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AQUATIC EFFECTS MONITORING PROGRAM DESIGN PLAN VERSION 6.0 – PLAIN LANGUAGE BRIEFING AND TECHNICAL REVIEW COMMENTS

Technical Memorandum # 367-22-02

DRAFT

Prepared for:

Environmental Monitoring Advisory Board (EMAB)
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PLAIN LANGUAGE SUMMARY

The Environmental Monitoring Advisory Board (EMAB) requested a technical review of the Aquatic Effects Monitoring Program (AEMP) Design Plan Version (v.) 6.0 for the Diavik Diamond Mines (2012) Inc. (DDMI; "Diavik") Project. This review included looking at:

- How well the design plan has been updated based on comments from the WLWB and other reviewers since the previous AEMP design;
- Changes since the last Design Plan 5.2;
- Recommendations related to fish health and fish tissue chemistry in relation to findings of NSC mercury investigation Phase 1 - May 2021;
- Consider recent Fish Response Plan V. 2 and WLWB direction in Reasons for Decision (RFD) for 2017-19 AEMP Re-Evaluation Report;
- Location and number of water quality sampling stations;
- Updated Action Level reporting schedule details;
- Weight of Evidence endpoints for fish;
- MDMER and expectations of equivalency;
- Updated AEMP sampling schedule;
- Clarification of variable selection for cumulative effects assessment;
- Data handling and analyses methods;
- Rationale for any proposed changes to the Design Plan; and
- Any additional recommendations for changes to Design Plan 6.0.

Key comments and recommendations include:

- **Lake Trout - Palatability Study Methods**: the report indicates mercury (and other metals) will be analysed in 10 Lake Trout from the same sex and size class under the palatability study. This is inconsistent with methods used in previous years for this program. This method also does not account for the positive relationship between fish size and mercury concentrations;
    - **Recommendation:** continue analysing mercury from a range of sizes of Lake Trout to be consistent with past programs and to allow for examination of mercury as it relates to the size of fish.

- **Lake Trout Mercury – Trigger for Monitoring**: the report indicates results of mercury in Lake Trout monitoring conducted under the Traditional Ecological Knowledge (TK) palatability studies cannot be used as a trigger to conduct a larger Lake Trout mercury program due to inconsistent methods. However, the TK palatability program has used relatively consistent methodologies since 2009 and the results of this program could therefore form the basis for defining a trigger for a Lake Trout in mercury study;

    - **Recommendation:** review results from the palatability study and develop an early warning trigger for a larger Lake Trout mercury program.

- **Cumulative Effects – Assessment Variables**: the report indicates that only substances that are greater than the normal range in the far-field areas and are consistently measured under both Diavik and Ekati AEMP programs will be included in the cumulative effects assessment. As previously commented, algae may be affected in the lake outflow area in an additive fashion and should be included;

    - **Recommendation:** include algae in the cumulative effects assessment.

- **Metal and Diamond Mining Effluent Regulations (MDMER) – Expectations of Equivalency**: the AEMP does not include monitoring in two fish species (only Slimy Sculpin is monitored), measurements of fish eggs, and chronic toxicity testing on a plant species, each of which are required under the MDMER;

    - **Recommendation:** if the intent is for the AEMP to include all requirements of the MDMER add an additional fish species and measurement of egg counts and fecundity to the fish monitoring program and chronic toxicity testing of effluent using a plant species. If these components are not included, provide a rationale.

TABLE OF CONTENTS

1.0 BACKGROUND AND SCOPE OF WORK

Diavik Diamond Mines (2012) Inc. (DDMI) submitted the Aquatic Effects Monitoring Program (AEMP) Design Plan Version (v.) 6.0 ("Design Plan Report"; report dated April 21, 2022) to the Wek'eezhii Land and Water Board (WLWB) and the report was distributed on May 17, 2022, for review.

North/South Consultants Inc. (NSC) conducted a technical review of the AEMP Design Plan Report v. 6.0 for the Environmental Monitoring Advisory Board (EMAB). As directed by EMAB in their Terms of Reference (ToR) for the review, the review focused on the following:

- How well the design plan has been updated based on comments from the WLWB and other reviewers since the previous AEMP design;
- Changes since the last Design Plan 5.2;
- Recommendations related to fish health and fish tissue chemistry in relation to findings of NSC mercury investigation Phase 1 - May 2021;
- Consider recent Fish Response Plan V. 2 and WLWB direction in Reasons for Decision (RFD) for 2017-19 AEMP Re-Evaluation Report;
- Location and number of water quality sampling stations;
- Updated Action Level reporting schedule details;
- Weight of Evidence endpoints for fish;
- MDMER and expectations of equivalency;
- Updated AEMP sampling schedule;
- Clarification of variable selection for cumulative effects assessment;
- Data handling and analyses methods;
- Rationale for any proposed changes to the Design Plan; and
- Any additional recommendations for changes to Design Plan 6.0.

