Technical Memorandum

Date: **May 15 2017**

To: **NIRB, AEM, NWB**
From: **Luis Manzo P.Ag.**

Re: **J170048 – Meadowbank Gold Project 2016 Annual Report Review**

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1. Introduction

We have reviewed Agnico Eagle Mines Limited's (AEM) Meadowbank Gold Project – 2016 Annual Report and the following relevant appendices:

- Appendix A1 – 2017 Mine Plan;
- Appendix A2 – 2016 Annual Report NIRB 11EN010;
- Appendix B1 – 2016 Annual Geotechnical Inspection ;
- Appendix C2 – 2016 Water Management Report and Plan;
- Appendix C4 – Predicted Water Quantity and Quality (2012-2016);
- Appendix D1 – Mine Waste Rock and Tailings Management Plan 2017;
- Appendix F3 – 2016 Landfarm Report;
- Appendix G1 – 2016 Core Receiving Environment Monitoring Program;
- Appendix G3 – EEM Cycle 2 Interpretative Report ECCC Comments and Agnico's Response;
- Appendix G8 – Phaser Lake Fishout Report; and
- Appendix G13 – 2016 Wildlife Monitoring Summary Report.

We have also reviewed AEM's Amaruq Exploration Access Road 2016 Annual Report and the following relevant appendices:

- Appendix 1 – NIRB Screening Decision 11 EN010 Annual Report;
- Appendix 2 – 2017 Work Plan;
- Appendix 3 – Road Management Plan Version 2, 2017;
- Appendix 4 – Summary of Revision; and
- Appendix 5 – Regulator Inspection Report.

Our comments and recommendations are presented in Section 2 "Review of Meadowbank Gold Project 2016 Annual Report and Recommendations", and Section 3 "Review of Amaruq Exploration Access Road 2016 Annual Report and Recommendations" of this memo, and our conclusions are presented in Section 4.

2. Review of Meadowbank Gold Project 2016 Annual

Report and Recommendations

General

The list of abbreviations at the beginning of the report is a great improvement (following our recommendation in the HESL review of the 2015 Annual Report). Some abbreviations, however, are not included in this list, and are not explained in the text (i.e., spelled out in full the first time they appear in the text). For example, 'D/S, 'TPS', 'TSM'.

Recommendation #1. Please include all abbreviations in the list at the beginning of the report, and spell out their meaning when first introduced in the text. Please ensure that the abbreviation list is in alphabetical order to make it easy to reference.

2.1 Section 1: Introduction

The 2016 Annual Report addresses reporting requirements under the following authorizations:

- NWB Type A Water License 2AM-MEA 1525;
- NIRB Project Certificate No. 4;
- DFO HADD Authorization NU-03-190 AWAR;
- DFO HADD Authorization NU-03-191 MinSite;
- DFO Authorization NU-14-1046 Phaser Lake;
- INAC Land Leases 66A/8-71-2 (AWAR) and 66A/8-72-2 (AWAR Quarries);
- KIA Right of Way KVRW06F04

AEM notes that reporting requirements for the Metal Mining Effluent Regulations (MMER) were submitted directly to Environment and Climate Change Canada (ECCC). We request that copies of these reports also be provided directly to the KIA.

Recommendation #2. AEM should provide copies to the KIA of all MMER reports submitted to ECCC.

2.2 Section 2: Summary of Activities

2.2.1 2016 Activities

AEM indicates that 2016 was another good year for the Meadowbank Mine, with operations exceeding production targets for the fifth consecutive year. Meadowbank was AEM's largest gold producer for the year, producing a total of 312,214 ounces of payable gold, as well as 221,000 ounces of silver. The mine is forecast to produce 320,000 ounces of gold in 2017, and 165,000 ounces of gold in

2018.

The Board of Directors approved development of the Amaruq deposit and the Meliadine Mine, both of which are slated to begin production in late 2019.

No comments.

2.2.2 2017 Mine Plan

The 2016 Mine Plan (fully described in Appendix A1) outlines activities planned for 2017. In addition to routine activities, construction of the Central Dike Phase 6, and Saddle Dam 3, 4, 5 Phase 3 will be completed.

Environmental monitoring (of wildlife, aquatic effects, groundwater, noise and air) will continue throughout 2017.

AEM plans to extract a total of 21.3 Mt of rock from Portage and Vault pits in 2017 (3.2 Mt from Portage and 18.1 Mt from Vault).

AEM plans to minimize greenhouse gas emissions by maximizing use of the waste storage facility and minimizing haulage cycle times.

No comments.

2.2.3 Amaruq Exploration Access Road

A comprehensive annual report of activities associated with the Amaruq Exploration Access Road is included in Appendix A2. A complete report is included separately.

No comments.

2.3 Section 3: Construction/Earthworks

2.3.1 Dikes and Dams

AEM outlines its surveillance program to monitor deformations, seepage and geothermal responses, as required by the water license:

- Daily inspection – carried out daily by a designated qualified engineer or technician;
- Thermistor and piezometer monitoring – carried out generally weekly or bi-weekly by a designated qualified engineer or technician;
- Detailed inspection - carried out generally monthly or bi-monthly by a designated qualified engineer or technician; and
- Engineering annual inspection – carried out annually by qualified engineer (consultant), during

open water, if possible, to verify that the facilities are functioning as intended.

No major concerns were raised for most of the monitored structures based on available geotechnical instrumentation data and visual inspection in 2016 (i.e., at dewatering dikes, and at Tailing Storage Facilities). The Central Dike showed no unexpected settlement, erosion, bulging or sloughing. Seepage first reported in 2014 at the downstream toe of the dike, however, continued in 2016. Mitigation measures were implemented in 2015 to control the seepage.

East Dike

AEM has been discharging seepage water from the East Dike collection system back to Second Portage Lake since January 2014. The discharge is monitored subject to MMER requirements and to date, AEM reports that parameters are within acceptable levels.

Bay Goose Dike

Mining activity ceased in the Goose Pit in 2015. There has been some seepage (~26 m^3/day in the summer) in four areas along the dike but it is not considered a risk. AEM reports that "*there is currently no downstream seepage collection and monitoring system as the amount of seepage through the dike is not significant*" but that "*the area will continue to be monitored to determine increases/decreases of the seepage in these areas*" , and *"the condition of the dike will continually be monitored*" p.12.

The first statement indicates that there is no monitoring of the seepage, which contradicts the second and third statements suggesting that monitoring is ongoing.

Recommendation #3. Please clarify whether monitoring of the seepage along the dike is occurring, and if so, with what frequency.

Central Dike

Seepage at the downstream toe of the Central Dike, which was first reported in the fall of 2014, continued in 2016. AEM began pumping the seepage back into the South Cell Rock Storage Facility (RSF) in April 2015. In 2016, the diesel pump was replaced with a permanent electrical pump. Golder is currently updating the seepage model, which will be completed in 2017.

