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Kelli Gillard
Technical Advisor & Doris North Monitoring Officer
Nunavut Impact Review Board
P.O. Box 1360
Cambridge Bay, NU
X0B 0C0

June 27, 2014

Re: The KIA's Comments on TMAC's *Annual Report for Doris North Gold Mine Project Certificate NIRB No. 003*

Dear Kelli Gillard

The KIA has reviewed TMAC Resources Inc. **2013 Annual Report for Doris North Gold Mine Project Certificate NIRB No. 003** and has some comments on; 1) Compliance Monitoring, and 2) Effects Monitoring to provide NIRB.

1) Compliance Monitoring

TMAC Resources Inc. reporting of how TMAC is carrying out the project in relation to the project certificate is accurate. The KIA sees no violation of any licences, permits, or authorizations in TMAC's execution of submitted plans or activities carried out at site.

The KIA had conducted inspections of the Hope Bay Project mine site in June and August of 2013. The summaries of the KIA's internal inspection reports, which were also provided to TMAC, are presented as follows:

Internal Report on June Hope Bay Inspection – June 19th to 21st, 2013

Summary

The inspection of Hope Bay Mining Ltd.'s mine site and facilities was conducted on June 20th, and 21st as per established inspection. Katsky Ventor of Hope Bay Mining Ltd. (HBML) (seconded to TMAC) accompanied Wynter Kuliktana (KIA Lands Officer) and me on the inspection. A total of 42 site components out of 66 components were inspected in accordance with the established schedule. Mine site components not inspected will be inspected in August. Ownership and operations of the Hope Bay Project was assigned from HBML to TMAC Resources Inc. in March, 2013 and the Doris North mine site re-opened in May.

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The mine site is in overall good condition as TMAC Resources Inc. continues with care and maintenance at the re-opened mine site. The mine was closed for the winter and was inspected twice a month by personnel from Cambridge Bay. During the previous, September 2012, site inspection, several vehicles, equipment, and waste material had been removed by sea-lift. The mine site is relatively empty of heavy equipment, vehicles, and C-cans in several locations. Conditions are the same as it was during the previous mine site inspection.

With the mine site re-opened, a minimal complement of about 20 to 30 personnel are at site engaged in care and maintenance and site preparation work. TMAC seeks to bring a mill for processing by mid-2014 to commence operations. Doris North will be used for on-going exploration of the belt while Boston Camp will remain closed.

Buildings remain at Windy Camp and drill holes at Windy and Patch Lake/Madrid were inventoried in 2012. Further clean-up of Windy Camp and the cutting and capping of drill holes is dependent upon TMAC obtaining additional funding. Some old camp tents are being removed from Windy Camp with consideration being given to interested Inuit salvaging some of these tents in accordance with the IIBA. This is currently being investigated by TMAC. External debris around Windy Camp has mostly been removed.

Mine site facilities, equipment, and infrastructure are in good condition and are unchanged from the September, 2012 site inspection. Un-used portions of Doris North are sealed as is Boston Camp.

Treated waste water is currently being discharged to the tundra at Doris North. The discharge pipe to the rock face is suspended with the pipe heating element removed. Discharge to the rock face will be done once the discharge pipe is repaired and temperatures are above freezing all the time.

Internal Report on June Hope Bay Inspection – August 24th to 25th, 2013

Summary

The inspection of Hope Bay Mining Ltd.'s mine site and facilities was conducted on August 24th, and 25th as per established inspection. Lea-Marie Bowes-Lyon of Hope Bay Mining Ltd. (HBML) (seconded to TMAC) accompanied Sam Angaluak (KIA Project Officer) and me on the inspection. A total of 36 site components out of 66 components were inspected in accordance with the established schedule. Mine site components not inspected in June were inspected in August.

The mine site is in overall good condition as TMAC Resources Inc. continues with care and maintenance at the re-opened mine site. Approximately fifty people are at

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the mine site during the summer. The mine site is still relatively empty of heavy equipment, vehicles, and C-cans in several locations. Conditions are largely the same as it was during the previous June mine site inspection.

Some of the tent structures were removed at Windy Camp. The salvageable tents that have been removed from Windy Camp are being provided local HTOs. Other buildings remain at Windy Camp and are sealed. Some of these buildings are dilapidated and need to be removed soon.

Drill holes at Windy and Patch Lake/Madrid were inventoried in 2012. Fifty drill hole stems have been cut and capped along the road during the summer. TMAC is not using grouting in the sealing of drill holes as was the standard practice for Newmont. Further clean-up of Windy Camp and the cutting and capping of drill holes is dependent upon TMAC obtaining additional funding.

The front of the Jetty has been rebuilt due to it being swamped by ocean waves. New rock armor has been added to the front of the Jetty and around the edges. The Jetty has been reinforced and resurfaced. The size of the Jetty is still the same as what is permitted by the DFO.

Mine site facilities, equipment, and infrastructure are in good condition and are unchanged from the June, 2013 site inspection. Un-used portions of Doris North are sealed as is Boston Camp.

Several caribou tracks were found in and around the Boston Camp clearly indicating the presence of wildlife in the area.

2) Effects Monitoring

The KIA's consultants have reviewed the Hydrology Compliance Report, Windy Lake Shoal Monitoring Report, Roberts Lake and Outflow Fish Compliance Report, the Aquatic Effects Monitoring Program Report, and the Wildlife Mitigation and Monitoring Report. Overall KIA's consultants find TMAC's conclusions to be valid for these reports and the summary presented in the 2013 Annual Report.

The KIA presented our wildlife biologist's comments on the WMMP to NIRB in our June 28th, 2013 response **Re: Wildlife Mitigation and Monitoring Program – 2012 Annual Report and Updated Wildlife Mitigation and Monitoring Program (WMMP)** and again in our February 11th, 2014 response **Re: Review Response to Comments Submitted by TMAC Regarding Board Recommendations 9 and 10, concerning WMMP.**

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Our Wildlife biologist has provided us the following comments on the 2013 Annual Report for Doris North.

