

July 30, 2015

ISSUED FOR USE
OUR FILE: W14103577-01

Government of Yukon
Department of Energy, Mines and Resources
Box 2703
Whitehorse, Yukon Y1A 2C6

Attention: Ms. Josée Perron, P.Eng.
Senior Project Manager, Assessment and Abandoned Mines

Subject: June 2015 Geotechnical Inspection of Earth Structures
Mount Nansen Site, YT.

1.0 INTRODUCTION

As requested, Tetra Tech EBA Inc. (EBA) has completed a geotechnical inspection of the earth structures located at the abandoned Mount Nansen mine site west of Carmacks, YT. The intent of the inspection was to provide a geotechnical engineering report on the stability of the tailings, water-retaining, and water diversion structures as part of the on-going care and maintenance program. The format and content of the inspection generally conforms to that recommended in the Canadian Dam Association's (CDA) *Dam Safety Guidelines* (2007). Similar inspections have been completed by EBA in the past. The scope of work for this study was to include two site inspections in 2015 (one near freshet in the spring (June), and one just before freeze-up in the fall (September)) per EBA's proposal dated April 27, 2015. The work was subsequently authorized under Contract C00028549 on May 6/15. This letter presents an interim report based on the June inspection, which will be combined with the September inspection to prepare the Annual Geotechnical Inspection Report.

2.0 OBSERVATIONS AND RECOMMENDATIONS

Mr. Richard Trimble, P.Eng. of EBA's Whitehorse Office completed a one-day inspection on June 11, 2015 in the company of Jeff Moore and Luca Poloni from the Yukon Government, Assessment and Abandoned Mines (YG-AAM). The structures examined were:

- North Interceptor Ditch/Dome Creek Diversion Ditch/Emergency Spillway
- Tailings Dam
- Seepage Collection Dam

Specific observations and recommendations are presented in the following sections of this letter, including selected photos. Other photos taken are available for review in EBA's files. Prior to the site visit, a site specific Health and Safety Plan was prepared and submitted to YG-AAM to forward to the site maintenance personnel, followed by the completion of onsite safety orientation and testing prior to accessing the site(s).

2.1 NORTH INTERCEPTOR DITCH/DOME CREEK DIVERSION/EMERGENCY SPILLWAY

2.1.1 Interceptor Ditch

The ditches above and around the tailings pond, connecting to the emergency spillway are intended to keep runoff water out of the tailings area, and were generally in a better condition than observed in previous years.

The effects of ice excavation and cleanout to keep the ditch flowing over the previous winter were evident, as was recent maintenance completed by the site contractor. See Photos below.

The primary concern with these ditches is the effects of erosion on the toes of the banks – this will have to be monitored and corrective actions taken after spring freshet or after large rainfall/runoff events. These corrective actions might include flattening the slopes to 1.5:1 and possible riprap placement at the toe of the slope if over-steepening occurs.



Photo 1:

Stable ditch slopes just south of Dome Creek intersection, looking downstream (June 11/15)

For all maintenance activities, care should be taken to maintain the width of the access road to be at least 6 m in this area. The excavated material from the upstream side could be re-used as fill on the downstream side to maintain the road width.

Erosion gullies from water entering the interceptor ditch were in the same condition as previous years and should continue to be monitored. These small erosion gullies are significant contributors to sand and silt deposits in the diversion ditch. Riprap has been placed at all these gullies, as previously recommended (see Photo 2). This hasn't been entirely effective in minimizing sand migration into the ditch, but does provide some stability to the sideslopes at these locations. A complete sand/silt barrier at these locations would require additional annual maintenance to clean out materials on the other side of the ditch, which is not considered necessary at this time.



Photo 2:

Armouring to minimize sand deposition from contributory gullies into channel bottom upstream of Dome Creek intersection looking west (June 11/15)

2.1.2 Diversion Ditch

The diversion ditch was in an acceptable and stable condition – no work is required at this time other than regular maintenance to remove silt/sand in the spring and fall of each year, as required to maintain flow and sideslope stability. Photo 3 shows the typical condition of the diversion ditch.



Photo 3: Typical condition of the Dome Creek diversion ditch looking upstream (June 11/15)

2.1.3 Combined Diversion Ditch and Emergency Spillway

The emergency spillway was in an acceptable and stable condition following repairs to several deficiencies that were identified during the inspection in the fall of 2014.

One “velocity check” requires the addition of several boulders to maintain its effectiveness during periods of high flow. Photo 4 shows this area. It is understood that this work was completed shortly after the site visit, and will be reported by the author during the fall 2015 inspection.



Photo 4:

Velocity check just below bridge requires the addition of several large boulders (in channel at centre of photo) to maintain its effectiveness during periods of high flow – looking north (June 11/15).

2.2 TAILINGS DAM

The water level in the tailings pond was well below the maximum operating level elevation, and lower than has been noted in previous years. The dam itself is considered to be in a stable condition with a large upstream tailings beach. No evidence of previously noted instabilities or seepage on the north abutment was observed, and there were no signs of significant erosion or permafrost thaw features that could affect stability. The surface of the dam was flattened in 2014, and this has assisted in visual monitoring. Vegetation has been adequately removed from all locations noted in previous inspections.



