Government of Yukon

INSTRUMENTATION DATA REVIEW
TAILINGS AND SEEPAGE COLLECTION DAMS
MOUNT NANSEN MINE, CARMACKS, YT

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1.0 INTRODUCTION

As requested by Mr. Hugh Copland, P. Eng., of the Government of Yukon (Assessment and Abandoned Mines Branch), EBA Engineering Consultants Ltd. (EBA) has completed a review of the additional geotechnical data available from May 2004 to November 2005 for the Tailings Dam and the Seepage Collection Dam at the Mount Nansen mine site. Two data reviews have been completed to date. The first was an initial review of data available prior to November 2001, completed by EBA in conjunction with the Mount Nansen Tailings Dam Safety Evaluation for Water Resources Division, Department of Indian Affairs and Northern Development – Yukon Region in September 2002 (Mount Nansen Summary Data Report). The second review was completed in February 2004 which included the data prior to November 2001 with sporadic data collected between November 2001 and December 2003.

The additional data provided from 2004 and 2005 for the review presented herein was combined with the previously analyzed data. This additional data consists of infrequent readings of thermistors and piezometers on the site, and almost complete daily flowmeter readings. Pond # 1 water levels were also provided; however, the real world coordinates for the benchmark used for these readings are unknown.

The review of the data is contained in the following sections of this report and includes a discussion of the data quality, trends, and observations resulting from the data reviewed. Specific plots of the obtained data are presented as Figures in the Appendices of this report. Background information on the dam instrumentation and monitoring along with a summary of the instrumentation installed at the dams can be found in EBA's report 'Mount Nansen Summary Data Report' dated September 2002. General Conditions regarding the use and limitations of this report are also attached.

2.0 RECENT INSTRUMENTATION DATA

Figure 1 shows the location of all instruments referenced in this report.

2.1 THERMISTOR DATA

EBA has been provided with intermittent thermistor data obtained between May 2004 and November 2005 for this review. This data is limited to eight sets of readings. In order to evaluate this additional thermistor data, existing plots from the first two reviews of the ground temperature versus time for each thermistor string installation have been updated with this new data.

The completed ground temperature versus time plots are presented as Figures A-1 to A-11.

2.2 PIEZOMETER DATA

EBA has been provided with intermittent piezometer data obtained between May 2004 and November 2005 for this review. This data is limited to eight sets of readings. In order to evaluate this additional piezometric data, existing plots of the resulting phreatic elevations versus time for each of the installation locations have been updated as Figures B-1 to B-5. Where known, only the active (thawed) piezometers are shown on these plots. The

variation of pond elevation with time, when available, has also been plotted on each of these Figures to allow a comparison between pond fluctuations and piezometer response.

2.3 POND LEVEL

Water level elevations within Pond # 1 (Tailings Pond) were recorded at varying intervals up to 2003 with a benchmark with a known elevation. These elevations with time are presented on Figures B-1 to B-5. Pond level readings taken in 2004 and 2005 include eight readings referenced to a staff gauge of unknown elevation and water level logger data recorded from June 2005 to Oct 4, 2005. The logger data was referenced to a nail on a power pole close to the data logger which has an unknown elevation. Therefore, the 2004 and 2005 data is unusable until the real world elevations of the staff gauge and reference nail are known.

It should be noted however that YTG personnel indicate that Tailings Pond # 1 was at its lowest level ever in November 2005.

2.4 SEEPAGE DATA

Daily flowmeter data has been provided from April 2004 to November 2005, with the exception of October and November 2004. Seepage rates have been updated for this time period by determining the volume of effluent pumped back to the tailings impoundment from the seepage pond that lies below the impoundment at the Mount Nansen mine site. Table 1 presents a summary of the average seepage rates.

3.0 DATA EVALUATION

3.1 INSTRUMENTATION DATA REVIEW

A detailed discussion of the data trends and specific observations resulting from the data at each borehole is presented in the following sections. Due to the limited ground temperature and piezometric data available from the last two years, trends for each instrument are discussed in general terms.

