



A TETRA TECH COMPANY

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

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

Subject: 2012 Geotechnical Inspection of Earth Structures
Mount Nansen Site, YT.

1.0 INTRODUCTION

As requested, EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company (EBA) has completed a geotechnical inspection of the current condition of the earth structures located at the abandoned Mount Nansen 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 recommended in the Canadian Dam Association's (CDA) Dam Safety Guidelines (2007). Similar inspections have been completed by EBA in the past, and EBA conducted a Dam Safety Assessment in 2002. The scope of work also includes a review and report summarizing recently collected ground temperature and piezometer instrumentation data – this report will be submitted as a separate document in March 2013.

2.0 OBSERVATIONS AND RECOMMENDATIONS

Two inspection trips were to be completed to the site – one in the spring of 2012 and one in the fall, for the purposes of examining the site under different water flow conditions.

Mr. Richard Trimble, P.Eng. of EBA's Whitehorse Office completed one-day inspections on both June 1 and October 1, 2012. The structures examined were:

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

The June inspection was completed just after the spring freshet, although there was still some snow and ice visible around the perimeter of the ponds and in the Dome Creek diversion. The water level in the tailings pond was also slightly higher as a result of the spring freshet. The October inspection was at a time of lower water in the tailings pond, but flows similar to that observed in June in the interceptor/ditch/spillway. A short duration snowstorm occurred at the time of the October inspection that obscured some of the surface features – this did not affect the observations and conclusions from the

trip, as the author is very familiar with the site. One advantage of the light snow covering was that it clearly showed the seepage locations into the seepage collection pond.

Specific observations and recommendations are presented in the following sections of this letter, and selected photos are attached. Other photos are also available for review in EBA’s files. The observations and recommendations presented relate to both the June and October inspections, unless specifically noted otherwise.

As previously noted, a separate report will be prepared and submitted for the review of the collected ground temperature and water level (piezometer) data.

2.1 NORTH INTERCEPTOR DITCH/DOME CREEK DIVERSION/EMERGENCY SPILLWAY

The ditches above and around the tailings pond, connecting to the emergency spillway were in similar conditions to previous years. In June, the effects of ice excavation and cleanout to keep the ditch flowing over the previous winter were evident – this included some oversteep sideslopes near Dome Creek, some areas of slower flow, and general siltation/sanding of the ditch bottom up to about the bridge. An email was sent to YG-AAM in June 2012 outlining these interim concerns, and in October, these items had been addressed by excavating the ditch bottom to make a uniform gradient, and flattening the sideslopes in the area previously identified. Photos 1 to 4, below, show before and after photos of these areas.



Photo 1: Oversteep ditch slope near Dome Creek (June 1/12)



Photo 2: Flattened slope near Dome Creek (YG Photo, October 2012)



Photo 3: Low flow in diversion ditch due to silt and sand deposits (June 1/12)



Photo 4: Cleaned out diversion ditch (October 1/12)

The pipes and supports noted in 2011 across the ditch and the mouth of the emergency spillway had been removed by October 2012, and the low areas in the access road along the interceptor ditch upstream of Dome Creek had been properly filled in. Erosion gullies from water entering the interceptor ditch were in the same condition as previous years.

The only concern with the reconstructed ditches will be the effects of erosion on the toes of the banks – this will have to be monitored and corrective actions taken (regular repair, possible riprap placement) if over-steepening occurs. The ditch sideslopes should be examined again after the 2013 spring runoff event.

2.2 TAILINGS DAM

The water level in the tailings pond was well below the maximum operating level elevation in both June and October, and the dam itself is considered to be in a stable condition (see Photo 5). 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. Minor surface thaw depressions previously observed on the south crest have not changed over the past several years.

Photo 5 shows the crest of the tailings dam on June 1, 2012, with no changes to stability observed in October 2012.



Photo 5: View to the south along crest of tailings dam (June 1/12)

There was one area of apparently increased (not observed in 2011) seepage noted at the toe of the dam, as shown in Photo 6.



