June 27, 2016

Ms. Emilie Hamm
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Assessment & Abandoned Mines
Department of Energy, Mines and Resources
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Project No.: 200.04002.00000
Client Reference No.: C00033145

Dear Ms. Hamm,

RE: MT. NANSEN MINE AMP – REVISION TO REPORTED EVENT 3 THRESHOLD TRIGGERS (NOVEMBER 2015 TO MARCH 2016)

In preparation of the April 2016 Mt. Nansen Mine monthly Adaptive Management Plan (AMP) assessment report, it came to my attention that mis-interpretation of the Mt. Nansen AMP Protocol (SLR, 2015) led to incorrect reporting of activation of threshold triggers for Event 3 – Changes in Seepage Pond Inflows/Volume Outside of Historic Norms. The mis-interpretation arose from a narrow reading of section *5.3 Narrative Trigger* of the AMP Protocol which states:

> *The trigger for the implementation of the AMP is "seepage pond water levels and pumping rates display a sustained change from the 2012 to 2013 pumping rate, water level and rate of water level change."*

This section should have been read together with the section 5.1 Description which indicates that:

> *…The water levels are measured daily, during open water, via a staff gauge. The discharge pumping rate is measured daily…"*

The error in trigger activation reporting occurred as a result of missing the specification that threshold triggers for the Seepage Pond water levels and water levels rate of change are to be assessed during the open water season only. Due to this mis-interpretation of the AMP Protocol, trigger activations for Seepage Pond water levels were reported in 6 monthly assessment reports from November 2015 to March 2016. Specifically, the following trigger activations were reported:

- **November 2015**
  - Statistically significant decreasing trend in the Seepage Pond water level.
- **December 2015:**
  - Statistically significant decreasing trend in the Seepage Pond water level.
- **January 2016:**
  - Statistically significant decreasing trend in the Seepage Pond water level.
- **February 2016:**
  - Exceedance of upper 95th percentile Seepage Pond water level threshold.
- **March 2016:**
  - Exceedance of upper 95th percentile Seepage Pond water level threshold.
  - Statistically significant decreasing trend in the Seepage Pond water level.

Please disregard these reported AMP trigger activations as they were not assessed during the open water season.

The next assessment of the Seepage Pond water level and water level rate of change will be completed in the April 2016 monthly assessment report.

Yours sincerely,
SLR Consulting (Canada) Ltd.

Christiane Buie, M.A., Dipl. Tech.
Environmental Planner

cc Patricia Randell
A/ Director, AAM
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Memorandum

To:	Emilie Hamm	**From:**	SLR Consulting (Canada) Ltd.
Company:	Government of Yukon Assessment and Abandoned Mines		
cc:	Patricia Randell	**Date:**	May 9, 2016
Subject:	***FINAL - MOUNT NANSEN MINE*** ***AMP MONTHLY ASSESSMENT – MARCH 2016***		

1.0 INTRODUCTION

The following summarizes the March 2016 assessment of the Adaptive Management Plan (AMP) Events, as outlined in the *Mount Nansen Water Quality and Quantity Adaptive Management Plan* (SLR, May 2015):

- AMP Event 2 - Changes in Water Quality in the Seepage Pond
- AMP Event 3 - Changes in Seepage Pond Inflows/Volume Outside of Historic Norms
- AMP Event 4 - Degraded Water Quality in Dome Creek Downstream of Mine Facilities (WQ-DC-U only)
- AMP Event 5 - Degraded Water Quality in Victoria Creek at Mine Access Road

The following Events are not included in this monthly assessment:

- AMP Event 1 - Degraded Water Quality in Dome Creek Downstream of Mill Area
  - No water quality samples were collected in March 2016 due to frozen conditions.
- AMP Event 4 - Degraded Water Quality in Pony Creek Downstream of Mine Facilities
  - No water quality samples were collected in March 2016 at WQ-DC-R due to frozen conditions.
- AMP Event 6 - Degraded Water Quality in Pony Creek Downstream of Mine Area
  - No water quality samples were collected in March 2016 due to frozen conditions.
- AMP Event 7 - Changes in Pit Water Level Elevation outside of Historic Norms
  - Information required to do a complete evaluation of the water level (*i.e.*, barometric compensation data) was not available at the time of producing this report. Due to pit-wall stability concerns, repairs to the data logger in the pit could not be completed. The data logger will be repaired once a pit-wall stability and safety assessment is completed and the pit is deemed safe for access. However, the top of the pond was surveyed on November 3, 2015, and the pond water had

an elevation of 1181.071 masl, which is lower than the 5th percentile (1181.79 masl) of the 2010 – 2013 water levels of the Brown-McDade Pit. This suggests that at this time, the AMP has the potential to be triggered.

