North/South Consultants Inc.

83 Scurfield Blvd.
Winnipeg, MB R3Y 1G4
Tel: (604) 284-3366
Fax: (204) 477-4173
Email: lzrum@nscons.ca
Web: www.nscons.ca

AQUATIC EFFECTS MONITORING PROGRAM DESIGN PLAN VERSION 4.0 – PLAIN LANGUAGE BRIEFING AND TECHNICAL REVIEW COMMENTS

Technical Memorandum # 367-16-04

Prepared for:

Environmental Monitoring Advisory Board (EMAB)
P.O. Box 2577
Yellowknife, NT
X1A 2P9

Prepared by:

North/South Consultants Inc.

Draft 23 September 2016

1.0 BACKGROUND AND SCOPE OF WORK

Diavik Diamond Mines (2012) Inc. (Diavik) submitted Version 4.0 of its Aquatic Effects Monitoring Program (AEMP) Design Plan on July 15, 2016 to the Wek'eezhii Land and Water Board (WLWB) in accordance with Part J, Item 3 of Water Licence W2015L2-0001 (Golder 2016a). The Design Plan Version 4.0 was circulated for review at the same time as Diavik's Quality Assurance Project Plan (QAPP) Version 3.0 (Golder 2016b). Part J, Item 4 of the Water Licence states: "To reflect changes in the AEMP Design Plan, the Licensee shall, every three years or as directed by the Board, review and revise the AEMP Quality Assurance Project Plan, for Board approval."

North/South Consultants Inc. (NSC) conducted a technical review of the AEMP Design Plan Version 4.0, with focus on Section 3.0 Study Design, for the Environmental Monitoring Advisory Board (EMAB). As directed by EMAB in their Scope of Work, the following points were evaluated during the review:

- Location and number of the new sampling stations for dust and water quality;
- Effectiveness of AEMP sampling schedule, in particular for sampling sediments, benthic invertebrates, and fish;
- New method to measure effects from dust deposition on Lac de Gras. Address if the Design Plan provides sound rationale for determining what areas of the lake receive more dust deposition than others;
- Variables used for measuring eutrophication;
- Adequacy of Action Levels for sediment quality;
- Process of developing new Effects Benchmarks and their protectiveness;
- Methods used to measure cumulative effects from Diavik and Ekati mines, including future contributions from the Ekati Jay Project;
- Updated detection limits;
- Completeness of variables analyzed;
- Data handling and analysis methods;
- Response Framework's ability to respond to change; and
- How the report addresses EMAB and NSC recommendations since previous re-design.

Section 2 provides a plain language briefing of the above points, along with any review comments and recommendations for consideration by Diavik and the WLWB. 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 AEMP Design Plan Version 4.0 is well written and organized and the inclusion of Appendix A (AEMP Version 4.0 Proposed Changes Document) that: (1) outlines all required and proposed changes made to the AEMP Design Plan since the last approved design (Version 3.5); and, (2) references where those changes are presented in Version 4.0, greatly improved the efficiency of the review.

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 Design Plan Version 4.0 (Section 1.0), and any additional review comments and recommendations borne from this review.