3.1.1 Data Quality

In terms of the general quality of the data, review of the data plots indicates that some erroneous data readings and sets have been recorded over the monitoring period. For the thermistor data, these erroneous readings are clearly seen as data spikes indicating rapid ground temperature changes above or below the general trend of the data. These spikes are believed to have resulted from personnel not fully allowing the data recorders to equalize prior to recording information. It is also possible that the thermistor readout box was malfunctioning or incorrectly connected during the readings. The majority of data spikes have been eliminated from the presented plots. Overall, EBA believes that the thermistor beads are functioning properly and believes that the data sets minus the data spikes are reasonable, although some trends are difficult to interpret.

For the piezometric data, the same types of erroneous errors are also visible in the data records. The data spikes in the piezometric data are particularly visible earlier in the records

and likely resulted from incorrect measurement procedures. Another cause of erroneous data for the piezometers is that in some cases individual piezometers are frozen and as such the obtained data is not of value.

As previously indicated, the pond level readings for 2004 and 2005 are not referenced to real world coordinates; therefore, the data, though believed to be of good quality, is not useful at this time besides the fact that it shows decreasing levels.

3.1.2 Borehole 12861-01

Borehole # 12861-01 is located on the south side of the dam crest. Based on the original mapping of the dam site, the original ground elevation at the borehole location is estimated to be 1139 m ± 0.5 m. Drilling of the borehole indicated the fill/native ground interface was at a depth of 13.7 m (elevation 1137.7 m). This suggests the area was stripped on the order of 1.3 ± 0.5 m during construction. The low end of this range is more in keeping with the documented stripping depths indicated in Klohn's 1996 Construction Report.

3.1.2.1 Thermistor Data

The first two reviews of the thermistor data (data prior to December 2003) from this location, as shown in Figure A-1, indicated that the deeper two thermistor beads were continuously frozen over the period of monitoring. However, a gradual warming trend over time (a positive slope) was present in both beads and was in the order of 0.15°C to 0.3°C over the monitoring period. Ignoring data spikes present in the records, it appeared that the upper thermistor bead had generally been above 0°C for the first 4 years, although it was marginally frozen (warmer than –0.1°C) during the late summer and fall of 1998 and 2001. This bead then continued to be marginally frozen during late summer and fall of 2002 and 2003.

These trends continue to be shown in the 2004 to 2005 data. The bottom two beads continue to have a slight warming trend in the order of 0.02 °C to 0.05°C over the two-year period. The upper bead continues to have a freezing trend (a negative slope), which was in the order of –0.08°C over the monitoring period. The slight warming of the deeper two beads is likely the result of latent heat from the freezing ground conditions within the vicinity of the upper bead. The last set of readings on November 18, 2005 are suspect and believed to be erroneous.

It is believed that the depth to the 0°C isotherm, which was initially estimated to be near the fill and native soil interface, has extended slightly upward into the fill and may remain in the fill throughout the year. Temperature data throughout the year would be required to verify the location of the 0°C isotherm.

3.1.2.2 Piezometer Data

Based on the thermistor results, it is concluded that only the upper piezometer has been active over the course of monitoring. The variation of phreatic levels at this location is shown in Figure B-1. The first two reviews of the data indicated that the phreatic level increases throughout the months of May to September and then gradually declines from October to April. Comparison of the phreatic level changes to the pond level changes seemed consistent with the piezometric level fluctuating in a somewhat lagged manner behind the pond level fluctuations and that over the review period the piezometric level decreased as did the pond elevation.

The phreatic level follows the same trend through May to September for 2004 and 2005. The peak elevation in 2004 mimics that of 2003 but increases in 2005. Given the pond level was reported to be at the lowest level over the entire monitoring period, it is unclear as to why the phreatic surface increased in 2005. Considering the typical decline from October to April, this elevated level may decrease by the spring of 2006.

3.1.3 Borehole 12861-02

Borehole # 12861-02 is located on the dam crest roughly above the former channel of Dome Creek. It contains a nine bead thermistor string and three pneumatic piezometers. Based on the original mapping of the dam site, the original ground elevation at the borehole location is estimated to be 1132.7 m ± 0.5 m. Drilling of the borehole indicated a fill/native ground interface at an elevation of 1132.2 m. This suggests the area was stripped on the order of 0.5 m ± 0.5 m during construction.