Stormwater Dike

Cracks were observed in the foundation of the dike in the summer of 2016. Monitoring of the dike's movement has been implemented, and a buttress type structure was constructed at the downstream toe of the dike (following recommendations by Golder, the designer of the dike). The Meadowbank Dike Review Board (MDRB) inspected the structure in September 2016 and made recommendations which are presented in Appendix B2.

Recommendation #4. Please also list the MDRB's recommendations in the Annual Report and indicate how they will be addressed.

2.3.2 Quarries

AEM is required to report on activities in quarries located along the All Weather Access Road (AWAR). In 2016, blasting of 30,000 tons of non-potentially acid generating (NPAG) material occurred in Quarry 2, but no other blasting occurred on other quarries situated on INAC and KIA leased land.

AEM continued remedial activities in Quarry 22, the former temporary storage area for contaminated material from a petroleum hydrocarbon (PHC) spill in 2012 along the AWAR. Scarification work to increase degradation of PHCs was carried out from July to September. Soil sampling was completed in September 2016 to monitor PHC degradation.

The quarry was inspected throughout the year to monitor runoff for any visible sheen. No issues were detected.

No comments.

2.4 Section 4: Water Management Activities

2.4.1 Fresh Water obtained from Third Portage Lake

A renewal and amendment of the Type A water licence for the Meadowbank Gold Project was granted in July 2015. The total volume of freshwater permitted for all uses and from all sources is now set at 2,350,000 m^3 per year until December 31, 2017, after which time the maximum will be 9,120,000 m^3 per year until the licence expires. A total of 608,308 m^3 of freshwater was used in 2016, well within the annual limit (~26% of maximum volume permitted).

No comments.

2.4.2 Fresh Water obtained from Wally Lake

No freshwater was taken from Wally Lake in 2016.

No comments.

2.4.3 Lake Level Monitoring

AEM reports that the water levels of Third Portage Lake, Second Portage Lake and Wally Lake have "*remained within the range of naturally occurring levels*" (p. 21) in 2016, yet no comparison with levels in the open water season of previous years is made. As we stated in our review of the 2015 Annual Report it would be helpful to present the range of naturally occurring water levels from each year of monitoring for these lakes, to validate the claim that variations in water levels have not been impacted by discharge volume.

Recommendation #5. Please provide data on variation in water levels for Third Portage Lake, Second Portage Lake and Wally Lake for each year monitoring of lake levels has been conducted.

2.4.4 Water Balance Water Quality Model Reporting Summary

AEM reports that the water management plan has been updated to reflect:

- Phaser and Vault Pit modifications;
- Updated truck mining fleet;
  Updated stockpile status;
- Modification to the Central Portage Pit Waste Rock Storage design and overall volume; and
- South Cell and North Cell Tailings Storage Facilities net acid generating (NAG) capping volumes and timeframe.

The water balance was also updated in 2016 to reflect the above modifications and changes to the life of mine (LOM) associated with prolonged mining activities. These include:

- Fresh water consumption revision;
  Total daily mill water requirement;
- Updated tailings deposition plan affecting the North Cell and South Cell deposition calendar;
- Pit water inflow revision based on observed flowmeter data as well as a revision of the pits and Tailings Storage Facility (TSF) run off inflows related to their underlying watersheds;
- Flooding sequence and volumes update to take into account the updated run off inflows, as well as to optimize flooding activities to reduce the impact on wall stability;
- Report on the dewatering of Phaser Lake in 2016;
  Updating the seepage section; and
- Changes in tailings dry density as observed through bathymetric analysis.

The updated water quality model indicates that treatment may be required for aluminum, arsenic, chromium, copper, iron, silver, selenium and fluoride so that the pit water quality meets CCME criteria at mine closure. This represents a change from the statements made in the 2014 Annual Report (which predicted that only copper and selenium might require treatment) and the 2015 Annual Report (which predicted that copper, silver, selenium and total nitrogen might require treatment) yet no explanations are

presented. Furthermore, the parameters of concern that are identified in the Annual Report as potentially requiring treatment do not align with those identified in Appendix C2 – 2016 Water Management Report and Plan. In particular, silver is not included as a parameter of concern requiring treatment at pit closure in Appendix C2 because "*silver is no longer problematic…due to a lower silver loading*" (Appendix C2 p.45), but total nitrogen equivalent is included as a parameter requiring treatment (although it is not listed as one in the Annual Report) (Appendix C2, Appendix C – 2016 Meadowbank Water Quality Forecasting Update, Section 6.2).

Recommendation #6. Please explain why there has been an increasing trend in the number of parameters predicted to exceed CCME guidelines for protection of aquatic life in pits at mine closure. Why are aluminum, arsenic, chromium, iron and fluoride now a concern in 2016 and is there any concern that the number of parameters will continue to increase?

Recommendation #7. We note that this change in water quality predictions was not presented or evaluated in Section 12.1.1.2 of the 2016 Annual Report, which discusses the accuracy of predicted impacts to water quality. AEM should include a discussion of why there is an increasing trend from year to year (since 2014) in the number of parameters predicted to exceed CCME guidelines in pits at mine closure.

Recommendation #8. Please address the discrepancy re: silver as a predicted parameter requiring treatment at closure in the 2016 Annual Report vs. Appendix C2.

Recommendation #9. Please address the discrepancy re: total nitrogen equivalent as a predicted parameter requiring treatment at closure in the 2016 Annual Report vs. Appendix C2.

2.4.5 Bathymetric Surveys

The water license requires that annual bathymetric surveys be conducted at the Baker Lake Marshalling Facility prior to the beginning of the shipping season. In 2016, the bathymetric survey was completed on July 9, and the shipping season commenced on July 21.

No comments.

2.4.6 Predicted vs Measured Water Quality [and Quantity]

An annual comparison between predicted water quality and quantity and measured water quality and quantity within Portage, Goose and Vault Pits is required under the water license. Percent differences of 20% or greater must be explained and their implications discussed.

A comparison of predicted and measured water quality and quantity within the pits was conducted for 2016, by comparing the measured water quality and quantity for that year with the predicted values for 2012- 2016. Under the water license, AEM is required to explain percent differences of >20%

between predicted and measured values.

AEM uses different formulas to calculate percent difference for water quality vs. water quantity (percent error for the former and percent change for the latter). No explanation is given for why the two parameters are measured differently. The formula provided for water quality is:

% difference = ((A-B)/B)*100

and the formula provided for water quantity is:

Relative % difference = (A-B)/((A+B)/2) * 100

where A = measured value and B = predicted value.

These formulas yield different results, which affect the determination of what measured and predicted values are >20% different from each other.

Recommendation #10. Please explain why percent difference is measured differently for water quality vs. water quantity predicted and measured values. Is the formula used for water quality different than the formula used in previous years? If so, this will confound inter-annual comparisons.