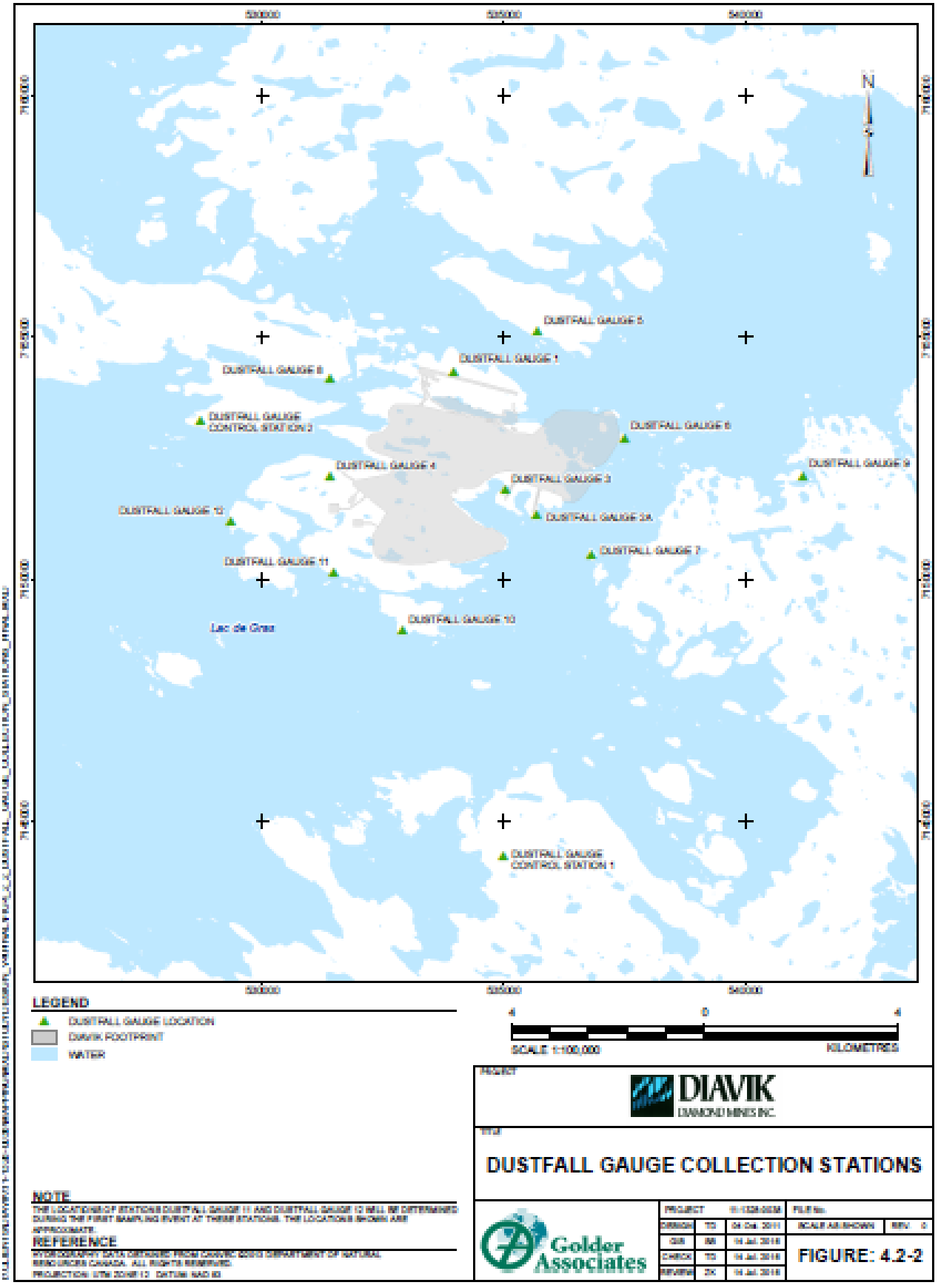
The following is organized according to the scope of work identified in Section 1.0.