Photo 5:

View to the south along centerline of tailings dam (June 11/15)

The water in the pond was recorded at 1.07 m on the installed staff gauge(s) which corresponds to an elevation of 1095.20 m (per June 2015 elevation survey completed by YG-AAM). This places the water at about 2.60 m below the design “pond operating level” of 1097.80 m. With respect to geotechnical stability, low water levels are always good to see.

2.3 SEEPAGE COLLECTION DAM

The water in the seepage collection pond was recorded at a level of 0.19 m on the staff gauge, and the pumping rate was 161 L/min at the time of the inspection. This pond elevation is close to the usual operating level of the pond over the past year, and according to the onsite maintenance personnel, it is necessary to pump at varying rates over the year to keep it at about this level. The corresponding elevation for the staff gauge reading is about 1077.09 m (per June 2015 elevation survey completed by YG-AAM) or about 1.01 m below the design operating level of 1078.10 m. Photo 6 shows the berm and edge of the pond at the time of the inspection.



Photo 6:

View of Seepage Collection Pond berm, looking north (June 11/15).

The three minor seeps that have been noted in previous years on the downstream face of the dam were observed as primarily wet spots on the ground surface, rather than actual seeps with flowing water. The other seeps flowing into the dam from the north abutment were also still observed, with similar volumes of clear water flowing – this is not a cause for concern. The two seeps from the base of the riprap on the upstream side of the pond were also observed this year, similar to previous years. The seepage water was clear, so no cause for concern.

The ground squirrel holes and burrows along the dam crest that were noted in previous years have been filled in, and it is understood that techniques used by Orkin Canada have been effective in mitigating the ground squirrel issues at this location.

All woody vegetation, including roots, has been removed from the crest of the dam and the upstream face, and within the top 5 m of the downstream face as noted in previous inspection reports.

No stability concerns are noted as a result of this pond inspection.

3.0 SUMMARY OF RECOMMENDATIONS

The following Table has been prepared to summarize the recommendations from the current geotechnical inspection. This table will be updated annually, with items noted as “completed” being removed from subsequent versions of the Table, and the others carried forward, if still applicable.

Table 1: Summary and Status of Maintenance Items from 2013 and June 2014 Geotechnical Inspections

| Item Description | Recommended Maintenance | Status |
|---|---|---------------------|
| <u>From 2014 Report</u> | | |
| North Interceptor, Diversion Ditch and Emergency Spillway | Monitor the condition of bank sideslopes on a regular basis, and if undercut/over-steepened by erosion, then either repair or provide armour consisting of non-woven geotextile and riprap. | Continue Monitoring |
| Tailings Dam | Continue to visually monitor permafrost thaw settlement on the downstream face near the south abutment. | Continue Monitoring |
| Seepage Collection Dam | Monitor seepage zones from toe of tailings dam and from base of north terrace. If water becomes silty, notify a geotechnical engineer immediately. | On-going |
| | Continue to record pumping rates from seepage collection pond, and notify a geotechnical engineer if the rates significantly increase to maintain a constant water pond elevation. | On-going |
| | Remove/relocate ground squirrels and backfill their burrows/nests to minimize potential for liner damage or the creation of seepage channels. | Completed |
| | Remove woody vegetation, including roots, from the crest and upstream face, and on the downstream face for a distance of 5 m from the crest as measured on the face. | Completed |

| Item Description | Recommended Maintenance | Status |
|---|--|-------------------------|
| <u>June 2015 Recommendations</u> | | |
| North Interceptor, Diversion Ditch and Emergency Spillway | Repair first “velocity check” below the bridge by adding several large riprap boulders to the centre of the channel. | To be completed in 2015 |
| Tailings Dam | No work required. | n/a |
| Seepage Collection Dam | Monitor seepage zones from below riprap at toe of tailings dam, from base of north terrace, and at the three previously identified locations on the downstream face of the dam. If seepage volumes significantly increase from that observed, or if water becomes silty, notify a geotechnical engineer immediately. | On-going |
| | Continue to record pumping rates from seepage collection pond, and notify a geotechnical engineer if the rates significantly increase to maintain a constant water pond elevation. | On-going |

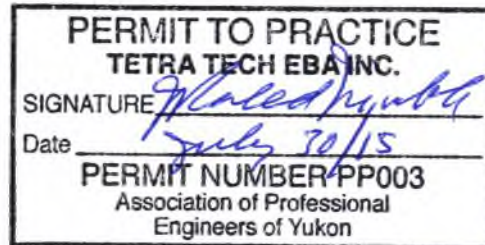
4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Government of Yukon, Energy Mines and Resources and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Government of Yukon, Energy Mines and Resources or for any Project other than the site described herein. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in the attached General Conditions.

5.0 CLOSURE

We trust this report meets your present requirements. The inspections reported herein are specifically related to geotechnical observations completed by the author regarding the north interceptor ditch/Dome Creek diversion/emergency spillway, tailings pond, and seepage collection pond at the time of the inspections. Should geotechnical stability issues be noted by site personnel during other routine inspections, EBA should be notified as these observations may affect the conclusions presented in this report. Should you have any questions or comments, or require any additional information, please contact the undersigned.

Sincerely,
Tetra Tech EBA Inc.



J. Richard Trimble, P.Eng., FEC
Principal Consultant, Arctic Region
Direct Line: 867.668.9216
Email: richard.trimble@tetrattech.com