The volume of water measured in the Portage Pit in 2016 was more than 20% below the volume predicted for 2013 to 2016. AEM explains that this is partly because seepage water from East Dike was pumped to the Portage Pit sump prior to 2014, but that since 2014 this seepage water has been pumped into Second Portage Lake, leading to a significant decrease in water quantity in Portage Pit between 2012 and 2015.

The volume of water measured in Goose Pit was more than 20% below the volume predicted for 2012 to 2016, indicating that the contribution of seepage and groundwater sources to the pit is less than originally predicted.

The volume of water measured in Vault Pit was more than 20% greater than the volume predicted in 2014 and 2015 (by 75% and 83% respectively). AEM suggests this is due to *"more precipitation including larger freshet and rainfalls in 2015"*. While this may be the case for 2015, it does not explain the 75% higher than expected volume measured in 2014 and would appear to contradict the lower volumes observed in Portage and Goose Pits in 2015. In 2016 there was no significant difference between predicted and measured volume.

Recommendation #11. Please explain possible reasons for the greater than expected water volumes measured in Vault Pit in 2014 and consider these against the reasons for reduced volumes in Portage and Goose Pits.

Water quality in the three pit sumps (Portage, Goose and Vault) showed similar patterns in 2016 to those in previous years (2012-2016). Most parameters of concern had greater than 20% differences

between their measured and predicted concentrations (i.e., in both positive and negative directions) in all pit sumps. AEM suggests several possible reasons for differences greater than +/- 20% between predicted and measured values:

- Management of seepage, groundwater and local runoff results in reduced volume of water available to attenuate loads reaching pits;
- Higher contaminant loads in pit water could be related to higher observed loads in seepages flowing into pits;
- Some parameter detection limits are higher than predicted values (e.g., for dissolved metal analysis);
- Un-ionized ammonia concentration in water is highly influenced by pH (higher pH = higher fraction of un-ionized ammonia);
- Pit water has higher background values of many parameters (e.g., ammonia, nitrate due to explosive activity during pit activity; runoff and seepage in contact with potentially acid generating [PAG] rock).

None of the pits are discharged directly to the environment.

Recommendation #12. AEM should ensure that the accredited laboratory used to analyze pit water quality can reach the required detection limits for pertinent comparisons for all future monitoring.

2.4.7 Additional Information

No additional information was requested in 2016.

No comments.

2.5 Section 5: Waste Rock Management Activities

2.5.1 Geochemical Monitoring

Within two years of the start of operations, AEM is required to re-evaluate the characterization of mine waste materials for acid generating potential, metal leaching and non-metal constituents to confirm predictions presented in the environmental impact statement, and to re-evaluate rock disposal practices (via sampling) to ensure preventive and control measures are incorporated into the Waste Management Plan. Results of the re-evaluations are to be provided to the NWB and NIRB's Monitoring Officer.

AEM indicates that it characterized PAG and NPAG materials of waste rock by analysing 25% of blast holes for percentages of sulphur and carbon in 2016. As we recommended in our review of the 2015 Annual Report, a summary of the proportion of each type of waste rock (i.e., PAG, uncertain, and NPAG) found in this analysis is now provided in the 2016 Annual Report.

AEM states that any PAG or uncertain waste rock material is placed in the middle of the facility and

is surrounded by NPAG material to encapsulate the PAG material. The effectiveness of this abatement measure is then evaluated by monitoring runoff or seepage water. AEM reports that no indication of PAG leaching has been observed from runoff water to date, but seepage results are not reported. No description of the monitoring method is given (e.g., how many samples collected, where, and how often).

Recommendation #13. Please report results of the seepage monitoring to confirm no PAG leaching has occurred at the waste rock storage facility.

Recommendation #14. AEM should provide details on the approach that is used to monitor the waste rock disposal method. In addition, AEM should indicate what the threshold level of acceptable PAG runoff or seepage will be, and describe available mitigation measures which can be applied if this level is surpassed.

AEM has recommended in previous annual reports that surface water chemistry sampling at fish-bearing watercourses be discontinued, unless turbidity issues were visually observed. AEM indicates that detailed monitoring will be implemented if an erosional issue arises, with, at a minimum, a single water chemistry sample being collected upstream and downstream of the source. In 2016, nine formal erosion inspections were completed by qualified environment technicians in May through September, and weekly visual inspections were conducted during AWAR inspections. Daily inspections were also made in collaboration with the Meadowbank Energy and Infrastructures Department. As no erosional issues were observed, surface water quality sampling was not carried out at non-HADD (harmful alteration, disruption or destruction of fish habitat) crossings or quarry contact water pools.

We are concerned that water quality issues unrelated to turbidity (e.g., PAG leaching) may be missed if regular surface water chemistry sampling does not occur at fish-bearing watercourses.

Recommendation #15. AEM describes a schedule for monitoring for turbidity issues in 2016 which combines formal and informal inspections. Will this approach be continued in future years? We recommend that, in addition to monitoring for turbidity yearly, detailed surface water chemistry sampling be conducted every three to five years at fish-bearing watercourses.

2.5.2 Waste Rock Volume

No comments.

2.5.3 Tailings Storage Facility

2.5.3.1 Tailings Storage Facility Capacity

The deposition plan model concludes that the total estimated capacity of the TSF North Cell and South Cell is 32.0 Mt. The total capacity of the North cell is estimated at 18.2 Mt and the total capacity of the

South Cell is estimated at 15.0 Mt. The sum of these totals (33.2 Mt) exceeds the combined estimated capacity (32.0 Mt). The estimated remaining capacity in the South Cell, as of the end of December 2015, is reported as 6.9 Mm^3. No updated estimate is given for the South Cell remaining capacity (i.e., as of December 2016), nor any estimate for the North Cell remaining capacity.

Recommendation #16. Please clarify the discrepancy between the total estimated capacity and the sum of the individual capacities for the North and South Cells.

Recommendation #17. Please explain why a 2016 estimate of remaining capacity is not reported for the South and North Cells.

2.5.3.2 Tailings Freezeback and Capping Thickness

AEM reports that a laboratory testing program was developed in 2016 (in collaboration with the Research Institute of Mines and Environment) to test the effects of freeze/thaw and wet/dry cycles on soapstone, which is to be used as cover material for the TSF and RSF. AEM states that testing was completed and that the results indicate that *"it seems that Meadowbank's soapstone has a good resistance to F/T and W/D cycles*" (p. 75). No data are presented to support this statement.

Recommendation #18. Please provide the results of the laboratory testing program on soapstone resistance to freeze/thaw and wet/dry cycles.

2.6 Section 6: Waste Management Activities

2.6.1 Landfill Monitoring, Waste Rock Storage Facility and Central Dike

No comments.

2.6.2 General Waste Disposal Activity

No comments.