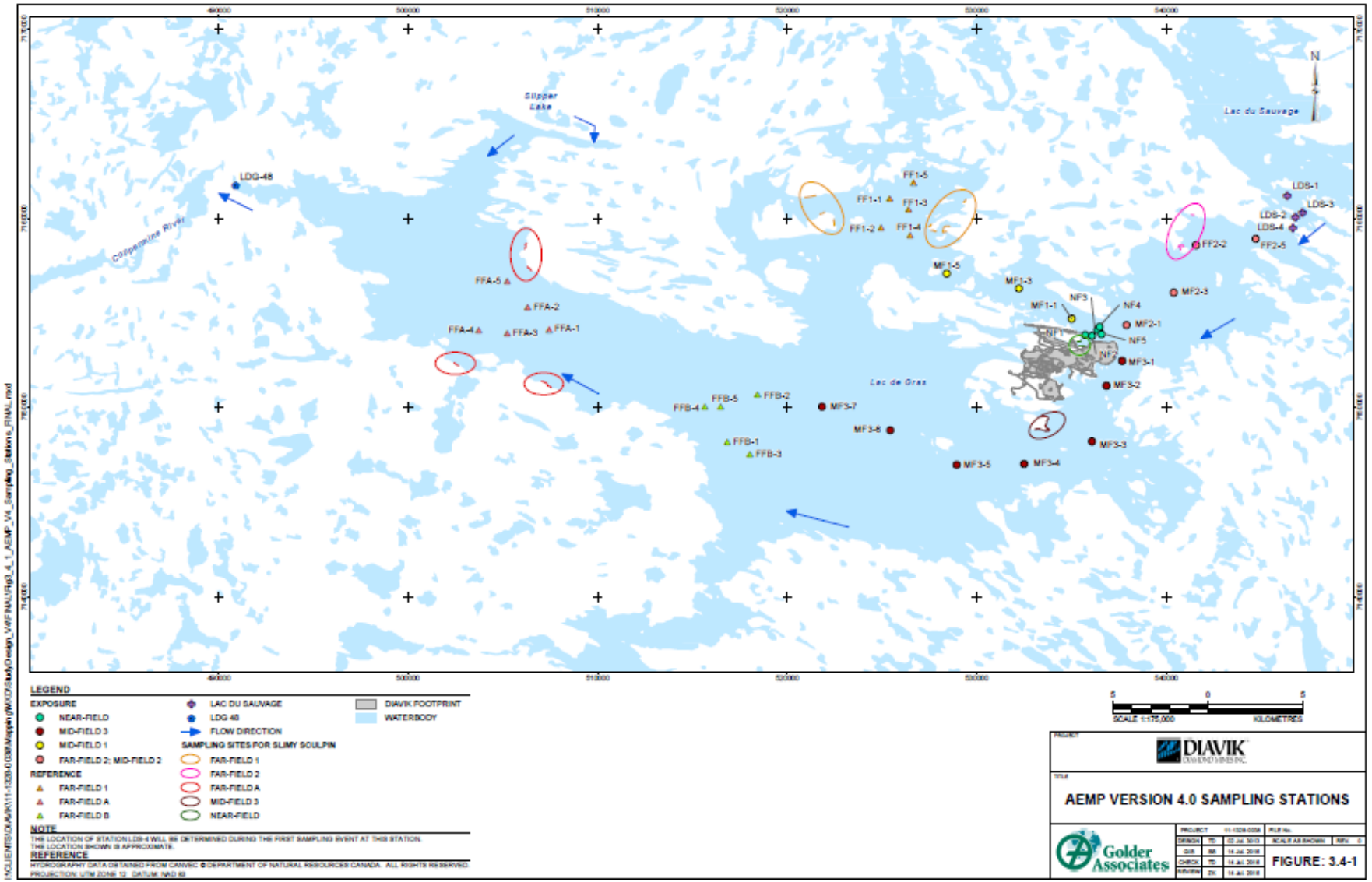
2.1 NEW DUST AND WATER QUALITY SAMPLING STATIONS

In response to EMAB's recommendation (May 7, 2015 intervention) regarding Diavik's Water Licence renewal application that Diavik should consider placing permanent dustfall monitoring gauges on East Island due west of the Mine infrastructure, Diavik is proposing to add two new monitoring locations on East Island (Figure 4.2-2; Section 4.2.2.2, p. 33-34; Appendix A, Section 13.0, p. A-23). The addition of these two locations appears to address EMAB's concern.

Diavik is also proposing to add a new sampling location to the outlet of Lac du Sauvage (LDS-4) to monitor the quality of the water flowing into Lac de Gras (Figure 3.4-1; Section 3.4.2, p. 19; Appendix A, Section 5.0, p. A-10 to 11). Addition of this site is an improvement to the program. As this site will be sampled annually, it can provide very useful information for context and interpretation of nearfield (NF) and midfield (MF) results for the water quality and eutrophication programs.

Recommendation: None.


520000
525000
540000
N
DUSTFALL GAUGE 5
DUSTFALL GAUGE 1
DUSTFALL GAUGE 8
DUSTFALL GAUGE CONTROL STATION 2
DUSTFALL GAUGE 6
DUSTFALL GAUGE 4
DUSTFALL GAUGE 3
DUSTFALL GAUGE 9
DUSTFALL GAUGE 12
DUSTFALL GAUGE 3A
DUSTFALL GAUGE 7
DUSTFALL GAUGE 11
Lac de Gras
DUSTFALL GAUGE 10
DUSTFALL GAUGE CONTROL STATION 1
LEGEND
DUSTFALL GAUGE LOCATION
DIAVIK FOOTPRINT
WATER
4
0
4
SCALE 1:100,000
KILOMETRES
PROJECT
DIAVIK
DIAMOND MINES INC.
DUSTFALL GAUGE COLLECTION STATIONS
NOTE
REFERENCE
Golder Associates
FIGURE: 4.2-2


