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AQUATIC EFFECTS MONITORING PROGRAM ANNUAL 2018 REPORT – PLAIN LANGUAGE BRIEFING AND TECHNICAL REVIEW COMMENTS

Technical Memorandum # 367-19-02

Prepared for:

Environmental Monitoring Advisory Board (EMAB)
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1.0 BACKGROUND AND SCOPE OF WORK

Diavik Diamond Mines (2012) Inc. (DDMI) submitted the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report on March 29, 2019 in accordance with Part J, Condition 8 and Schedule 8, Condition 4 of Water Licence W2015L2-0001 (Golder 2019). The report was distributed for review by the Wek'eezhii Land and Water Board (WLWB) on April 11, 2019.

North/South Consultants Inc. (NSC) conducted a technical review of the 2018 AEMP Annual Report for the Environmental Monitoring Advisory Board (EMAB). The following aquatic environment components were reviewed by NSC personnel with technical knowledge and expertise in each of the areas: dust; effluent and water chemistry; plankton; eutrophication indicators; and components of the Traditional Knowledge (TK) Fish Camp study (see below). As directed by EMAB in their Scope of Work for the review, the following points were considered:

- Diavik responses to previous North/South recommendations, if applicable;
- Appropriateness of sampling timing and frequency;
- Quality of data collected;
- Methods used to analyze data;
- Adequacy of discussion of results;
- Implications of results;
- Defensibility of conclusions and recommendations;
- Emerging issues that may indicate environmental change over time;
- Potential project-related effects;
- Methods, results, discussion and conclusions of the 2018 Fish Camp with respect to fish tissue and water quality sampling, including observations taken during processing of fish and preparation of samples;
- Action levels reached and adequacy of proposed follow-up;
- Adaptive management responses; and
- Include recommendations on improvements to monitoring/management actions for EMAB's consideration.

Section 2 provides a plain language briefing of the key review comments, along with recommendations for consideration by EMAB. Detailed technical review comments and

recommendations are provided in Table 1 and in the Excel comments template as required for submission to the WLWB.

2.0 PLAIN LANGUAGE BRIEFING

The following sections present a plain language briefing of NSC's comments in relation to the points identified by EMAB for evaluation during the review of the 2018 AEMP Annual Report, and any additional review comments and recommendations borne from this review. The following sections present key comments for discussion by EMAB members and refer to:

- Diavik commitments;
- Dust monitoring blank samples;
- AEMP benchmarks;
- Plankton results and discussion;
- Dust effects on phosphorus;
- Nitrogen results for LDG-48;
- Zooplankton biomass estimates; and
- Anthropogenic loading of total phosphorus (TP).

To aid in this discussion, useful figures (and corresponding numbering and captions) are included from the 2018 AEMP Annual Report.

The technical review comments (Table 1) include additional detailed comments that recommend various revisions to clarify either the presentation of results and/or their interpretation to improve the overall quality of the report; these comments are excluded from the discussion below. Editorial comments are provided in Appendix 1.

It is noted that with the exceptions discussed below, comments provided on the 2017 AEMP report (NSC 2018) were addressed, where applicable, in the 2018 AEMP report.

2.1 DIAVIK COMMITMENTS

Overall, Diavik has addressed the commitments identified in Table 2, Attachment A: Table A-1 in the main document. It is noted here that two commitments could not be addressed by Diavik due to time constraints. These are noted below for followup in a subsequent draft of the report and future reporting.

- "DDMI to present spatial extent of the effects of eutrophication indicators for both the ice-covered and open-water seasons in future AEMP Annual Reports." This directive was acknowledged by Diavik but was not included in the 2018 report due to insufficient time.

- "DDMI to provide a tabular summary of results for eutrophication indicators with percent change from baseline and the previous year in future AEMP Annual Reports." This directive was acknowledged by Diavik but was not included in the 2018 report due to insufficient time.

2.2 DUST DEPOSITION

2.2.1 Blank Sample Results

The results of one blank from SS5-5 from the snow chemistry monitoring program are presented in Table 3.4-1 (Appendix I, Section 3.4, page 3-20) and raw data were provided by Diavik as an excel file. The excel file for Appendix 1 (dust monitoring program results) includes data for "Sample Bag" which is labeled as "EBW". These data appear to be results for an "equipment blank", presumably specifically for the sampling bags used for the program. Results for this blank should be incorporated into the report, including providing a description of sampling methods. Cursory review of the results indicate that the sampling bags may impart some contamination to samples as evidenced by the concentrations of aluminum (0.3 µg/L), total dissolved phosphorus (2.4 µg/L), and total zinc (0.82 µg/L) which are similar to the other blank sample (SS5-5) concentrations of aluminum (0.42 µg/L), total phosphorus (2.7 µg/L), and total zinc (0.32 µg/L). Identification of the nature of the SS5-5 blank would also be useful as it is not readily apparent what it represents (it appears to be an equipment blank but there is some lack of clarity).

Recommendation: Include explicit descriptions of all blank samples in the methods and results. Include results of all types of quality assurance/quality control (QA/QC) samples in the discussion, including sample bag results.

2.3 EFFLUENT AND WATER QUALITY

2.3.1 AEMP Benchmarks

While it is noted that effects benchmarks have been derived over a number of years, some benchmarks were identified using published guidelines that have since been revised. For example, the Health Canada drinking water quality guideline for pH has been modified from 6.5-8.5 to 7-10.5 and the selenium guideline was increased from 10 to 50 µg/L; in both these instances, there is no immediate ramification for the AEMP as the protection of aquatic life (PAL) guidelines are more stringent and were therefore applied for reporting. The Council for Ministers of the Environment (CCME 1999) also recently revised the PAL guideline for zinc (2018) and several years ago (2015) updated the guideline for silver.

It is suggested that benchmarks be periodically updated to reflect revisions to the Canada Council for Ministers of the Environment (CCME 1999) aquatic life guidelines and the Health Canada drinking water quality guidelines.

Recommendation: Consider updating AEMP benchmarks to reflect revisions to CCME PAL and Health Canada drinking water quality guidelines on a regular basis.

2.4 PLANKTON

2.4.1 Plankton Results and Discussion

The patterns of phytoplankton and zooplankton biomass presented in Appendix XI differ. Specifically, total zooplankton biomass presented in Figure 3-5 (page 19) shows an increasing trend from the NF to the MF areas; this trend was even more pronounced for cladoceran biomass. Conversely, phytoplankton biomass as presented in Figure 3-2 (page 13), shows relatively similar densities across the four areas. Can Diavik comment on potential reasons for the observed differences?

Recommendation: Provide a discussion and interpretation of the phytoplankton and zooplankton results collectively.