It has been noticed that some things of interest on the maintenance inspection report cards at the end of the report (Appendix C) that didn't get incorporated into the WMMP or weren't addressed in the summary:

- There are some care and maintenance inspection forms in Appendix C that were filled out with no area labeled. Each form has Area fields to label (3) per form, and they were rarely filled in, making it difficult to determine the location referred to in the comments;
- On one of those forms, with no area fields filled in, there is a note stating "wolverine could be denning in waste rock pile". I didn't see this integrated into an adaptive monitoring or adaptive management plan, and saw no mention of it anywhere else. If something like this is noted, it should be looked into to prevent the crushing of a den, if waste rock is added to the pile.
- Many of the forms mention "wildlife tracks" or "old wildlife tracks". If the inspectors are unable to identify them to species or just to general wildlife order, having them take a photo of the footprint with a ruler beside it could help a wildlife biologist to determine which species (or at least order) of wildlife these statements are referring to. These notes could refer to old Arctic ground squirrel tracks, grizzly tracks, caribou tracks... it would be nice to at least have that level of distinction.
- There is an inspection report that notes that there was a forced entry at the Orbit Shop (Roberts Bay), but there is not distinction on the forms to tell whether the entry is by wildlife (grizzly) or humans. The inspection sheets simply ask if there are: "Signs of entry (forced or wildlife)"- Yes or No. It would be ideal to distinguish between these two, as one implies attractants that are affecting grizzly behaviour, and the other implies human break and enter. Perhaps changing the inspection forms to distinguish between the two would help, or asking the inspector to note if it is a wildlife-related incident (due to which species) would help. Grizzly bears can pry door latches, so even that note doesn't help to distinguish between the two possibilities.
- One of the inspection reports mentions fox tracks at the portal of the white weatherhaven south of the portal. Since foxes sometimes den underneath weatherhavens, it would be nice to include more details on the location of the tracks in such situations, and whether it looks like they are going to and from the structure, or just passing by.
- in the WMMP summary sections, in the bulleted list, there is a statement that says: "The number of grizzly bear events recorded at treatment sites did not differ from the number recorded at control sites, suggesting that grizzly bears were not avoiding areas within 1 km of Project infrastructure in 2013. Please present this information as it was presented for short-eared owls 2 bullets below the grizzly bullet (i.e., present as the number of recorded events per camera days).

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The following is excerpted from the KIA's engineering consultant's review of the **Doris North Gold Mine Project Hydrology Compliance Report 2013.**

3.0 COMMENTS AND DISCUSSION

3.1. General

This report presents a factual account of the results of a set of hydrological measurements carried out during 2013 at Doris North Gold Mine Project. The observed measurements are mainly in the form of stream flows and water levels recorded at various site locations. The data presented was obtained within the framework established by the Water Licence No. 2AM-DOH0713 Type A. It is our understanding that this licence was valid until September 30, 2013, hence now it is expired, unless it has been renewed, but that detailed is not explained in the monitoring report.

The following comments and discussion are based on the review of both complementary documents; the hydrology report itself and the water licence agreement which appears to govern the former. The review comments are organized in two groups, general and specific, and within them, in a subjective order of importance.

The main general comments are as follows:

- There are no significant concerns about the work performed, the methods used or the information presented. Consequently, the report provides general hydrological information deemed necessary by ERM Rescan's interpretation of the water licence, specifically within the points listed in Section 1 (Introduction) of the report.
- When the 2012 (Rescan, 2012) and 2013 (ERM Rescan, 2014) monitoring reports are compared, one can notice that the introduction section of the 2012 report lists more complying points than the 2013. The points listed in the 2012 report and not listed in the 2013 report are:
    - Part F, Item 1a: The water management plan should include a requirement to continuously monitor Doris Lake levels and outflow during the two years of mining and beyond to confirm water balance and model predictions.
    - Part G, Item 29: The licensee shall ensure that water within the Tailings Impoundment Area is maintained at an elevation of at least 28.3 m above sea level such that a minimum of 4 m of water cover is maintained over the tailings at all times.

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- Doris North Project Certificate (NIRB No 3, September 15, 2006): "Hope Bay Mining Limited will monitor stage and discharge in Doris Outflow both upstream and downstream of the decant discharge point to provide information that can be used in assessing the accuracy of the impact predictions relating to fish habitat downstream".

- The facts these aforementioned points are not listed in the 2013 reports makes the reviewer question if they have been properly addressed or due to proposed changes in the project design, these requirements have been revised. Anyhow, the report should include a brief explanation if this constitutes a change in scope of the work and hence, a change in compliance requirements.

- The scope of the report is not specific enough to address the fact that not all water related aspects of the requirements or stations stated by the Water Licence are presented in the report. This point was already mentioned in the review of the 2012 report. For example, total water quantities used (potable and process), hydrotechnical conditions of water courses (erosion), water quality, etc., are not provided. It may be the case that these other aspects are not to be included in the hydrology report, but if this is the case, the scope of work should be more clearly stated, including an explanation of what is not included in the current report. If the aspect under concern is not applicable due to the situation of the mining project (care and maintenance), it should be also clearly stated. This analysis could be shown in a table format for easy visualization and understanding.

- The report is lacking a conclusions section, since it only presents a summary section. It is recommended that a section that discusses the conclusions of the report is incorporated. Such a section should include clear statements addressing the following aspects:
  - Annual hydrological conditions and if they have been normal or abnormal in comparison with local weather conditions or past observed data.
  - Summary of the specific fulfillment of regulatory requirements and how where they accomplished. If all requirements have not been fulfilled, an explanation of why they have not been done so and the following plan of action should be included. It is recommended this is shown in a table format for clear visualization and understanding.
- The hydrology report presents the data in a factual way, without incorporating any interpretation of the data collected. It is recommended that this sort of interpretation is incorporated into the report in order to give the reader a better understanding of the study area and the relevance of the collected data; i.e. to the revision of water balance design criteria, for example. If such an

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interpretation is not in the agreed scope of work, the introduction should clearly state it.

3.2. Specific

Within the more detailed and specific comments concerning the hydrology compliance report, the main points are as follows:

- Although the report presents information about water levels at Tail Lake, it is not clearly stated if it complies with the requirement of 4 m of water cover as a minimum; this should be clearly stated in the conclusion section and its compliance results table.
- There is no description of the 2013 meteorological conditions that exist in the area, especially air temperature. The hydrology of an area underlain by permafrost is controlled by air temperatures. As such, a brief description of the local meteorological conditions gives some context to understand the general hydrology of the area and within the particular year being reported; e.g., the occurrence of freshet events. It is therefore recommended to include some brief weather related explanations.
- Related to the previous point, it is recommended that hydrographs show air temperature, as well as precipitation. In this way, it is easier for the reader to correlate and understand the existence of peak stream flows like the freshet related one. On a related matter, is the reported precipitation total precipitation or only liquid? How is it measured? This should be clearly explained. Additionally, the correlation of air temperature, precipitation and field observed hydrological parameters is important for the reader because it gives background on understanding the natural processes that govern the area, these versus anthropogenic driven changes.
- How are demobilization dates decided for the flow gauging stations? This is important since the report states that the basal flow is estimated to be the low flow observed close to the date of demobilization of stations. Data gathering stops when the station is taken down and as such, it is not known if the basal flow is actually less than the values noted. It is suggested to compare the basal flow estimates with the results of a theoretical separation of the annual hydrograph and evaluate how different they may be.
- In fact, baseflow is defined by Singh (1992) as "*the ground water contribution to stream flow*". It continues on saying that "*most baseflows originate from the water table*". Then it states that "*the water table is the water saturated sediment whose surface is in communication with the atmosphere through the pore openings between sediment grains and is therefore under atmospheric pressure*". However,

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on permafrost underlain grounds, where the active layer freezes in winter, it is very difficult to state that the lower flows observed by the end of the field recording season correspond to baseflows. As such, it is recommended that reference to baseflows be deleted; just mention the low flow values recorded at the end of the field season.

