable since 1988 (Photo 8). Further downstream, the south bank, comprised of mine waste, is eroding and the bank is sliding (Photo 9). There is an apparent advance of the dump into the creek channel.

While the changes in the channel bottom in its downstream sector are difficult to establish (on the basis of visual observation and by comparing the photographs), changes of the bank configurations are more readily identifiable. In this channel sector, erosion has an adverse impact on the north bank. There is evidence of retrogressive failures and sloughing of undercut banks (Photo 10).

The armoured channel and the weir in the upstream sector of the channel were affected by some erosion; however, the performance of the armoured section has been satisfactory until now. At the same time, it should be recognized that there has not been a major flood since its construction in 1983. Changes in the configuration of channel banks occurred locally since the last inspection in 1990 within its middle and downstream sectors.

3.0 PORCUPINE CREEK WASTE DUMP

The movement of this waste dump into the Porcupine Creek valley continues. It is apparent that the rate of movement of its individual sectors varies. The southern segment of the dump appeared to be, at the time of the site visit, more active than the northern one (Photo 11). As usual, the movement is better defined (by fresh scarps and fissures) along the upper reaches of the dump than at its toe.

This notwithstanding, changes in the valley blockage, which occurred between 1990 and 1992, document the relatively high mobility of this dump. The valley blockage, until 1990, used to be comprised of a relatively narrow ridge (slump material and a heaved ground). During the recent site visit, a new valley blockage has developed south from the original one, chiefly due to the heaving of the valley bottom. High water level marks in front of this blockage indicate that water is seasonally ponded in front of the dump to a level some 1 m higher than the usual elevation of the lake. There was no overflow across this valley plug at the time of our site visit and the old channel upstream from the original blockage

was almost dry (Photo 12). However, there are high water level marks indicative of seasonal flow through the channel.

The original valley blockage appears to be wider than before and its crest is probably slightly higher than in 1990 (Photo 13). There was no surface flow through the old channel, downstream from the blockage and along the east side of the waste dump. All water discharging from the lake infiltrated, in August 1992, into the dump and seeped through the waste rock. The discharge points at the north end of the dump have changed as well. Previously observed springs located above the access road on the north slope of the dump were dry while heavy flow, forming a small stream (Photo 14), daylighted at the toe of the waste dump. This discharge is concentrated and occurs along the natural ground and waste material interface. The seepage path through the waste dump has been apparently modified and its overall gradient, near the discharge point, is now bigger. However, the discharge flow was clear without suspended solids.

The changes in the dump configuration and Porcupine Creek regime do not indicate, in our opinion, that a major dump failure or flooding would occur in the near future. The Porcupine Creek watershed upstream from the dump is less than 2.5 km^2 and the valley blockage is wide, relative to the lake head and volume.

4.0 WOLVERINE CREEK TAILINGS PILE

The tailings (approximate total volume of 7×10^6 m^3) were placed over the valley slopes, dipping at an average angle of about 16 to 17 degrees to the valley bottom. The tailings, originally stacked in two piles, merged due to their sloughing into a single sheet covering the west valley wall. However, two original lobes are still in evidence in the valley bottom (Photo 16).

The southern lobe, which initially blocked the valley in 1974, continues to restrict the creek channel at its upstream end. Periodically, the channel is temporarily blocked due to the dump sloughing. This event occurred the first time in 1986 and its reoccurrence is more frequent recently. At the time of our site visit, erosion of such a stream blockage was in progress (Photo 17).

The southern segment of the tailings pile shows signs of relatively rapid movements. The cracks are fresh and wide opened. Its toe upstream from the rock-lined weir is generally steeper than 50 degrees and locally subvertical. More tailings are pushed up in the toe area and the height of the toe is gradually increasing (Photo 18).

At the downstream side of the southern lake, the toe is driving the subgrade up and ahead. As a result, deformations (cracks and sloughing) occur on the opposite valley slope.

The north tailings pile lake is apparently less active than the southern one. While its height above the valley bottom has increased, there is no evidence of a recent valley blockage. However, the dump toe is spreading in an upstream direction and bulging of the original ground in front of the toe continues (Photo 20). Tailings on the east side of the channel indicate that at some time the drainage was obstructed.