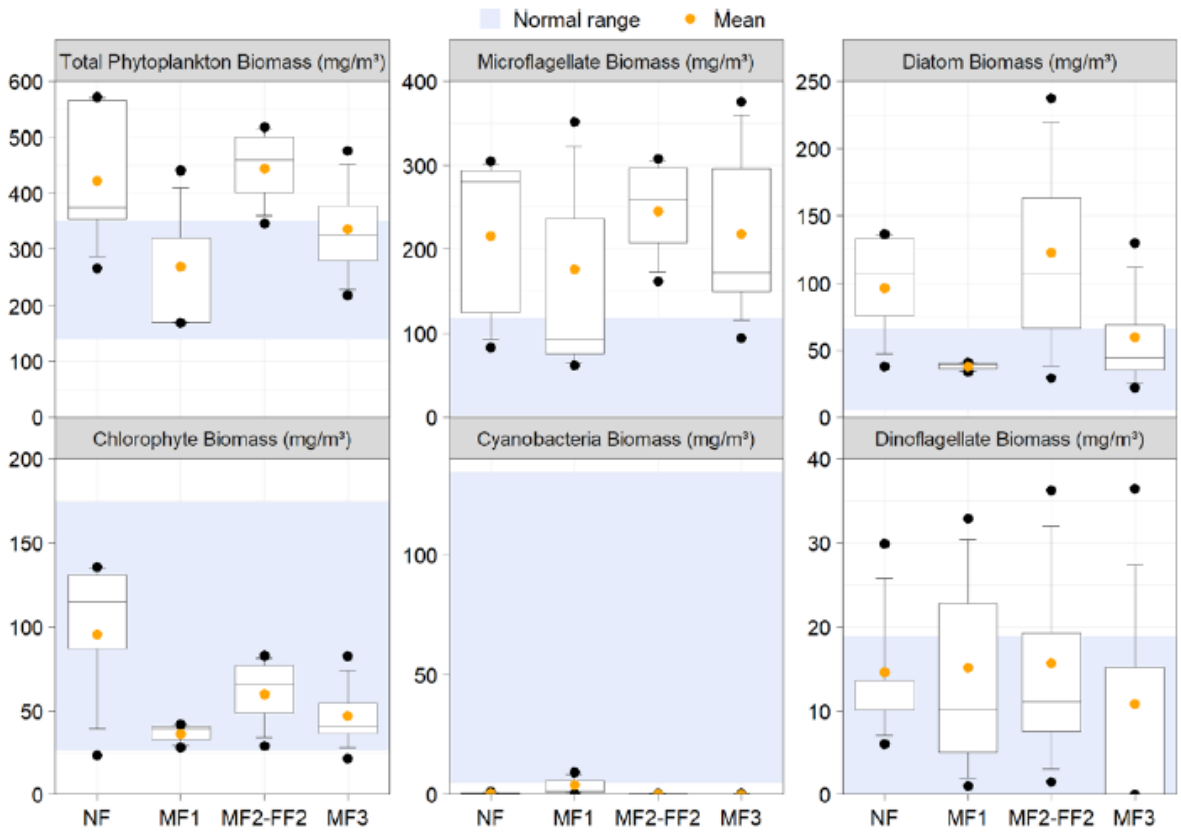

Figure 3-2. Biomass of Major Phytoplankton Groups in Lac de Gras, 2018 (from Golder 2019).

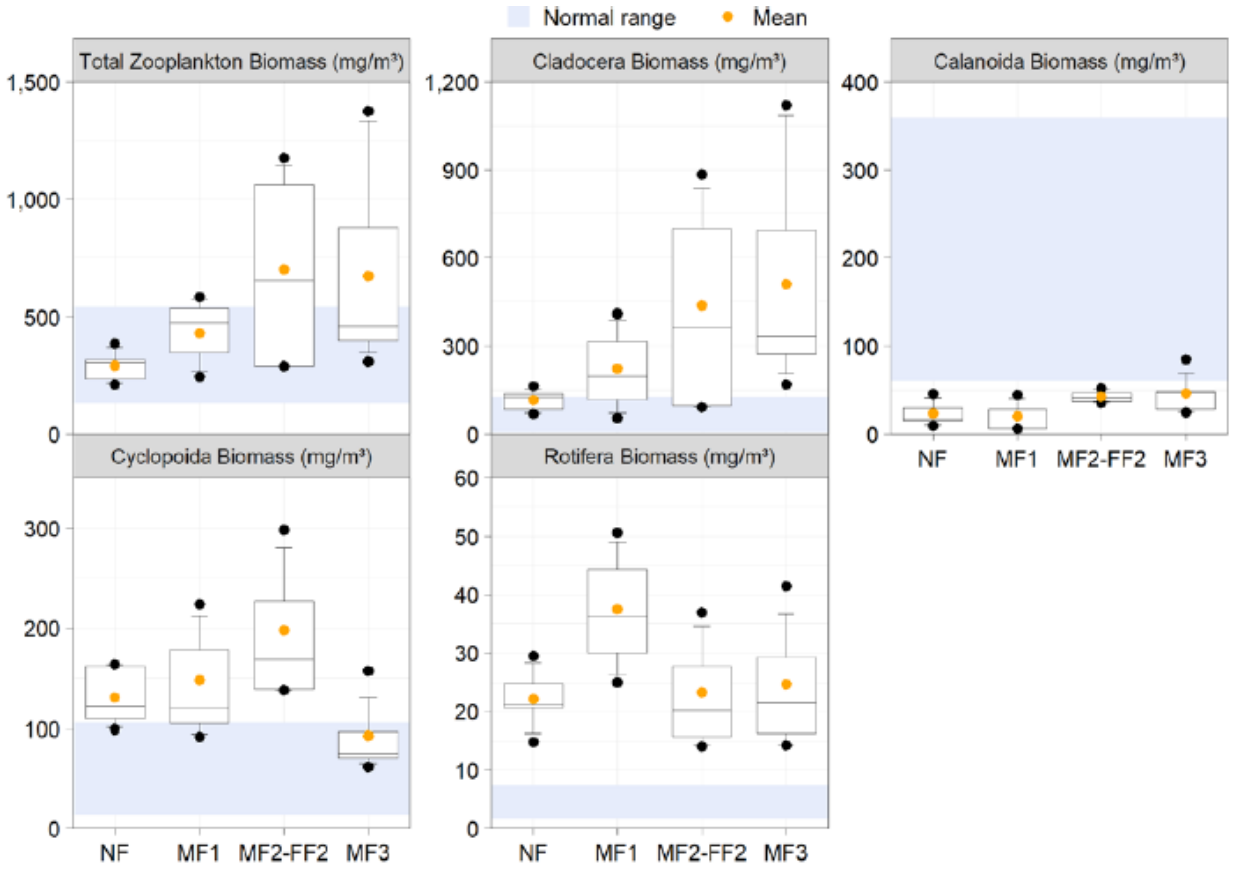

Figure 3-5. Biomass of Major Zooplankton Groups in Lac de Gras, 2018 (from Golder 2019).

2.5 EUTROPHICATION INDICATORS

2.5.1 Dust Effects on Phosphorus

The report concludes that: "Overall, TP concentrations in the NF and MF areas were consistent with the Mine effluent being a greater source of TP input to the lake than dust" (Appendix XIII, Section 3.2, page 26). However, Figure 3-8 (page 27) indicates the highest concentration of TP occurred at site MF3-2 (see red circle below), which would suggest that dust was a significant source of TP to the lake. The highest concentration of TP and TSS measured in snow occurred at site SS3-8 and the nearby Dust 7 site had relatively high levels of dust; these sites are near site MF3-2.

Recommendation: Review and revise text in relation to dust effects on TP.