- AMP Event 8 - Changes in Groundwater Quality Downgradient of the Brown-McDade Pit
  - During the spring 2015 field visit it was noted that these wells had been damaged. It was anticipated that they would be repaired in the fall 2015, however further investigations (via camera footage) showed that the extent of the repair was greater than initially assessed (sand at the bottom of the well requires that the well be redeveloped). The repair will be conducted when conditions allow. Additionally, as per the Mt. Nansen AMP, a minimum of four data points are required to complete a trend line development. This assessment will be carried out when sufficient sampling data are available, post well repair.
- AMP Event 9 - Degraded Water Quality in Brown-McDade Pit
  - Assessment of this AMP is carried out on an annual basis and was last reported on in the August 2015 AMP assessment.

2.0 AMP EVENT 2 – CHANGES IN WATER QUALITY IN THE SEEPAGE POND

2.1 Description

The Seepage Pond at the toe of the tailings impoundment collects shallow groundwater seepage from the tailings area. The seepage collected in the pond is continuously pumped to Dome Creek. The discharge from the Seepage Pond is a primary source of contaminants to Dome Creek including sulphate, arsenic, iron, manganese and cadmium.

The water quality in the Seepage Pond is measured monthly, at the Seepage Pond outlet pipe, WQ-SEEP, with the exception of spring. At this time, an additional sample is collected during freshet. Water quality samples are analyzed for a full suite of parameters including total suspended solids, cyanide species, nitrogen species, sulphate, hardness, total and dissolved metals.

A summary of the AMP thresholds for Event 2 is provided in Table 1.

Table 1: Summary of AMP Event 2 Thresholds

Indicators	Location	Thresholds	Frequency
Sulphate Total and Dissolved Arsenic Total Cadmium Total and Dissolved Iron Total and Dissolved Manganese Total Zinc Total and WAD Cyanide	WQ-SEEP	• Monitoring results at WQ-SEEP above the reference EQS for Dissolved Arsenic (0.15 mg/L), Total Iron (1.0 mg/L) or Total Cadmium (0.02 mg/L), Total Manganese (0.5 mg/L), Total Zinc (0.3 mg/L), Total Cyanide (0.3 mg/L), WAD Cyanide (0.1 mg/L); or, • Three consecutive monitoring results at WQ-SEEP greater than the upper 95th percentile of the reference period (2008 to 2013); or • A statistically significant increasing trend (0.05) which, when extrapolated forward one year, would result in values greater than the 95th percentile. For the purposes of AMP trend line development, data for station WQ-SEEP from 2008 and on will be used for the trend analysis.	Monthly

2.2 AMP Event 2 – Data Review

Assessment under the AMP of the relevant water quality data from WQ-SEEP was carried out using the March 2016 water quality data. The results of the assessment are summarized in Table 2.

Table 2: Summary of AMP Event 2 Assessment

Indicators	Trigger Activation	Results
Sulphate	No	• March sulphate concentration (737 mg/L) was below the 95th percentile threshold value of 822.6 mg/L. • Statistically significant increasing trend in sulphate concentrations but not estimated to reach the threshold value until 2019.
Total Cyanide	Yes	• March concentration (0.0796 mg/L) was well below the EQS threshold value of 0.3 mg/L. • Total cyanide concentration in March was above the 95th percentile threshold value of 0.076 mg/L. • Increasing trend, although not statistically significant.
WAD Cyanide	No	• March concentration (0.015 mg/L) was below the EQS threshold value (0.1 mg/L). • WAD Cyanide concentrations have been below the 95th percentile threshold (0.035 mg/L) since Jan 2010. • Statistically significant decreasing trend.