Because of increased elevation of the channel bottom at the upstream head of the southern tailings pile lake and about 1 m high beaver dam at this location, a single lake has been formed (instead of two separate ones) at the time of our site visit.

The field observations indicate that both segments of the tailings pile continue to move downhill and that the rate of movement is significant. The channel blockages apparently occur more frequently than in the past, but are relatively easily eroded away. The armoured spillway channel functions as designed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the observations made during the 1992 site visit, the following conclusions are made:

- All waste dumps and tailings piles continue to be unstable.
- Evaluation of rate and extent of movements, as discussed in this report, is qualitative and based on visual observations only. Most of the previously installed monitoring devices are inoperational.
- Risk of significant flooding due to massive failure of Porcupine Creek or Clinton Creek waste dumps is believed to be low.

- Significant flooding of the Clinton Creek valley could occur if the existing (armoured) Hudgeon Lake outlet is breached.

- Significant flood and transport of tailings through the Wolverine Creek valley and into the Clinton Creek valley could occur if a major plug of the Wolverine Creek channel is formed, then overflown and breached.

Because of the potential hazards, it is recommended to consider the following actions and measures:

- armouring (by rip-rap) of the Hudgeon Lake outlet,

- maintenance of the existing rock weir and armoured channel downstream from the Hudgeon Lake outlet,

- visual monitoring of main dumps and creek channels (at least once a year) by the Water Resources personnel and by a geotechnical specialist, as required,

- maintenance of the water gauge on Clinton Creek,

- consider installation and monitoring of water gauges in Hudgeon and Wolverine Lakes, and

- maintenance of warning signs along the access road and at the creek channels.