- The generation of the hydrographs follows a standard procedure. However, the 24 hour averaging of the 10 min discharge data in the arctic may result in a non-representative value due to the high daily variations in flow. The comment is not intended to change the procedure, but this context should be noted and perhaps an estimation of the variance of the data presented so it gives the reader a measure of how representative is the calculated average.
- Additionally to the previous point, some sections of the hydrographs were estimated and shown in dotted lines. It is recommended to state how these data were interpolated.
- The report mentions that the section on station Doris TL-2 changed due to slumping, which is a possible indication of degrading permafrost. When did this occur? It is understandable that a new rating curve is needed. However, this bears the question as to causative mechanism and if any mitigation measures are required for this slumping stream section.
- The 2013 report does not mention the Roberts Bay lake monitoring station as the 2012 report did. If the station is no longer being included, it is recommended that the 2013 reports gives a brief explanation regarding its deletion.
- There are some occurrences where a water flow value is given, but it is not specifically stated if it corresponds to daily average, hourly peak, or what type of observation is in terms of its time frame. Any values quoted must have a proper adjective type (e.g. daily, weekly, annually, etc.).

4.0 SUMMARY AND CONCLUSIONS

This memorandum summarizes BGC's comments and discussions with respect to the review of the Doris North Gold Mine Project Hydrology Compliance Report 2013 and Water Licence No: 2AM-DOH0713 Type A. The comments here presented have the objective to ensure that KIA receives proper information that a) complies with the regulatory requirements and b) are appropriate in terms of describing the environmental current conditions of their land.

This review identified some areas with respect to the Hydrology Compliance Report 2013, where additional information is recommended. The main points are as follows:

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- Clearly identify the scope of work of the report and state what aspects of the regulatory requirements have been addressed and which ones have not been included, or will be included elsewhere. This could be shown in a table format for easy visualization and understanding.
- Include a conclusions section where it is clearly pointed out how the regulatory requirements have been addressed if properly done so, along with any relevant interpretation of the data collected. Similarly to the previous point, this could be summarized in a table format.
- Expand in the context description of the study area and its hydrological behaviour.

It should be noted that the aforementioned points were noted in the review of the 2012 report (BGC, 2013) and they have not yet been addressed in this year's report.

The following is excerpted from the KIA's fish consultant's review of the **Windy Lake Shoal Monitoring Report** and the **Roberts Lake and Outflow Fish Compliance Report.**

Palmer Environmental Consulting Group Inc. (PECG) was retained by Kitikmeot Inuit Association (KIA) to review the Doris North Project 2013 Compliance Monitoring Reports for Fish Compensation in Roberts Lake and Outflow and Windy Lake. The specific reports and authorizations reviewed were:

• Golder 2007. Doris North Project No Net Loss Plan, Revision 6, 2007. Edmonton, AB: Prepared for Miramar Hope Bay Limited by Golder Associates Ltd.
• Rescan 2010a. Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Lake. Vancouver, BC: Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.
• Rescan 2010b. Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Outflow. Vancouver, BC: Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.
• Rescan 2014a. Doris North Project: 2013 Windy Lake Shoal Compliance Monitoring Report. Yellowknife, NWT: Prepared for TMAC Resources by Rescan Environmental Services Ltd.
• Rescan 2014b. Doris North Project: 2013 Roberts Lake and Outflow Fish Compliance Monitoring Report. Yellowknife, NWT: Prepared for TMAC Resources by Rescan Environmental Services Ltd.
• DFO *Fisheries Act* Authorization No. NU-02-0117.3 issued to TMAC Resources June 19, 2013 for the creation of two rock shoals located in Windy Lake due to the impact at the Tail Lake outflow.

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Please note that *Fisheries Act* Authorization(s) could not be located for impacts to Tail Lake and associated compensation (Roberts Lake outflow, Stream E09, four shoals in Windy Lake), and thus were not verified during this review.

Overall, the monitoring reports indicated that the compensation was functioning as intended and demonstrated general compliance with the No Net Loss Plan (Golder 2007) and its revisions (Rescan 2010a, b). In a few cases, our review has identified where more detail would be helpful for assessing the success of compensation measures. General and specific comments for each of the monitoring reports (Rescan 2014a, b) are given below:

Windy Lake Compensation (Rescan 2014a):
General Comments:

Windy Lake compensation shoals appear to be functioning as intended in terms of structural stability and the establishment of primary and secondary producers. However, the lack of fish using any of the pre-existing or compensation areas suggests that Windy Lake may support low densities of fish and that the compensation shoals may have been more suitable in a different lake. It would be useful for the reviewer to have available comparisons of the baseline fish communities and habitat in Windy Lake vs. Tail Lake and its outflow in order to assess the compensation effectiveness relative to the habitat lost.

When evaluating the ability of all the compensation structures combined to maintain No Net Loss of habitat in the project area, the success of the Roberts Lake outflow enhancement (Rescan 2014b) which allows Arctic charr access to an area 3.8x greater than the loss of Tail Lake provides the greatest contribution of compensation habitat. In comparison, the four Windy Lake rock shoals constructed for the loss of Tail Lake habitat is minor (0.31ha) relative to the habitat gain expected due to the Roberts Lake outflow enhancement (132.18 HU). Thus, the low densities of fish observed in Windy Lake may not be a critical piece in the overall picture for maintaining No Net Loss in the project area.

Habitat loss for the Tail Lake outflow, considered separately from Tail Lake, was compensated for by two Windy Lake shoals with an area of 0.17ha, which is more than 6x the ninespine stickleback habitat loss area (Rescan 2010b, p4-2). Criteria of success (Rescan 2010b, P6-1) and *Fisheries Act* Authorization requirements have been generally met thus far as the compensation shoals have established primary and secondary productivity and densities of fishes similar to that in non-enhanced rearing areas of Windy Lake.

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Specific comments:

Methods:

P2-1: The text on page 2-1 states that monitoring sites were established in 2012. Please clarify the year of establishment as other records indicate 2011.

P2-6: Is four plates per site for periphyton consistent with previous years?

Results:

P3-1: Monitoring details from 2012 are not available for review and therefore, the consistency of methods and appropriateness of statistical testing cannot be verified among years. We would recommend that future reporting contain a brief year-to-year comparison of methods and results.

P3-7: It should be made clear in the results that the periphyton and benthic invertebrate data should be interpreted with the understanding that the use of artificial substrates does not directly measure the biological indices between the habitat types, but rather measures the rate of establishment between the habitat areas. A true measurement of the difference in biological communities would be measured from the existing or newly added substrate.

P3-1: Are the established shoals at the appropriate depths? This information was not identified in the reports.

Rescan 2010a. P6-3: It was indicated that underwater videography would be incorporated to assess fish populations on the compensation shoals. Was this methodology ever implemented? If not, a discussion as to why would be helpful.

Roberts Lake and Outflow Compensation (Rescan 2014b):

General comments:

The Roberts Lake outflow enhancement appears to be quite effective despite 2013 being a low discharge year.