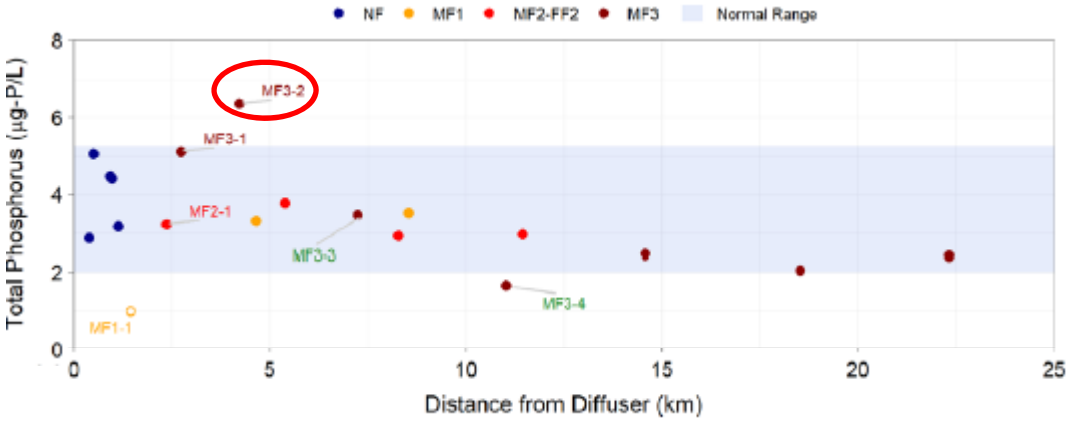

Figure 3-8. Concentrations of Total Phosphorus in Lac de Gras in Relation to Dust Deposition during the Open-water Season, 2018 (after Golder 2019).

2.5.2 TN at LDG-48

The text indicates that: "At LDG-48 during the open-water season, TN concentrations were greater than all other stations in Lac de Gras and TDN concentrations were similar to those in NF and MF1 areas. In 2017, TDN concentrations were also greater at LDG-48 than all other stations in Lac de Gras. Therefore, 2018 is the second year where TDN concentrations were elevated at LDG-48 compared to stations closer to the Mine." (Appendix XIII, Section 3.6, page 32)

Figure 3-12 (Appendix XIII, page 33) does not support these statements. Therefore the results from 2017 remain an anomaly (i.e., 2018 results did not resemble the 2017 results). Figures from the 2018 and 2017 AEMP reports are presented below for reference.

DDMI committed to "evaluating TDN concentrations at LDG-48 in 2018 to determine in the 2017 value is typical (WLWB comment 22)" (Table A-1 Main Report). Given that 2017 is not "typical" relative to 2018 results, some discussion should be provided in the text on the 2017 data.

Recommendation: Please review text and figures and revise accordingly and address the DDMI commitment.

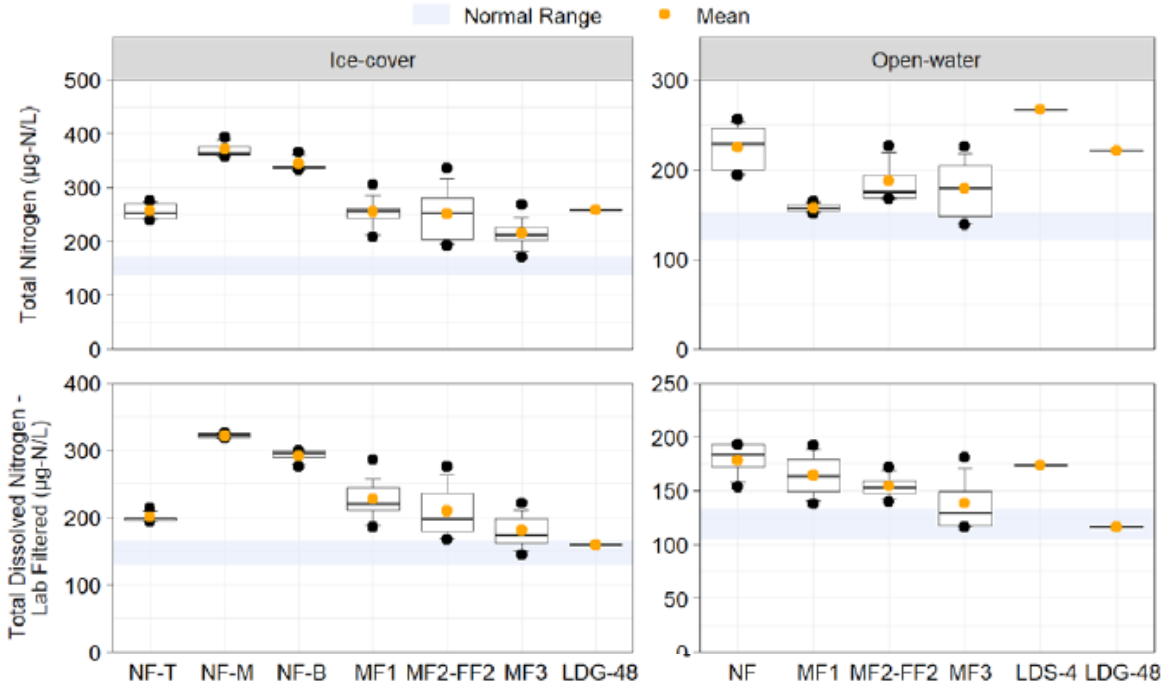

Figure 3-12. Concentrations of Total Nitrogen and Total Dissolved Nitrogen in Lac de Gras during the Ice-Cover and Open-Water Seasons, 2018 (after Golder 2019).

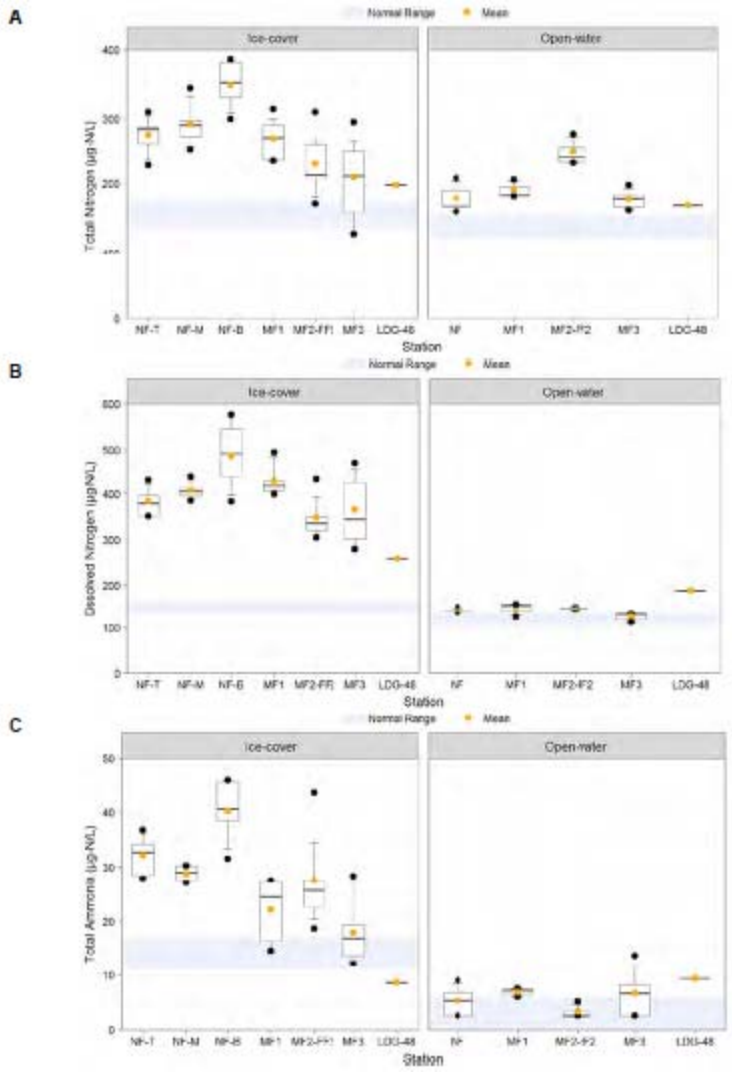

Figure 3-11. Concentrations of Total Nitrogen, Total Dissolved Nitrogen, and Total Ammonia in Lac de Gras during the Ice-Cover and Open-Water Seasons, 2017 (after Golder 2018).