Slipper Lake
Coppermine River
Lac du Sauvage
Lac de Gras
LDG-48
LDS-1
LDS-2
LDS-3
LDS-4
LDS-5
FF1-1
FF1-2
FF1-3
FF1-4
FF1-5
FF2-2
FFA-1
FFA-2
FFA-3
FFA-4
FFA-5
FFB-1
FFB-2
FFB-3
FFB-4
FFB-5
MF1-1
MF1-3
MF1-5
MF2-1
MF2-3
MF3-1
MF3-2
MF3-3
MF3-4
MF3-5
MF3-6
MF3-7
NF1
NF2
NF3
NF4
NF5
N
LEGEND
EXPOSURE
NEAR-FIELD
MID-FIELD 3
MID-FIELD 1
FAR-FIELD 2; MID-FIELD 2
REFERENCE
FAR-FIELD 1
FAR-FIELD A
FAR-FIELD B
LAC DU SAUVAGE
LDG 48
FLOW DIRECTION
SAMPLING SITES FOR SLIMY SCULPIN
FAR-FIELD 1
FAR-FIELD 2
FAR-FIELD A
MID-FIELD 3
NEAR-FIELD
DIAVIK FOOTPRINT
WATERBODY
NOTE
REFERENCE
SCALE 1:175,000
KILOMETRES
DIAVIK
AEMP VERSION 4.0 SAMPLING STATIONS
Golder Associates
FIGURE: 3.4-1

2.2 AEMP SAMPLING SCHEDULE

In response to the WLWB (December 19, 2014 Letter, Response to requests regarding the Diavik Aquatic Effects Monitoring Program), Diavik included a revised AEMP schedule as part of Design Plan Version 4.0; however, no changes to the frequency of sampling are proposed with the exception of the large-bodied fish program. Diavik is proposing that a Lake Trout mercury survey will only be completed if triggered by the results of the small-bodied fish health survey (i.e., Action Level 2 is reached).

Comment 1: The schedule for sediment quality and benthic invertebrates is unchanged from the Design Plan Version 3.5 and is reasonable given that there is the provision for follow-up studies at an increased frequency in the AEMP Response Plan (Section 7.5, p. 97-98) if an Action Level 1 in the Response Framework (Section 5.2.4, p. 82-83) is triggered for biological components.

Recommendation 1: None.

Comment 2: Given the increase in chlorophyll *a* and total nitrogen (TN) over time, notably in 2014, it may be prudent to measure phytoplankton taxonomy and biomass in the mid-field (MF) area (at a minimum) on a more frequent basis (i.e., more than every three years).

Recommendation 2: Suggest consideration of collecting phytoplankton samples from MF sites each year of sampling rather than only on a three-year rotational basis. Samples could be collected and archived and analysed in the event that nutrient and chlorophyll *a* data indicate an increasing effect spatially and/or if near-field (NF) plankton data indicate an escalating effect.

Comment 3: The sampling schedule indicates that the mercury (Hg) in Lake Trout survey will only occur if the results of the mercury in small-bodied fish (i.e, Slimy Sculpin) study indicate an increasing trend in Hg concentrations caused by the mine. This assumes that Hg concentrations in sculpin are indicative of concentrations in trout.

There are concerns associated with this proposed approach including inherent and fundamental differences in the ecology, movement, trophic position, and habitat use between the two species. Ultimately these differences mean that it may not be biologically appropriate to use monitoring information from one species as an indicator of risk for the other. Sculpin are typically captured in nearshore areas (approximately 40 cm of water; Section 3.4.2, p. 22) in a habitat unlikely to be used for foraging by Lake Trout. More importantly, Lake Trout are unlikely to feed on sculpin and more likely to consume Round Whitefish in the pelagic zone (i.e., and accumulate Hg via a trophic pathway that does not include sculpin). Additionally, being a top predator, Lake Trout are most at risk to biomagnification of mercury. For all of these reasons, monitoring of mercury in sculpin is not considered to be a good representation of potential effects in Lake Trout. Lastly, monitoring of mercury in Lake Trout is far more relevant from the perspective of monitoring for potential effects on humans.