The ToR indicated to identify the issues of most importance for EMAB. Section 2 provides a plain language briefing of 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 TECHNICAL REVIEW

The following sections present key comments in relation to the points identified by EMAB for evaluation during the review of AEMP Design Plan Version 6.0 (Section 1.0), and any additional review comments and recommendations borne from this review.

2.1 LAKE TROUT: PALATABILITY STUDY METHODS

The description of the metals in fish monitoring (Section 4.9) includes details for Slimy Sculpin but the only description of Lake Trout monitoring refers to the Traditional Ecological Knowledge (TK) palatability program. The report indicates: "Analysis of Lake Trout muscle tissue as part of the TK study will be conducted on a minimum of 10 fish collected during the palatability study (see Section 4.1). The samples will be of one sex and age/size class if possible. Methods used for collection and analysis of Lake Trout tissues will be the same as those currently employed during palatability testing; however, angling may be considered as a less damaging sampling strategy. Individual fish will be selected for analysis of metal concentrations." Section 4.1 provides no details of sampling and analysis methods.

In a review of mercury in Lake Trout monitoring (NSC 2021) it was noted that Lake Trout analysed for mercury (and other metals) under the palatability program have actually been comprised of a range of lengths and have not been restricted to a similar or same size class as noted in the Design Plan v. 6.0. Linear regression analysis applied to the palatability data sets indicated relationships between fish length and mercury concentrations were significant since 2009 (NSC 2021). This indicates the size ranges sampled were sufficiently broad to account for the general relationship between size and mercury in fish. An excerpt from NSC (2021) is provided int Table 2 for reference below.

It would be more appropriate and informative to continue to analyse mercury in Lake Trout from a range of sizes to account for size-dependency. Further, this would provide more comparable data for assessing changes in mercury over time.

Table 2. Summary of TK palatability studies: 2002-2018 (modified from NSC 2021).

Year	Number of Samples Collected	Length-Standardized Mercury (mg/kg w.w.) [1]		Fork Length (mm)				
		Mean	95% CI	Median	Mean	Range	SD	SE
2002	5	0.108	0.053 - 0.220	710	593	390 - 750	164	73
2003	4	not significant		665	675	595 - 775	67	33
2004	4	data were not provided						
2009	10	0.222	0.167 -0.295	645	627	430 - 750	86	27
2012	13	0.141	0.092 - 0.215	675	677	562 - 754	52	14
2015	20	0.167	0.135 - 0.207	658	660	508 - 844	87	19
2018	15	0.164	0.121 - 0.224	698	704	620 - 880	76	20

[1] Standard fork length = 620 mm

Recommendation: Continue analysing mercury from a range of Lake Trout fork lengths to be consistent with past palatability programs and to allow for derivation of length-standardized mercury concentrations (i.e., linear regressions between fork length and mercury concentrations).

2.2 LAKE TROUT: MERCURY SURVEY TRIGGER

The report states that statistical analysis of the fish tissue chemistry collected as part of the TK program will not be performed because of inconsistencies in the sampling protocols, sample sizes, fishing locations, and size of fish and therefore cannot be used as an early warning trigger for conducting a larger Lake Trout mercury program.

NSC (2021) reviewed available information and data for the Lake Trout mercury monitoring program at the request of EMAB (report submitted with submission of the EMAB 2017-2019 AERER Review). While that review noted that there were differences noted in these parameters among data sets, most of the differences noted actually occur between the two types of programs (i.e., AEMP vs. TK Lake Trout mercury monitoring programs).

The TK palatability program has used relatively consistent methodologies since 2009 and the results of this program could therefore form the basis for defining a trigger for a Lake Trout in mercury study. Since 2009, the sample size of the palatability studies has been >10 fish, the range and mean fish lengths have been similar, the samples have all been analyzed as fillets, and a length-standardized mean could be calculated (NSC 2021, Table 2, p. 6).

Recommendation #1: Review results from the palatability study and develop an early warning trigger for a larger Lake Trout mercury program.

Recommendation #2: Analyse temporal trends for other metals measured in Lake Trout as part of the palatability studies, considering reported increases for some metals in Slimy Sculpin.

2.3 CUMULATIVE EFFECTS ASSESSMENT VARIABLE SELECTION

EMAB had previously provided comments regarding the list of parameters that are included (presented) in reporting regarding the assessment of potential cumulative effects of the Diavik and Ekati mines (see EMAB Comments #19, 26, and 27, 2017-2019 AERER review and the NSC 2022 2017-2019 AERER Addendum Review).

The WLWB provided a directive to Diavik with respect to the 2017-2019 AERER Addendum on this issue:

"Addendum Requirement #4: The Board requires DDMI to clarify in the 2017 to 2019 Aquatic Effect Re-evaluation Report Addendum why particular parameters were not included in the Cumulative Effects assessment based on the approach described in Version 5.2 of the AEMP Design Plan."