2.5.3 Plankton Biomass Estimates

Zooplankton biomass measured as ash-free dry mass (AFDM; Appendix XIII, Figure 3-16, page 38) differed from biomass measured through the taxonomic enumeration and identification method (as presented in Appendix XI, Figure 3-5, page 19). Specifically, the indicator used for the eutrophication report (AFDM) shows that biomass was above the normal range in the NF MF1, and MF2-FF2 areas and that "no significant decreasing trends with distance from the diffuser were observed in zooplankton biomass along any of the three transects in 2018" (page 51), whereas the indicator presented in the Plankton Report shows total biomass was within the

normal range in the NF and MF1 areas and a "clear pattern of increasing total zooplankton biomass with increasing distance from the effluent discharge." (Appendix XI, page 17).

In addition, phytoplankton biomass and chlorophyll *a* measurements do not show strong agreement (see excised Figures 3-14 and 3-14 below). Lastly, the increasing spatial trend in zooplankton biomass is not reflected in the chlorophyll *a* or phytoplankton biomass data. A disconnect between the zooplankton and phytoplankton biomass may reflect lags in community responses. Alternatively, these differences may reflect analytical error.

Given the discrepancies, it would be beneficial to incorporate both measures of zooplankton biomass into the discussion for the eutrophication report, as well as incorporate phytoplankton biomass into the overall discussion and interpretation of results provided in Section 4.2, Appendix XIII.

Recommendation: Include both measures of zooplankton biomass and phytoplankton biomass into the overall discussion and interpretation of results collectively

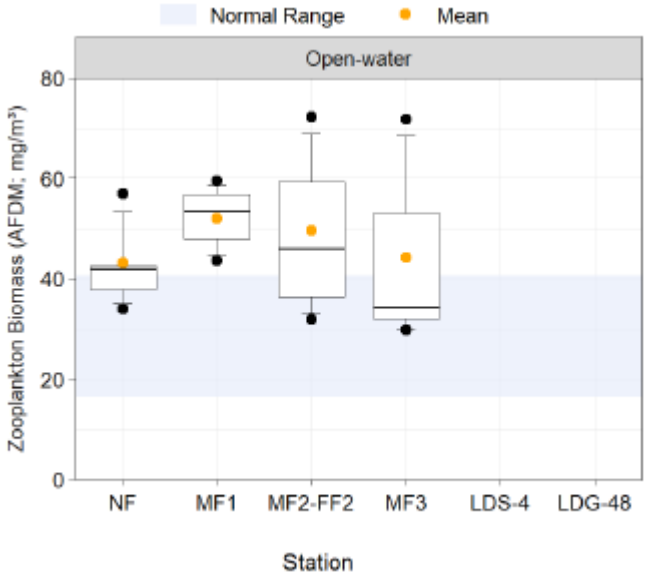

Figure 3-16. Total Zooplankton Biomass (as AFDM) in Lac de Gras during the Open-Water Season, 2018 (from Golder 2018; Appendix XIII).

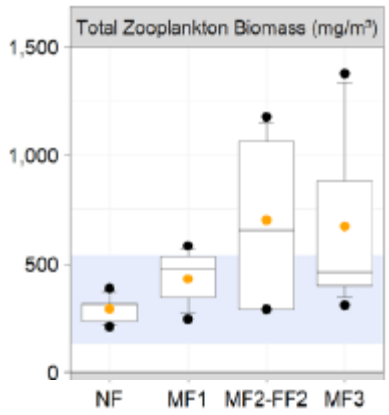

Figure 3-5. Total Zooplankton Biomass in Lac de Gras during the Open-Water Season, 2018 (from Golder 2018; Appendix XI).

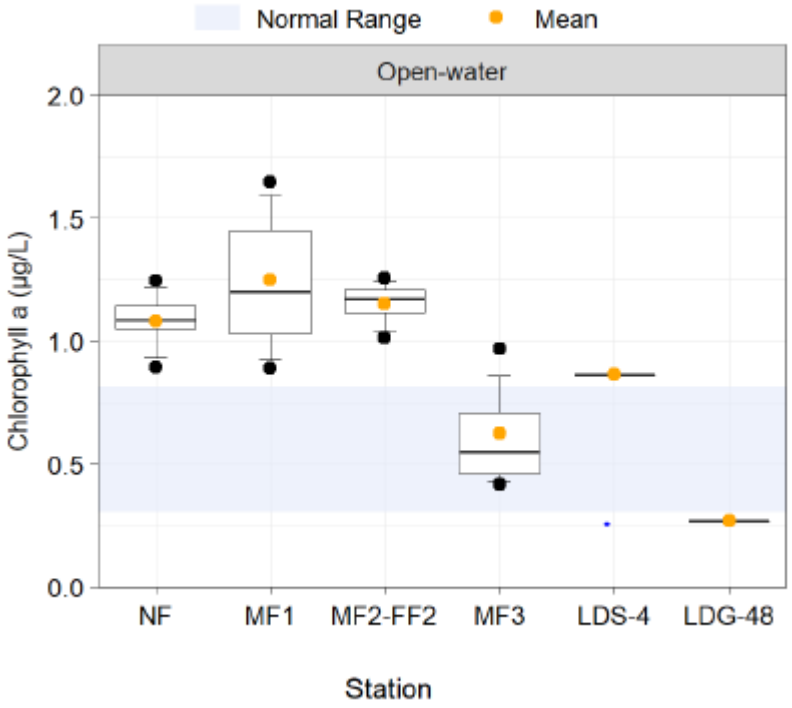

Figure 3-14. Chlorophyll a Concentrations in Lac de Gras during the Open-Water Season, 2018 (from Golder 2018; Appendix XIII).

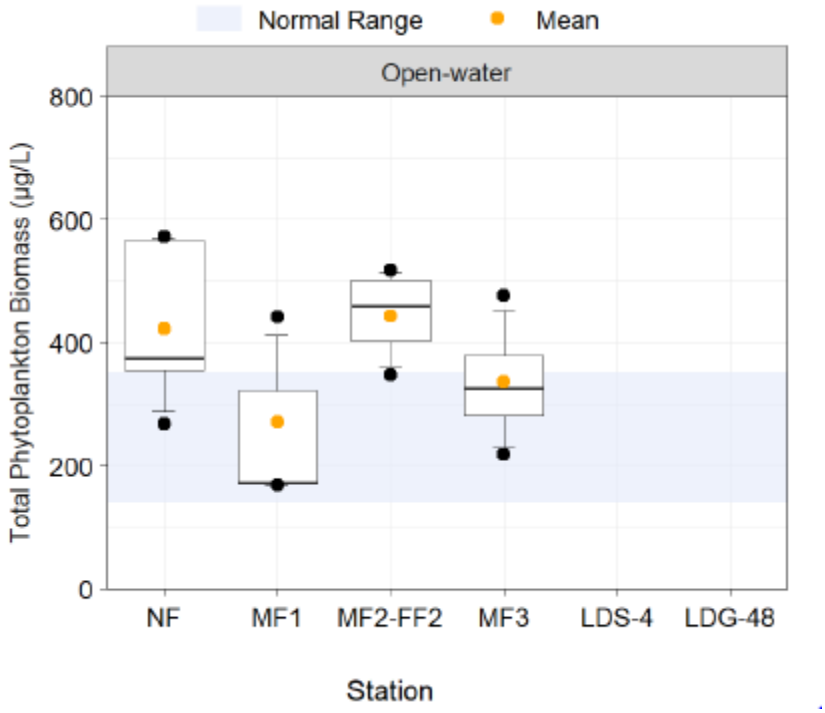

Figure 3-15. Total Phytoplankton Biomass in Lac de Gras during the Open-Water Season, 2018 (from Golder 2018; Appendix XIII).