Since mercury levels in Lake Trout are monitored every three years as part of the palatability studies (see Table 3.5-1, p. 25), the results of these studies could be used as a trigger for the more comprehensive large-bodied fish tissue mercury survey. Even though the sample size from the palatability study is low (n=10), this approach would be more appropriate than using the results from the mercury monitoring of sculpin for the reasons outlined above (which may also be determined from a small sample size, n=8 or more). In addition, mercury would not be monitored in sculpin every 3 years, according to the current study design, if toxicological effects are not observed (Section 4.8.1, p. 57). Should this case occur, a Lake Trout survey would not be triggered for at least 7 years.

Recommendation 3: Consider the inclusion of results from the palatability studies as a trigger for the large-bodied fish tissue mercury studies.

It is further suggested that results of the Lake Trout mercury monitoring from the palatability studies conducted in 2002-2004 and 2012 be included in the comparison of yearly (length-adjusted) means to increase the period for past temporal analysis and for comparison with future results from palatability studies.

2.3 METHOD TO MEASURE EFFECTS FROM DUST DEPOSITION

In response to the WLWB's requests (October 27, 2014 Decision Package; May 26, 2016 Decision Package) and EMAB's comment (May 7, 2015 intervention), the Study Design Version 4.0 will include an analysis of the effects on water quality, indicators of eutrophication, and sediment quality at stations potentially affected by dust emissions (Appendix A, Section 22.0, p. A-42 to 43). The AEMP sampling stations that fall within the expected zone of influence from dust include the five stations in the NF area and mid-field stations MF1-1, MF2-1, MF3-1 and MF3-2. The approach outlined by Diavik to evaluate effects from dust deposition on water and sediment quality, and eutrophication indicators appears to be reasonable.

Recommendation: None.

2.4 EUTROPHICATION VARIABLES

In response to EMAB's comment (May 7, 2015 intervention) regarding Diavik's Water Licence renewal application that Diavik should consider including total phytoplankton biomass (measured as biovolume by the plankton component) as an indicator of eutrophication in addition to the measurement of chlorophyll *a*, Diavik has added phytoplankton biovolume to the list of variables analyzed for the eutrophication indicators component (Section 4.5, p. 49-51; Appendix A, Section 16.0, p. A-25).

The addition of phytoplankton biovolume to the list of eutrophication indicators will improve the overall assessment of effects and changes over time. It would be additionally useful to incorporate key findings and conclusions from the plankton component within the discussion of

eutrophication effects, including but not necessarily limited to, taxonomic composition and supporting variables that may affect plankton (e.g., water temperature). In addition, Section 4.5.4 (p. 51) would benefit from a description of how phytoplankton biovolume data will be incorporated into reporting moving forward.

Recommendation: Consider inclusion of additional information within discussion of eutrophication indicators results - at a minimum a general discussion of conditions and key findings from other relevant sections of the report to provide context (e.g., atypical conditions such as high water temperatures, bloom of a particular algal species). The document would also benefit from clarification as to how phytoplankton biovolume data will be analysed and incorporated into future reporting.

2.5 SEDIMENT QUALITY ACTION LEVELS

In response to the WLWB's request (October 27, 2014 Decision Package), Diavik has developed a Response Framework for sediment quality for inclusion in Design Plan Version 4.0 (Section 5.2.2, p. 78-79; Appendix A, Section 37.0, p. A-59 to 61). It is proposed that Action Levels for sediment quality follow the same general structure used for water quality with the following modifications:

- The extent of effect required for Action Level 3 to occur will be the NF area instead of the mixing zone boundary, which is sampled as part of the SNP – collection methods differ between the SNP and AEMP so the sediment data in the NF will be used so that results are comparable among the Action Levels.
- Similar to water quality, if a sediment variable triggers Action Level 3, Diavik will confirm site-specific relevance of Effects Benchmark, establish Effects Threshold, and define the Significance Threshold if it does not exist. In contrast to water quality (developing an EQC), sediment quality will include a condition that an evaluation of cause must be conducted to identify the main source(s) of effects.
- The management actions required at Action Levels 4 and higher will be determined if an Action Level 3 is triggered.

The Action Levels proposed by Diavik appear to be reasonable.

Recommendation: None.