3.1.3.1 Thermistor Data

The first two reviews of the thermistor data from this location, as shown in Figure A-2, indicated that the three thermistor beads that were placed above the fill/native soil interface, and the first bead that lies within the native foundation soils remained above 0°C over the period of monitoring and generally showed a decrease in temperature over that time. The final five thermistor beads in this borehole were all located in the frozen native sand underneath the organic soil and remained frozen over the course of monitoring. The sixth and eighth deepest bead malfunctioned as of April 2001.

These trends continue with the additional data set from 2004 and 2005. The upper three beads continue with a cooling trend throughout the reporting period while the first bead with the native soils appearing to maintain being marginally frozen (warmer than –0.1°C). The remaining three beads indicated a consistent frozen condition at a relatively consistent temperature.

The initial reviews of the data from this installation suggested that the 0°C isotherm was located between an elevation of 1131.2 m and 1130.8 m throughout 2001 and increased to approximately 1131.5 m between 2001 and 2003. This isotherm appears to be around 1131.7 m or roughly 0.5 m below the fill and native ground interface by the end of 2005.

3.1.3.2 Piezometer Data

The piezometric data from this location has been plotted in Figure B-2. Data from the top two piezometers have been included in the plot as the lowest of the piezometers (# 7711) is believed to be frozen. Comparison of the two piezometers shows the higher piezometer provides values that are up to 1.0 m greater that the lower instrument. This is to be expected based on the downward gradient of the phreatic surface. It is felt that the upper piezometer is likely representative of the phreatic levels within the dam structure.

The variation of piezometric levels with time appears to match the general pattern previously described for Borehole # 12861-01; however, the piezometric level is consistently lower than that of Borehole # 12861-01.

The phreatic level follows the same trend through May to September for 2004 and 2005. The peak elevation in 2004 mimics that of 2003 but increases in 2005. Again, as mentioned with the 12861-01 instrumentation, it is unclear as to why the phreatic surface increased in 2005, but may decrease by the spring of 2006.

3.1.4 Borehole 12861-03

Borehole # 12861-03, located on the dam crest, was aligned to penetrate into the native soils that formed the south facing slope above the Dome Creek channel. This borehole contains three pneumatic piezometers and three thermistor beads. The thermistor beads are not coupled to the piezometers.

The original mapping of the dam site suggested that the original ground elevation at this location would be approximately 1138.0 m ± 0.5 m. The depth of stripping below the original ground is not known but construction records suggest a range of 0.3 m to 0.6 m was typical for the dam foundation preparation. Therefore the fill/native soil interface was expected within a range of 1138.2 to 1136.9 m. Unfortunately, the drilling records from this borehole do not provide any evidence to delineate the actual interface between the fill sand and the native foundation sand.

3.1.4.1 Thermistor Data

Ground temperature data from this borehole is presented on Figure A-3. The three thermistor beads at this location are located near the crest of the dam and do not provide any information on the permafrost table position at this location, but reflect the effects of seasonal freezing and thawing.

The additional data follows the trends and values of the initial data presented in the first two reviews.

3.1.4.2 Piezometer Data

This borehole has three piezometers, two of which were placed above the permafrost level at the time of installation. The initial reviews of the data (prior to November 2001) from all three of the piezometers (see Figure B-3) suggested that the lower piezometer remained frozen. The phreatic level suggested by the two upper piezometers differed from each other in the order of 0.5 m with the upper piezometer consistently providing higher values.

The large decrease shown for the upper bead in the fall of 2001 until the summer of 2002, was believed to be erroneous.

Comparison of the phreatic level changes to the pond level changes seemed consistent with that originally evaluated, i.e., the piezometric level fluctuated in a somewhat lagged manner behind the pond level fluctuations and that over the review period the piezometric level decreased as did the pond elevation.