2.5.4 Discussion of Anthropogenic Loading of TP

Appendix D of the Eutrophication Indicators Report (Appendix XIII) presents the approach and results for estimating TP loading to Lac de Gras, including from effluent, direct discharge from the A21 dyke, and dust. However, the Main Report Main report identifies TP loading from effluent (375 kg; Section 4.3.1, page 35) and from direct discharge from the A21 dyke (25.1 kg; Section 4.3.3, page 39) but does not identify loading from dust (Section 4.3.2, page 38). Additionally, there is no discussion of the cumulative load from each of these sources. Similarly, the main body of the Eutrophication Indicators Report (Appendix XIII) lacks this cumulative discussion. A similar comment was raised in review of the 2017 AEMP monitoring report (NSC 2018).

Recommendation: Incorporate discussion of all anthropogenic sources of TP to Lac de Gras within the main document and Appendix XIII.

2.6 DETAILED TECHNICAL REVIEW COMMENTS

Detailed technical review comments and recommendations are provided in the following Table 1; these are also provided in the Excel comments template as required for submission to the WLWB.

Table 1. Technical review comments and recommendations on the 2018 AEMP Annual Report.

TOPIC	COMMENT	RECOMMENDATION
Main Document, Table 2, Attachment A: Table A-1, page 4	WLWB Directive: "DDMI to present spatial extent of the effects of eutrophication indicators for both the ice-covered and open-water seasons in future AEMP Annual Reports." This directive was acknowledged by Diavik but was not included in the 2018 report due to insufficient time. NSC had recommended presentation of open-water season and ice-cover season results in two figures in review of the 2017 AEMP report (see row 25 of review comment submission; NSC 2018). We reiterate this recommendation here.	Present results in two separate figures in subsequent draft of the 2018 AEMP report.
Main Document, Table 2, Attachment A: Table A-1, page 4	WLWB Directive: "DDMI to provide a tabular summary of results for eutrophication indicators with percent change from baseline and the previous year in future AEMP Annual Reports." This directive was acknowledged by Diavik but was not included in the 2018 report due to insufficient time.	Present results as directed in subsequent draft of the 2018 AEMP report.
APPENDIX I, Dust Deposition Report, Section 2.2., Methodology, Dustfall Snow Surveys, pages 2-2 to 2-6	There are inconsistencies between the text (page 2-6), Table 2-1 (pages 2-2 to 2-4) and Figure 2-1 (page 2-5) in the number of dustfall snow stations that were sampled. The text and Figure 2-1 indicate 27 stations, and Table 2-1 indicates 30 stations were sampled for snow dustfall.	Please review the document and update the text, table and/or figure as appropriate.
APPENDIX I, Dust Deposition Report, Section 2.3., Methodology, Snow Water Chemistry, multiple pages	There are inconsistencies between the text (page 2-17), Table 2-1 (pages 2-2 to 2-4) and Figure 2-1 (page 2-5) in the number of stations indicated that were sampled for snow chemistry. The text indicates 17, Table 2-1 and Figure 2-1 indicate 18 stations were sampled for snow water chemistry. Appendix D provides snow chemistry data for 19 sites (plus QC samples).	Please review the document and update the text, table and/or figure as appropriate.
APPENDIX I, Dust Deposition Report, Section 2.3., Methodology, Snow Water Chemistry, multiple pages	Table 2-1 (pages 2-2 to 2-4) and Figure 2-1 (page 2-5) indicate that stations SS3-4 and SS3-5 were not sampled for snow chemistry in 2018. However snow chemistry data for these sites are included in Section 3, Results and in the raw data presented in Appendix D.	Please review the document and update the text, table and/or figure as appropriate.

TOPIC	COMMENT	RECOMMENDATION
APPENDIX I, Dust Deposition Report, Section 3.3 Results, Snow Water Chemistry, pages 3-13 to 3-19	There are several inconsistencies between the text and the figures (Figures 3.3-2 to 3.3-4) that are presented in this section. Errors were observed for the following parameters: copper, nickel, and phosphorus. For example the texts states: "Median 2018 phosphorus concentrations were greatest (43.6 ug/L) in the 251-1,000 m zone and decreased with increasing distance from the project." (page 3-19). This statement disagrees with the data presented in Figure 3.3-4, which shows phosphorus was highest in the 0-100 m zone.	Review and update the text and figures as appropriate.
APPENDIX I, Dust Deposition, Section 3.4, Results, Quality Assurance and Control, Table 3.4-1, page 3-20	The approach used for calculating RPD (i.e., excluding measurements that are less than 5 times the analytical detection limit) is acknowledged as common practice. It would be useful to include the actual detection limits in Table 3.4-1 as this would assist with interpretation of the QA/QC sample results (i.e., means close to 5 times the analytical detection limit would be expected to have higher RPDs than means notably higher than the detection limit).	Add analytical detection limits to Table 3.4-1.
APPENDIX I, Dust Deposition, Section 3.4, Results, Quality Assurance and Control, Table 3.4-2, page 3-21	The results of one blank from SS5-5 are presented in Table 3.4-1 (page 3-20) and raw data were provided by Diavik as an excel file. The excel file for Appendix 1 (dust monitoring program results) includes data for "Sample Bag" which is labeled as "EBW". These data appear to be results for an "equipment blank", presumably specifically for the sampling bags used for the program. Results for this blank should be incorporated into the report, including providing a description of sampling methods. Cursory review of the results indicate that the sampling bags may impart some contamination to samples as evidenced by the concentrations of aluminum (0.3 µg/L), total dissolved phosphorus (2.4 µg/L), and total zinc (0.82 µg/L) which are similar to the other blank sample (SS5-5) concentrations of aluminum (0.42 µg/L), total phosphorus (2.7 µg/L), and total zinc (0.32 µg/L). Identification of the nature of the SS5-5 blank would also be useful as it is not readily apparent what it represents (it appears to be an equipment blank but there is some lack of clarity).	Include explicit descriptions of all blank samples in the methods and results. Include results of all types of quality assurance/quality control (QA/QC) samples in the discussion, including sample bag results.
APPENDIX I, Dust Deposition, Section 4, Summary, page 4-1	Appendix 1 (page 4-1) indicates that dustfall rates were higher at the three control sites relative to site SS2-4. The explanation provided is: "This may be explained by the northeastern location of SS2-4 which is less frequently downwind of the mine relative to other areas and the greater distance of SS2-4 from the A21 open pit relative to the control stations. Whereas all control sites are located south, southeast, and northwest of the Project where winds are more predominant." This suggests that control stations are potentially affected by the Project. To what extent might the control stations be affected by the Project and how does the Project effect at the control sites affect interpretation of monitoring results overall?	Provide a discussion of the implications of potential Project effects on dust at the control stations with respect to interpretation of the dust monitoring program results overall (i.e., are effects potentially consequential in terms of monitoring for Project effects or are effects marginal and not consequential for the program).