2.6 EFFECTS BENCHMARKS

Design Plan Version 4.0, Appendix B, derives benchmarks for the protection of aquatic life for multiple constituents that were identified as Action Level 2 substances in either water or sediment:

- Aluminum (water);

- Antimony (water);
- Bismuth (sediment);
- Lead (sediment);
- Silicon (water);
- Sodium (water);
- Tin (water); and
- Turbidity (water).

For each variable, a scientifically-based benchmark is derived and appropriate reference citations are included. The proposed benchmarks were based on available scientific information and the rationale provided is reasonable and clearly documented.

Diavik proposes the use of the CCME guidance for turbidity (CCME 1999; updated to 2016), which is based on a static assumed ratio of 3:1 for turbidity to total suspended solids (TSS) concentrations. As the relationship between TSS and turbidity is site-specific, ideally the benchmark for turbidity should be based on a site-specific relationship. It is recognized, however, that existing data may be insufficient to develop a reliable regression for Lac de Gras due to low ranges for both variables.

Recommendation: If feasible, develop a site-specific regression between TSS and turbidity and incorporate this information into the turbidity benchmark. Should available data be inadequate (which is understood to be a serious limitation for operational monitoring), consider revisiting this analysis in the future with acquisition of additional data. It is understood based on communications with Diavik that other datasets (i.e., effluent and/or dike monitoring data) are likely not appropriate for derivation of a regression for use in the AEMP lake monitoring. Should no reliable regression be derivable/applicable, it is acknowledged that use of the suggested benchmark is likely the best current option available and is consistent with other monitoring programs lacking in site-specific regression information.

2.7 CUMULATIVE EFFECTS

In the November 27, 2015 Decision Package for the AEMP Reference Conditions Report Version 1.1, the WLWB requested that Diavik work with Ekati in the development of Design Plan Version 4.0 to address concerns regarding the potential for cumulative effects from the two mines on the aquatic environment of Lac de Gras (Section 6.1, p. 93-94; Appendix A, Section 51.0, p. A-71 to 73). In the Design Plan Version 4.0, Diavik is including a preliminary analysis of potential cumulative effects resulting from interactions between the Diavik and Ekati mines.

Diavik's approach for assessing the potential for cumulative effects related to the Diavik and Ekati Projects is focused on the northwestern area of the lake where cumulative effects are most likely to overlap in time and space. The proposed approach seems reasonable, however, it is unclear whether the analysis and reporting would consider all water quality and eutrophication variables or would be subject to the Substances of Interest (SOI) screening procedure and subsequent Response Framework triggers.

Recommendation: Please clarify whether all water quality and eutrophication variables will be assessed and if not, how metrics will be selected for detailed analysis and reporting. Please clarify what Response Framework triggers would be applied, notably for eutrophication metrics.

2.8 DETECTION LIMITS

The QAPP, Version 3.0 (Golder 2016b), requires that Diavik periodically review the analytical detection limits (DLs) use for the AEMP to confirm that they are appropriate for the analysis of AEMP data (Appendix A, Section 17.0, p. A-26 to 29). Diavik has provided an updated list of analytical DLs used for AEMP components in Tables 5 to 8 (Appendix A) and Sections 4.3.3, 4.4.3, 4.5.3, and 4.9.3 of the Design Plan Version 4.0.

While it is acknowledged that analytical detection limits change over time and that in some cases they may in fact increase, the detection limit noted for total mercury in water (10 ng/L) is notably higher than that used in 2014 (2 ng/L). Although 10 ng/L is lower than the Canadian Council of Ministers of the Environment (CCME) protection of aquatic life (PAL) guideline for inorganic mercury and the AEMP benchmark (both 26 ng/L), the lower DL would be more sensitive and therefore useful for tracking changes over time. All but one sample analysed from Lac de Gras in 2014, for example, would have been reported as below detection if the proposed new higher DL were used; for context about 85% of samples from the open-water season were above detection in 2014. Diavik's QAPP (Version 3.0) indicates: "Alberta Environment and Sustainable Resource Development (AENV 2006) recommend that, if possible, DLs be 10 times lower than the applicable benchmark; British Columbia Ministry of Environment (2009) recommend that DLs be at least five times lower than benchmarks." (QAPP, Section 4.1.2, p. 43). It is understood that practical constraints often limit the ability to take advantage of some analytical methodologies and options, however, if feasible a lower DL would be preferred for this parameter.