The enhancement of Roberts Lake stream E09 yielded no fish during its first year of post-enhancement monitoring. As the stream E09 enhancement is considered to be bonus habitat in the overall habitat balance (Rescan 2010a), the failure to support fish thus far should not be considered a critical issue. It is noted in the monitoring report (Rescan 2014b, page 4-4) that channel morphology likely influenced the lack of fish at the Roberts Lake stream E09 enhancement site, as the compensation pools

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were constructed above a number of cascades which may be impeding fish passage in low discharge years. If future compensation efforts are required in this system, the construction of pools which are more readily accessible to juvenile Arctic charr would likely be more effective for increasing juvenile densities (e.g. downstream sections of stream E09 or in stream E14).

Specific comments:

Methods:

P3-1: Three pass depletion methods were used but it is unclear how the method was employed to estimate population density per species.

P3-5: CPUE was used to determine densities. More details are required to understand the data analysis methods employed. Please provide a detailed breakdown of data analysis methods, including the sample sizes for each level, the number and origin of replicate data, the avoidance of pseudo replication (e.g., were all samples/replicates independent?), and the method for calculating CPUE (e.g. were all passes summed?) It appears as though sample sizes may be quite low (n=2-4), in which case the ability to detect statistical differences will be hindered and any results from these tests may be misleading. With restricting sample sizes, an emphasis on qualitative results would be more beneficial for the reader.

P3-5: Descriptive statistics for all biological and CPUE data outlined in the methods were not located in the results section.

P. 3-7: The monitoring program was changed to capture returning adults rather than emigrating smolts. The change is appropriate for two reasons: (1) the logistic difficulties associated with field sampling during high flows, and (2) returning adults are the most likely life stage to be restricted by low flows in the boulder garden and thus have the most direct benefit from the enhancement.

P3-8: Monitoring of the Roberts Lake outflow changed in 2013 to an automated Vaki Riverwatcher System due to safety risks. Understandably, encounters with dangerous wildlife in the study area required a fast transition in surveying methods and thus there are no years where the two methods were compared. A discussion on the potential biases between the two field methods would be helpful for assessing future monitoring results. For example, is the Vaki Riverwatcher camera system as effective at identifying individual fish which migrate past the fence multiple times? Or is the new technology more effective at identifying the number of migrating fish?

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P. 3-11: States that CPUE will be calculated per fence per 24 h, however CPUE does not appear to be available in the results. Please add CPUE to results or remove this from methods section.

P3-14: Descriptive statistics do not appear to be available for CPUE data. Please revise for consistency between methods and results.

P3-14: Survival rate was not standardized to the number of days the fence was operating in a given year, which varied from 23 days in 2003 to 48 days in 2010 (Table 4.2-1 P.4-7). For comparison purposes, survival should be standardized by using a period common to all years or any other justifiable method which reduces the potential effect of sampling period variability.

Results:

P4-1: Data from pre-enhancement years (2010-2012) are not available for review. Thus, the consistency of methods and appropriateness of statistical testing cannot be verified among years. We would recommend that future reporting contain a brief year-to-year comparison of methods and results.

P4-1: Given that no fish were caught in any year at the enhancement site, the use of a mixed model anova to compare with sites where fish were caught is invalid as the difference in samples violates parametric test assumptions (all samples must be normally distributed with equal variances).

P4-1: How was CPUE data pooled within E09 for comparison with stream E14?

P4-1: There is an unequal number of years sampled for the two streams, although it seems as though 2010 data was still included in analyses. There does not appear to be any correction for an unbalanced study design in the methods. Was a correction incorporated in the analysis? Is it possible that 2010 sampling at one site only may influence the results? Are the results different if 2010 is omitted?

P4-7: Statistical testing of survival should also be standardized for sampling period.

P. 4-7: Text on page 4-7 states that "...survival in 2013 was always higher (by a minimum of 24%) than pre-enhancement years." This statement is unclear as post-enhancement survival is only 14% greater than 2010, and 16% greater than 2003.

Rescan 2010a. P6-2: The criteria for success is stated as a 25% increase in the mean number of Arctic charr smolts that go to sea in a single open-water season compared to the mean number that went to sea during the pre-improvement monitoring period. Is the 25% being adopted for the mean number of returning

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Arctic charr adults to reflect the program changes? If so, please provide a summary evaluation of this criterion using results from the first year of monitoring. Please also provide commentary regarding whether the second criterion of success (the elimination of stranding of adults spawners in the boulder garden) was met in 2013.

Rescan 2010a P6-3: The criteria for success outlined for Roberts Lake stream E09 were not met. The criteria were: newly created rearing habitat supports greater densities of rearing fish than adjacent natural sections of the stream. As indicated in the monitoring report (Rescan 2014b), this was only the first year of data collection after stream enhancement and additional seasoning of the habitat is required before drawing firm conclusions as to the efficacy of the compensation for increasing juvenile Arctic charr density. Furthermore, the time delay in increased fish density here should not be considered a critical issue as the success of the Roberts.

The following is excerpted from the KIA's aquatic consultant's review of the **2013 Aquatic Effects Monitoring Program Report.**

Introduction
As of the 2013 AEMP, the Doris North project is still in care and maintenance. Some minor construction activities were carried out in 2013 to maintain the site. The jetty in Roberts Bay was damaged during the summer of 2013 resulting in some erosion. A silt curtain was installed during repair work to contain the suspended solids generated by that work.

Water management activities continued to be necessary at the Project site. Water levels in Doris Lake were managed through discharges to Doris Creek. TMAC stated that this water discharge has occurred seasonally since 2011 and has been closely monitored to ensure that established discharge criteria are met.

Existing infrastructure at the site which did not require maintenance included "*the 5,000,000 L tank and berm at Roberts Bay, the 20,000,000 L tank farm at Roberts Bay, the Roberts Bay pad, the road and associated airstrip between Roberts Bay and Doris Camp, the access road to the Doris Lake pump house, the 2,500,000 L tank farm at Doris Camp, Doris Camp Pads X and Y (including the camp, generator, and sewage and water treatment system), Doris Camp Pads B, C, E/P, F, G, H/J, I, Q, the helipad, and the lower reagent pad*".

TMAC outlined the potential interactions the Project may have with the aquatic environment. Those which could potentially impact the aquatic environment under current operations carried out at the site were as follows:

- Shipping activity at the marine jetty in southern Roberts Bay
- Construction of roads and infrastructure

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- Runoff from site infrastructure, roads, waste rock, explosives facility; and
- Accidental spills.

Comment: HESL agrees with TMAC's assessment of the potential interactions which the Project may have with the aquatic environment. We also agree with the assertion that treated effluent from the Tailings Impoundment Area (TIA) is not presently of concern while the project is under care and maintenance as no tailings have been placed in the facility and no discharges have yet occurred.