TOPIC	COMMENT	RECOMMENDATION
APPENDIX II, Effluent and Water Chemistry Report, Section 2.1, Methods, Field Sampling, Table 2-1, page 6	Table 2-1 presents distances of monitoring sites from the effluent diffuser. Given that A21 Dike dewatering occurred over the period of the 2018 AEMP, it would be useful to also include distances of sites from the discharge site (SNP 1645-41), at a minimum for the MF3 sites in the vicinity.	Add distances of MF3 sites from the A21 Dewatering Diffuser (SNP 1645-41).
APPENDIX II, Effluent and Water Chemistry Report, Section 2.3.4.3, Methods, Data Analysis, Comparison to Effects Benchmarks, Table 2-5, pages 14-15	While it is noted that effects benchmarks have been derived over a number of years, some benchmarks were identified using published guidelines that have since been revised. For example, the Health Canada drinking water quality guideline for pH has been modified from 6.5-8.5 to 7-10.5 and the selenium guideline was increased from 10 to 50 ug/L; in both these instances, there is no immediate ramification for the AEMP as the protection of aquatic life (PAL) guidelines are more stringent and were therefore applied for reporting. The Council for Ministers of the Environment (CCME 1999) also recently revised the PAL guideline for zinc (2018) and several years ago (2015) updated the guideline for silver. It is suggested that benchmarks be periodically updated to reflect revisions to the Canada Council for Ministers of the Environment (CCME 1999) aquatic life guidelines and the Health Canada drinking water quality guidelines.	Consider updating AEMP benchmarks to reflect revisions to CCME PAL and Health Canada drinking water quality guidelines on a regular basis.
APPENDIX II, Effluent and Water Chemistry Report, Section 3.3, Results, Depth Profiles, page 56	The text (page 56) discusses pH profiles and explains that pH typically decreased with depth (as would be expected) at most sites but that pH increased with depth at two sites; MF2-3 and FF2-2. A discussion of possible reasons for this difference is lacking.	Briefly discuss possible reason(s) why pH may have increased with depth at MF2-3 and FF2-2 during the open-water season.
APPENDIX II, Effluent and Water Chemistry Report, Section 3.6, Results, Effects from the A21 Dike, pages 108-109	Diavik notes in the AEMP Report that several metals (aluminum, antimony, boron, chromium, copper, lead, and tin) demonstrated clear spatial trends consistent with a dike-related effect in Lac de Gras and provided a discussion of potential causes. In order to more thoroughly explore this observed effect and potential linkage to the A21 dike, the results of the dike monitoring report (referred to on page 2) should be considered collectively with the results of the 2018 AEMP.	Provide a more comprehensive discussion of results for the A21 dike monitoring and the AEMP results.

TOPIC	COMMENT	RECOMMENDATION
Appendix XI, Plankton Report, Section 3.1.1, Results, Phytoplankton Taxonomic Richness and Biomass, pages 9-13 and Section 3.2.1, Results, Zooplankton Biomass and Taxonomic Richness, pages 16-19	The patterns of phytoplankton and zooplankton biomass presented in Appendix XI differ. Specifically, total zooplankton biomass presented in Figure 3-5 (page 19) shows an increasing trend from the NF to the MF areas; this trend was even more pronounced for cladoceran biomass. Conversely, phytoplankton biomass as presented in Figure 3-2 (page 13), shows relatively similar densities across the four areas. Can Diavik comment on potential reasons for the observed differences?	Provide a discussion of the phytoplankton and zooplankton results collectively.
APPENDIX XI, Plankton Report, Section 4.1 Discussion, Phytoplankton Community, page 22	Paragraph 1 page 22 states: "Total phytoplankton biomass and chlorophyte biomass were greatest in the NF area…" This statement is true in regards to chlorophyte biomass but is incorrect for total phytoplankton biomass. Total phytoplankton biomass in the NF was lower than MF2-FF2 when the mean and median are considered, but the NF had a higher maximum and a wider range than MF2-FF2.	Review the data and update as appropriate.
Appendix XI, Plankton Report, Section 4.2, Discussion, Zooplankton Community, page 22	The discussion indicates that: "Slight spatial patterns of increasing cyclopoid and calanoid copepod biomass were also observed in 2018." (page 22) The boxplots do not indicate a spatial trend; is this statement appropriate?	Review statement and revise accordingly.
Appendix XI, Plankton Report, Section 4.2, Discussion, Phytoplankton Community, page 23	The zooplankton discussion indicates: "Overall, a community shift towards more cladoceran biomass and lower copepod biomass appears to have occurred in the NF and MF areas of Lac de Gras, compared to the 2008 to 2010 reference condition." Consider adding discussion regarding whether this shift was also observed in past monitoring years.	Consider expanding discussion to include previous monitoring results.
Appendix XI, Plankton Report, Section 4.2, Discussion, Zooplankton Community, pages 23-24	There appears to be a contradiction in the text. On page 23, it is indicated that "Cladoceran biomass was within the normal range in the NF area and above the normal range in and MF areas."; on page 24 it is stated that: "The 2018 zooplankton community displayed a response consistent with nutrient enrichment, as demonstrated by increased total biomass, richness, and biomass of cladocerans and cyclopoid copepods in the NF area."	Review text and revise accordingly.
Appendix XI, Plankton Report, Appendix A, Quality Assurance and Quality Control, page A-2	Appendix A indicates that: "Phytoplankton laboratory QC split samples were not requested in 2018 as a result of an oversight when requesting analysis from the new taxonomist, which is a deviation from the QAPP (Golder 2017)." This statement should be reiterated within the main body of this appendix.	Please add statement to the main methods section.

