Notes of Site Visit

Cullaton Lake Mine

July 24, 1999

Prepared for
Nunavut Water Board

August 10, 1999
P12721.00

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1 Introduction

On July 24, 1999 a site visit was held at the Cullaton Lake minesite by representatives of the Nunavut Water Board (Board), Homestake Mining (Homestake), the property owner, local representatives of the Kivalliq Inuit Association, the local Hunters and Trappers Association (HTA) and the Hamlet of Arviat as well as Sustainable Development. The purpose of the visit was to review the site conditions as Homestake was in the process of renewing its water licence. The property has been undergoing site reclamation and restoration work since 1985. Homestake had requested modifications to the existing Licence conditions in light of the results of the monitoring data to date and wants to begin abandonment of the site.

The Cullaton Lake property is regulated under the conditions of Water Licence N6L2-0940 (Licence).

This trip was part of a series of mine site visits arranged by the Board across Nunavut in order to give the participants an overview of the properties which will be requiring review in the near future. The following is a list of the participants and their affiliations:

Dionne Filiatrault - Technical Advisor, Nunavut Water Board and trip leader, from Gjoa Haven
Patricia Renaud- summer work student, Nunavut Water Board, Gjoa Haven
Joe Savikataaq - Sustainable Development, Rankin Inlet
Hugh Nateela - Kivalliq Inuit Association, Arviat
Mark Kalluak - Hunters and Trappers Association, Arviat
Joshua Curley - Councillor, Hamlet of Arviat
Sharon Meyer - Environmental Analyst, Homestake Mining
J.P. Primeau - JP Consulting, Consultant for Homestake Mining
Dimitri Georgiou - Geotechnical Engineer, Trow Consulting, Thunder Bay, Ont.
Holger Hartmaier - Geotechnical Engineer, Acres International Limited, Consultant for Nunavut Water Board

2 Site Visit Itinerary

2.1 Friday, July 23, 1999

- D. Filiatrault (DF), P. Renaud (PR) and H. Hartmaier (HH) travel by commercial carrier from Iqaluit to Rankin Inlet
- Overnight at Discovery Lodge in Rankin Inlet

2.2 Saturday, July 24, 1999

- DF, PR, HH meet J. Savikataaq (JS) at airport in Rankin Inlet
- 8:15-9:00 AM, fly to Arviat with Caravan chartered from Skyward Aviation
- meet Hugh Natella (HN), Mark Kalluak (MK) and Joshua Aviky (JS) at airport in Arviat
- 9:45-10:45 AM, fly from Arviat to Cullaton Lake, land on airstrip
- meet Sharon Meyer (SM), Dimitri Georgiou (DG) and JP Primeau (JP) at airstrip
  They had arrived earlier by helicopter from Arviat.
- SM gives brief overview of mine history and reclamation work done to date
- JP, DG, MK and HH fly by helicopter to tailings area, others ferried by helicopter to other sites on the property
- walk over tailings area until 1:00 PM
- DF, PR, SM and HH fly from tailings area to mine campsite, walk over campsite area until 1:45 PM
- return by helicopter from DF, PR to airstrip by 2:00 PM
- 2:00-2:30 PM have lunch at airstrip with everyone together
- 2:30-3:30 PM return flight to Arviat, drop off HN, MK, JC at airport
- 4:00-5:00 PM fly from Arviat to Rankin Inlet
- overnight at Discovery Lodge

2.3 Sunday, July 25, 1999

- stay in Rankin Inlet, waiting for return flight on Monday
- work on field notes and report

2.4 Monday, July 26, 1999

- return flight to Calgary via Yellowknife and Edmonton, DF, PR stay in Yellowknife

3 Observations

Upon arrival over the site, the pilot circled over the minesite area to give everyone an overall view of the layout and extent of the facilities. After landing and meeting the representatives from Homestake, Sharon Meyer gave everyone a briefing on the minesite and reclamation work done to date. Appendix A contains photographs taken during the site visit.

3.1 Background Data

The following data was supplied by the Board from a property summary prepared by DIAND in 1994 as well as other information sources available from NWT Energy, Mines and Petroleum Resources.