2. Methods

2.1 and 2.2 – AEMP summary and study design

The AEMP was conducted in accordance with the Doris North Gold Mine Project: Aquatic Effects Monitoring Plan under the Type A Water Licence (NWB No. 2AM-DOH0713). The AEMP has endeavoured to follow the EEM requirements under MMER to monitor project impacts to

- Water quality
- Water column structure
- Sediment quality
- Primary producers (phytoplankton and periphyton), and
- Benthic invertebrate community (density and taxonomy)

The Project footprint was divided into two study environments, each with "exposure" and "reference" sites(s). The freshwater environment was further subdivided into lakes and streams (Table 1). At each site an assessment was made of water quality, sediment quality, periphyton biomass and benthos. Lake and marine sites were also assessed for physical limnology and physical oceanography respectively.

Table 1. Number of Sites used for Doris North 2013 AEMP

Sites	Freshwater		Marine
	Lakes	Streams	
Exposure	3	3	2
Reference	2	2	1

The sampling location, description and purpose for each of the sites was well described in Table 2.1-1 of the AEMP Report reproduced here. Streams were sampled four times in the open water season during June, July, August and

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September. Lakes and the marine environment were sampled once during the ice covered season, in the month of April and three times in the open water season in the months of July, August and September.

Comment: The samples have been spaced by at least one month when possible in accordance with MMER. HESL acknowledges that this can sometimes be challenging due to inclement weather and other external factors, yet notes that all sampling dates were at minimum three weeks apart. HESL feels that the collection of samples was sufficiently spaced such that the aquatic environment has been well characterized.

Benthos were assessed by TMAC at all stream, lake and marine sites during the open water season, in the month of August. TMAC states that the AEMP benthos sampling was designed to comply with EEM requirements under Schedule 5 in the MMER. Metrics used to assess benthos were:

- Benthic Invertebrate Density
- Family Richness,
- Simpson Diversity Index,
- Simpsons Evenness Index, and
- Bray-Curtis Index.

TMAC assessed and reported the total organic carbon concentration, particle size; and sample percent comprised of gravel, sand, silt and clay in sediment samples.

Comment: HESL notes that benthic invertebrates were collected following a similar protocol to that used under Ontario's Benthic Biomonitoring Network[1] (OBBN) and satisfied the requirements stipulated by the MMER. Each exposure and reference site was sampled at five substations, each of which consisted of three composite subsamples. TMAC has also assessed benthos using all required metrics under MMER and accompanied their assessment with the mandatory sediment quality parameters.

[1] *Ontario Ministry of the Environment. 2007, Ontario Benthos Biomonitoring Network: Protocol Manual.*

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Table 2.1-1. AEMP Sampling Locations, Descriptions, and Purpose, Doris North Project, 2013

Sampling Location	Coordinates (13W)	Description	Purpose
Doris North Outflow	434177E 7559910N	Immediate downstream of Discharge point from the Tailings Improvement Facility	First exposure site downstream of TIA discharge location
Little Roberts Lake	434624E 7562747N	Small lake downstream of Doris Outflow	First and only lake exposed to upstream discharge
Little Roberts Outflow	434367E 7563094N	Steam downstream of Little Roberts Lake	Second exposure stream downstream of TIA discharge location
Roberts Bay East (RBE)	433430E 7563850N	Marine bay into which Little Roberts Lake drains	Marine receiving environment for freshwater system downstream of TIA discharge location
Roberts Outflow	435129E 7562881N	Stream upstream of Little Roberts Lake, which drains the much Larger Roberts Lake	To characterize any influence of abandoned silver mine and past neighbouring exploration activity (North Arrow Minerals Inc.) on Roberts Outflow and potentially downstream in Little Roberts Lake and Little Roberts Outflow, and to be able to differentiate this from potential effects of TIA discharge upstream.
Doris Lake North	433815E 7558222N	Large lake located south of main Project site. North part of lake is adjacent to Project infrastructure.	Potential exposure site due to close proximity of Project infrastructure and explosives storage.
Doris Lake South	434288E 7555935N	Large lake located south of main Project site. South part of lake is 4 km away from Project infrastructure.	South site can be used to characterize any potential changes to the lake (whether local or lake-wide).
Roberts Bay West (Jetty; RBW)	432479E 7563346N	Small marine bay where jetty is located.	Potential exposure marine area due to marine activities and infrastructure.

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Reference Lake D	447566E 7561201N	Small reference lake located west of the Project.	Reference lake meant to closely resemble the morphology, habitat, and, fish community of Little Roberts Outflow.
Reference Lake D Outflow	448109E 7562830N	Reference outflow located west of the Project	Reference stream meant to closely resemble the morphology, habitat, and fish community of Little Roberts Outflow.
Reference Lake B	424050E 7532000N	Large reference lake located southwest of the Project	Reference lake meant to closely resemble the morphology, habitat, and fish community of Doris Lake.
Reference Lake B Outflow	427150E 7530515N	Reference outflow located southwest of the Project	Reference stream meant to closely resemble the morphology, habitat, and fish community of Doris Outflow.
Ida (Reference) Bay (ref-Marine 1)	441152E 7563018N	Marine bay located west of the Project.	Marine reference area meant to provide a reference for the two potential marine exposure sites (Roberts Bay East, Roberts Bay West (Jetty))

The MMER outline deleterious water quality substances under Schedule 4. Each substance is required to be monitored for EEM programs and has an associated minimum detection limit under Schedule 3 of MMER. Table 2 outlines the Schedule 4 substances; required detection limits; and the realized detection limits achieved in the 2013 AEMP.

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Table 2. Achieved and Required Detection Limits of Schedule 4 MMER Deleterious Substances.

Schedule 4 Deleterious Substance	Units	Schedule 3 Minimum Detection Limit	Realized Detection Limit	
			Fresh Water	Marine
Total Suspended Solids	mg/L	2.0	1.0	2.0 – 3.0
Cyanide	mg/L	0.010	0.001	0.001
Arsenic	mg/L	0.010	0.00005-0.0005	0.0004
Copper	mg/L	0.010	0.0005	0.00005
Lead	mg/L	0.030	0.00005	0.00005
Nickel	mg/L	0.020	0.0002	0.00005
Zinc	mg/L	0.010	0.0003	0.0008
Radium-226	mg/L	0.010	0.010	0.010

Comment: All substances were assessed using the required detection limits outlined by the MMER. HESL notes that TSS measurements in the Marine Environment occasionally were assessed using a higher than specified detection limit – 3 mg/L as opposed to the required 2 mg/L. We do not feel this would have altered conclusions regarding the Projects impact on the aquatic environment which will be discussed in our review of the Results. HESL notes that Radium-226 was assessed in all samples. This may be reduced in the future given MMER section 13(2) as Doris North will not be operated as a uranium mine. Section 13(2) reads:

13(2): ***"Despite section 12 and subject to subsection (3), the owner or operator of a mine, other than an uranium mine, may reduce the frequency of testing for Radium-226 set out as item 8 of Schedule 4 to not less than once in each calendar quarter if that substance's concentration in the effluent is less than 0.037 Bq/L in 10 consecutive tests conducted under section 12."***

2.3– Evaluation of Effects

Baseline data for the Doris North Project have been collected since 1995. Over that time, some sample locations have been moved throughout the water body though TMAC endeavoured to maintain continuity of their data. Water quality samples were collected at the same depth using sites with similar physical limnology and sample depth. Where possible TMAC has compared the 2013 data to historical data using a

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"Before vs. After Analysis" called the "Before-After-Control-Impact (BACI) analysis" in accordance with Smith 2002[2].