TOPIC	COMMENT	RECOMMENDATION
Appendix XI, Plankton Report, Appendix A, Quality Assurance and Quality Control, pages A-2 to A-4, Table A-1,	The QA/QC review of phytoplankton data considers results for counts (i.e., abundance) and not biomass (Appendix XI, Plankton Report, Appendix A, Quality Assurance and Quality Control, pages A-2 to A-4, Table A-1). However, the plankton component of the AEMP is focussed on results for phytoplankton biomass and not abundance. It is recommended that an analysis and discussion of QA/QC results for biomass, in addition to abundance, be provided. Phytoplankton biomass is derived from two estimates: (1) counts of algal cells; and (2) measures/estimates of cell biovolume. Phytoplankton biomass results are therefore affected by an additional source of variability (i.e., biovolume measurements) beyond measures of algal abundance. A similar comment was submitted in the review of the 2017 (NSC 2018) and the 2016 Annual AEMP Report (NSC 2017): "Comparison of duplicate phytoplankton samples should be done both for abundance (i.e., cell counts) as well as biomass. The latter is typically more variable than the former as it is derived from two measurements (cell counts and algal cell size). As biomass is the metric of concern for the AEMP QA/QC should focus on this metric."	Provide an analysis and discussion of phytoplankton biomass QA/QC results.
APPENDIX XIII, Eutrophication Indicators Report, Section 2.3.3, Methods, Data Analysis, page 7 and Section 2.1.1, Methods, Field Sampling, page 2	The dates when A21 dewatering water was discharged directly to Lac de Gras versus dates when the water was diverted to the NIWTP are unclear. Section 2.3.3 (page 7) indicates: "The effluent loadings and concentrations summarized herein also include the dewatering discharge diverted from the A21 Dike to NIWTP during the period of 7 November 2017 to 24 April 2018 (DDMI 2018)." This appears to contradict an earlier statement in Section 2.1.1 (page 2): "Dewatering of the A21 Dike occurred during the 2018 sampling period, from 3 November 2017 to 24 April 2018 (DDMI 2018). Approximately 50% of the water enclosed by the dike, which met effluent quality criteria as per Part H, Items 26 and 29 of the Water Licence, was directly discharged without treatment to Lac de Gras at SNP 1645-41 from 3 to 24 November 2017 (Figure 2-1). When water quality levels began to approach Water Licence limits, the remaining water was directed to the NIWTP at SNP 1645-41N for treatment prior to discharge. Water quality sampling at SNP 1645-41 and 1645-41N occurred in accordance with DDMI's Water Licence requirements (WLWB 2015)."	Please clarify what dates A21 discharges were released directly to Lac de Gras and what dates water was diverted to the NIWTP.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.1, Results, Nutrients in Effluent and the Mixing Zone, pages 16 and 17	Paragraph 6 (page 16, continued on page 17) discusses trends in nitrogen concentrations at the mixing zone boundary and presents the idea that the decline in nitrogen between May and July is due to assimilation by algae and bacterial nitrification. Although it was not discussed in the report, it is likely that rapid assimilation by algae is also the explanation for the decline in SRP at the mixing zone boundary that was observed during the same time period.	Consider adding discussion of spatial trends for SRP and potential explanations for the observed trends.

TOPIC	COMMENT	RECOMMENDATION
APPENDIX XIII, Eutrophication Indicators Report, Section 3.2, Results, Effects of Dust Deposition, page 26	Paragraph 2 on page 26 states "Overall, TP concentrations in the NF and MF areas were consistent with the Mine effluent being a greater source of TP input to the lake than dust." However, Figure 3-8 indicates the highest concentration of TP occurred at site MF3-2 which would suggest that dust was a significant source of TP to the lake. The highest concentration of TP and TSS measured in snow occurred at site SS3-8 and the nearby Dust 7 site had relatively high levels of dust; these sites are near site MF3-2.	Review and revise text in relation to dust effects on TP.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.3, Results, Direct Discharge of A21 Dewatering Flows, page 28	Paragraph 3 on page 28 acknowledges that sampling during the ice-cover season occurred five months after discharge from the A21 dike yet the paragraph concludes that "...it does not appear that the direct discharge contributed to nutrient enrichment in Lac de Gras." It is likely that effects of discharge from the A21 dewatering event on TP concentrations was simply no longer observable at the time of sampling.	Provide clarification that effects from dike dewatering discharge likely to have dissipated prior to undertaking the 2018 AEMP sampling.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.6, Results, Nutrients in Lac de Gras, pages 32-33	There appear to be some discrepancies in the text compared to Figure 3-12 (pages 32 and 33). The text indicates that: "At LDG-48 during the open-water season, TN concentrations were greater than all other stations in Lac de Gras and TDN concentrations were similar to those in NF and MF1 areas. In 2017, TDN concentrations were also greater at LDG-48 than all other stations in Lac de Gras. Therefore, 2018 is the second year where TDN concentrations were elevated at LDG-48 compared to stations closer to the Mine." However Figure 3-12 shows that TN at LDG-48 is similar to the NF area and TDN at LDG-48 is actually lower than the NF and MF areas.	Review text and figures and revise as required.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.6, Results, Nutrients in Lac de Gras, pages 32-33	The text indicates that: "At LDG-48 during the open-water season, TN concentrations were greater than all other stations in Lac de Gras and TDN concentrations were similar to those in NF and MF1 areas. In 2017, TDN concentrations were also greater at LDG-48 than all other stations in Lac de Gras. Therefore, 2018 is the second year where TDN concentrations were elevated at LDG-48 compared to stations closer to the Mine." (page 32) As noted above, Figure 3-12 (page 33) does not support these statements. Therefore the results from 2017 remain an anomaly (i.e., 2018 results did not resemble the 2017 results). DDMI committed to "evaluating TDN concentrations at LDG-48 in 2018 to determine in the 2017 value is typical (WLWB comment 22)" (Table A-1 Main Report). Given that 2017 is not "typical" relative to 2018 results, some discussion should be provided in the text on the 2017 data.	Please review text and figures and revise accordingly and address the DDMI commitment.

TOPIC	COMMENT	RECOMMENDATION
APPENDIX XIII, Eutrophication Indicators Report, Section 3.7, Results, Chlorophyll a, Phytoplankton and Zooplankton Biomass, pages 36-38	Zooplankton biomass measured as ash-free dry mass (AFDM; Figure 3-16, page 38) differed from biomass measured through the taxonomic enumeration and identification method (as presented in Appendix XI, Figure 3-5, page 19). Specifically, the indicator used for the eutrophication report (AFDM) shows that biomass was above the normal range in the NF MF1, and MF2-FF2 areas and that "no significant decreasing trends with distance from the diffuser were observed in zooplankton biomass along any of the three transects in 2018" (page 51), whereas the indicator presented in the Plankton report shows total biomass was within the normal range in the NF and MF1 areas and a "clear pattern of increasing total zooplankton biomass with increasing distance from the effluent discharge." (Appendix XI, page 17). In addition, phytoplankton biomass and chlorophyll a measurements do not show strong agreement (Figures 3-14 and 3-15, page 37, Section 3.7). Lastly, the increasing spatial trend in zooplankton biomass is not reflected in the chlorophyll *a* or phytoplankton biomass data. A disconnect between the zooplankton and phytoplankton biomass may reflect lags in community responses. Alternatively, these differences may reflect analytical error. Given the discrepancies, it would be beneficial to incorporate both measures of zooplankton biomass into the discussion for the eutrophication report, as well as incorporate phytoplankton biomass into the overall discussion and interpretation of results.	Include both measures of zooplankton biomass and phytoplankton biomass into the overall discussion and interpretation of results collectively.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.9, Results, Action Level Evaluation, Text and Table 3-4, pages 58-65; and Section 4.3, Summary and Discussion, Extent of Effects, Text and Table 4-1, pages 59-60	There appear to be discrepancies in the percent of affected area (spatial extent of effect) for chlorophyll a in the results and discussion. Pages 55 and 56 (including Table 3-4) indicate the extent of effect (i.e., above normal range) is 12.2% of the lake area. The text on page 59 and Table 4-1 (page 60) indicates an area of 14.7%.	Please review text and tables and revise accordingly.