Cullaton Lake is a former underground gold producer located at longitude 61° 16' N and 98° 30'W, about 230 km west of Arviat, NT and 360 km north of Churchill, Manitoba. The deposit is located in two zones. The Cullaton Lake or "B" zone is a sedimentary exhalite deposit with the gold hosted by sulfide facies iron formation in Henik Group greywacke, argillites and lava. The principal mineralogy of this deposit consists of pyrrhotite, pyrite, minor arsenopyrite, chalcopyrite and gangue minerals magnetite, siderite, iron silicates, chert and ankerite.

The Shear Lake zone consists of sheared orthoquartzites of the Hurwitz Group, with the gold associated with pyrite. The pyrite is altered to iron oxides above the 100 m level in the mine. The Shear lake zone is located about 5 km north of the B-Zone and 2 km south of the airstrip.

Mine development began in 1975 with initial underground exploration of the B-Zone. Mining of the B-Zone took place between 1981-1985. Between 1982-1983 initial underground exploration of the Shear Lake zone was undertaken. Mining of the Shear Lake zone was done between 1984-1985.

Original mine reserves included 89,600 tons of probable ore grading 0.49 oz/ton at the B-Zone and 400,000 tonnes with 100,000 oz. Au at Shear Lake. A 330 tpd mill was constructed at the B-Zone in 1981, which processed about 341 tpd by August, 1983. The mill waste is deposited into two tailings ponds. Tailings Pond 1 contains the mill waste and Tailings Pond 2 provides supplementary retention for tailings water and assists in cyanide degradation. Shear Zone tailings comprise about 60% of the tailings. A total of 373,380 tonnes of tailings were deposited in Tailings Pond 1, which are now covered by till and water. *

* **Note:** Ore grades and tonnages are given as quoted from other sources. No attempt was made to convert to a consistent set of units to avoid misrepresentation.

Since 1985, the minesite has been undergoing an abandonment and reclamation program. Homestake acquired the property from Corona in 1993 as part of a larger property transfer. Since the property contains no further economical reserves, Homestake wishes to complete the restoration and abandonment under the provisions of the new Licence.

Mitigative measures to date include:

- construction of a spillway in Tailings Pond 1 to control the water level and maintain the tailings below water level
- covering of exposed tailings in Tailings Pond 1 with natural till soil (1.4 m over the B-Zone tailings and 0.5 m over the rest) to inhibit access of water and oxygen as well as raise the summer level of the permafrost to permanently freeze the tailings
- spilled tailings outside of Tailings Pond 1 were cleaned up and placed under till cover in Tailings Pond 1
- waste rock was used to block off mine entrances, cover tailings pond, strengthen tailings dikes or generally stabilize structures and drainage channels
- demolition of the mill and other surface structures with waste placed in quarry area located south of Tailings Pond 1
- trimming of about 1.5 m off the crest of the dike around Tailings Pond 1 and lowering of the water level by 6" to 1' (150-300 mm) to maintain 1 m of freeboard and still provide sufficient water cover over the tailings
- clean-up and removal of remaining surface structures and equipment at the mine camp located at Shear Lake and at the airstrip.

SM mentioned that water quality monitoring has shown that the water in Tailings Pond 1 and 2 has not exceeded allowable limits during the current licence period and that coming to the site to conduct this monitoring is an expensive burden on the company. Therefore she has recommended that in the new Licence, the monitoring be suspended as part of the abandonment process.

3.2 Inspection of Landfill Site

DG, JP, MK and HH were flown south by helicopter from the airstrip, to the south end of Tailings Pond 2. JP and DG briefly exited the helicopter to take a water quality sample and there was no foot traverse done at this location.

The helicopter then flew to the south end of Tailings Pond 1 where all passengers were dropped off to conduct a foot traverse of the landfill, Tailings Pond 1 dike and disposal area and the mill site. The helicopter then returned to the airstrip to ferry the other participants to other locations at the minesite.

The landfill is located in a quarry located to the south of Tailings Pond 1. The quarry was used by the mine to provide supplementary rockfill for construction. Demolition debris from the minesite is buried in the quarry and covered with till. The east portion of the quarry is filled with water to a depth of about 3 m. Along the shoreline, rockfill has been placed as erosion protection for the till covering. However, due to the large voids left when the construction debris was placed, the till covering has settled or collapsed, exposing pieces of metallic debris, especially along the shoreline.