2.6.3 Incinerator

The average mercury level measured in the stack testing exceeded ECCC guidelines in 2014. AEM subsequently initiated an investigation into the possible cause of this exceedance and suggested it could be due to incineration of alkaline batteries, despite the existence of a battery recycling program. As a result, AEM launched an extensive awareness campaign across all mine departments to encourage proper disposal of batteries onsite. We are pleased to see that follow-up stack testing in

2016 found that the average mercury level was well below ECCC guidelines.

2.6.4 Additional Information

No comments.

2.7 Section 7: Spill Management

More spills were reported in 2016 than in any previous year from 2011-2015: 34 to the Government of Nunavut Spill hotline and 374 non-reportable spills were reported internally. AEM acknowledges there is a significant increase in reported spills, and in 2016 it began a Spill Reduction Action Plan to address the problem. AEM indicates that "*a KPI was developed to monitor and follow the situation*" (p. 86). It is not clear what a KPI is.

> **Recommendation #19.** Please define KPI and add to acronym list at beginning of the Annual Report. Assuming KPI stands for "Key Performance Indicators", AEM should indicate what KPI(s) they have selected and how it/they will help address the increased frequency of spills in 2016.

There appears to be a mistake in the number of spills reported to the hotline for the 2011-2015 period. The 2016 Annual Report indicates that 18, 12, 16, 7, and 9 spills were reported in 2011, 2012, 2013, 2014, and 2015 respectively. The 2015 Annual Report, however, indicates that 18 spills were reported in 2015, and 12, 16, 7 and 9 were reported in 2011, 2012, 2013 and 2014 respectively.

> **Recommendation #20.** Please clarify the number of reported spills for the 2011-2015 period.

AEM reports that spill prevention training was provided to employees in 2016. While training includes "induction training" for new employees, visitors and contractors, it is not clear how frequently refresher training is provided to long-term staff.

> **Recommendation #21.** Please indicate whether refresher training is part of spill prevention initiatives, and if so, how frequently it is provided to staff.

Landfarm

AEM decided to find a new location for the landfarm (Landfarm 2) to continue treatment of contaminated soil, since the existing landfarm (Landfarm 1) is located on the northwest side of the South Tailings Cell, which is predicted to be flooded with reclaim water in the summer of 2017. Landfarm 2 was constructed in 2016. An extension of Landfarm 1 was also built at a higher elevation in 2016 to continue treatment of soil at this location. AEM does not indicate where Landfarm 2 is located, nor

when it will begin operation. Similarly, it is not clear when Landfarm 1 will cease operation, and how the remaining soil there will be managed to avoid exposure to flooding and the generation of unnecessary contact water in the summer of 2017. AEM states that more information on landfarm activities is presented in Appendix F3 "2016 Landfarm Report", however, basic information on operations, location, and mitigation of flooding should also be summarized in the Annual Report.

Recommendation #22. Please indicate the location of Landform 2 and explain when it will begin operation in the Annual Report.

Recommendation #23. Please explain when Landfarm 1 will cease operation, and how the remaining soil at the landfarm will be managed to avoid exposure to flooding anticipated in the summer of 2017.

2.8 Section 8: Monitoring

2.8.1 Core Receiving Monitoring Program (CREMP)

AEM reports that "*as in the past, there were some statistically significant mine-related changes relative to baseline/reference conditions identified in 2016*" (p. 115) in water chemistry of Meadowbank Study Lakes, relating to alkalinity, conductivity, hardness, major cations (calcium, potassium, magnesium and sodium) and total dissolved solids. Despite exceedances of early warning triggers for several water quality parameters, AEM concludes that "*observed changes are still relatively low and unlikely to adversely affect aquatic life*" (p. 115). No evidence is provided to support the argument that these exceedances are not harmful to aquatic organisms.

Recommendation #24. Please provide support for the statement that water chemistry exceedances "*are…unlikely to adversely affect aquatic life*" and a discussion of actions that have been taken in response to these early warning trigger exceedances.

Some polycyclic aromatic hydrocarbons (PAHs) were measured in composite sediment samples collected at Second Portage, Third Portage, Wally and Innuguguayalik Lakes. AEM states, however that "*the absolute concentrations are unlikely to pose risk to benthic invertebrates at the NF [near field] locations*" (p. 116). AEM does not explain the reasoning behind this statement.

Recommendation #25. Please provide support for the statement that PAHs measured in Meadowbank lakes are not expected to adversely affect benthic invertebrates.

2.8.2 MMER and EEM Sampling

2.8.2.1 Portage Attenuation Pond Discharge

AEM indicates that the Portage Attenuation Pond has not been used since November 2014, when

tailings deposition began in it. Hence, no subsequent discharge of effluent to Third Portage Lake has occurred since November 2014, and the sample locations of ST-9 (Portage Attenuation Pond effluent discharge point) or ST-MMER-1 are no longer active.

No comments.

2.8.2.2 Vault Attenuation Pond Discharge

AEM states that the results of the 2016 Environmental Effects Monitoring (EEM) effluent characterization monitoring were previously reported to ECCC. It is not clear why this information is not also presented in the Annual Report. AEM plans to submit the EEM Cycle 3 Interpretive Report (evaluating Wally Lake- Vault Discharge) to ECCC in July 2018.

Recommendation #26. Please provide the results of the 2016 EEM effluent characterization monitoring of the Vault Attenuation Pond Discharge in the Annual Report.

Recommendation #27. Please provide the KIA with a copy of the EEM Cycle 3 Interpretive Report in 2018.

2.8.2.3 East Dike Discharge

AEM states that the results of the 2016 EEM effluent characterization monitoring for the East Dike Discharge were previously reported to ECCC. It is not clear why this information is not also presented in the Annual Report.

Recommendation #28. Please provide the results the 2016 EEM effluent characterization monitoring for the East Dike Discharge in the Annual Report.

2.8.2.4 EEM Interpretive Report Cycle 2 and EEM Study Design Cycle 3

No comments.

2.8.3 Mine Site Water Quality and Flow Monitoring (and Evaluation of NP2)

2.8.3.1 Construction Activities

No comments.

2.8.3.2 Dewatering Activities

No comments.

2.8.3.3 Mine Site Water Collection System

AEM reports that "*copper is slightly elevated above CCME at NP-2 South, East, West, and NP1-West "* (p. 127). The CCME guideline for protection of aquatic life for copper is 0.002 mg/L. Average levels in 2016 at NP-2 South and NP-2 Winter were 2-3 times above the CCME limit (0.005 and 0.0062 mg/L respectively). AEM does not provide any criteria by which to assess whether these levels are *slightly* or *significantly* elevated above CCME guidelines from a biological perspective. No discussion of potential impacts on aquatic organisms is provided.