Indicators	Trigger Activation	Results
Total Arsenic	Yes	• Total arsenic concentration in March (0.126 mg/L) was above the 95th percentile threshold value of 0.057 mg/L, and was part of four consecutive exceedances (December 2015, January, February and March 2016. • Statistically significant increasing trend in total arsenic concentrations estimated to reach 95th percentile threshold value in less than 1 year.
Dissolved Arsenic	Yes	• March concentration (0.077 mg/L) was below the EQS threshold value of 0.15 mg/L. • Dissolved arsenic concentrations have been above the 95th percentile threshold value of 0.035 mg/L for 11 months in a row (May, June, July, August, September, October, November, December 2015 and January, February, March 2016). • Statistically significant increasing trend in dissolved arsenic concentrations, estimated to reach the 95th percentile threshold value (0.035 mg/L) in less than 1 year.
Total Cadmium	No	• Current concentration (0.00042 mg/L) was well below EQS threshold of 0.02 mg/L. • Concentration measured in March is below the 95th percentile threshold of 0.00117 mg/L. • Statistically significant decreasing trend.
Total Iron	Yes	• Current concentration (18.9 mg/L) is well above the EQS threshold of 1.0 mg/L and concentrations have been since at least 2008. • Concentration measured in March is below the 95th percentile threshold of 20.8 mg/L. • Increasing trend, although not statistically significant.
Dissolved Iron	Yes	• Current concentration (17.8 mg/L) was above the 95th percentile threshold of 9.67 mg/L, and is part of six consecutive exceedances (October, November, December 2015 and January, February, March 2016). • Statistically significant increasing trend estimated to reach 95th percentile threshold value (9.67 mg/L) in less than 1 year.
Total Manganese	Yes	• Current concentration (6.4 mg/L) was well above EQS threshold of 0.5 mg/L and has been since 2008. • The March concentration was below the 95th percentile threshold value of 9.2 mg/L and has been since Feb 2010. • Statistically significant decreasing trend in total manganese concentrations.

Indicators	Trigger Activation	Results
Dissolved Manganese	No	• The March concentration (6.4 mg/L) was below the 95th percentile threshold value of 8.8 mg/L. • Statistically significant decreasing trend.
Total Zinc	Yes	• Current concentration (0.116 mg/L) was below the EQS threshold of 0.3 mg/L. • March concentration was above the 95th percentile threshold value of 0.028 mg/L, and is part of seven consecutive exceedances (September, October, November, December 2015 and January, February, March 2016). • Statistically significant increasing trend estimated to reach 95th percentile threshold value in less than 1 year.

2.3 Follow-up Action Required

The above noted changes in water quality in the Seepage Pond, as measured at WQ-SEEP, have been previously documented in various reports including *Mount Nansen – Assessment of Zinc Concentrations in the Seepage Pond* (SLR 2015) and *Mount Nansen 2013 Annual Surface Water Quality Review* (SLR 2015). As a result of those reports, additional work is being carried out to investigate the sources of the changing water quality in the Seepage Pond, including sulphate, total zinc, total and dissolved arsenic, and total and dissolve iron. Some of the recommendations for proposed study/investigations included:

- A detailed hydrogeological and geochemical assessment of the water quality trend in seepage water and groundwater to fully assess the changing conditions in the Seepage Pond and upgradient in the tailings area, and evaluate potential impacts to ongoing attenuation processes.
- The development of a contingency plan for the potential treatment of Seepage Pond water should the concentrations reach a point where treatment is required.

3.0 AMP EVENT 3 - CHANGES IN SEEPAGE POND INFLOWS/VOLUME OUTSIDE OF HISTORIC NORMS

3.1 Description

The Seepage Pond at the toe of the tailings impoundment collects shallow groundwater seepage from the tailings area. The seepage collected in the pond is continuously pumped to Dome Creek. The maximum design operating level of the Seepage Pond is 1078.1 masl. The pond water levels are measured daily, during open water, via a staff gauge. The discharge pumping rate is measured daily via an inline flowmeter (H-SEEP) installed in 2012 and routinely checked using timed volumetric measurements.