The voids in the landfill material may result in additional areas of settlement and collapse, particularly along the shoreline area. These areas pose a man-made hazard for future use of the site and should be repaired. Additional rockfill should be placed along the shoreline area to provide sufficient cover over the exposed areas and to accommodate future settlements until the till cover has become stabilized.

3.3 Tailings Pond 1

3.3.1 Dike

The tailings dike was traversed on foot from the south to the north. During this time JP was taking water quality samples at the sampling stations and DG was taking notes on the dike condition as part of the annual inspection.

The top 1.5 m of the dike had been removed for site contouring purposes in 1994. The exposed top of the dike is composed of a well graded compacted sand-gravel-cobble mix, with the maximum grain size of about 30 cm and most of the material being gravel sized or less. The materials consist mainly of blasted rock, predominantly the orthoquartzite member of the host rocks. The material which

was taken off the crest appeared to have been spread over the downstream slope of the dike, thus widening the crest to about 10-12 m and flattening the downstream slope. The upstream slope was irregular and scalloped due to wave action and partially covered with waste rockfill for erosion protection. The crest appears to be free of any obvious cracks and settled areas.

A zone of seepage was noted near the south abutment, consisting of an area of ponded water about 6-7 m across at the downstream toe of the dike. At this point the dike is about 4 m high and has a flat downstream slope, estimated to be at about 5H:1V. There is no sign of active seepage and the water appears to be clear. The ponded water is one of the water quality monitoring stations.

According to DG and JP there is some debate as to whether this water is in fact seepage through the dike. To be on the safe side, Homestake has been taking water quality samples to check if there are any contaminants present related to the tailings disposal. None have been found. As part of the final site abandonment, it is recommended that this area be blanketed with a free draining sand and gravel filter covered with rockfill to a depth of at least 1m to prevent any possibility of degradation due to seepage effects in the future.

The spillway breach through the dike consists of a 5 m wide by 1 m deep channel cut through the crest of the dike. In 1994, the water level in Tailings Pond 1 was lowered by 150-300 mm. The spillway was cut to maintain about 1 m of freeboard. The base of the spillway cut has been lined with a High Density Polyethylene (HDPE) liner and covered with rockfill. At the downstream end of the spillway, a small steel flow measuring weir was installed. According to JP and DG, flow through the spillway occurs only during the spring freshet and typically fills the channel to a depth of about 150 mm. Flow measurements by means of the weir are ineffective because most of the flow bypasses under or around the weir, through the rockfill.

The HDPE liner under the weir has also been disturbed by water flows and should be repaired. The HDPE liner is also partially exposed near the upstream end of the spillway. The liner appears to have been placed directly on the underlying rockfill with no sandy cushion to prevent punctures. For the long term performance of the spillway, it is recommended that this area be repaired.

A small amount of gulleying has occurred where the spillway discharges along the downstream slope of the dike. A stilling basin area has been excavated beyond the downstream toe, which holds the water prior to seeping or flowing toward the holding area in tailings Pond 2 to the east.

There is a concern about the reduction in the height of the dike by 1.5 m. Without further details on how the dike was constructed, the main concern is the lack of frost protection for the dike. Since there is only 1 m of freeboard, and the depth of the active zone at this site is likely to be at least 1.2-1.5 m, the water seeping through the dike will be subject to seasonal freezing effects. The formation and collapse of ice lenses in the dike embankment may lead to long term degradation of the structure. It would be helpful to ask Homestake for any technical documentation such as drawings and reports which describe the design and construction of the dike and the technical basis behind the trimming of the crest.

JP pointed out that the tailings were being re-suspended by wave action, resulting in a migrating zone of flocculated tailings, which may be washed out of the tailings pond area during the spring freshet.

Wind induced waves in tailings ponds with shallow water covers (<2 m) can re-suspend tailings and increase oxygen transfer, especially if breaking waves occur. The re-suspended tailings may become oxidized and release metals and acidity more than the tailings at rest.