Photo 6: View of seepage from toe of tailings dam, just above the seepage collection pond (June 1/12)

This seepage was rusty in colour with a “sheen” on the surface. This intermittent seepage has been noticed before, and is the reason for the large riprap placed at the toe in this location. This area should continue to be monitored, and the water sampled and tested for comparison to both the tailings pond water and Dome Creek to try and ascertain its source.

The following table presents that staff gauge readings and corresponding elevations (from EDI level survey) in August 2012.

Mount Nansen Staff Gauge Readings/Elevations		
Tailings Pond		
Design Operating Level: 1097.8 m		
Staff Gauge Reading	Geodetic Elevation (m)	Reading Date
0.65	1095.86	
0.66	1095.87	
0.67	1095.88	
0.68	1095.89	
0.69	1095.90	
0.70	1095.91	
0.71	1095.92	
0.72	1095.93	Aug.7/12
0.73	1095.94	Oct.1/12
0.74	1095.95	
0.75	1095.96	
0.76	1095.97	
0.77	1095.98	
0.78	1095.99	
0.79	1096.00	

2.1 SEEPAGE COLLECTION DAM

The water level in the seepage collection pond was also below the design elevation, and the dam was noted to be in a stable condition. Several seepage zones were observed on the downstream toe, similar to previous years. These are intermittent seepages that have been noted sporadically over the years, and not considered to significantly affect dam stability.

Mount Nansen Staff Gauge Readings/Elevations		
Seepage Collection Pond		
Design Operating Level: 1078.1 m		
Staff Gauge	Geodetic	
Reading	Elevation (m)	Reading Date
0.28	1077.29	
0.29	1077.30	
0.30	1077.31	
0.31	1077.32	Oct.1/12
0.32	1077.33	
0.33	1077.34	Aug.7/12
0.34	1077.35	
0.35	1077.36	
0.36	1077.37	
0.37	1077.38	
0.38	1077.39	
0.39	1077.40	
0.40	1077.41	
0.41	1077.42	
0.42	1077.43	



Photo 7: Seepage noted in approximately the centre of downstream face of seepage collection dam (barrel was used as a marker) June 1/12.

In the summer of 2012, YG-AAM personnel noted an increase in seepage from the toe of the sand terrace on the north side of the seepage collection pond. The water was clear and free of sediment. During the October 1/12 inspection, the recent and light snowfall provided an opportunity to view the seepage coming from this slope – it was not concentrated in one spot, but was originating from the entire toe (see Photo 8).

It is recommended that seepage from this side of the pond be examined at least weekly to look for signs of increased or decreased flow, and to verify that the seepage water remains clear of silt and fine grained sand. Record photos from the same location should be taken about once a month during unfrozen conditions.



Photo 8: Seepage observed from base of sand terrace at north slope of seepage collection pond on October 1/12.

3.0 SUMMARY OF RECOMMENDATIONS

The following Table has been prepared to summarize the recommendations from the annual 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.

Appendix A contains a copy of an email sent to YG-AAM shortly after the June 1/12 inspection. The items that could be completed were subsequently addressed by YG-AAM prior to the October 1/12 inspection.

Table 1: Summary and Status of Maintenance Items from 2011 and 2012 Annual Geotechnical Inspections

Item Description	Recommended Maintenance	Status
From 2011 Report		
North Interceptor, Diversion Ditch and Emergency Spillway	Remove pipeline and wooden supports near spillway inlet.	Completed
	Clean out the sand deposits in the upper and central portion of the ditch on an annual basis. If a permanent solution is required, then armour the sides and base with non-woven geotextile and suitably sized riprap.	Continue Monitoring
	Remove the abandoned pipeline and wooden supports from the diversion ditch (1) just downstream of Dome Creek, (2) upstream of the bridge, as well as (3) over the entrance to the spillway to avoid potential future flow disruptions.	Completed
Tailings Dam	Continue to monitor permafrost thaw settlement on the downstream face near the south abutment.	Continue Monitoring
	Consider conducting a review of the status of existing instrumentation in the dam – some of the cables are in “rough” shape and may need to be replaced (if they’re still necessary).	Completed
Seepage Collection Dam	Monitor erosion rills on the downstream side of the north abutment and repair by filling with riprap if they continue to enlarge.	Continue Monitoring