The environmental consequence of changes in the Seepage Pond inflows/volumes above historic norms is the potential exposure of aquatic and terrestrial resources, and human users to increased levels of contaminants in the downstream receiving environment in Victoria Creek due to increased seepage from the tailings impoundment area. In addition, as a result of higher than normal seepage inflows, there is a concern related to the stability of the dam structure.

A summary of the current AMP information for Event 3 is provided in Table 3.

Table 3: Summary of AMP Event 3 Thresholds

Indicators	Locations	Thresholds	Frequency
Seepage Pond pumping rate Seepage Pond water level Seepage Pond water level rate of change	H-SEEP	• Four consecutive average weekly results greater than the upper 95th percentile or lower than the lower 5th percentile of the 2012 to 2013 data record; or • A statistically significant (0.05) increasing or decreasing trend in the monitoring results. For the purposes of AMP trend line development, data from 2012 on will be used for the trend analysis.	Daily

3.2 AMP Event 3 – Data Review

Assessment under the AMP of the relevant water level and discharge data from H-SEEP was carried out using the March 2016 data. Note that the water elevations provided in October 2015 and January 2016 are likely an ice surface measurement and not a water level measurement. The results of the assessment are summarized in Table 4.

Table 4: Summary of AMP Event 3 Assessment – H-SEEP

Indicators	Trigger Activation	Results
Seepage Pond pumping rate	Yes	• Throughout March, the average weekly Seepage Pond pumping rates (122 to 125 L/min) did not exceed the upper 95th percentile threshold (240.12 L/min). • Throughout March, the average weekly Seepage Pond pumping rates (122 to 125 L/min) were below the 5th percentile threshold (156 L/min). • Statistically significant decreasing trend in the Seepage Pond pumping rate.
Seepage Pond water level	Yes	• Throughout March, the average weekly Seepage Pond water level (1077.51 to 1077.54 masl) exceeded the upper 95th percentile threshold (1077.50 masl) • The average weekly Seepage Pond water levels throughout March (1077.51 to 1077.54 masl) were above the lower 5th percentile threshold (1077.1 masl). • Statistically significant decreasing trend in the Seepage Pond water levels.
Seepage Pond water level rate of change	No	• Throughout March, the average weekly Seepage Pond water level rate of change (-0.004 to 0 m/day) did not exceed the upper 95th percentile threshold (0.092 m/day). • The average weekly Seepage Pond water level rates of change (-0.004 to 0 m/day) did not exceed the lower 5th percentile threshold (-0.100 m/day) in March. • Decreasing, non-significant, trend in the Seepage Pond water level rate of change.

3.3 Follow-up Action Required

The Seepage Pond water level and pumping rate triggers were activated in March with statistically significantly decreasing trends in the Seepage Pond pumping rate and water level and, average weekly pumping rates below their respective 5th percentile threshold and water levels above their respective 95th percentile threshold. Confirmation of an annual calibration of the flow meter should be conducted.

4.0 AMP EVENT 4 – DEGRADED WATER QUALITY IN DOME CREEK DOWNSTREAM OF MINE FACILITIES

4.1 Description

Dome Creek, downstream of the tailing impoundment area, receives inputs from the mine site via direct discharge from the Seepage Pond, inflows from the mill area, and seepage and groundwater inflows from mine site facilities. The water quality in Dome Creek below the mine site facilities is measured at stations WQ-DC-U and WQ-DC-R. Station WQ-DC-U is located downstream of the confluence of Dome Creek and the Seepage Pond discharge and station WQ-DC-R is located in Dome Creek at the mine access road crossing. Water quality samples are collected monthly, with the exception of spring. At this time, an additional sample is collected during freshet. Water quality samples are analyzed for a full suite of parameters including total suspended solids, cyanide species, nitrogen species, sulphate, hardness, total and dissolved metals.

The water quality in Dome Creek, below the mine site facilities, shows a clear mine-related influence with elevated concentrations of key contaminants of concern including sulphate, arsenic, iron, manganese, cadmium, and zinc. Total and WAD cyanide is also present in Dome Creek below the mine facilities, although at concentrations typically well below the CCME guidelines.