Recommendation: If feasible, a lower detection limit for total mercury in water would be preferable to increase the sensitivity of the program. It is our understanding that at least some commercial analytical laboratories can provide services with lower analytical detection limits than proposed by Diavik (i.e., lower than 10 ng/L) with reasonable analytical hold times to make this a feasible option for sample analysis.

2.9 VARIABLES ANALYZED

A number of changes to the lists variables analyzed for AEMP chemistry components (i.e., water quality, indicators of eutrophication and fish tissue chemistry), have occurred since the last AEMP re-design (Appendix A, Section 16.0, p. A-25 to 26; Appendix A, Tables 5 to 8). These changes generally reflect the addition or removal of variables due to laboratory changes and appear appropriate.

Recommendation: None.

2.10 DATA HANDLING AND ANALYSIS METHODS

Comment 1: Appendix A, Section 23.0 (p. A-43 to 44) describes a modification to the spatial analyses for sediment quality (SQ) and benthic invertebrate (BI) components. Where there are statistical differences for a SOI among FF areas, comparisons between NF and FF data would be considered to indicate a Mine effect only if the concentration in the NF area is greater than the highest FF area mean value (SQ) or lower than the lowest FF area mean value (BI).

Recommendation 1: It is understood that total organic carbon and grain size may have a large influence on sediment chemistry; however the rationale for the proposed change is not clear. Please provide further discussion of the reason(s) for limiting the comparisons to the FF dataset with the largest extremes.

Comment 2: Section 4.8.2 (p. 58) indicates that ageing structures are to be archived. However, age is described as one of the biological variables to be included in the statistical analysis (p. 61) and will be used to estimate age structure. As well, the abundance of young of the year and age-1 sculpin is described as an indicator of reproductive performance (p. 61) and Growth-Size at Age is also listed as an endpoint for weight of evidence (WOE) analyses (see Tables 4.10-1 and 4.10-2).

Recommendation 2: Please clarify determination of fish ages (for endpoints) as structures are being archived.

2.11 RESPONSE FRAMEWORK

Comment 1: The sampling program in 2014 indicated substantive increases in chlorophyll *a* and TN that extended to the MF areas. Due to the lack of concurrent FF sampling, calculation of the spatial extent of effects could not be completed with accuracy. The 2014 AEMP report stated: "For chlorophyll *a*, the extent of effects during the open-water season encompassed all stations among the three MF areas (Figure 4-3), indicating the effect may extend beyond the stations sampled in 2014. Based on these results, the extent of effects on chlorophyll *a* was estimated as greater than or equal to 234.1 km^2." TN exceeded the normal range at site LDG-48 (the furthest site sampled in 2014); chlorophyll *a* was not analysed at this site. Diavik notes in Appendix A,

Section 11.0 (p. A-21 to 22 that "the extent of effects are spreading (e.g., chlorophyll *a* and total nitrogen)." Section 4.5.4 (p. 51) indicates: "For the Aquatic Effects Re-evaluation Report, the size of the affected area of the lake will be compared to the affected areas calculated in previous years (Golder 2011a, 2016b)." Based on the 2014 results, without annual FF data, these comparisons may not be adequate. Action Level 3 was exceeded in an estimated 13.2% of the lake but the actual area affected may have been larger (i.e., FF sites not sampled).

Recommendation 1: Given the recently observed increases in effects, it may be warranted to expand the frequency of sampling in FF areas to assist with defining the spatial extent of effects on a more frequent basis and to allow for a more accurate estimate of the area affected and comparison to the Action Level 3 trigger. Alternatively, the Response Framework could be modified to provide a mechanism for increased monitoring in FF areas if NF/MF results suggest this is warranted. Could DDMI comment on the results of the 2015 and 2016 AEMP (i.e., were similar effects observed in 2015 and 2016)?