For the 2004 data, the upper two piezometers indicate roughly the same phreatic surface as that presented in 2003. The 2005 data for these piezometers shows the upper piezometers decreasing while the lower piezometers increased mimicking the results from 12861-01 and –02. For both 2004 and 2005, the lowest piezometers that were originally believed to be frozen showed values higher than the first two piezometers. No explanation is presented for this.

3.1.5 Borehole 12861-05

Borehole # 12861-05 is located on the south side of the toe berm. It was located to penetrate into the former north facing slope that lies above the Dome Creek channel and floodplain. The borehole contains three piezometers each coupled with a thermistor bead. The upper piezometer/thermistor lies just above the fill/native soil interface elevation and the lower two have been placed within the underlying native foundation sand.

Based on the original mapping of the dam site, the original ground elevation at the borehole location is estimated to be 1132.4 m ± 0.5 m. Construction records indicate stripping depths ranged from 0.3 m to 0.6 m. Drilling of the borehole had indicated the fill/native ground interface was at an elevation of 1132.4 m.

3.1.5.1 Thermistor Data

The initial two reviews of the thermistor data from this location, as shown in Figure A-4, indicated that the upper two thermistor beads were affected by seasonal temperature changes within the surrounding soil. The third thermistor bead at this location lies below the permafrost table and maintained a consistent temperature throughout the reporting period.

These trends continue with the additional data set from 2004 and 2005. The upper bead exhibits a higher peak temperature in both 2004 and 2005 than previously reported. The remaining bead maintained to be frozen and at a relatively consistent temperature. The November 18, 2005 reading for the deepest bead appears suspect and erroneous.

The 0°C isotherm is estimated to be in the range of 3.9 m to 4.6 m below the fill interface during 2004 and 2005. This is consistent with previously recorded values.

3.1.5.2 Piezometer Data

Based on the thermistor results, it is concluded that all of the piezometers are either frozen or are subject to seasonal freezing. The deepest of the three piezometers has been continuously frozen over the period of monitoring. Data from the remaining two piezometers is shown in Figure B-4.

Initial comparison of the phreatic level changes to the pond level changes seemed consistent with the other boreholes - over the review period the piezometric level decreased as did the pond elevation. Again, comparison of the two piezometers shows the higher piezometers provides slightly higher values, this is to be expected.

Levels were quite consistent through 2003, 2004 and the beginning of 2005. Similar to the first three boreholes there was a slight raise in the levels in 2005. As discussed, given reported historic low level of Tailings Pond # 1, the phreatic level should decrease by the spring of 2006.

3.1.6 Borehole 12861-06

Borehole # 12861-06 was installed on the top of the toe berm roughly over the centre of the former Dome Creek valley. It was advanced to install a nine bead thermistor string that extends down to a depth of 16.8 m. The original ground elevation at this location was estimated to have an elevation of 1130.7 m ±0.5 m. The fill/native ground interface was encountered at a depth of 10.0 m giving an interface elevation of 1129.9 m. Hence, the depth of stripping during construction is estimated to be in the order of 0.8 m ±0.5 m.

3.1.6.1 Thermistor Data

The recorded ground temperatures at this location are shown in Figure A-5. Initial reviews of the plot showed that the three thermistor beads located in the fill soils have remained above 0°C throughout the monitoring period and showed seasonal variations in temperature while all of the thermistor beads below the fill soils remained continuously frozen over the monitoring period. These six beads indicated that the ground temperatures became slightly colder with depth over the course of monitoring. The readings were relatively constant throughout the reporting period.

These trends continue with the additional data set from 2004 and 2005. The bead closest to the fill interface (1131.1 m) appears to have a freezing trend (a negative slope) with temperatures hovering around 0°C during 2004 and 2005. The August 22 and November 18, 2005 reading for the deepest six beads appear suspect and erroneous.

The 0°C isotherm is estimated to be at an elevation of 1129.9 m or roughly at the fill interface.

3.1.7 Borehole 12861-07

Borehole # 12861-07 is located just off of the north end of the toe berm crest on the north abutment terrace beside Dam # 1. This borehole contains three piezometers each coupled with a thermistor bead. The depths where the instruments have been placed are 4.0 m, 6.0 m and 10.0 m.