The analysis model looks at non-parallelism over time between exposure and reference water bodies. The model was applied as follows (From Appendix B): *"The BACI estimate is computed as the "difference in the differences":*

$$BACI=(\mu PA-\mu PB)-(\mu RA-\mu RB)$$

where μPA is the mean variable reading in the Project *class of sites* after *Project initiation, μPB is the mean variable reading in the Project class of sites* before *Project initiation, μRA is the mean variable reading in the reference class of sites after Project initiation, and μRB is the mean variable reading in the reference class of sites* before *Project initiation. The BACI contrast is estimated by replacing the population means above by the model-based estimates. Estimated differences close to 0 would indicate no evidence of non-parallelism.*

Note that the hypothesis that the BACI contrast has the value of zero is identical to the hypothesis that the Period*Class *interaction is zero with identical p-values... The BACI model was fit using R version 2.15.2."*

Recommendation: HESL agrees with the use of the BACI analysis for evaluating Project effects. A note of contention was TMAC's use of a reduced level of significance. A threshold of significance for evaluation P values was set at 0.01 to address multiple comparisons. HESL therefore evaluated project effects in the 2013 AEMP at a more conservative level of significance threshold of 0.05, using the statistics provided by TMAC, to recognize the need for environmental protection. Unless otherwise noted, the more conservative statistical test did not alter the conclusions made by TMAC.

HESL notes that confidence in results from BACI analysis may be diminished as they are subject to improvements over time in detection technology. Many parameters in the project area were consistently below their respective method detection limits. As the BACI analysis substitutes non detect values with ½ the detection limit for statistical analysis, improved detection limits will drive period specific means down. This was not seen as a concern for the BACI analysis in this report. Parameters affected by the point in question had concentrations below effects based thresholds for the protection of aquatic life.

[2] *Smith, E.P. 2002, BACI Design. Encyclopedia of Environmentrics. Wiley: New York*

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3. Evaluation of Effects

TMAC has presented the results from the 2013 AEMP by assessment type which has then been subdivided into streams (where applicable), lakes and then the marine environment. We will present our review following the progression of these results. Baseline data is available for most sites from 1995 onward with some gaps in years. Construction began in the project area in 2010 thus only data up until 2009 are considered truly representative of baseline conditions (aside from any changes resulting from exploration and advanced exploration activities). Data from 2010 onward is occasionally used for comparison with 2013 but is not included in the BACI analysis.

3.1 Under-Ice Dissolved Oxygen

TMAC reported that dissolved oxygen was not adversely impacted by the Project.

3.1.1 Streams

Dissolved oxygen was not assessed under ice in the freshwater streams.

3.1.2 Lakes

Measured dissolved oxygen dropped below the CCME guideline for cold-water early life stages (9.5 mg/L) in the upper most 10m of the water column and was below the cold-water guideline for other life stages (6.5 mg/L) in the lower portion. This has been observed in the historical baseline data for those sites and was observed currently and historically and in the reference sites. Similarly dissolved oxygen in Little Roberts Lake dropped below CCME guidelines in the same manner as was observed in the shallow reference lake. Dissolved oxygen was below early life stage guideline in May and below the non-early life stage guideline in April in both water bodies.

3.1.3 Marine

Marine dissolved oxygen was above the CCME guidelines throughout the water column in all exposure and reference sites corresponding with observations recorded in the baseline data.

Comment: HESL agrees with TMAC's assertion that the Project did not negatively impact concentrations of dissolved oxygen in the aquatic environment. The decision to not measure dissolved oxygen in the freshwater streams is acceptable as all watercourses froze through to the sediment.

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3.2 Secchi Depth

Secchi depth was measured in the lake and marine sites; Secchi depth was not assessed in the shallow streams.

3.2.1 Lakes

Mean Secchi depth in 2013 was within the range of baseline measurements. The BACI analysis did not indicate a significant difference between the exposure lakes and the reference sites.

3.2.2 Marine

Secchi depth reached the sediment at all marine sites in 2013. TMAC indicated that the project did not have an impact on water clarity.

Comment: HESL agrees with TMAC's conclusion that the project did not have an influence on water clarity in the fresh water or marine environment.

3.3 Water Quality

3.3.1 Streams

Baseline data for exposure streams was available from 1996, 1997, 2000, and 2003 through 2009.

Of the assessed parameters at exposure sites with associated CCME or MMER guidelines, aluminum, cadmium, iron and mercury were detected in at least one sample above the associated CCME guidelines.

Mean aluminum in the 2013 exposure and reference sites was lower than the historical data. Aluminum exceeded the CCME pH –dependent guideline of 0.1 mg/L in Roberts Bay; Little Roberts and reference outflows indicating that the exceedance was not driven by project activities.

Some cadmium samples exceeded the new hardness dependent CCME guidelines but were not 5x the detection limit and were within the natural variability of background concentrations. TMAC noted that the highest concentration measured in 2013 was 0.0000201 mg/L at the Doris Outflow compared with the site specific hardness dependent guideline of 0.0000197 mg/L.

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Comment: HESL commends TMAC on the use of the very low detection limit for cadmium of 0.000005 mg/L. This provides good confidence in assessments of potential project impacts to water quality.

Iron concentrations exceeded the CCME guideline (0.3 mg/L) at the Little Roberts Outflow in several samples collected in June of 2013. Similar exceedances have been noted in the historical data. Results from the BACI analysis indicated 2013 concentrations were not statistically different from baseline data.

Mercury concentrations were below the detection limit of 0.0005 µg/L in the majority of samples. Other sample concentrations were above the detection limit but below the CCME guideline (0.026 µg/L). One sample exceeded the guideline at Roberts Outflow in July (0.106 µg/L). The duplicate sample collected at the same time was close to the detection limit (0.00064 µg/L) suggesting the exceedance was likely an anomalous result.

Ammonia, nitrate, cyanide and radium-226 were all below their respective detection limits in all samples. Other measured parameters were above the detection limit in some samples but below the CCME guidelines and not statistically different from baseline data. pH, alkalinity and hardness were not distinguishable from historical data.

Comment: HESL concurs with TMAC's conclusion that project activities did not have a significant impact on freshwater stream water quality.

3.3.2 Lakes

Lake water quality data was available from 1995 to 1998, 2000, and 2003 to 2009.

pH and alkalinity were not statistically distinguishable from baseline data. Hardness increased slightly but statistically significantly in Doris Lake South but not Doris Lake North. No other lake sites differed significantly from baseline.

Recommendation: TMAC should continue monitoring hardness at the Doris Lake South site as it will be proximal to the proposed effluent discharge from the Tailings Impoundment Area. While the statistically significant change may have been a result of project activities, there is currently little risk to the aquatic environment.