The WLWB also provided a directive to Diavik with respect to the AEMP Design Plan, Version 6 on this issue:

"**AEMP Design Plan, Version 6, Requirement #4**: The Board requires DDMI to clarify in Section 6.1 the circumstances for when a parameter would not be included in the cumulative effects assessment."

The Design Plan v. 6.0 indicates that "only variables that have concentrations greater than the normal range in the far-field areas (i.e., FFA and FFB) and are consistently measured by both AEMP programs in Lac de Gras will be included in the cumulative effects assessment."

NSC had previously commented that chlorophyll *a* should be included in the cumulative effects assessment as there may be synergies between the two mines that may not be identified solely based on conditions at FF sites. As previously noted, for example, one mine could increase phosphorus and the other nitrogen which together may lead to increases in algal abundance.

Recommendation: Include chlorophyll *a* in the cumulative effects assessment, regardless of conditions measured at FF stations.

2.4 MDMER AND EXPECTATIONS OF EQUIVALENCY

The Study Design report indicates: "On 1 June 2018, diamond mines became subject to the Metal and Diamond Mining Effluent Regulations (Government of Canada 2002). A first study design under the MDMER was to be submitted by the earlier of 1 June 2021 and the day on which an equivalent document was required to be submitted under territorial laws (per Section 38[1] of the MDMER). The Government of the Northwest Territories (GNWT) and the Government of Canada

(i.e., Environment and Climate Change Canada [ECCC]) were, however, already considering an equivalency agreement for operating mines in the Northwest Territories such that duplication between the MDMER (e.g., Environmental Effects Monitoring [EEM]) and water licence requirements (e.g., AEMP) could be avoided. Due to the expectations of equivalency, application of the EEM-related components of the MDMER to the Mine (i.e., both monitoring and reporting requirements) have not been described herein."

The AEMP Design Plan v. 6.0 incorporates elements and requirements of the MDMER in terms of the study design, methods, and data analysis and interpretation. However, several elements of the MDMER requirements with respect to monitoring are not currently incorporated in the AEMP.

2.4.1 Fish Monitoring

The primary difference between the AEMP and the MDMER monitoring requirements is that only one fish species is monitored under the AEMP. The MDMERs (Government of Canada 2002) require conduct of: "a study respecting fish population, if the highest concentration of effluent in the exposure area, during a period in which there are deposits, is greater than 1% at any location that is 250 m from a point at which the effluent enters the area from a final discharge point, unless the results of the previous two biological monitoring studies indicate

(i) for all effect indicators with no assigned critical effect size, no effect on the fish population, and

(ii) for all effect indicators with an assigned critical effect size, no effect on the fish population or an effect on the fish population the absolute value of the magnitude of which is less than the absolute value of its assigned critical effect size."

Environment Canada (2012) indicates "The recommended method for carrying out the fish survey is to monitor adults of two species of relatively sedentary finfish that have been exposed to effluent over a long period of time…. In selecting the two species…preference should be given to: resident (non-migratory) fish species identified in a site characterization sexually mature female and male fish species that are abundant in both the exposure and reference areas fish species for which fishing or sampling permits can be obtained fish species that have the highest exposure to effluent."

The Diavik AEMP includes monitoring of only a single fish species (Slimy Sculpin).

In addition, the MDMERs require measurement of egg counts and fecundity for females of both fish species if sexually mature and practicable. The AEMP does not include measurement of these metrics.

2.4.2 Toxicity Testing

The MDMERs require chronic toxicity testing on fish species (Fathead Minnow or salmonid fish), an invertebrate species (*Ceriodaphnia dubia*), an algal species, and an aquatic plant (*Lemna minor*).

The Study Design v. 6.0 includes chronic toxicity testing of effluent on three of these groups in accordance with MDMERs, but excludes chronic toxicity testing for the fourth group, *Lemna minor*.

Recommendation: Clarify if the intent of the AEMP is to incorporate all requirements of the MDMER and if so, either add an additional fish species and measurement of egg counts and fecundity to the fish monitoring program and chronic toxicity testing of effluent using *Lemna minor* or indicate why these components will be excluded.

3.0 SUPPORTING MATERIALS FOR REVIEW

Canadian Council of Ministers of the Environment (CCME). 2004. Canadian water quality guidelines for the protection of aquatic life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems. In: Canadian environmental quality guidelines, 2004, CCME, Winnipeg Environment Canada. 2012. Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring. Environment Canada, Ottawa, Ontario.

Golder. 2022a. Diavik Diamond Mines (2012) Inc. Aquatic Effects Monitoring Program Study Design Version 6.0. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, April 2022.

Golder. 2022b. Diavik Diamond Mines (2012) Inc. 2017 to 2019 Aquatic Effects Re-Evaluation Report v. 1.0 Addendum. Submitted to Wek'eezhii Land and Water Board, April 2022.