The original ground elevation at this location was estimated to be approximately 1142 m. As the present elevation is 1143.3 m it is concluded that some fill soils have been placed over this location. During the drilling program it was not possible to differentiate between fill soils and native soils, so the actual fill thickness (if any) cannot be confirmed.

3.1.7.1 Thermistor Data

The recorded ground temperatures at this location are shown in Figure A-5. The initial reviews of the plot showed all three beads showing seasonal variations in temperature over the monitoring period.

These trends along with the recorded temperature ranges appear consistent in 2004 and 2005 with the exception of the high temperature recorded by the upper bead in the summer of 2004.

The 0°C isotherm is estimated to be at or below the lowest bead at 1133.1 m or 9.4 m below the fill interface.

3.1.7.2 Piezometer Data

Based on the thermistor results, it is concluded that all three of the piezometers are subject to seasonal freezing. Data from the three piezometers is shown in Figure B-4.

Levels were quite consistent through 2003, 2004 and 2005. No apparent correlation between the decrease in the pond level and phreatic level is present. Comparison of the three piezometers shows the higher piezometers provides higher phreatic levels as to be expected.

3.1.8 Borehole 12861-08

Borehole # 12861-08, which contains a 7 bead thermistor string extending at a depth of 15.2 m, is located near the toe of Dam # 1. The original ground elevation at the borehole location was estimated to be 1130.0 m ±0.5 m. The fill/native soil interface depth discovered during drilling was 3.3 m giving an interface elevation of 1129.3 m. Therefore stripping during construction was in the order of 0.7 m ±0.5 m.

3.1.8.1 Thermistor Data

Initial reviews of the ground temperature records from this installation, as plotted on Figure A-7, indicated that the upper bead was subject to seasonal freezing while the deeper four remained frozen throughout the year. The three deepest beads located in the native sands were gradually warming since July 1999.

These trends appear to continue in 2004 and 2005. The upper bead exhibits similar values as previously reported while the three deepest beads continue to have a slight warming trend in the order of 0.03°C to 0.04°C over a one year period between 2003 and 2004. The three reading sets from 2005 for the deepest three beads appear suspect and erroneous.

The 0°C isotherm is estimated to be around 1125.3 m or 4 m below the fill interface during the summer months.

3.1.9 Borehole 12861-10

Borehole # 12861-10 was the only borehole advanced through the seepage collection dam (Dam # 2) during the initial reviews. This thermistor string was destroyed during the reconstruction of the dam in October 2000. New ground temperature instrumentation, 14618-BH01, 14618-BH03 and 14618-BH04, was installed in the dam in January 2001 to replace Borehole # 12861-10.

3.1.10 Borehole 14618-BH01

Borehole # 14618-BH01, which contains a 16 bead thermistor string extending at a depth of 12 m, is located on the upper bench east of and adjacent to the north end of Dam # 2. The original ground elevation at the borehole location was estimated to be 1130.5 m. The permafrost table at the time of drilling was at 1118.3 m (12.2 m) depth.

3.1.10.1 Thermistor Data

Only 10 of the 16 thermistor beads have been monitored to date. These ground temperature records, as plotted on Figure A-8, indicate that the upper three beads are subject to seasonal freezing and thawing while the remaining beads remain frozen throughout the year. These lower beads indicate that the ground temperature becomes slightly colder with depth over the course of monitoring. The initial reviews indicated that the readings were relatively constant throughout the beginning of the reporting period while the six deepest beads indicated decreasing temperatures since 2002.

The upper three beads show consistent values in 2004 and 2005 as the previous years. Based on the limited data, the six deeper beads appear to have levelled off and maintained a relatively consistent temperature over this reporting period. The last two reading sets from 2005 for the deepest six beads appear suspect and erroneous.

Based on the limited data, the 0°C isotherm is estimated to be around 1127.5 m which is 4.0 m below the ground surface.