Respectfully submitted,

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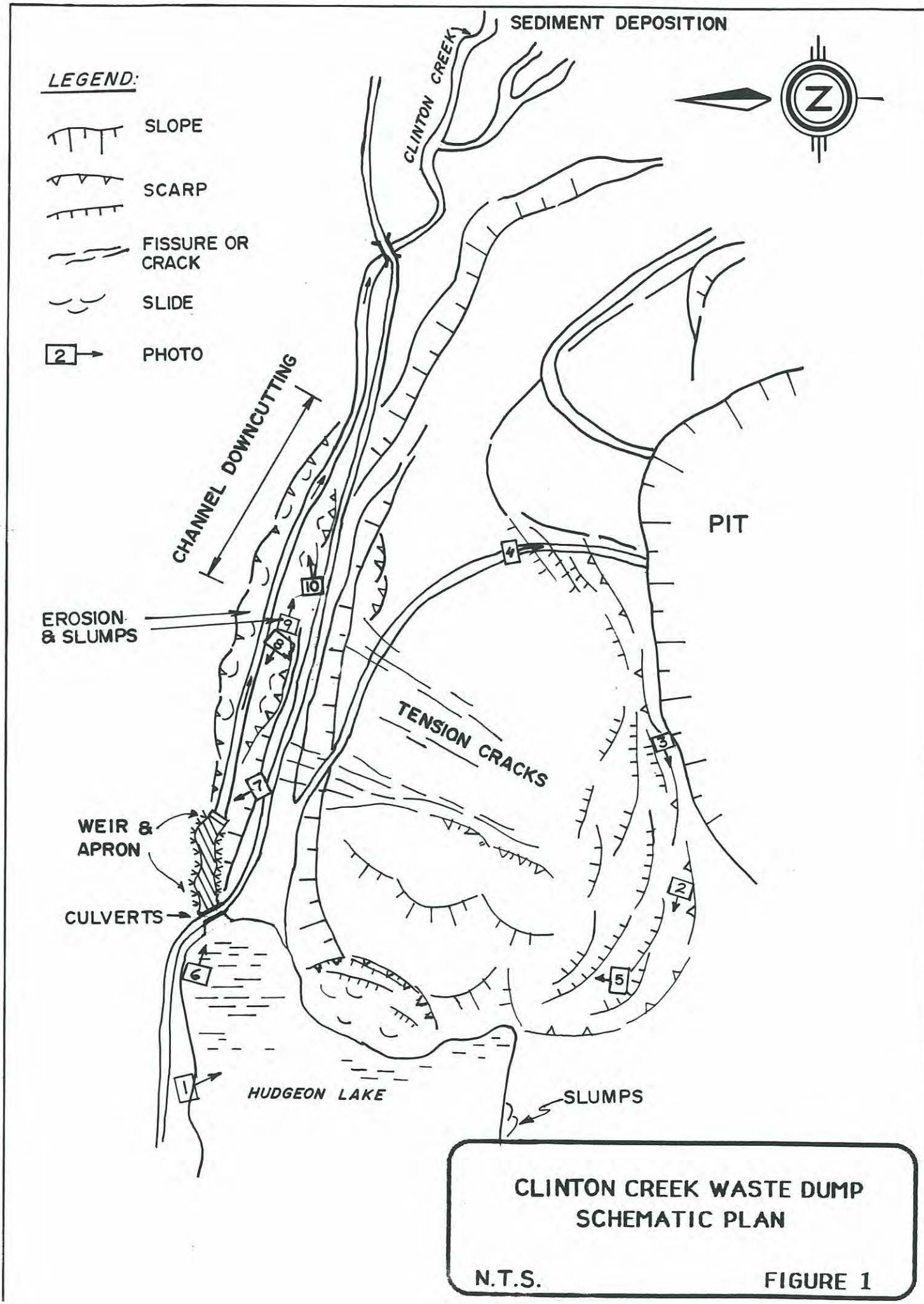
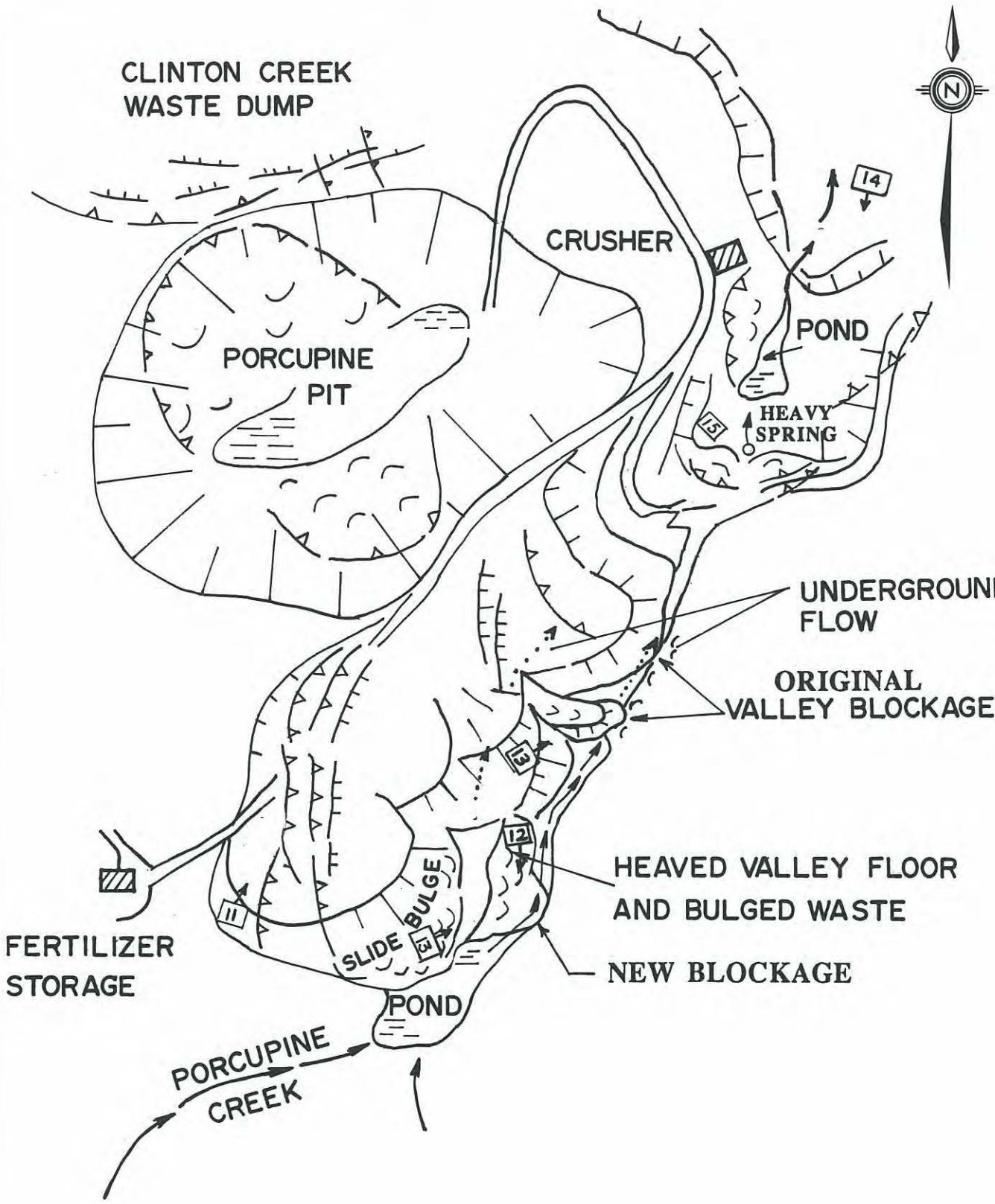
APPENDIX A