The suspended tailings driven by wind and wave action may spill outside the tailings containment area during the spring melt. It is important therefore to check the water balance for the tailings pond to make sure that the existing water levels will be maintained for the long term and that excessive spillway discharges do not occur which could erode the dike, or result in more tailings outside the diked area. The chemistry of the suspended tailings should also be checked to evaluate the impact of minor releases. Water quality monitoring should also be done of the spillway discharge during the spring freshet flow period.

Near the north end of the dike, the crest width increases to about 21 m. In this area, patches of bluish greened stained ground (see photos) were noted on the downstream slope of the dike. SM of Homestake took samples of this material for analysis.

Homestake should report to the Board as to results of the analysis of this material and recommendations for clean up.

3.3.2 Above Ground Covered Tailings Area

The above water portion of the tailings are found in the north and west sides of the tailings pond. These have been covered with till and have been monitored with piezometers and thermistors since 1994 to check on the development of permafrost.

The covered area looks level with no anomalous settled or heaved areas. A small beach along the edge of the covered area shows there is about 1 m of till cover over the tailings (see photo).

The temperature data for the thermistors and piezometric data should be included with the annual geotechnical inspection carried out by Trow, which should be sent to the Board. I would like to see the latest set of readings as well as copies of the previous inspection reports.

3.4 B-Zone Mill Area

Some fuel storage tanks and concrete building foundations remain at the millsite area. Pallets of drill core are stacked on one of the concrete pads. The surrounding terrain has been mostly leveled and is covered with blasted rockfill and sand and gravel road topping. There were no geotechnical concerns discussed with respect to this area.

3.5 Shear Lake Zone

Bunkhouse/office trailers and miscellaneous equipment which is being dismantled for offsite transport remain at the Shear Lake site. The portal to the underground mine workings has been backfilled and covered with rockfill. Waste rock dumps exist along the shoreline of Shear Lake and along the east side of the site along the road to the airstrip. The waste rock is composed mainly of the sheared orthoquartzite rock unit which contains oxidized pyrite, giving it a rusty colour. According to SM, there is no acid producing potential associated with this rock.

4 Conclusions and Recommendations

On the whole, minesite reclamation appears to be proceeding in a manner leading to complete site abandonment in the near future. From a geotechnical perspective the following issues were raised:

- *concerns about voids and exposure of demolition debris in the quarry area landfill*
- *assessment and treatment of seepage zone near south abutment of Tailings Pond 1 dike*
- *check geomembrane liner in base of spillway and repair base and cover as required*
- *assessment of impacts of reducing Tailings Pond 1 dike crest elevation by 1.5 m*
- *check chemistry of suspended tailings and water being spilled from spillway during spring freshet to assess potential impacts*
- *confirmation of water balance for Tailings Dike 1 to ensure minimum water cover over tailings and to prevent excessive erosion of spillway*
- *Homestake to forward results of analysis of blue-green stained soil at north end of Tailings Pond 1 dike to the Board with recommendations for clean up (if required).*

In addition to the above concerns, the following documentation is requested:

- Drawings and documents related to the design and construction of the tailings dikes, particularly Tailings Pond 1 dike.
- Copies of geotechnical inspection reports
- Thermistor and piezometric data for covered tailings area in Tailings Pond 1
- Any data related to the lowering of the dike crest by 1.5 m.

Respectfully submitted,

Holger Hartmaier, P.Eng., M.Eng.,
Consultant Geotechnical Engineer

Appendix A

Cullaton Lake Site Visit

July 24, 1999

Site Photos

Departing from Arviat with charter aircraft from Skyward Aviation Ltd.,
To Cullaton Lake.

View of Cullaton Lake site from northeast; Airstrip in foreground,
Shear Lake zone to left of centre.

View of Shear Lake Zone, looking east.

View looking southeast towards Tailings Ponds #l and #2.

View of mill, site and Tailings Pond #l (centre above road) and Tailings Pond #2 (on left), looking SE.

Looking NW over project site. Tailings Pond #2, in foreground, Tailings Pond #l to left of centre, road to Shear Lake and airstrip in background, right of centre.