Recommendation #29. Please qualify the statement that 2016 average copper levels at NP-2 South and NP-2 Winter are "*slightly elevated*" by providing evidence that such levels are not a serious concern for aquatic life. Please report comparisons of current water quality with those present prior to development in addition to "average" levels during operation of the mine.

2.8.3.4 Baker Lake Marshalling Facilities

No comments.

2.8.3.5 All Weather Access Road (AWAR) and Quarries

No comments.

2.8.3.6 QAQC Sampling

AEM is required to hire an independent contractor to conduct water quality monitoring under the NIRB Project Certificate. AEM refers to "qualified technicians" and "Agnico technicians" conducting water quality field sampling, but the name of the independent contractor is not listed.

Recommendation #30. Please provide the name of the company hired to provide the field technicians for water quality monitoring. If AEM's own staff participated in a portion of the field sampling, please indicate which field events were conducted by the third party's field technicians, and which were conducted by AEM's staff.

2.8.3.7 Seepag

e Mill Seepage

AEM implemented a monitoring program for mill seepage in 2014, as part of the Freshet Action Plan. The 2016 Annual Report indicates that concentrations of CN free, CN total and copper were below regulatory guidelines, while iron concentrations were higher at monitoring wells, while all parameters were below CCME guidelines for the Protection of Aquatic Life at Third Portage Lake. No data are presented to support these statements in the Annual Report, nor in Appendix C2, Appendix D- 2017 Freshet Action Plan.

Recommendation #31. Please provide a table summarizing monitoring results, with comparisons to regulatory guidelines/thresholds for the mill seepage monitoring program.

2.8.4 Visual AWAR Water Quality Monitoring

No comments.

2.8.5 Blast Monitoring

No comments.

2.8.6 Groundwater

No comments.

2.8.7 Habitat Compensation Monitoring Program

No comments.

2.8.8 Fish-out Program Summary

No comments.

2.8.9 AEMP

2.8.9.1 Introduction

No comments.

2.8.9.2 Potential Sources of Impacts and the Conceptual Site Model (CSM)

No comments.

2.8.9.3 Summary of Results of AEMP – Related Monitoring Programs

Table 8.73 (Summary of 2016 CREMP Results) indicates that acenaphthylene, a polycyclic aromatic hydrocarbon, exceeded the threshold at Third Portage Lake, but that the concentration was less than 5 times the method detection limit. AEM concludes that “acenaphthylene is not considered a risk to benthic invertebrate community at TPE [Third Portage Lake]” (p. 151). No magnitude, spatial scale, causation or permanence are assigned to the chemical’s occurrence at Third Portage Lake. It is not clear why this information is missing, since the CCME guidelines indicate that acenaphthylene is a persistent substance,

with a half-life of between 12 days and 14 weeks in water. Given this, it is unclear why that chemical was deemed as posing no risk to benthic invertebrates.

The occurrence of acenaphthylene at Third Portage Lake is not discussed in the text of the Annual Report. Similarly, the PAHs measured in sediment of Second Portage, Wally and Innuguguayalik Lakes, which are discussed in Section 2.8.1 (CREMP; see Recommendation #24), are not summarized in Table 8.73.

Recommendation #32. Given the fact that acenaphthylene is a persistent substance, please explain why it is not considered a risk to benthic invertebrates in Third Portage Lake, and fill in the information in Table 8.73 regarding the chemical's magnitude, spatial scale, causation, permanence, and management action for its occurrence in the lake.

Recommendation #33. Please discuss the occurrence of acenaphthylene in Section 2.8.1 of the report.

Recommendation #34. Please include information on the PAHs measured in the sediment of Second Portage, Wally and Innuguguayalik Lakes in Table 8.73.

2.8.9.4 Integration of Monitoring Results

No comments.

2.8.9.5 Identification of Potential Risks and Discussion

The difference in Lake Trout size and weight observed between Third Portage Lake populations and reference lake populations is explained as possibly being due to "*an inherent difference*" between the receiving lake and reference lakes and "*an artifact of using lake trout as a sentinel species*" (p. 155). No further explanation is given. As we stated in our review of the 2015 Annual Report, this lack of discussion is problematic, because it suggests that a foundation of the CREMP is fundamentally flawed (i.e., using the two reference lakes chosen for fish comparisons and using Lake Trout as a sentinel species), yet no solution to the potential problem is identified. It is not clear why AEM believes that the observed differences are due to artifacts of study design and not mine-related impacts. Furthermore, if there are inherent differences between Third Portage Lake and the two reference lakes, and if Lake Trout is not a suitable sentinel species, then there is little confidence in the data and an alternative approach to monitoring fish needs to be established.

Recommendation #35. Please explain why the observed differences in the Lake Trout populations is considered due to factors related to study design and not mine-related impacts. Discuss if this difference was present at the start of the project when the reference lakes were first chosen. Given this conclusion, please indicate how the study design will be changed to overcome these problems, allowing for more robust monitoring of potential mine-related impacts on fish populations.

2.8.9.6 Recommended Management Actions

No comments.

2.8.10 Noise Monitoring

No comments.

2.8.11 Air Quality Monitoring

AEM reports that the measured concentrations of dioxins and furans for the incinerator stack testing exceeded the Government of Nunavut standard in one out of three tests in 2016, by 12.5%. No explanation is given for the exceedance or its magnitude.

Recommendation #36. Please explain why there was an exceedance of 12.5% above the Government of Nunavut standard for dioxins and furans in one of the incinerator stack tests and what management actions were taken to prevent future occurrences.

2.8.12 Creel Survey Results

No comments.

2.8.13 Wildlife Monitoring

2.8.13.1 Annual Monitoring

No comments.

2.8.13.2 Harvest Study Results

No comments.

2.8.13.3 Caribou Migration Corridor Information Summary

No comments.

2.8.13.4 Caribou Collaring Study

No comments.

2.8.13.5 Raptor Nest Survey

No comments.

2.8.14 Country Food

No comments.

2.8.15 Archaeology

No comments.

2.8.16 Climate

No comments.

2.9 Closure

2.9.1.1 Mine Site

The Portage Rock Storage Facility is designed for storage of PAG waste rock in a manner that will prevent acid rock drainage generation over the long-term. The strategy focuses on freeze control of the PAG waste rock, with a 4 m layer of NPAG rock capping the PAG rock that is encapsulated in permafrost. AEM states that "*the waste rock below the capping layer is expected to freeze, resulting in low rates of acid rock drainage (ARD) generation in the long term*" (p. 170). A similar approach is used in the Tailings Storage Facility so that "*the tailings will freeze in the long term, and …the talik that currently exists below 2PL Arm will freeze before seepage from the TSF will reach the groundwater below the permafrost*" (p. 170).

As we stated in our review of the 2015 Annual Report, the strategy for long-term storage of PAG waste rock is contingent on there being permafrost over the long-term. How has climate change been incorporated into the design and modelling of the storage strategy? If permafrost is disappearing because of higher temperatures, the likelihood that acid rock drainage generation will occur increases.