FIGURES



CLINTON CREEK WASTE DUMP
SCHEMATIC PLAN

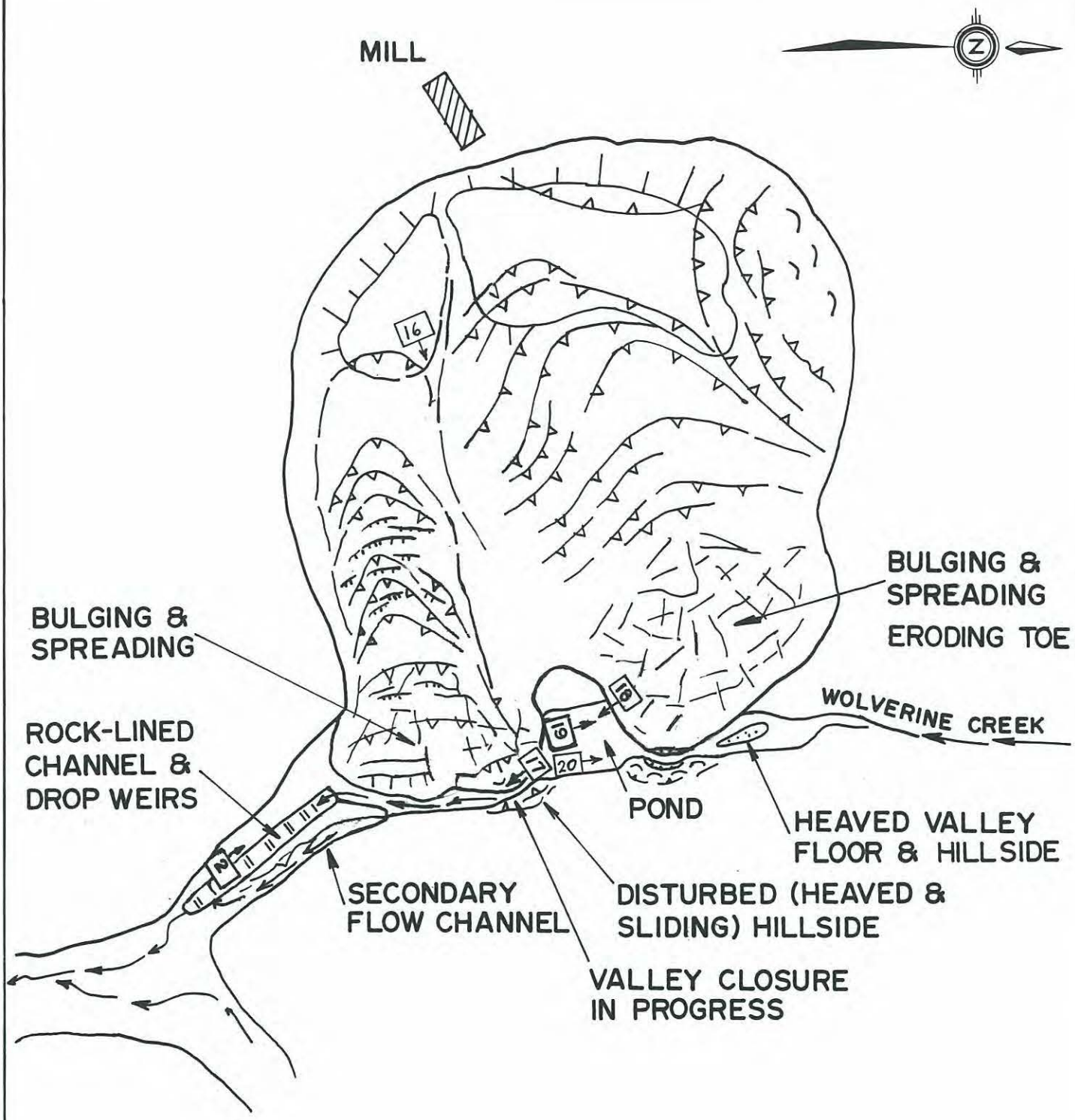
N.T.S. FIGURE 1



NOTE: LEGEND ON FIG. 1

PORCUPINE CREEK WASTE DUMP
SCHEMATIC PLAN

N.T.S. FIGURE 2



NOTE: LEGEND ON FIG.1

WOLVERINE CREEK
TAILINGS PILES
SCHEMATIC PLAN

N.T.S. FIGURE 3

APPENDIX B

PHOTOGRAPHS

Photo 1: Clinton Creek waste dump and Hudgeon Lake in the foreground. While the general configuration appears to be similar as in 1990, cracks and scarps confirm ongoing movement.

Photo 2: Fresh cracks parallel the headscarp of the Clinton Creek dump.

Photo 3: View of a ridge between the Porcupine pit and Clinton Creek waste dump. Slides from the pit wall extend into the dump material.

Photo 4: A step in the former access road into the pit indicates extent of the dump vertical displacement at this location.

Photo 5: View of the Clinton Creek waste dump forming the valley plug. Hudgeon Lake outlet in background.

Photo 6: Modified Hudgeon Lake outlet; two culverts have been removed and an overflow channel excavated. The remaining two culverts are partially blocked.

Photo 7: A notch was eroded into the armoured channel plug (left from the big boulder) since 1990.

Photo 8: Clinton Creek channel within the upstream half of its length through the waste dump shows very little changes since 1988 (refer to Photo 8 of the 1990 report).

Photo 9: Middle segment of the Clinton Creek channel; south bank is sliding into the channel.