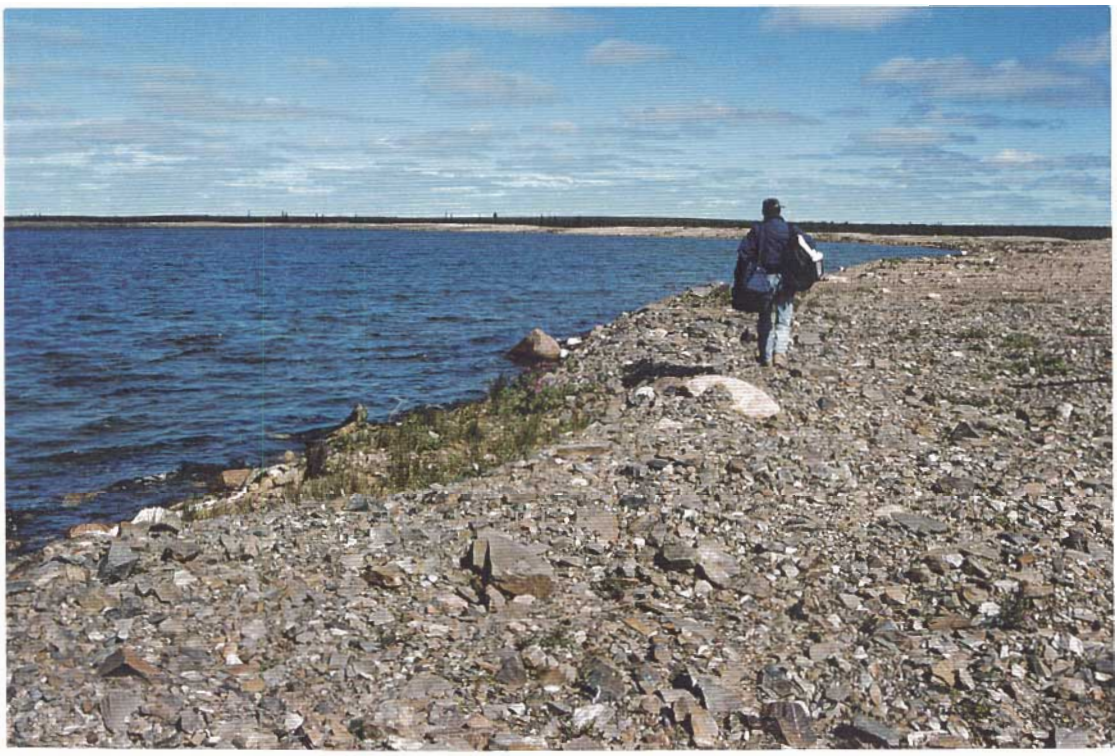
Looking west across Tailings Pond #2 (foreground) and #l, background.
Road to Shear Lake Zone/airstrip to right.

Looking west towards Shear Lake and airstrip.

Quarry site, located south east of Tailings Pond #l. Used for disposal of demolition debris from mine and mill buildings. Covered with till. Rockfill along shoreline.

Collapse of till cover over demolition debris along west shoreline of Quarry.

Protruding pieces of metal demolition debris buried in landfill area in quarry.



Southern end of tailings dike, between quarry area and Tailings Pond #1.

Tailings pond #l, looking north from south end. Distant shoreline contains tailings above water line, capped by till.

South abutment of dike of Tailings Pond #l, upper 1.5m of dike has been removed for contouring.

Seepage zone through #l tailings dike near south abutment. Water sampling point.

Taking water quality sample from Tailings Pond #l.

Spillway breach in #l Tailings Pond dike – approximately 1m deep below crest level. Partially exposed HDPE liner on right.

Flow measurement weir at downstream end of spillway breach. Normal spring freshet flow is up to 6" (150mm) depth in channel. Most of the flow by-passes the weir through rockfill underneath. Note disturbed geomembrane liner.