A summary of the AMP thresholds for Event 4 is provided in Table 5.

Table 5: Summary of AMP Event 4 Thresholds

Indicators	Locations	Thresholds	Frequency
Sulphate Total and Dissolved Arsenic Total Cadmium Total Zinc Total and Dissolved Iron Total and Dissolved Manganese	WQ-DC-U and WQ-DC-R	• Three consecutive monitoring results at WQ-DC-U or WQ-DC-R greater than the upper 95th percentile of the reference period (2008 to 2013); or, • A statistically significant (0.05) increasing trend in the monitoring results from WQ-DC-U or WQ-DC-R which, when extrapolated forward one year, would result in values greater than the 95th percentile. For the purposes of AMP trend line development, data from 2008 and on is used for the trend analysis.	Monthly

4.2 AMP Event 4 – Data Review

Note that due to dry/frozen conditions, samples were not collected from WQ-DC-R, therefore only relevant water quality data from March 2016 at WQ-DC-U were used to conduct an

assessment under the AMP of Event 4. The results of the assessment are summarized in Table 6.

Table 6: Summary of AMP Event 4 Assessment – WQ-DC-U

Indicators	Trigger Activation	Results
Sulphate	No	• March concentration (732 mg/L) was below the 95th percentile threshold (785.1 mg/L). • Statistically significant increasing trend in sulphate concentrations but not estimated to reach 95th percentile threshold value for another 3 years.
Total Arsenic	No	• March concentration (0.060 mg/L) was above the 95th percentile threshold (0.052 mg/L); but not part of three consecutive exceedances. • Statistically significant increasing trend in total arsenic concentrations but not estimated to reach 95th percentile threshold value this year – estimated to reach 5 years from now.
Dissolved Arsenic	Yes	• March concentration (0.040 mg/L) was above the 95th percentile threshold (0.031 mg/L), and is part of five consecutive exceedances (November, December 2015 and January, February and March 2016). • Statistically significant increasing trend in dissolved arsenic concentrations but not estimated to reach threshold value this year – estimated to reach threshold in August 2017.
Total Cadmium	No	• March concentration (0.00020 mg/L) was below 95th percentile threshold (0.00066 mg/L). • Decreasing trend, but not statistically significant.
Total Iron	No	• March concentration (5.1 mg/L) was below the 95th percentile threshold (10.5 mg/L). • Increasing trend, but not statistically significant.
Dissolved Iron	No	• March concentration (3.17 mg/L) was below the 95th percentile threshold (5.35 mg/L). • Statistically significant increasing trend in dissolved iron concentrations but not estimated to reach threshold value this year – estimated to reach 6 years from now.
Total Manganese	No	• March concentration (5.91 mg/L) was below the 95th percentile threshold value of 5.94 mg/L. • Statistically significant increasing trend in total manganese concentrations but not estimated to reach threshold value this year – estimated to reach 6 years from now.

Indicators	Trigger Activation	Results
Dissolved Manganese	No	• March concentration (5.57 mg/L) was below the 95th percentile threshold value of 5.68 mg/L. • Statistically significant increasing trend in dissolved manganese concentrations but not estimated to reach threshold value this year – estimated to reach 6 years from now.
Total Zinc	No	• March concentration (0.047 mg/L) was below the 95th percentile threshold (0.090 mg/L). • Decreasing trend, though not significantly significant.

4.3 Follow-up Action Required

The only AMP trigger activated at WQ-DC-U under AMP Event 4 during the March 2016 assessment was five consecutive exceedances of dissolved arsenic. The concentrations measured in December 2015 (0.036 mg/L) and January 2016 (0.034 mg/L) are within the historical range for this site, while the November 2015, February and March 2016 concentrations (0.05 mg/L, 0.04 mg/L and 0.04, respectively) are not. The water quality in Dome Creek at WQ-DC-U is influenced by the discharge from the Seepage Pond (WQ-SEEP has exceeded it's dissolved arsenic threshold (0.035 mg/L) for the past 11 months). It is evident that the year-round discharge of water from the Seepage Pond, particularly during low flow conditions, results in increases in various parameters downstream in Dome Creek. The ongoing investigation of the Seepage Pond and the Mill Area (See Section 2.3) should provide further insight in the changes being seen in Dome Creek.