3.1.11 Borehole 14618-BH03

Borehole # 14618-BH03, which contains a 16 bead thermistor string extending at a depth of 10 m, is located along the toe of Dam # 2, on the north side. The original ground elevation at the borehole location was estimated to be 1128.0 m. The permafrost table at the time of drilling was at 1118.6 m (9.4 m) depth.

3.1.11.1 Thermistor Data

Only 10 of the 16 beads have been monitored to date. These ground temperature records, as plotted on Figure A-9, indicate that the upper two or three beads are subject to seasonal freezing and thawing while the remaining beads appear to remain frozen throughout the year. The continuously frozen beads indicate that the ground temperature becomes slightly colder with depth over the course of monitoring. The initial reviews indicated that the readings were relatively constant throughout the reporting period.

These trends continue with the additional data set from 2004 and 2005. The upper bead has malfunctioned and did not provide any data for the 2004 and 2005 period. The three reading sets from 2005 appear suspect and erroneous, if valid, the last two sets indicate a cooling trend of the deeper beads.

Based on the limited data, the 0°C isotherm is estimated to be around 1126.0 to 1126.5 m which is 1.5 m to 2.0 m below the ground surface.

3.1.12 Borehole 14618-BH04

Borehole # 14618-BH04, which contains a 16 bead thermistor string extending at a depth of 10 m, is located along the toe of Dam # 2, on the south side. The original ground elevation at the borehole location was estimated to be 1127.5 m. The permafrost depth at the time of drilling at 1118.5 m (9.0 m).

3.1.12.1 Thermistor Data

Only 10 of the 16 beads have been monitored to date. These ground temperature records, as plotted on Figure A-10, indicate that all beads in the thermistor string are either frozen or are subject to seasonal freezing. The continuously frozen beads indicate that the ground temperature becomes slightly colder with depth over the course of monitoring. The initial reviews indicated the readings were relatively constant throughout the reporting periods.

Although the data is limited, it appears that the bead at elevation 1125.5 m and 1125.0 m which were subject to seasonal freezing and thawing in 2001 and 2002 have remained frozen in 2003, 2004 and 2005. These two beads along with the remainder of continuously frozen beads appear to have a cooling trend (a negative slope). The November 18, 2005 reading for the deepest bead appear suspect and erroneous.

Based on the limited data, the 0°C isotherm is estimated to be at 1125.6 m during the summer months, which is 1.9 m below the ground surface.

3.2 SEEPAGE DATA REVIEW

To evaluate the seepage, monthly average seepage rates were calculated from the daily readings submitted and are presented in Table 1. These seepage rates were developed by determining the volume of effluent pumped back to the tailings impoundment from the Dam # 2 pond that lies below Dam # 1.

The volume of effluent pumped back from the seepage pond provides only an estimate of the total seepage volume escaping from the tailings impoundment. It is only an estimate because the seepage pond neither captures all of the possible seepage that escapes the impoundment nor does it retain all of the seepage that is captured. Moreover, the seepage pond is also subject to inflows from sources other than the tailings impoundment seepage. Direct precipitation and runoff from the dam slope and the north and south abutment slopes can all contribute to the volume of water contained in seepage pond at any time. Irrespective of these concerns, the pumped - back volume of effluent is a strong indicator of the seepage performance of the impoundment and it can be compared to the design

criteria that were developed for seepage passing through the dam structure and dam foundation.

Seepage rates presented in Table 1 for the years 1999 through 2003 differ from those originally presented in the first two reviews. The original seepage data provided to EBA had a volumetric error on the water pumped back to Tailing Pond # 1. This error was corrected by the care and maintenance contractor and new seepage rates were provided to EBA. These corrected seepage rates along with the 2004 and 2005 data are presented in Table 1.