TSS and total ammonia-nitrogen were within the range of baseline concentrations and did not exceed the CCME guideline. Nitrate and cyanide were below the detection limit. Radium-226 was at or slightly above the detection limits in all reference and exposure sites except at Doris Lake South where one sample collected

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in July measured at 0.056 Bq/L. This did not exceed the Authorized Limit of Deleterious Substances stipulated under MMER Schedule 4 for a single grab sample (1.11 Bq/L).

Cadmium, copper and iron exceeded the associated CCME guideline value in at least one sample.

Most cadmium samples were below the detection limit of 0.005 µg/L at all exposure and reference sites. Out of the ten samples collected from Doris Lake North, a single sample had a cadmium concentration (0.047 µg/L) above the detection limit and above the hardness dependent CCME guideline. Cadmium did not differ significantly from baseline concentrations.

Recommendation: The frequency with which cadmium was below the detection limit at Doris Lake North suggests that the one sample detected above the method detection limit is not likely to pose a significant risk to aquatic life. Given that the next sample collected from that site was below the detection limit, HESL has reached the conclusion that the duration which aquatic life may have been exposed to elevated cadmium is temporally limited. Cadmium concentrations should be monitored closely in future years to ensure concentrations are not increasing.

Copper concentrations in a sample were above the site specific hardness dependent CCME guideline in Doris Lake North. No site differed significantly from baseline concentrations as the naturally observed historical variability encompassed measurements in 2013.

Iron samples collected at the exposure sites did not differ significantly from baseline conditions and were all below the CCME guideline (0.3 mg/L). Iron was measured in excess of the CCME guideline at the reference lakes in April of 2013.

All other parameters were below their parameter specific CCME guidelines and were not distinguishable from baseline data using the BACI analysis.

Recommendation: Cadmium and copper concentrations should be closely monitored seasonally to ensure no increasing trend concentrations is emerging at Doris Lake North. Iron concentrations should be monitored in the reference lakes to ensure they are still comparable to exposure lakes. TMAC may need to consider a new reference site if this is not the case. HESL agrees with TMACs conclusion that project activities have not had a significant impact on the water quality of fresh water lakes on site.

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3.3.3 Marine

Historical water quality data in the marine environment was available from 1996 and 2004 to 2008 at Roberts Bay East and for 2009 for Roberts Bay West. This makes it more difficult to compare current data to historical data. As a result it is prudent to draw conclusions of impacts from Project activity by comparing exposure sites with reference sites. An assessment using the BACI analysis is still possible for Roberts Bay East.

pH, alkalinity and hardness were all similar between exposure sites and the reference site. These three parameters were statistically similar to historical data at Roberts Bay East using the BACI analysis.

There was no increase in measured TSS at either Roberts Bay East or West relative to the reference site despite construction on the jetty in Roberts Bay. TSS was lower in 2013 than in previous years at Roberts Bay West.

All other samples were below the CCME guideline, within the variation observed historically and similar to measured values in the reference site.

Comment: HESL agrees with TMAC's assessment that project activities have not had a significant impact on water quality in the Marine Environment.

3.4 Sediment Quality

MMER requires that sediment samples are analyzed for particle size and total organic carbon concentration to complement benthic invertebrate community surveys. Full sediment chemistry was also assessed by TMAC.

3.4.1 Streams

Particle size in the streams was different in 2013 from baseline years. Both Doris and the Reference B outflows had a larger proportion of sand and a lower proportion of gravel. TMAC notes that the parallel shift in sediment composition at both an exposure and reference site indicate this is natural variation. Particle size also shifted at the Little Roberts outflow. Gravel and sand content was higher while clay and silt content was lower. This change was not paralleled in the reference stream. TMAC indicates that this may have been a result of the natural spatial heterogeneity in stream sediments. They also state that sediment chemistry concentrations will likely be lower at the Little Roberts Outflow site as fine sediments are naturally associated with higher metal and total organic carbon concentrations.

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Correspondingly, TOC, chromium, copper, lead and zinc were statistically lower in the Little Robert Outflow than baseline conditions using the BACI analysis. The change in chromium was paralleled by the reference site. All other parameters were near or below their detection limits and below all CCME guidelines.

Recommendation: HESL agrees with TMAC's assessment that project activities likely had no impact on the aquatic environment. Changes in particle size likely represent natural heterogeneity in the environment as do the variations in sediment chemistry. Particle size and sediment chemistry should continue to be monitored to better understand the heterogeneity occurring at the sites within the project assessment area.

3.4.2 Lakes

The period of record for lake sediment data is the same as that available for water quality. Samples collected in 2013 at Doris Lake North were not directly comparable with historical data as samples have been collected from sites differing by approximately 500 m over the years. It is thus more appropriate to compare sediment chemistry to reference sites at Doris Lake North than using the BACI analysis.

Particle sizes at all lake sites were consistent with previous years and were dominated by fine sediments (silt and clay) in 2013. Silt content decreased slightly but significantly while clay content increased slightly but significantly in 2013 compared with the 2009 sediments in Doris Lake South. TMAC states that this slight change is likely a result of natural heterogeneity rather than a project impact. There were no other significant changes in particle size in either the exposure or reference sites.

Only copper concentrations in Doris Lake North and South exceeded the CCME interim sediment quality guideline (ISQG) of 37.3 mg/kg but were below the probable effect level guideline of 90 mg/kg. However, the mean concentration was statistically lower than baseline indicating that aquatic life has not been put at risk. Furthermore, TMAC states that copper concentrations were highly variable in the historical data indicating a large natural variability in observable concentrations. Copper concentrations at the other exposure and all reference sites did not differ from historical measurements.

Lead concentrations in the sediments of Little Roberts Lake were statistically significantly lower than baseline concentrations. All other measured parameters were below all CCME guidelines and not statically different than historical measurements.

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Comment: HESL agrees with TMAC's conclusion that lake sediments have not been impacted by project activities. The minor differences observed in 2013 sediment chemistry from baseline conditions are more likely to represent natural variation than project related improvements to sediment quality as all activities near the lakes are associated with care and maintenance operations.

3.4.3 Marine

Baseline data in the marine environment were not directly comparable to 2013 data as methodology varied from year to year and not all sites were located at the current AEMP sites. Particle size assessment is unaffected as comparison is made between 2009 and 2013 when the same sites were used with consistent methodology between years. Other sediment quality parameters are best compared with reference sites as opposed to historical data.

Roberts Bay West and the reference site consisted mainly of sand, silt and clay with very little gravel. Sediment at Roberts Bay East was made up predominantly of sand with some silt and little gravel or clay. Sand decreased in the Roberts Bay West and reference sites while silt increased. The change in sediment composition at the Roberts Bay West site is less likely the result of proximal jetty repair activities as it was paralleled by changes in the reference site. TMAC states that the greater proportion of fine sediments in the Roberts Bay West and reference sites would likely result in greater concentrations of TOC and metals.