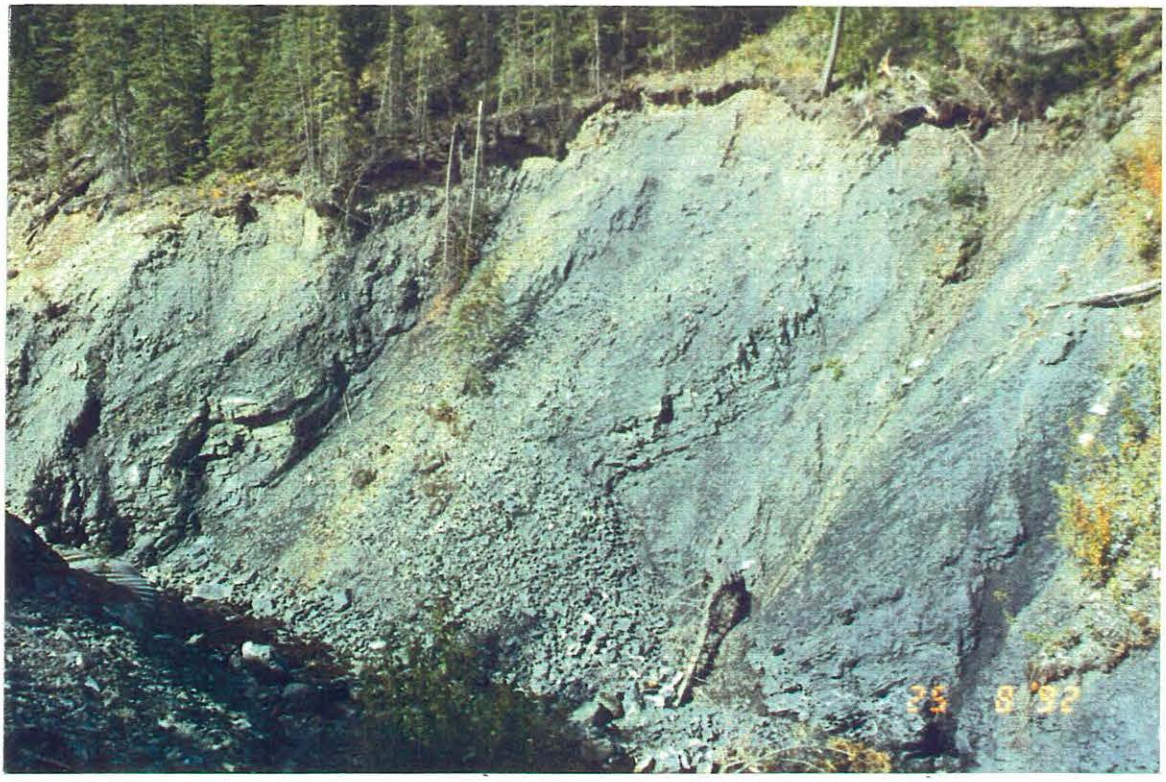


Photo 10: Undercut and sliding north side of the Clinton Creek channel in its downstream sector.

Photo 11: Oblique view of the Porcupine Creek waste dump, looking north. Movement of the dump is well illustrated by fresh fissures and scarps, widespread along the headscarp and throughout the southern dump segment.

Photo 12: Looking upstream towards new blockage of the Porcupine Creek valley, caused by ground heaving.

Photo 13: Original valley blockage has been widened as a result of ongoing ground and dump movement.

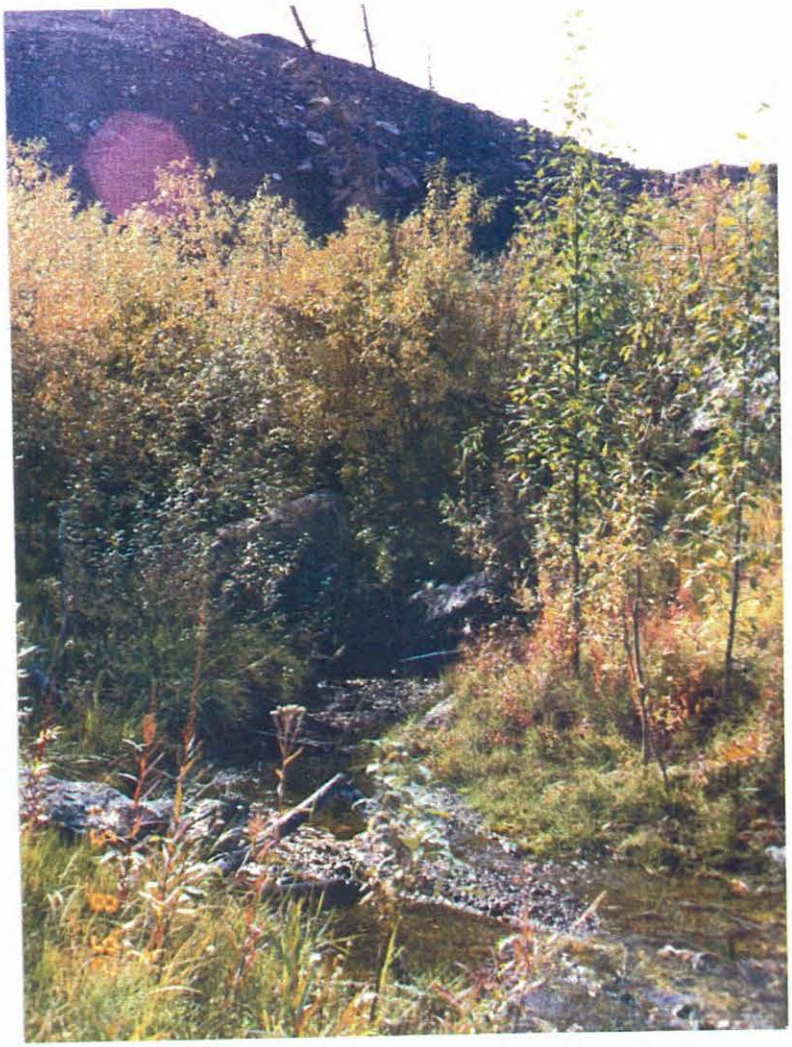


Photo 14: Seepage discharging from the north toe of the Porcupine Creek dump.