Golder. 2021. 2014 to 2019 AEMP Response Plan – Fish, Version 2.0. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, July 2021.

Golder. 2020a. Diavik Diamond Mines (2012) Inc. 2017 to 2019 Aquatic Effects Re-Evaluation Report for the Diavik Diamond Mine, Northwest Territories. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, December 2020.

Golder. 2020b. Diavik Diamond Mines (2012) Inc. Aquatic Effects Monitoring Program Study Design Version 5.2. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, July 2020.

Golder. 2019. Diavik Diamond Mines (2012) Inc. Aquatic Effects Monitoring Program Study Design Version 5.1. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, October 2019.

Government of Canada. 2002. Metal and Diamond Mining Effluent Regulations (current to 23 February 2022 and last amended on 21 February 2022). SOR/2002-222. Available at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/. Accessed: 6 June 2022.

North/South Consultants Inc. (NSC). 2022. 2017-2019 Aquatic Effects Re-Evaluation Report v. 1.0 Addendum – Plain Language Briefing and Technical Review Comments. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-22-01. June 2022.

NSC. 2021a. 2017-2019 Aquatic Effects Re-Evaluation Report – Plain Language Briefing and Technical Review Comments. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-21-03. July 19, 2021.

NSC. 2021b. Technical review of Diavik Diamond Mines Aquatic Effects Monitoring Program Lake Trout mercury program. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-21-02. May 2021.

NSC. 2021b. Aquatic Effects Monitoring Program 2019 Annual Report – Plain language briefing and technical review comments. Prepared for the Environmental Monitoring Advisory Board. Technical Memorandum # 367-21-01. January 22, 2021.

NSC. 2020. Aquatic Effect Monitoring Program Design Plan Version 5.1 – Plain language briefing and technical review comments. Technical Memorandum # 367-20-01. January 10, 2020. 26 pp.

Wek'eezhii Land and Water Board (WLWB). 2022a. Diavik - 2017 to 2019 Aquatic Effects Re-Evaluation Report and V. 4.0 of the Quality Assurance Project Plan (W2015L2-0001): Reasons for Decision. January 31, 2022.

WLWB. 2022b. Diavik - 2017 to 2019 Aquatic Effects Re-Evaluation Report and V. 4.0 of the Quality Assurance Project Plan (W2015L2-0001): Review summary and attachments.

WLWB. 2020a. Diavik – Aquatic Effects Monitoring Program (AEMP) Design Plan v. 5.1 (W2015L2-0001): Review comment table.

Table 1. Technical review comments and recommendations on the AEMP Design Plan v. 6.0.

TOPIC	COMMENT	RECOMMENDATION
Section 3.2, Assessment and Measurement Endpoints, Table 3.2-1, p. 18	Row 2 of Table 3.2-1 Valued Ecosystem Components and Measurement Endpoints Associated with the AEMP indicates metals are analysed in a 2 cm profile. Metals are analysed in the top 1 cm of sediments under the AEMP.	Correct the reference to sediment depth that is analysed under the AEMP.
Sampling Schedule, Section 3.5, p. 25 & Fish Health, Section 4.8.1 Background, p. 62	Section 3.5 notes that a "a Lake Trout fish health survey would be defined in an AEMP Response Plan, which would be implemented as and when approved by the WLWB. It is possible that such a program would be limited to a non-lethal tissue chemistry sampling program (e.g., for mercury analyses from tissue plugs) or could be a lethal fish health survey, dependent on the Action Level trigger which initiated the study.....The specific timing of a follow-up study, however, would be defined in an AEMP Response Plan (Section 7.5), which would be implemented as and when approved by the WLWB." In Section 4.8.1 it is indicated that "the specific scope and timing of a Lake Trout survey would be specifically defined in an AEMP Response Plan (Section 7.5) and would be determined by the nature of the Action Level exceedance...If initiated, the Lake Trout program may be limited to a non-lethal tissue chemistry sampling program (e.g., for mercury analyses from tissue plugs) or may be a lethal fish health survey, dependent on the Action Level trigger which initiated the study."	Clarify where the detailed design and methods (field, laboratory, and data analysis methods) will be presented in the event that a larger mercury in Lake Trout program is to be conducted.
Sampling Schedule, Section 3.5, Table 3.5-1, p. 27	Table 3.5-1 Summary of the AEMP Design Plan Version 6.0 indicates sediment quality is monitored in the 0-5 cm depth interval at the edge of the mixing zone. Currently, monitoring occurs in the 0-1 cm depth for metals and nutrients and 10-15 cm for particle size at all other sites in Lac de Gras. It would be more appropriate to sample the same sediment depth as for all the other sites at this station and sampling a shallower depth would be a more sensitive means to detect changes over time.	Consider modifying the depth of sediment analysed at the edge of the mixing zone to be consistent with the methods employed at other sites in Lac de Gras or if this is an error, correct the table.
Water Quality, Section 4.3.4.3, Substances of Interest, p. 43	Criterion 3: Variables that trigger Action Level 1 or greater in the Response Framework (Section 5.2.1) will be included as SOIs. Under this criterion, NF median concentration of variables that biomagnify (i.e., mercury and selenium) will be compared to the current detection limit in addition to two times the reference data set median concentrations, resulting in a more stringent comparison for mercury and no change for selenium.	Clarify how results for mercury and selenium will be compared to current detection limits.