Recommendation #37. Please indicate how climate change effects on permafrost are taken into account in the design and modelling of success of the freeze control strategy for PAG waste rock and confirm if a 4m cap is sufficient to ensure long-term freezing of the waste rock. Please ensure this information is incorporated into the updated Closure and Reclamation Plan.

2.9.1.2 AWAR

No comments.

2.9.1.3 Quarries

No comments.

2.9.2 Reclamation Costs

2.9.2.1 Project Estimate

No comments.

2.9.2.2 AWAR and Quarries

No comments.

2.10 Section 10: Plans/Reports/Studies

2.10.1 Summary of Studies

No comments.

2.10.2 Summary of Revisions

No comments.

2.10.3 Executive Summary Translations

No comments.

2.11 Section 11: Modifications/General/Other

2.11.1 Modifications

No comments.

2.11.2 International Cyanide Management Code

No comments.

2.11.3 Inspections, Compliance Reports and Non-compliance Issues

No comments.

2.11.4 AWAR Usage Reports

2.11.4.1 Authorized and Unauthorized Non-mine Use

No comments.

2.11.4.2 Safety Incidents

No comments.

2.11.5 On-board Vessel Encounter Reports

No comments.

2.11.6 Traditional Knowledge, Consultation with Elders and Public Consultation

No comments

2.11.7 Mine Expansion

No comments.

2.11.8 Insurance

No comments.

2.11.9 SEMC

No comments.

2.11.10 Socio Economic

2.11.10.1 Meadowbank Workforce

No comments.

2.11.10.2 Hours Worked by AEM Employees at Meadowbank

No comments.

2.11.10.3 Employment Retention

No comments.

2.11.10.4 Employment Demographics for Nunavut Based Employees

No comments.

2.11.10.5 Education & Training

Training Hours

It is very difficult to read Figure 41 because the white portion of the bar graphs blends in with the white background.

> **Recommendation #38.** Please change the colour scheme in Figure 41 to provide more contrast between the bar graphs and background.

Health and Safety Training Hours Provided to Inuit

AEM states that "*the majority of mandatory training sessions are offered via e-learning priori to an employee's arrival on site*" (p. 200). While training prior to commencing employment is clearly important, frequent refresher courses on health and safety would be beneficial for all staff. It is not clear whether refresher courses on health and safety issues are offered to Meadowbank staff on a regular basis.

> **Recommendation #39.** Please indicate whether refresher courses in health and safety are provided to Meadowbank staff on a regular basis.

Cross Cultural Training Program

AEM reports that 59 employees successfully completed cross cultural training in 2016. How is it determined who participates in the program? Is it voluntary, or mandatory for certain people?

> **Recommendation #40.** Please clarify the selection process for participation in the Cross Cultural Training Program. If voluntary, what steps has AEM taken to improve participation rates?

2.12 Section 12: Post-Environmental Assessment Monitoring Program (PEAMP) – Evaluation of Impact Predictions

2.12.1 Aquatic Environment

2.12.1.1 Accuracy of Predictions

The results of the 2016 monitoring of surface water quality and surface water quantity were compared with predicted values in Tables 12.2 and 12.3. It is not clear why the results discussed earlier in the Annual Report's Section 4.6 (Predicted vs Measured Water Quality [and Quantity]; Section 2.4.6 of this Review) are not presented here as well. In particular, no mention is made of the lake volumes that exceeded the
>20% percent difference threshold between predicted and measured values, nor the parameter of concern concentrations that exceeded the >20% percent difference threshold between predicted and measured values.

> **Recommendation #41.** Please include a discussion in Section 12.1.1 (and in the Tables 12.2 and 12.3) of the exceedances of >20% percent difference for water quality and water quantity which are presented earlier in Section 4.6 of the Annual Report.

2.12.1.2 Effectiveness of Monitoring Programs

No comments.

2.12.1.3 Recommendations for Additional Mitigation for Adaptive Management

No comments.

2.12.1.4 Contributions to Regional Monitoring

No comments.

2.12.2 Terrestrial and Wildlife Environment

2.12.2.1 Accuracy of Predictions

AEM reports that two Terrestrial Ecosystem Monitoring Program thresholds were exceeded or potentially exceeded in 2016: waterfowl mortalities, and potentially, sensory disturbance of caribou related to the AWAR.

In Table 12.5, however, under Predatory Mammals, AEM reports that "*one fox* [was] *euthanized after not responding to deterrents* [and] *one killed on mine road* [and] *one killed on AWAR*" (p. 224). These three mortalities exceed the stated threshold of one mortality per year for predatory mammals. It is not clear why these mortalities are not considered exceedances of the predicted impacts for terrestrial wildlife.

Recommendation #42. Please clarify why the deaths of the three Arctic foxes are not considered exceedances of predicted impacts for terrestrial wildlife.

2.12.2.2 Assessment of Trends

An assessment of historical trends for mortality of predatory mammals should be conducted since the threshold of one mortality per year was exceeded in 2016 (see Recommendation #40).

Recommendation #43. Please assess the historical trends for mortality of predatory mammals for the Meadowbank project.

2.12.2.3 Effectiveness of Monitoring

No comments.

2.12.2.4 Recommendations for Additional Mitigation or Adaptive Management

AEM discusses mitigation measures to reduce waterfowl mortalities, but not mortality of predatory mammals (e.g., Arctic foxes). Discussion of additional mitigation measures to prevent or reduce mortality of predatory mammals should be included.

Recommendation #44. Please include a discussion of mitigation measures that will be implemented to prevent or reduce further mortality of predatory mammals on site and along the mine road and AWAR.

2.12.2.5 Contributions to Regional Monitoring

No comments.

2.12.3 Noise

No comments.

2.12.3.1 Accuracy of Predicted Impacts

No comments.

2.12.3.2 Effectiveness of Monitoring

No comments.

2.12.3.3 Recommendations for Additional Mitigation or Adaptive Management

No comments.

2.12.3.4 Contributions to Regional Monitoring

No comments.

2.12.4 Air Quality

2.12.4.1 Accuracy of Predicted Impacts

No comments.

2.12.4.2 Effectiveness of Monitoring

No comments.

2.12.4.3 Recommendations for Additional Mitigation or Adaptive Management

No comments.

2.12.4.4 Contributions to Regional Monitoring

No comments.

2.12.5 Permafrost

2.12.5.1 Accuracy of Predicted Impacts

No comments.

2.12.5.2 Effectiveness of Monitoring

No comments.

2.12.5.3 Recommendations for Additional Mitigation or Adaptive Management

No comments.

2.12.5.4 Contributions to Regional Monitoring

2.12.5.5 Contributions to Regional Monitoring

There are two headings with the same title, but different information.