5.0 AMP EVENT 5 – DEGRADED WATER QUALITY IN VICTORIA CREEK AT MINE ACCESS ROAD

5.1 Description

Victoria Creek, downstream of the mine site area, receives inputs from the mine site from surface water inflows and from groundwater inflows from mine site facilities. The receiving environment for the site is represented by sampling location WQ-VC-R. This location is downstream of inputs from both Dome and Back Creek, and includes all potential mine related inputs to the receiving environment. In contrast to Dome Creek, Victoria Creek is known to support fish and fish habitat. The water quality in Victoria Creek at WQ-VC-R is collected monthly, with the exception of spring. At this time, an additional sample is collected during freshet. During winter, water quality in this area is sampled 100 m downstream at WQ-VC-R+100. Water quality samples are analyzed for a full suite of parameters including total suspended solids, cyanide species, nitrogen species, sulphate, hardness, total and dissolved metals.

The water quality in Victoria Creek, below the mine site facilities, shows a clear mine-related influence with elevated concentrations of key contaminants of concern, compared to background, including sulphate, dissolved arsenic, dissolved iron, dissolved manganese, dissolved cadmium, and dissolved zinc. The water quality at WQ-VC-R is also significantly influenced by elevated levels of suspended solids from both natural and anthropogenic sources (including placer mining in the Back Creek and Pony Creek watersheds). Due to this influence of upstream sediment inputs, the development of the AMP Event for Victoria Creek is based on dissolved metals. Taking this approach enables the isolation of site-related influences and

eliminates the interfering effects of elevated suspended solids contributed from upstream, in the Victoria Creek catchment.

A summary of the AMP thresholds for Event 5 is provided in Table 7.

Table 7: Summary of AMP Event 5 Thresholds

Indicators	Locations	Thresholds	Frequency
Sulphate Dissolved Arsenic Dissolved Cadmium Dissolved Zinc Dissolved Iron Dissolved Manganese	WQ-VC-R or WQ-VC-R+100	• Three consecutive monitoring results at WQ-VC-R or WQ-VC-R+100 greater than the upper 95th percentile of the reference period (2008 to 2013); or • A statistically significant (0.05) increasing trend in the monitoring results from WQ-VC-R or WQ-VC-R+100 which, when extrapolated forward one year, would result in values greater than the 95th percentile. For the purposes of AMP trend line development, data from 2008 and on will be used for the trend analysis.	Monthly

5.2 AMP Event 5 – Data Review

Assessment under the AMP of the relevant water quality data from WQ-VC-R was carried out using the March 2016 water quality data. The results of the assessment are summarized in Table 8.

Table 8: Summary of AMP Event 5 Assessment

Indicators	Trigger Activation	Results
Sulphate	No	• March concentration (41.0 mg/L) was below the 95th percentile threshold (45.9 mg/L). • Statistically significant increasing trend in sulphate concentrations but not estimated to reach threshold value this year – estimated to reach 4 years from now.
Dissolved Arsenic	No	• March concentration (0.001 mg/L) was below the 95th percentile threshold (0.002 mg/L). • Decreasing trend, but not statistically significant.
Dissolved Cadmium	No	• March concentration (0.00002 mg/L) was below the 95th percentile threshold (0.00009 mg/L). • Decreasing trend, but not statistically significant.
Dissolved Iron	No	• March concentration (0.010 mg/L) was below the 95th percentile threshold (0.270 mg/L). • Decreasing trend, but not statistically significant.
Dissolved Manganese	No	• March concentration (0.005 mg/L) was below the 95th percentile threshold (0.120 mg/L). • Increasing trend in concentrations but not statistically significant.

Indicators	Trigger Activation	Results
Dissolved Zinc	No	• March concentration (0.004 mg/L) was below the 95th percentile threshold (0.0082 mg/L). • Decreasing trend in concentrations but not statistically significant.

5.3 Follow-up Action Required

No AMP triggers were activated at WQ-VC-R under AMP Event 5 during the March 2016 assessment. Therefore no follow up is required at this time.