2012 Recommendations		
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 suitably sized riprap.	Continue Monitoring
Tailings Dam	Continue to visually monitor permafrost thaw settlement on the downstream face near the south abutment.	Continue Monitoring
	Monitor and possibly test seepage from toe of tailings dam immediately above seepage collection pond, to determine its origin.	Continue Monitoring
Seepage Collection Dam	Monitor seepage quantity and clarity of water from base of sand terrace to north of seepage collection pond,	Continue Monitoring
	Monitor seepage zones on downstream face of dam	Continue Monitoring
	Continue to collect pumping data, with periodic calibration checks using the “time to fill a 20 L pail method”.	Continue Monitoring

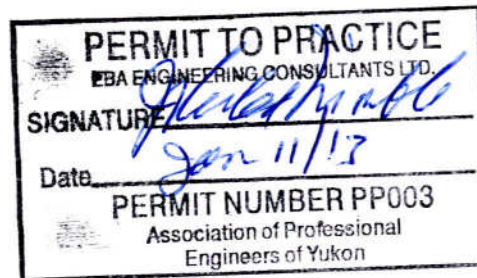
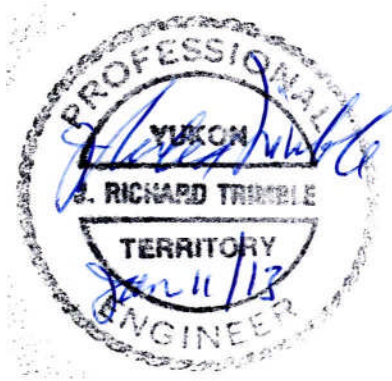
4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Government of Yukon, Energy Mines and Resources and their agents. EBA, A Tetra Tech Company, 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, please contact the undersigned.

Sincerely,
EBA, A Tetra Tech Company



J. Richard Trimble, P.Eng., FEC
Principal Consultant, Arctic Region
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Attachment: EBA General Conditions

APPENDIX A

Email sent from Richard Trimble to Josée Perron and Jeff Moore, June 7/12 – this summarizes the observations from the June 1/12 inspection. These items were subsequently addressed by YG-AAM.

Josée;

As you're aware, I completed the "spring" geotechnical inspection on June 1/12 in the company of Jeff Moore. Although nothing critical was observed, there are a couple of items that probably need some attention before freeze-up:

1. Dome Creek diversion ditch – the excavation work this past winter has over-steepened the bank close to where Dome Creek enters (see attached photo 1192). This should be flattened to about 1.5:1 (H:V) and provided with some armouring at the toe so the bank doesn't get undercut any more over the summer.
2. Permafrost disturbance – several channels were inadvertently cut into the permafrost/natural soils this past winter to drain water (see photo 1199)– these should be "hand" backfilled with the excavated materials (replace organics on top) to minimize future disturbance to the terrain. Also consider doing something similar closer to Dome Creek where the hoe was working.....
3. Diversion ditch clean-out --- there were some rumours on site about cleaning the silt/sand from the base of the ditch to provide more volume in anticipation of another winter's glaciation. The water seems to be flowing pretty good right now, and I would like to suggest that ditch cleanout is not required at this time. Once you start lowering the grade in one spot, then you'll need to excavate upstream and downstream to keep the water flowing – this disturbance will silt up the creek further down. It's running clear now, so I would just leave it. In anticipation of next winter freeze-up, regular (daily) inspections should be completed after freeze-up – with ice excavation as necessary – to keep the water flowing.

I also still believe that there might be a "short circuit" from the Dome Creek diversion ditch to the seepage collection pond. It would be interesting to compare water chemistry from Dome Creek with the "iron rich" seep just above the seepage pond, and with the seepage pond water itself....

Please phone or email if you have any questions, or require more information.

All for now,
Richard

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Photo 1192



Photo 1199

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

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2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.