> **Recommendation #45.** Please clarify the headings referring to *Contributions to Regional Monitoring.*

2.12.6 Socio Economic

2.12.6.1 Accuracy of Predicted Impacts

No comments.

2.12.6.2 Effectiveness of Monitoring

No comments.

2.12.6.3 Recommendations for Additional Mitigation or Adaptive Management

No comments.

2.12.6.4 Contributions to Regional Monitoring

No comments.

Appendix D1: Waste Rock and Tailings Management Plan

Permafrost

AEM discusses the impact of climate change on site conditions in Section 2.1.4.3. This section appears incomplete, as it contains several paragraphs that are repeated, and error messages. In addition, the conclusions drawn on climate change effects are not well supported. According to the text, a 6.4˚C increase in maximum average air temperature is predicted for the region by 2100 (i.e., for sites located at 65˚N latitude), with accompanying reductions in near-surface permafrost of 12-15%, and increases in active layer thickness of 15-30%. Yet, the text then says that:

"*predictions based on a warming of 4°C to 5°C over the next 50 years (NRC, 2004) (approximately double the rate predicted above) suggests [sic] that the Meadowbank site would remain within the zone of continuous permafrost, but the active layer thickness would be expected to increase, and the total thickness of permafrost may slowly reduce in time"* (p. 10).

The rate of warming stated (4 to 5°C over the next 50 years) is not double the 6.4°C increase stated by 2100. The implications of either rate on permafrost and waste rock/tailings management at Meadowbank are significant, and merit an in-depth analysis and discussion. Yet, no further details are presented either in this Appendix or in the Annual Report.

Recommendation #46. Please address the discrepancy in predicted temperature increases presented in the text.

Recommendation #47. Please present an in-depth discussion of the implications of a 4 to 6.4°C maximum average air temperature increase for the permafrost at Meadowbank, and subsequently, waste rock and tailings management over the long-term (i.e., >100 years), particularly management of PAG waste rock.

Control Strategies for Acid Rock Drainage in Cold Regions

AEM outlines its control strategies for acid rock drainage in Section 4. The strategies employed by AEM (freeze controlled and climate controlled) rely on continuous permafrost and low net precipitation, two conditions that are threatened by climate change in the Meadowbank region. For example, the Nunavut Climate Change Centre (see http://www.climatechangenunavut.ca/en/understanding-climate-change/climate-change-nunavut) indicates that permafrost depth and coverage are predicted to decrease in the future, while precipitation is expected to increase across the territory (and has already increased by 8% in Nunavut over the last century).

Given the significant reliance on a stable cold and relatively dry climate at Meadowbank for control of acid mine drainage, we believe the potential threats of climate change on AEM's control strategies over the short- and long-term merit an in-depth assessment and discussion in the Annual Report.

Recommendation #48. AEM should discuss ongoing mitigation and adaptive management strategies to reduce the impact of climate change on project activities, project infrastructure and the long-term stability of the site post-closure. In particular, AEM should consider new Intergovernmental Panel on Climate Change (IPCC) models for climate change in the region that have emerged since the Meadowbank Environmental Assessment and how they affect original plans for control of acid mine drainage over the short- and long-term at the mine..

Tailings Management Strategies

AEM outlines tailings management strategies in Section 7.2. As with acid rock drainage, tailings disposal depends on the "*arid climate and permafrost environment*" (p. 58) currently present at Meadowbank. AEM states that "*it is anticipated that the tailings will eventually become encapsulated by permafrost*" (p. 58), but no assessment or discussion of the short- and long-term efficacy of this strategy under climate change is provided.

Recommendation #49. AEM should discuss ongoing mitigation and adaptive management strategies to reduce the impact of climate change on project activities, project infrastructure and the long-term stability of the site post-closure. In particular, AEM should consider new IPCC models for climate change in the region that have emerged since the Meadowbank Environmental Assessment and how they affect original plans for tailings disposal over the short- and long-term at the mine.

Tailings Reclamation

AEM's plans for tailings reclamation (Section 7.3) consist of aggradation into surrounding permafrost to limit the movement of contaminants through surface and groundwater, with the tailings material capped with NAG material to keep them frozen as much as possible. AEM states that: "*Tailings material, beneath the minimum 2.0 m thick cover, appears to remain frozen for all years (excluding the warmest years) from the 100-year database, accounting for climate change*" (p. 60). Temperatures in the region are expected to rise in the future under climate change, potentially beyond what has been recorded over the past 100 years. It is thus questionable whether conclusions on the efficacy of tailings reclamation strategies based on previous climate trends are reliable under a changing climate. The Sabina Gold & Silver Corporation is using a 5 m cap in response to climate change uncertainty at its Back River Gold Project.

Recommendation #50. AEM should discuss ongoing mitigation and adaptive management strategies to reduce the impact of climate change on project activities, project infrastructure and the long-term stability of the site post-closure. In particular, AEM should consider new IPCC models for climate change in the region that have emerged since the Meadowbank Environmental Assessment and how they affect original plans for tailings reclamation over the short- and long-term at the mine.

Recommendation #51. Please evaluate whether a 2 m cap is sufficient for keeping tailings frozen, given climate change projections for the region and why a 2m cap is considered sufficient for tailings encapsulation, but 4m is proposed for waste rock (See2.9.1.1).

Tailings Freezeback and Seepage

In section 7.4, AEM states that "*tailings are to remain frozen for a period of over 150 years following closure, taking into account the agreed-upon climate change scenario*" (p. 61). It is not clear what scenario is being used for modelling.

Recommendation #52. Please indicate what climate change scenario is being used to predict the duration of tailings freezeback and whether the prediction needs to be updated in response to newer IPCC climate change models.

Recommendation #53. Please discuss mitigation plans if post-closure monitoring reveals that freezeback will not last for over 150 years.

3. Review of Amaruq Exploration Access Road 2016 Annual Report and Recommendations

3.1 Introduction

The Amaruq Exploration Access Road (AEAR) will link the Meadowbank mine site to the Amaruq Exploration site, approximately 50 km to the northwest. It will be a private road, situated on both Crown Land and Inuit Owned Land (IOL), with gates at either ends to allow closures for bad weather, road accidents, road maintenance and wildlife issues. The road has been approved to be 6.5 m wide and approximately 64 km in length, with 11 bridges, 28 corrugated round culverts over watercourses and additional localized drainage culverts.

AEM has sole responsibility for the construction, inspection, operation, maintenance and decommissioning of the AEAR. As such, the road is subject to a number of authorizations, leases and permits including:

- NWB Type B Water License 8BC-AEA 1525;
- INAC Land Use Permit (N2015F0026), Leases 66H/08-02-1 (AWSR) and 66H/08-01-1 (AWAR Quarries);
- KIA Right of Way KVRW15F01 and Quarries KVCA 15Q02; and
- DFO Letter of Advice issued on March 14, 2016.