Photo 15: Seepage from the Porcupine Creek dump flows into a lake formed in the valley a short distance downstream.

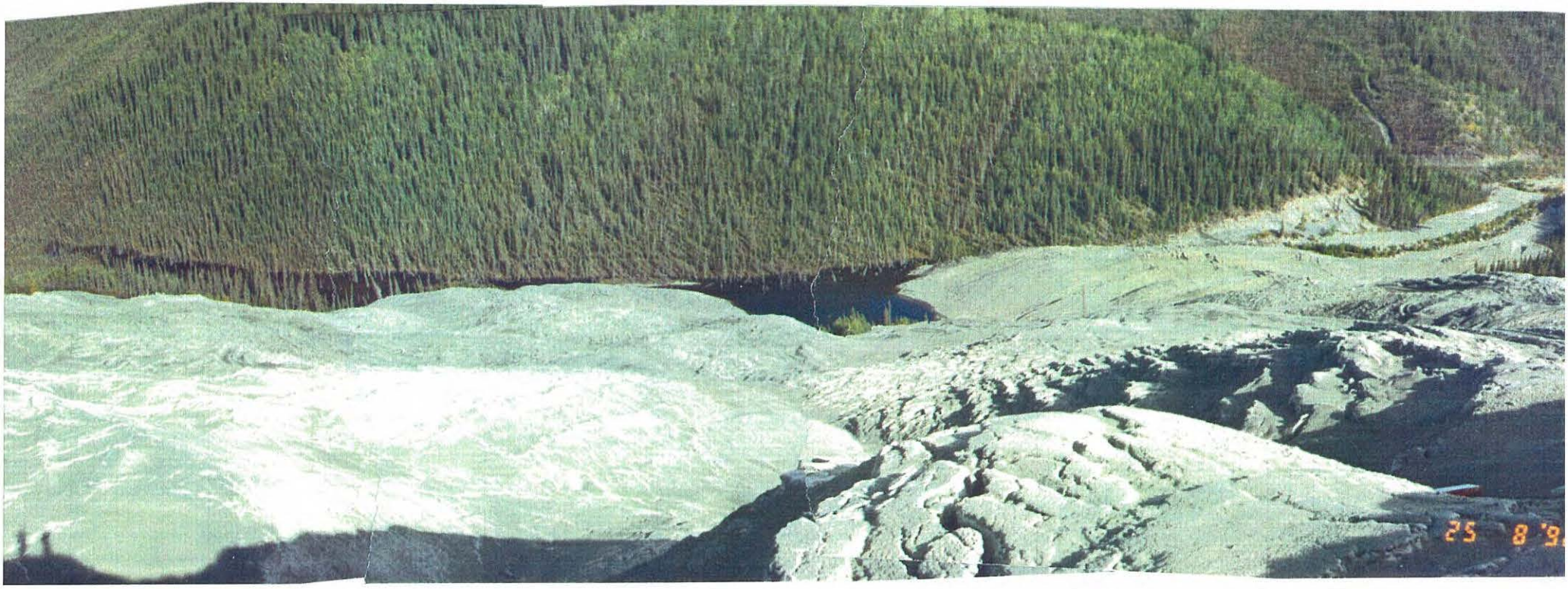


Photo 16: View of the Wolverine Creek valley from the top of the tailings pile. Note increasing size of the lobe, partially influenced by beaver dams.

Photo 17: View of the upstream section of the south lobe impinging on the Clinton Creek channel. Note recent blockage being eroded.

Photo 18: Looking downstream at the southern lake.

Photo 19: Overlooking the broken-up surface of the southern tailings pile lake. Toe of the north lake in the background.

Photo 20: Channel along the toe of the northern lake looking upstream. Note bulged-up ground on the east side of the channel.