TOPIC	COMMENT	RECOMMENDATION
Toxicity Testing, Section 4.3.4.5, p. 44	The MDMERs require chronic toxicity testing on a fish species (Fathead Minnow or salmonid fish), an invertebrate species (*Ceriodaphnia dubia*), an algal species, and an aquatic plant (*Lemna minor*). The Study Design v. 6.0 includes chronic toxicity testing of effluent on three of these groups in accordance with MDMERs, but excludes chronic toxicity testing for the fourth group, *Lemna minor*.	If the intent is to ensure that the AEMP incorporates MDMER requirements, effluent should be subject to chronic toxicity testing for *Lemna minor*. If this component is not included, provide a rationale for the exclusion.
Sediment Quality, Section 4.4.2, Field Methods, p. 49-50	Sediment sampling methods described in Section 4.4.2 indicate that TOC and particle size will be analysed in 10-15 cm sediment while TN, TP, and metals will be analysed in the upper 0-1 cm of sediment. The 2017-19 AERER indicates that: "In 2013, 2016, and 2019... TOC was analyzed in both the top 1 cm core samples and the top 10 to 15 cm Ekman grab samples." Will TOC continue to be analysed in the upper 1 cm as well as the 10-15 cm depth moving forward?	Clarify what depth of sediment will be analysed for TOC (i.e., will it continue to be analysed in both 0-1 cm and 10-15 cm depths). Recommend continuing analysis of the 0-1 cm depth to provide comparable information to nutrients and metals for analysis and interpretation.
Sediment Quality, Section 4.4.3, Laboratory Methods, p. 51	Table 4.4-1: Sediment Quality Variables for the AEMP Design Plan Version 6.0 indicates particle size and TOC will be analysed in the 0-5 cm depth. This contradicts what is described in the text on p. 49-50.	Clarify the depth sediment that will be subject to analysis for TOC and particle size.

TOPIC	COMMENT	RECOMMENDATION
Plankton, Section 4.6.4, Data Analysis and Interpretation, p. 58	The Design Plan v. 6.0 notes that a power analysis was conducted for total biomass and taxonomic richness of both phytoplankton and zooplankton data, to assess the statistical power of the proposed analyses (see Appendix C of Golder 2020a). EMAB (Comment #23) had commented in its review of Design Plan v. 5.1 that the results of the power analysis indicate relatively low power to detect change relative to the reference condition. Given these results, it was recommended to conduct a power analysis on a second indicator of algal abundance (chlorophyll *a*) that is analysed as part of the AEMP. DDMI's response indicated "that a power analysis of chlorophyll *a* is not necessary because chlorophyll *a* concentration would not be useful to assess the toxicological impairment pathway. This variable is not included in the Action Level evaluation for toxicological impairment. Chlorophyll *a* concentrations in the NF and MF areas have been consistently greater than the upper bound of the normal range from 2007 to 2016 (Section 5.3.1.3 in the 2014 to 2016 Aquatic Effects Re-evaluation Report Version 1.1), and in 2017 and 2018 (2017 AEMP Annual Report and 2018 AEMP Annual Report). Increased chlorophyll *a* concentration is consistent with the EA prediction that the introduction of nutrients, particularly phosphorus, by the minewater discharge would result in an increase in primary productivity. Therefore, since reduced chlorophyll *a* concentration (1) is not a variable analyzed to evaluate toxicological impairment, (2) has not been observed in effluent-exposed areas, and (3) is not expected to occur in those areas, the suggested power analysis would not be a useful addition to the AEMP Design Plan." Since chlorophyll a and phytoplankton biomass are both measured in the AEMP and both are indicators of algal abundance, it would be useful to provide measures of the statistical power of both metrics within the AEMP. Further, it is noted that should power analysis reveal chlorophyll a to be a more sensitive indicator than biomass, it may be a more suitable metric to include in the toxicological impairment pathway. Regardless of this consideration, knowledge of the power of the chlorophyll a metric for detecting change for the nutrient enrichment pathway - which as noted has been affected by the Mine - would be beneficial for interpreting the results of the program and could inform future modifications to the study design.	Conduct a power analysis of chlorophyll *a*.