Sediments at Roberts Bay West and in the reference site contained higher concentrations of TOC, arsenic, chromium, copper, lead and mercury than previous years. The mean copper concentration (25.0 mg/kg) at Roberts Bay West, was greater than the CCME ISQG (18.7 mg/kg). TMAC states that this was likely the result of a shift in sediment composition to an increased proportion of fine sediments. All other parameters were below the CCME guidelines.
Sediment at Roberts Bay East was within the range observed historically and below the CCME parameter specific guidelines.

Recommendation: HESL agrees that some of the change observed at Roberts Bay West was a result of the changing sediment composition but is concerned that project activities at the jetty may also be implicated. TMAC should closely monitor copper concentrations at the Roberts Bay West and reference sites to ensure construction activity has not had a lasting impact on the sediment composition.

HESL feels that project activities may have impacted sediment quality in the marine environment but detrimental impacts to aquatic life cannot be determined at this time. TMAC should continue to monitor sediment

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chemistry and composition in the marine environment to determine if changes are more closely correlated with particle size or project activities. If the latter is the case steps should be taken to ensure project activities do not degrade the environment. This will need to be addressed during the permitting phase, specifically in the water management plans. Reports should be submitted to the KIA to allow for critical peer review of sediment quality data.

3.5 Primary Producers

Baseline data was not available for all sites. Periphyton was used to assess the response of primary producers in streams while phytoplankton was used for assessment in lakes and in the marine environment.

3.5.1 Streams

At the Doris outflow periphyton biomass was highly variable over time; chlorophyll α decreased by an order of magnitude between 1997 and 2009 prior to any project activities. TMAC states that this made it difficult to isolate influences from the project. What can be said is that periphyton biomass was within the range observed historically.

Periphyton biomass increased at the Little Roberts Outflow in 2013 relative to 2009 and was within the range observed historically at the Roberts Outflow.

Comment: HESL agrees that the variability observed in primary producers makes it difficult to isolate project impacts. Primary producers are likely too variable to determine if the Project has had an impact on aquatic life.

3.5.2 Lakes

Phytoplankton biomass was within the range observed historically at all exposure and reference sites in the project area.

Comment: HESL agrees with TMAC that there is no evidence project activities have had an impact on periphyton biomass in the fresh water lakes.

3.5.3 Marine

Mean marine phytoplankton biomass was lower at all sites in 2013 as compared with measurements collected in 2009. TMAC states this was likely a result of how values below the detection limit were treated for statistical analysis as the detection limit used in 2013 was lower than that for 2009. The values in 2009 and prior were

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represented as ½ the detection limit which was lower than the real values measured in 2013. As these changes did not correspond with changes in nitrate concentrations and were paralleled by in the reference sites TMAC did not feel the project negatively impacted the primary producer community.

Recommendation: HESL agrees that it is unlikely the project has impacted the primary producer community in the marine environment due to the similarity in changes observed between the exposure and reference sites. However, changes in the community should be monitored in conjunction with water and sediment quality to ensure the weight of evidence does not suggest an impact to aquatic life from project activities.

3.6 Benthos

Benthos were collected between 2010 and 2013, thus a baseline predating project activities was not available. The 2013 benthic community was compared to existing data from 2010, 2011 and 2012.

3.6.1 Streams

Density at both the Roberts Outflow and in the reference B outflow was within the range observed in the historical data. An increase in density was observed in the Doris Outflow, Little Roberts Outflow and the reference Outflow. Reference and exposure sites were paralleled.

Species richness was similar to previous years at all sites. Results from the Simpson's evenness index calculations indicated non-parallelism between the Doris Outflow and the reference site over time. Evidence of parallelism was observed in the Simpson's evenness index between other sites. Results from the Simpsons diversity index were similar to previous years and were parallel between exposure and reference sites.

The Roberts Outflow was the only site where a non-parallel change was observed over time with the reference site with regards to the Bray-Curtis Index. Community composition of benthos in the Roberts Outflow is becoming more similar to the reference site over time. Evidence of parallelism was observed for the other sites.

Comment: HESL agrees with TMAC that a significant impact of project activities on the benthic community is unlikely. Most observed changes are more likely due to natural variation as the Doris North Project is currently in care and maintenance.

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3.6.2 Lakes

Density was higher in the shallow lakes than the deep lakes though all density observations were parallel between exposure and reference sites. Richness was higher in the shallow lakes and changes were also parallel with the reference lakes over time. Evenness and density were both stable over time and parallel to the reference lakes.

The Bray-Curtis index showed high inter-annual variability. Non-parallelism at both the Doris North and South sites was observed in comparison with the reference site though the variability makes this assessment somewhat unreliable. All changes between Little Robert Lake and the Reference site were parallel.

Recommendation: HESL feels that the benthic community results do not indicate a significant impact to the aquatic environment from project activities. Non-parallel observations of the benthic community at Doris North and South should be closely monitored in the future to ensure that observed changes are due to natural variability rather than Project impacts.

3.6.3 Marine

There was evidence of non-parallel changes in density over time between both the Roberts Bay West and East sites and the reference site. TMAC states that this non-parallelism is driven by relatively high density at the exposure sites in 2010 and relatively low density at the reference site in the same year. Non-parallel increases were observed in richness between the Roberts Bay West and Reference sites as the latter increased by a greater magnitude. Richness was low and non-parallel at the Roberts Bay East site.

While non-parallelism was observed between the exposure and reference sites with respect to the evenness and diversity indices, the high inter-annual variability made an assessment of potential project impacts on aquatic life problematic. When coupled with the non-parallelism observed through the Bray-Curtis index it builds an argument that the benthic community was influenced by the erosion of the jetty and subsequent construction activities.

Recommendation: HESL feels that the erosion of the jetty and subsequent construction activities had influenced the benthic community in the marine environment. HESL notes that the repair work underway on the jetty constitutes a mitigation measure. TMAC should endeavour to reconstruct the jetty during repair operations in such a way as to decrease the possibility of significant future erosion.

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4. Conclusions

Overall there is little evidence of project impacts on the fresh water aquatic environment. Water and sediment chemistry show little change between historical data and 2013. Similarly water and sediment chemistry were similar to the reference sites. Primary producer and benthic invertebrate results do not provide strong evidence of an impact on aquatic life from project activities.
The marine environment shows minor impacts from project activity which may be attributable to natural heterogeneity in the sediment. This impact was not observable through the water quality data. Sediment chemistry does show some change from historical data and differences compared with the reference site. Similarly there was evidence of non-parallelism between the exposure and reference sites in multiple assessments of the benthic community. These changes in the marine environment may be driven by either the erosion of the jetty or natural heterogeneity.

The low magnitude of these changes and their uncertain attribution do not provide rationale for a claim under Article 20 under the Nunavut Land Claims Agreement. As the Doris North Project shifts from care and maintenance to an operational mine, TMAC should continue to provide the KIA with monitoring reports so that an independent assessment of changes to the aquatic community can be made.

Yours truly

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