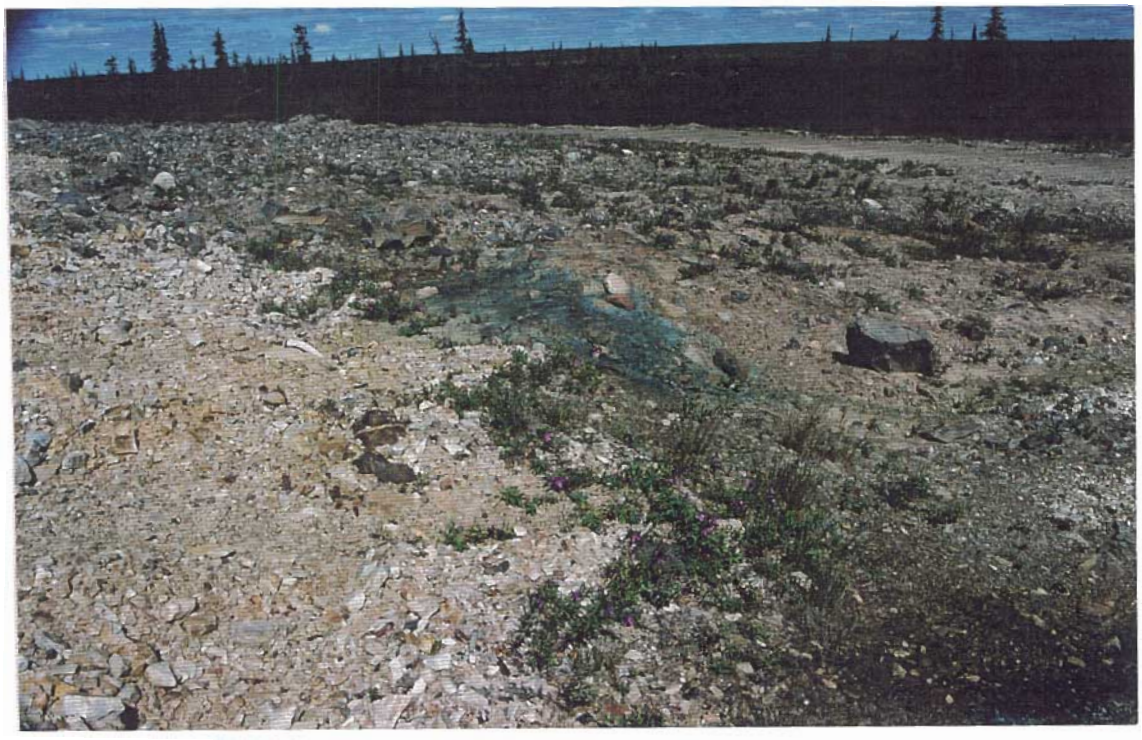
View of spillway looking upstream from downstream side of dike.

Excavated stilling basin area at downstream toe of spillway. Water sampling point.

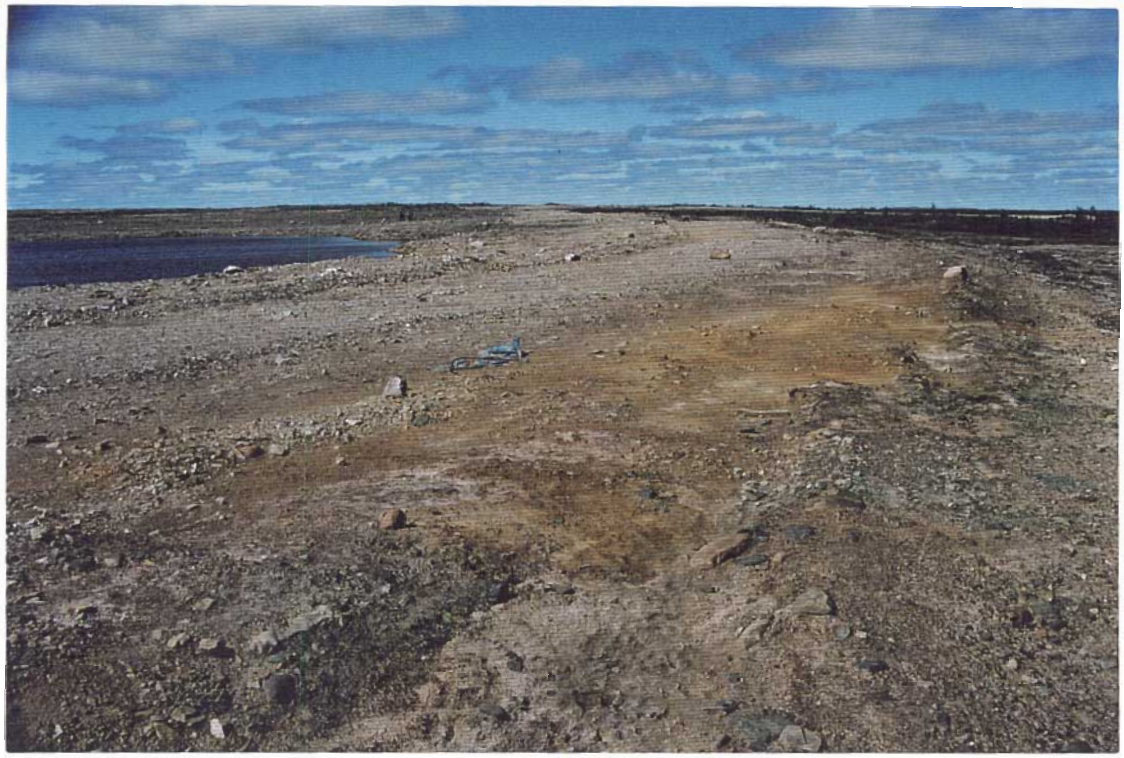
View of Tailings Pond #2 (Polishing Pond) from spillway area.