TOPIC	COMMENT	RECOMMENDATION
Fish Health, Section 4.8.1, Background, p. 62	The report indicates that a Lake Trout survey may be initiated "If Slimy Sculpin fish health assessment endpoints demonstrate effect equivalent to Action Level 3", which is "a statistically significant difference in one or more effect endpoints is determined with a direction indicative of impairment to fish health and a magnitude of difference equal to or above the critical effects size that was beyond normal range, and that was observed in two consecutive sampling events" (p. 62). The action levels defined in Table 5.2-4 indicate that Action Level 3 is "A measurement endpoint beyond the normal range" and that Action Level 2 triggers the Lake Trout study. The text in Design Plan v. 5.2 appears to be correct and states "If Slimy Sculpin fish health assessment endpoints demonstrate effects equivalent to Action Level 2 (i.e., a statistical difference from the mean of the reference condition data set indicative of a toxicological response in fish was determined in fish collected from the MF area; Table 5.2-4), it is expected a Lake Trout survey may be initiated." There appears to be an error in the text in Version 6.0.	Amend the text to cite the correct Action Level and definition.
Fish Health, Section 4.8.1, Background, p. 62	Previous and most current AEMP Design Plans incorporate monitoring of one fish species (Slimy Sculpin). Environment Canada (2012) indicates “The recommended method for carrying out the fish survey is to monitor adults of two species of relatively sedentary finfish that have been exposed to effluent over a long period of time."	If the intent is to ensure that the AEMP incorporates MDMER requirements, monitoring of a second fish species should be included in the AEMP. If this component is not included, provide a rationale for the exclusion.
Fish Health, Section 4.8.2, Field Methods, p. 64	The MDMERs require measurement of egg counts and fecundity for females of both fish species if sexually mature and practicable. The AEMP does not include measurement of these metrics.	If the intent is to ensure that the AEMP incorporates MDMER requirements, egg counts and fecundity metrics should be included in the fish health monitoring program. If this component is not included, provide a rationale for the exclusion.
Fish Tissue Chemistry, Section 4.9.3, Laboratory Methods, p. 69	The AEMP indicates that five Slimy Sculpin samples will be selected after the initial analysis to represent a range of fish lengths, where possible (given limitations in sample volume), and sent to Flett Research Ltd. (Winnipeg, MB) for QC of the mercury results. However, the samples submitted for metals analysis (including mercury) are composite samples from the same size class. It is unclear how a range of fish lengths can be analysed at the secondary lab (Flett Research) unless the intent is to submit entirely separate samples of individual fish. If the latter is the intent, it is unclear how those results would serve as QA/QC verifications of the primary lab results from composite fish samples of the same length.	Clarify how the fish samples that will be submitted to Flett Research for mercury analysis will be collected and selected for submission.

TOPIC	COMMENT	RECOMMENDATION
Fish Tissue Chemistry, Section 4.9.2, Field Methods, p. 69	The Study Design indicates that metals will be analysed in sculpin, with each sample being comprised of eight composite tissue samples from fish captured at each of the four study areas. It is noted that "each sample will be a composite of whole fish...and will be based on fish of the same sex and of the same size class. The mean length and weight of the fish comprising these samples will be recorded." It is not clear if each composite sample will be similarly comprised of individuals from the same sex and size class or if that statement is intended to be applied to the individual 8 fish that will form an individual composite sample. This relates to the issue of bioaccumulation and the general positive relationship between fish size and concentrations of mercury and selenium. If the 8 samples consist of fish of varying size classes, either in past years including samples used to define normal ranges, or moving forward, it is unclear how reliable comparisons to normal ranges or temporal trends would be for these substances as the samples may not be comparable. A related comment was submitted by EMAB (Comment #51) on the 2017-2019 AERER review in which it was recommended that figures showing mercury vs. length and weight regressions be presented in the report.	Clarify if each of the eight composite samples of sculpin will be comprised of fish of the same sex and age class. Present results of regression analyses between fish length and mercury in reports. Present the target length ranges of sculpin that will be collected for metals analysis, considering the length ranges of fish analysed in previous years, including the dataset used to define normal ranges to demonstrate comparability of data sets.