TABLE 1: MONTHLY AVERAGE SEEPAGE FROM FLOWMETER DATA

Month	1999 (L/s)	2000(1) (L/s)	2001(1) (L/s)	2002(1) (L/s)	2003(1) (L/s)	2004(1) (L/s)	2005(1) (L/s)
January		2.1	2.3	2.2	2.3		2.8
February		2.0	2.3	2.4	2.3		2.3
March	5.2 (3) (1)	2.1	2.2	2.4	2.5		2.3
April	4.4 (19) (1)	2.0	2.3	2.1	2.2	2.5	2.5
May	2.9 (30) (1)	2.5	2.6	2.7	2.2	3.4	2.3
June	2.4 (19) (1)	2.1	2.3		2.5	2.9	2.7
July	3.7 (5) (1)	2.5	2.4	2.3	2.6	2.8	2.8
August		3.2	2.2		2.6	3.0	2.8
September	1.6 (2) (1)	3.4	2.4	2.4	3.0	2.8	4.1
October	2.8 (13) (1)	3.2	2.7	2.5	2.9		3.7
November	2.2	2.6	2.6	2.4	2.7		3.9
December	2.2	2.4	2.6	2.4		2.5	

Notes: (1) Parentheses indicate number of manual readings

The average rates per month for 2000 through 2003 versus the average of the 2004 and 2005 data for the months of April, May, June, July and August have increased in the order of 0.2 to 0.5 L/s.

The average seepage rates for 2004 and 2005 appear to be somewhat elevated from those recorded in 2000 through 2003 for all months with the exception of September 2004, December 2004, February 2005, March 2005, and May 2005. The average rates per month for 2000 through 2003 versus the average of the 2004 and 2005 data for the months of

April, May, June, July and August have increased in the order of 0.2 to 0.5 L/s. Furthermore, the seepage rates from September through November 2005 have increase 0.9 L/s to 1.3 L/s from August 2005.

Given the pond level was reported to be at the lowest level over the entire reporting period in the fall of 2005, it is unclear why the seepage rates have increased from September to November 2005.

4.0 RECOMMENDATIONS FOR FUTURE MONITORING

It is difficult to predict trends of intermittently collected data. If it is the intention of the Government of Yukon to use the thermistor and piezometer data to assist in preparing the final abandonment plan for the mine, then readings on this instrumentation are required on a regular and frequent basis.

Correspondingly, it is EBA's recommendation that data loggers be installed at all thermistor locations, to take daily readings, and store minimum/maximum/averages on a monthly basis, and that piezometers be recorded manually, once per month. EBA is availible to assist you in providing a cost estimate for the installation of the data loggers, if required.

The seepage rates since November 2005 should be reviewed to determine if the elevated rates in September through November 2005 have continued, or decreased to more typical values observed in the past.

The reference nail and staff gauge for the datalogger should be tied into real world coordinates. This will enable the comparison of the pond level, piezometer and seepage data which may help explain some of the trends observed.

5.0 LIMITATIONS

The contents of this report are based on the geotechnical instrumentation data provided to EBA by the Government of Yukon. The provided data, in the form of sporadic thermistor readings and pneumatic piezometer readings, has been supplemented by EBA's previous experience on site.

Accordingly, the information, plots and evaluations presented in this report are based on the supplied data. Actual conditions at the site may vary from those described by the data. Should different conditions be encountered during subsequent site activities, it is requested that EBA be notified so that the contents of this report can be reviewed to confirm that they are still appropriate.

This report and the recommendations contained in it are intended for the sole use of the Government of Yukon. EBA does not accept any responsibility for the accuracy of any of the data (except where verified by EBA) or for the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than those indicated above. Any such unauthorized use of this report is at the sole risk of the user.

6.0 CLOSURE

EBA trusts that this report meets with your approval. Please do not hesitate to contact the undersigned should you have any questions or comments.

EBA Engineering Consultants Ltd.

PROFESSIONAL ENGINEER YUKON TERRITORY J.P.W. BERKERS June 29/06

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GEOTECHNICAL REPORT – GENERAL CONDITIONS

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.

2.0 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.

3.0 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.

4.0 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.

5.0 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorologic conditions; and with development activity. Interpretation of water conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

6.0 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.

7.0 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.

8.0 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.

9.0 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.

10.0 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.

11.0 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.

12.0 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.

13.0 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

14.0 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.

15.0 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), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that 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. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that 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.