Flocculated tailings in suspension due to wind and wave action forming shallows in Tailings Pond #l near spillway. These materials have potential to spill out during annual freshet.

Blue stained area along downstream side of tailings dike on north side.



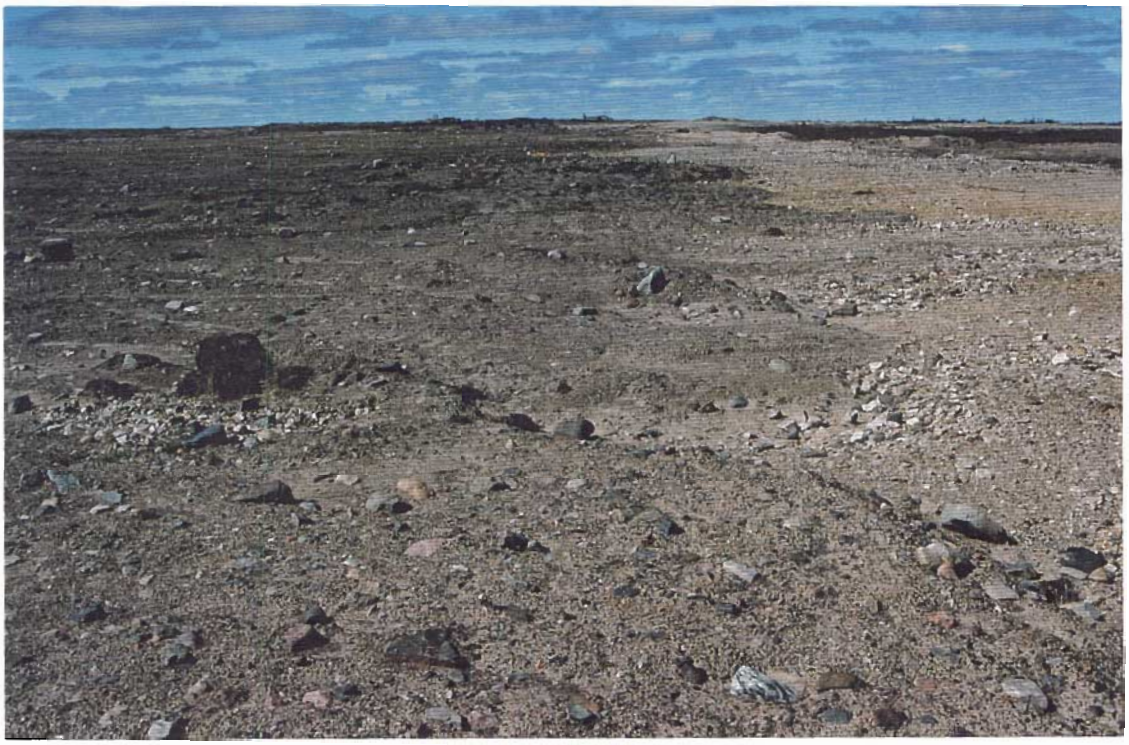
Patches of blue stained ground along north side of tailings dike.