TOPIC	COMMENT	RECOMMENDATION
Fish Tissue Chemistry, Section 4.9.2, Field Methods, p. 69	The description of the metals in fish monitoring (Section 4.9) includes details for Slimy Sculpin but the only description of Lake Trout monitoring refers to the TK palatability program. The report indicates: "Analysis of Lake Trout muscle tissue as part of the TK study will be conducted on a minimum of 10 fish collected during the palatability study (see Section 4.1). The samples will be of one sex and age/size class if possible. Methods used for collection and analysis of Lake Trout tissues will be the same as those currently employed during palatability testing; however, angling may be considered as a less damaging sampling strategy. Individual fish will be selected for analysis of metal concentrations." Section 4.1 provides no details of sampling and analysis methods. In a review of mercury in Lake Trout monitoring (NSC 2021) it was noted that Lake Trout analysed for mercury (and other metals) under the palatability program have actually included a range of trout lengths and have not been restricted to a similar or same size class as noted in the Design Plan v. 6.0. Linear regression analysis was applied to the palatability data sets in NSC (2021) and relationships between fish length and mercury concentrations were significant indicating the size ranges sampled were sufficiently broad to account for the general relationship between size and mercury in fish. It would be more appropriate and informative to continue to analyse mercury in Lake Trout from a range of sizes to account for size-dependency. Further, this would provide more comparable data for assessing changes in mercury over time.	Continue analysing mercury from a range of Lake Trout fork lengths to be consistent with past palatability programs and to allow for derivation of length-standardized mercury concentrations (i.e., linear regressions between fork length and mercury concentrations).
Fish Tissue Chemistry, Section 4.9.4, Data Analysis and Interpretation, p. 70	The data analysis and interpretation for metals in fish tissue (Section 4.9.4) indicates that "temporal trend analysis of the fish tissue chemistry data will follow the approach in Golder (2018) and will be provided in the Aquatic Effects Re-evaluation Report." This report is listed as: Golder. 2018. Aquatic Effects Monitoring Program 2017 Annual Report. Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT, Canada. April 2018 in the references section. The cited document does not contain information on analysis of metals in sculpin as this component was not monitored in the 2017 AEMP. There is also insufficient information provided regarding comparisons to normal ranges for mercury and selenium which are generally related to fish size/age. The report only indicates: "Metal concentrations will be compared to the normal range in each AEMP Annual Report."	Please provide a description in sufficient detail of how all data analyses, including temporal trends, will be conducted for evaluating metals in sculpin. This should include details of how the data will be treated for analysing mercury and selenium results given the general relationships to fish size.

TOPIC	COMMENT	RECOMMENDATION
Fish Tissue Chemistry, Section 4.9.4, Data Analysis and Interpretation, p. 70	The report states that statistical analysis of the fish tissue chemistry collected as part of the TK program will not be performed because of inconsistencies in the sampling protocols, sample sizes, fishing locations, and size of fish and therefore cannot be used as an early warning trigger for conducting a larger Lake Trout mercury program. NSC (2021) reviewed available information and data for the Lake Trout mercury monitoring program at the request of EMAB (report submitted with submission of the EMAB 2017-2019 AERER Review). While that review noted that there were differences noted in these parameters among data sets, most of the differences actually occur between the two types of programs (i.e., AEMP vs. TK Lake Trout mercury monitoring programs). The TK palatability program has used relatively consistent methodologies since 2009 and the results of this program could therefore form the basis for defining a trigger for a Lake Trout in mercury study. Since 2009, the sample size of the palatability studies has been >10 fish, the range and mean fish lengths have been similar, the samples have all been analyzed as fillets, and a length-standardized mean could be calculated (NSC 2021, Table 2, p. 6).	Review results from the palatability study and develop an early warning trigger for a larger Lake Trout mercury program. Analyse temporal trends for other metals measured in Lake Trout as part of the palatability studies, considering reported increases for some metals in Slimy Sculpin.
Response Framework, Section 5.2.1, Action Levels, Water Quality, p. 82	Design Plan v. 6.0 has added comparisons to detection limits "for variables that biomagnify (i.e., mercury and selenium)...resulting in a more stringent comparison for mercury and no change for selenium. As a result of this change, mercury and selenium will be included as SOIs when their concentrations are consistently greater than the detection limit." It is unclear how "consistently greater than the detection limit" will be defined.	Clarify what is meant by "consistently greater than the detection limit" (i.e., a percentage of measurements or detections in all measurements).
Action Levels, Section 5.2.4, Biological Components, p. 89, Table 5.2-4	Action levels for benthic invertebrates presented in Table 5.2-4 do not identify the associated metrics; the table indicates "the mean of a community variable" and points to a footnote that refers the reader back to Section 4.7.4. It is unclear what benthic invertebrate metrics will be subject to the action level assessment.	Please identify the list of benthic invertebrate metrics that will be subject to the action level assessment in Table 5.2-4 (a list in a footnote would be adequate).