TOPIC	COMMENT	RECOMMENDATION
APPENDIX XIII, Eutrophication Indicators Report, Appendix D; and Main Report, Section 4.3, Results and Discussion	Appendix D of the Eutrophication Indicators Report (Appendix XIII) presents the approach and results for estimating TP loading to Lac de Gras, including from effluent, direct discharge from the A21 dyke, and dust. However, the Main Report Main report identifies TP loading from effluent (375 kg; Section 4.3.1, page 35) and from direct discharge from the A21 dyke (25.1 kg; Section 4.3.3, page 39) but does not identify loading from dust (Section 4.3.2, page 38). Additionally, there is no discussion of the cumulative load from each of these sources. Similarly, the main body of the Eutrophication Indicators Report (Appendix XIII) lacks this cumulative discussion.	Incorporate discussion of all anthropogenic sources of TP to Lac de Gras within the main document and Appendix XIII.
Main Report, Section 10.2, Traditional Knowledge Studies, Methods, page 60-61	It is difficult to assess the method of fish collection and metals analysis because the Methods section does not provide a description of the field and laboratory methods. Based on Figure 10-1 it can be assumed that all trout analyzed for mercury were captured within 4 km of the mine site. No sampling dates are provided for individual Lake Trout analyzed for mercury, but dates are provided for the TK camp which occurred from 2-6 August, 2018. This timing is suitable for comparing mercury concentrations to other studies.	Provide additional detail of the field and laboratory methods (e.g. date, method, and location of capture for each fish).
Main Report, Section 10.2, Traditional Knowledge Studies, Methods, page 61	Although the main report states that: "Summary statistics, including sample size, percentage of metal concentrations greater than the DL, minimum, median, maximum, and SD values are included in the TK report" (page 61), these statistics could not be located. Only raw data on mercury (and other metal) concentrations and associated biological variables of the trout (i.e., weight, age, sex, maturity status) are presented in the TK study without any further statistical analyses.	Provide summary statistics for Lake Trout mercury concentrations and associated biological variables. Suggest calculating a mean mercury concentration adjusted for an average fish length (this length should be the same as used in previous studies).
Appendix XIV , Traditional Knowledge Studies, Section 3.2.3, Observations from Watching Fish and Water, Fish and Fish Habitat, Summary of Fish Tissue Laboratory Analyses, Table 3.2-5, page 47 and Appendix XIV, Appendix 4	There are 20 analyses of metal scans listed in Appendix "Diavik - AEMP Annual Report - 2018 - Appendix XIV - 4 and 5 - TK - Fish+Water Raw Data - Mar 29_19.xlsx', with five fish having two full data sets. If these represent five duplicate analyses, it is unclear why in most cases (fish 8, 13, and 28) the higher of the two concentrations was reported in Table 3.2-5 (page 47), whereas for fish 15 the lower concentration was used, and for fish 9, neither result from the Excel spreadsheet (0.25 and 0.241 ppm) corresponds to the value reported in Table 3.2-5 (0.259 ppm).	Provide a table caption and explain the results provided in the Appendix file. Describe methods for data analysis and presentation.

TOPIC	COMMENT	RECOMMENDATION
Main Report, Section 10.2, Traditional Knowledge Studies, Methods, page 61 and Appendix XIV, Traditional Knowledge Studies, Section 3.2.3, Observations from Watching Fish and Water, Fish and Fish Habitat, Summary of Fish Tissue Laboratory Analyses, page 48	The TK study discusses only mercury concentrations and only in the context of the "Health Canada guideline for fish consumption" (based on the concentration of 0.5 ppm used in Figure 3.2-1, page 48, it can be assumed that comparisons are made to the Health Canada standard for retail fish). The conclusion that mercury concentrations of all 15 trout analyzed for mercury have concentrations below the Health Canada guideline is correct. Further discussion of the results were not attempted based on the following rationale: "as previously indicated through AEMP Reviews, TK fish palatability results are not suitable as an early warning trigger for conducting a larger mercury in Lake Trout program as the sampling protocols, sample size, fishing locations, and size of fish are not consistent between years because these are not items that participants identified as concerning. As such, detailed temporal or special statistical analyses of the fish tissue chemistry collected as part of the TK program is not appropriate" (Main Report, page 61). Such a justification for a lack of any statistical analysis of the mercury concentrations from the 2018 TK study does not seem to be justified based on past Board decisions. In its review of the 2015 AEMP annual report of April 24, 2017, the Board and concluded that 'the palatability and tissue chemistry analyses that are part of the Design are to be conducted once every three years and are not linked to a Slimy Sculpin trigger. Thus, it appears that the comparisons to baseline concentrations of tissue metals should have been included as part of the 2015 AEMP Annual Report'. The fish analyzed for metals as part of the TK study represent valuable information on mercury concentrations in Lake Trout that should be compared to baseline concentrations and to concentrations obtained during other AEMP sampling, considering potential differences in methodology, timing and location of sampling, and in the size of the fish.	Discuss results obtained for 2018 in the context of earlier data on mercury concentrations in Lake Trout.
All Sections	Editorial comments are provided in Appendix 1.	

3.0 SUPPORTING MATERIALS FOR REVIEW

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian environmental quality guidelines. CCME, Winnipeg, MB. Updated to 2019.

Golder. 2019. Diavik Diamond Mines (2012) Inc. Aquatic Effects Monitoring Program 2018 Annual Report. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, March 2019.

North/South Consultants Inc. (NSC). 2017. Aquatic Effects Monitoring Program 2016 Annual Report – Plain language briefing and technical review comments. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-17-01.

NSC. 2018. Aquatic Effects Monitoring Program 2017 Annual Report – Plain language briefing and technical review comments. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-18-04.

APPENDIX 1: EDITORIAL COMMENTS

Table A1. Editorial review comments on the 2018 AEMP Annual Report.

TOPIC	COMMENT	RECOMMENDATION
Main Report, Section 6.2, Methods, page 50	The text (page 50) refers to Figure 1-2: mine site plan; text should refer to Figure 1-1: sampling stations, 2018 AEMP.	Change figure reference to 1-1.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.1, Results, Nutrients in Effluent and the Mixing Zone, pages 16-24	Results are presented for nutrients in effluent both as monthly loads and as scatterplots as in previous reports. It is noted that: "Concentrations and loads of TP, TDP and SRP were greatest in November 2017, possibly due to higher effluent concentrations and larger effluent volumes (Figure 3-1) due to the addition of A21 dewatering flows to the NIWTP." (page 16). It would be useful to identify the date on all figures when A21 dewatering flows were first routed to the NIWTP to assist with interpretation of results.	Consider adding a demarcation on the figures to indicate when A21 dike water was routed to the NIWTP.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.7, Results, Chlorophyll a, Phytoplankton and Zooplankton Biomass, page 36	Paragraph 2 on page 36 states: "Chlorophyll *a* concentrations at LDS-4 were greater than most of those in the MF area but less than those in the NF or MF1 and MF2-FF2 areas." There appears to be a typo; should the first reference be to the MF3 area?	Review the text and update as appropriate.
APPENDIX XIII, Eutrophication Indicators Report, Section 3.9, Results, Action Level Evaluation, page 55	The last sentence of paragraph 2 on page 55 erroneously refers to Figure 4-2 rather than Figure 4-3.	Review the text and update as appropriate.
APPENDIX XIV, Traditional Knowledge Studies, Section 2.3.3, Watching Water: Checking and Tasting Water, Figure 2.3-5, page 23	The caption for Figure 2.3-5 (page 23) indicates that the sampling sites presented were the sites sampled in 2018, but the figure actually presents all AEMP sites. There also does not appear to be a map provided that identifies the two sites sampled for water quality under this study (i.e. sites TK1 and TK2).	Correct Figure 2.3-5 to present only 2018 sampling sites. Consider adding the TK sites to the map or providing a separate map to illustrate locations.