Area of oxidized sulphide bearing waste rock and blue stained patches on north side of Tailings Pond #l.

Looking south along tailings dike, from water end. Blue stained areas and oxidized sulphides are on left.

Consistency of typical materials exposed in crest of tailings dike.
Mainly quartzite rockfill – well graded from about 30cm to sand size.



Extension of tailings dike to west. Helicopter is parked at mill site.
Till covered tailings area on left.

Till covered tailings area. Black pipes visible in background contain piezometers and thermistors.

West shoreline of tailings pond #l, small area of exposed tailings on beach, covered by till and rock fill.

Looking east across Tailings Pond #1 towards dike with spillway breach just left of centre of photo.

Taking measurements from thermistor in covered tailings section.

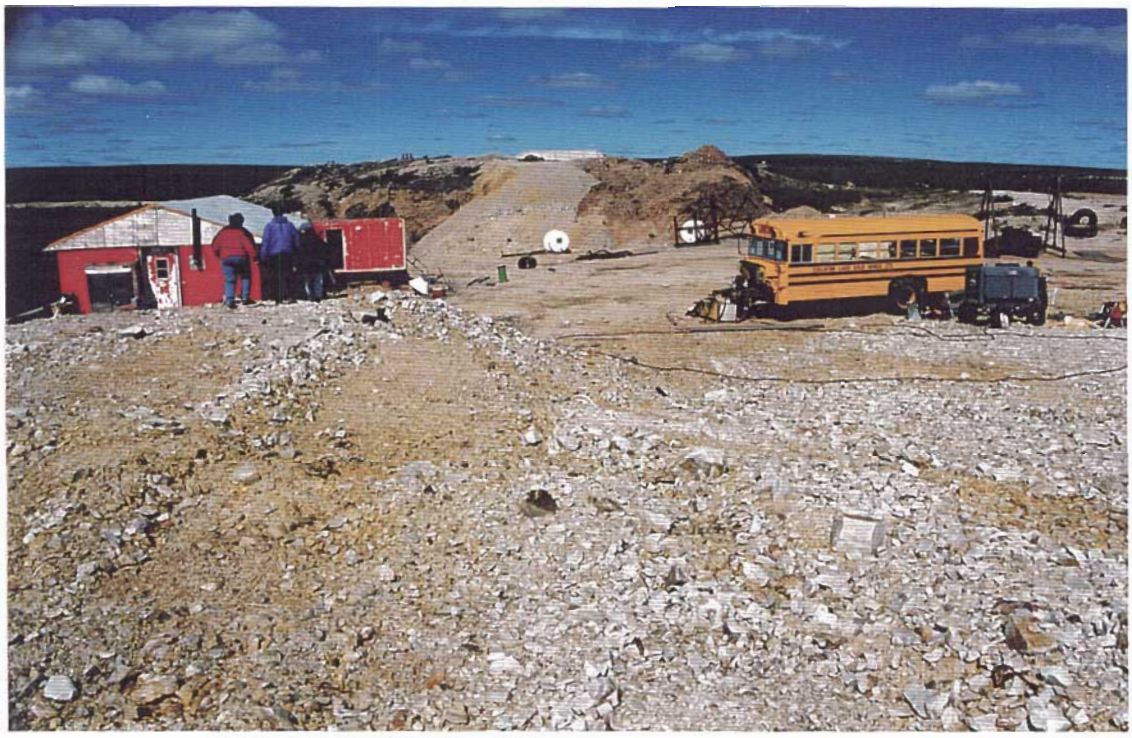
Looking southeast from mill site towards Tailings Pond #l. Drill core is stacked on old concrete foundation on left. Covered tailings area in background.

Tanks and concrete footings at mill site.

Looking southwest over mill site area.

Shear Lake Zone – portal area covered with waste rock.

Shear Lake area – camp buildings and miscellaneous equipment.



Shear Lake area – looking north over camp buildings and portal.