TOPIC	COMMENT	RECOMMENDATION
Effects Benchmarks, Section 5.3.1, Water Quality, p. 91, Table 5.3-1	The report indicates that "According to CCME (2004), the Canadian trigger ranges for TP are 4 to 10 µg/L for oligotrophic lakes, and 10 to 20 µg/L for mesotrophic lakes. In their decision regarding Version 5.1 of the AEMP design, the WLWB provided direction that the effects benchmark for TP was to be set at 7.5 µg/L in Version 5.2 of the AEMP design; this benchmark was carried forward to Version 6.0." It is noted that the CCME Guidance Framework for the Management of Phosphorus in freshwater systems actually incorporates a "tiered approach where phosphorus concentrations should not (i) exceed predefined 'trigger ranges'; and (ii) increase more than 50% over the baseline (reference) levels." A concentration of 7.5 ug/L represents a 50% increase above the upper boundary of the normal range for the -ice-cover season (2-5 ug/L). The CCME (2004) notes that "if the increase from the baseline is greater than 50%, the risk of observable effects is considered to be high, and further assessment is recommended." Reference: CCME. 2004. Canadian water quality guidelines for the protection of aquatic life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems. In: Canadian environmental quality guidelines, 2004, CCME, Winnipeg.	Recommend referencing the 50% increase above background as one of the factors incorporated into the CCME phosphorus guidance framework.
Alignment of AEMPS in Lac de Gras, Section 6.1, Data Analysis Approach, p. 100	The Design Plan v. 6.0 indicates that "only variables that have concentrations greater than the normal range in the far-field areas (i.e., FFA and FFB) and are consistently measured by both AEMP programs in Lac de Gras will be included in the cumulative effects assessment." NSC had previously commented that chlorophyll *a* should be included in the cumulative effects assessment as there may be synergies between the two mines that may not be identified solely on the basis of conditions at FF sites (see EMAB Comments #19, 26, and 27, 2017-2019 AERER review and the NSC 2022 2017-2019 AERER Addendum Review). As previously noted, for example, one mine could increase phosphorus and the other nitrogen which together may lead to increases in algal abundance.	Include chlorophyll *a* in the cumulative effects assessment, regardless of conditions measured at FF stations.

TOPIC	COMMENT	RECOMMENDATION
Normalization of Sediment Quality Data and Sampling Method Changes, EMAB Comment #11, Review of AEMP Design Plan v. 5.1 and DDMI Responses	EMAB (Comment #11) in its review of the AEMP Design Plan v. 5.1 noted that while normalization of sediment quality data to supporting variables (i.e., total organic carbon [TOC] and percent fines) is valid and appropriate for trend analysis, this approach is predicated upon the assumption that there are no mine-related effects on the supporting variables (i.e., TOC and percent fines). DDMI's response indicated: "As stated by the reviewer, normalization assumes no mine-related effect on sediment particle size (% fines) and total organic carbon (TOC), as well as a strong correlation between these variables and chemistry variables. Sediment quality supporting variables (i.e., % fines and TOC) were analyzed in recent comprehensive AEMP years when sediment quality data were collected (i.e., 2013 and 2016) and no mine-related effect was observed for these parameters, as reported in the corresponding AEMP Annual Reports. Although the 2014 to 2016 Aquatic Effects Re-evaluation Report reported some spatial and temporal variation in % fines and TOC, these were attributed to background spatial variation and changes in sampling methods, rather than mine-related effects (Section 6.3.3.1). These results are consistent with expectations, because the level of Mine-related nutrient enrichment observed in Lac de Gras is unlikely to result in measurable enrichment of bottom sediments with organic material, or in a change in inorganic particle size distribution. All sediment quality variables, including supporting variables, will continue to be included in the effect analyses during comprehensive monitoring years, and if selected as Substances of Interest, supporting variables will undergo detailed analysis. If a mine-related effect is detected on % fines or TOC in the future, use of these variables for normalizing the sediment chemistry data will be reconsidered and potentially discontinued. The WLWB in its RFD on the 2017-2019 AERER issued Addendum Requirement #2 which stated: "The Board requires DDMI to address the Board's previous direction from the 2014 to 2016 Re-evaluation report related to the change in sediment sampling methods (i.e., requirement 5E). DDMI must explicitly address the implications, if any, of the sediment methodology changes and consider ways in which it can overcome these implications." The AERER Addendum response provide by DDMI indicated: "For particle size, TOC and TN, there was no indication that the change in methods affected data interpretation." DDMI's AERER Addendum response appears to contradict the response provided to EMAB	Provide an explicit assessment of the implications for the changes in sampling methods on TOC and particle size or conduct correlation analyses on blocks of data between these method changes separately (i.e., 2007-2010 and 2013-onward). Depending on the outcome of these analyses, the approach for trend analyses may require modification.

TOPIC	COMMENT	RECOMMENDATION
	Comment #11 on the AEMP Design Plan v. 5.1: "Although the 2014 to 2016 Aquatic Effects Re-evaluation Report reported some spatial and temporal variation in % fines and TOC, these were attributed to background spatial variation and changes in sampling methods, rather than mine-related effects (Section 6.3.3.1)." Further, as presented in NSC (2022) in its review of the 2017-2019 AERER Addendum: "…the analysis and interpretation of results for other parameters (i.e., metals) is directly affected by the accuracy of TOC and particle size measurements as these supporting parameters are used to "normalize" data for metals. Any bias in results for TOC and/or particle size resulting from the sampling method change could therefore carry through to the interpretation of the results for metals."	