3.2 Road Construction/Quarries

3.2.1 Road Construction

3.2.1.1 Summary of Construction Activities

Road construction began in February 2016. By the end of 2016, AEM reports that 27.5 km of the road had been completed, from KP 16+900 to KP 47+000. The KP labels do not appear on Figure 1: Amaruq Exploration Access Road Layout and are not explained in the text, making it difficult to determine what sections of the road were finished in 2016.

> **Recommendation #54.** Please explain what KP 16+900 and KP 47+000 are in the text, and label on Figure 1. This information is presented in Appendix 2 but should also appear in the Annual Report itself.

3.2.1.2 Geotechnical Inspection

The Water License requires that annual geotechnical inspections of the road be conducted, including stream crossings and quarry and borrow areas. AEM reports that no annual geotechnical inspection of the AEAR was carried out in 2016, but that it plans to complete one in 2017. AEM also states that the Amaruq Road Supervisor and Environment Department typically conduct weekly inspections of the AEAR for geotechnical or environmental issues during construction. The results of these weekly inspections are not summarized in the Annual Report.

> **Recommendation #55.** In the absence of an annual geotechnical report for 2016, AEM should provide a summary of the weekly inspections conducted by the Amaruq Road Supervisor and Environment Department.

3.2.2 2017 Work Plan

AEM submitted its 2017 Work Plan for the AEAR to the KIA in December 2016 (Appendix 2). The Work Plan mainly focuses on activities planned for the IOL portion of the road. The AEM states that Figure 1 of the Annual Report illustrates what portion of the road is on IOL, but Figure 1 does not contain this information.

Recommendation #56. There are at least seven different colours assigned to the road in Figure 1, but no legend explaining what these colours mean. Please provide information to explain what the different colours mean, and also indicate what portion of the road is on IOL.

3.2.3 Quarries

No comments.

3.3 Water Management Activities

3.3.1 Summary of Water Use Activities

No comments.

3.3.2 Unauthorized Discharges

No comments.

3.3.3 Seepage Monitoring

No comments.

3.3.4 Monitoring Program

No comments.

3.3.5 Additional Information

No comments.

3.4 Waste Management Activities

3.4.1 General Waste Disposal Activity

No comments.

3.4.2 Additional Information

No comments.

3.5 Spill Management

Table 5.1 lists 14 non-reportable spills that occurred in relation to the AEAR construction in 2016. A majority of these spills (9/14 or 64%) were due to broken equipment (e.g., hydraulic hose, hydraulic cylinder, coolant line, engine oil pan valve, engine head gasket). It would seem that this type of spill should be almost entirely preventable through proper maintenance and inspection.

> **Recommendation #57.** Please indicate why so many spills are due to broken equipment, and what action is being taken to reduce this risk in the future.

3.6 Monitoring

3.6.1 Water Crossings Visual Inspection

No comments.

3.6.2 Archaeology

No comments.

3.6.3 Blast Monitoring

No comments.

3.6.4 Acid Rock Drainage and Metal Leaching

Several acronyms are used in this section which are not spelled out in the text (e.g., ABA, ML, SFE, WRA).

> **Recommendation #58.** Please ensure that all acronyms are spelled out in full the first time they appear in the text. We also recommend a list of acronyms at the beginning of the AEAR Annual Report.

3.6.5 Wildlife Monitoring

No comments.

3.7 Closure

3.7.1 Progressive Reclamation

3.7.1.1 Road

No comments.

3.7.1.2 Quarries

No comments.

3.7.1.3 Plan modification

No comments.

3.7.1.4 Reclamation Costs

No comments.

3.8 Plans/Reports/Studies

3.8.1 Summary of Revisions

No comments.

3.8.2 Executive Summary Translations

No comments.

3.9 Modifications/General/Other

3.9.1 Public Consultation

No comments.

3.9.2 Inspections, Compliance Reports and Non-compliance Issues

No comments.

3.9.3 AWAR Usage Reports

3.9.3.1 Authorized usage

No comments.

3.9.3.2 Unauthorized non-mine use

No comments.

3.9.3.3 Safety Incidents

No comments.

Appendix 3 – Amaruq Road Management Plan, Version 2 2017

The Road Management Plan discusses mitigation measures and protocols to protect wildlife, prevent permafrost degradation, and control surface runoff and sedimentation during construction and operations.

In Section 10.1, AEM describes the general wildlife monitoring program that will be established once the road is constructed. The data collected will include type of wildlife observed, estimate of numbers, and nearest kilometre marking along the road. We believe it would also be useful to record what the wildlife is doing when observed, and estimated distance from the road.

> **Recommendation #59.** We recommend recording wildlife behaviour and distance from the road as part of the regular wildlife surveys to be established once construction is complete.

In Section 10.1.2, an adaptive management flow chart is presented for monitoring and management of predatory mammals in the vicinity of the AEAR and associated eskers (Figure 3). If an active den is found, the flow chart indicates that monitoring will be initiated during the denning season "*from a maximum possible distance*" (p. 40). It would be helpful to state a limit to how close observers should approach dens to minimize disturbance during monitoring, based on established guidelines in the scientific literature.

> **Recommendation #60.** Please provide a minimum distance observers should stay away from dens during monitoring.

In Section 11.1 AEM states that water quality monitoring will be conducted during road construction and operation to test water quality draining from open borrow pit sites and from the road base materials. It is not clear what water quality parameters will be measured, nor how frequently or where along the AEAR.

> **Recommendation #61.** Please explain the water quality monitoring program design for the AEAR, including parameters to be measured, frequency of sampling and location of sampling sites.

4. Conclusions

We are generally satisfied with the information and conclusions presented in the 2016 Meadowbank Annual Report, and we are glad to see that many of concerns raised in our review of the 2015 Annual Report have been addressed. We identified numerous sections of the 2016 Annual Report, however, that require additional background information or detail to help clarify and justify statements made, including:

- Water Quality and Quantity;
- Waste Rock Management;
- Spill Management;
- Water Quality Monitoring;
- Climate Change Impacts on Closure Plans;
- Socio Economic Considerations; and
- Evaluation of Impact Predictions.

In addition, we identified several sections of the Amaruq Exploration Access Road 2016 Annual Report that require additional clarification, including:

- Progress on road construction;
- Geotechnical surveys;
- Spill management;
- Wildlife monitoring; and
- Water quality monitoring.

While the project appears to be operating in a way that does not result in undue impact to the receiving environment as per the project certificate and water license, the lack of information in these sections makes it difficult to fully evaluate whether all potential impacts of the mine are being adequately monitored. These considerations should be addressed in future annual reports for the Meadowbank Project and its expansions.

5. Closing

We hope this memo meets your current needs. Should you have any questions, please do not hesitate to contact Lands Department Kivalliq Inuit Association (dirlands@kivalliqinuit.ca). We would be happy to answer any questions you may have.

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