Comment 2: Diavik identified an issue with the previously developed action level triggers for the water quality assessment and it is clear that a revision is required (Appendix A, Section 36.0, p. A-50 to 58). The key issue was the occurrence of triggers to Action Level 2, when Action Level 1 was not triggered. Diavik provides a suggested modification to the Action Level 2 trigger, while maintaining the existing Action Levels 1 and 3 triggers. The suggested change eliminates the existing issue but also generates few occurrences of Action Level 2 exceedances (i.e., less conservative/cautious). One potential alternative solution is to modify Action Level 1 to specify EITHER an exceedance of 2 x the median reference condition OR an exceedance of the normal range of reference conditions. Using the example data provided, this change would also eliminate the identified issue but would result in a higher number of Action Level 1 and Action Level 2 exceedances (i.e., more conservative/cautious). No change would occur to Action Level 3 exceedances.

Recommendation 2: Please provide discussion of consideration given to alternate modifications of the Action Level triggers.

2.12 ADDRESSING PREVIOUS RECOMMENDATIONS

The inclusion of Appendix A (AEMP Version 4.0 Proposed Changes Document) that: (1) outlines all required and proposed changes made to the AEMP Design Plan since the last approved design (Version 3.5) and, (2) references where those changes are presented in Version 4.0, greatly improved the efficiency of the review.

2.13 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 AEMP Design Plan Version 4.0

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Updates to the AEMP Sampling Schedule (Appendix A, Section 6.0, p. A-11 to 15)	Given the increase in chlorophyll a and total nitrogen (TN) over time, notably in 2014, it may be prudent to measure phytoplankton taxonomy and biomass in the mid-field (MF) area (at a minimum) on a more frequent basis (i.e., more than every three years).	Suggest consideration of collecting phytoplankton samples from MF sites each year of sampling rather than only on a three-year rotational basis. Samples could be collected and archived and analysed in the event that nutrient and chlorophyll a data indicate an increasing effect spatially and/or if near-field (NF) plankton data indicate an escalating effect.

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Study Design, Sampling Schedule (Section 3.5, p. 23); Revision to Sampling Schedule for Mercury in Lake Trout (Appendix A, Section 9.0, p. A-17 to 18)	The sampling schedule indicates that the mercury (Hg) in Lake Trout survey will only occur if the results of the mercury in small-bodied fish (i.e, Slimy Sculpin) study indicate an increasing trend in Hg concentrations caused by the mine. This assumes that Hg concentrations in sculpin are indicative of concentrations in trout. There are concerns associated with this proposed approach including inherent and fundamental differences in the ecology, movement, trophic position, and habitat use between the two species. Ultimately these differences mean that it may not be biologically appropriate to use monitoring information from one species as an indicator of risk for the other. Sculpin are typically captured in nearshore areas (approximately 40 cm of water; Section 3.4.2, p. 22) in a habitat unlikely to be used for foraging by Lake Trout. More importantly, Lake Trout are unlikely to feed on sculpin and more likely to consume Round Whitefish in the pelagic zone (i.e., and accumulate Hg via a trophic pathway that does not include sculpin). Additionally, being a top predator, Lake Trout are most at risk to biomagnification of mercury. For all of these reasons, monitoring of mercury in sculpin is not considered to be a good representation of potential effects in Lake Trout. Lastly, monitoring of mercury in Lake Trout is far more relevant from the perspective of monitoring for potential effects on humans. In addition, mercury would not be monitored in sculpin every 3 years, according to the current study design, if toxicological effects are not observed (Section 4.8.1, p. 57). Should this case occur, a Lake Trout survey would not be triggered for at least 7 years.	Consider the inclusion of results from the palatability studies as a trigger for the large-bodied fish tissue mercury studies. Since mercury levels in Lake Trout are monitored every three years as part of the palatability studies (see Table 3.5-1, p. 25), the results of these studies could be used as a trigger for the more comprehensive large-bodied fish tissue mercury survey. Even though the sample size from the palatability study is low (n=10), this approach would be more appropriate than using the results from the mercury monitoring of sculpin for the reasons outlined above (which may also be determined from a small sample size, n=8 or more). It is further suggested that results of the Lake Trout mercury monitoring from the palatability studies conducted in 2002-2004 and 2012 be included in the comparison of yearly (length-adjusted) means to increase the period for past temporal analysis and for comparison with future results from palatability studies.

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Revisions to the Lists of Variables Analyzed for Chemistry Components (Appendix A, Section 16.0, p. A-25 to 26); Eutrophication Indicators Data Analysis and Interpretation (Section 4.5.4, p. 51)	Phytoplankton biovolume has been added to the list of eutrophication indicators, as suggested by reviewers. This will improve the overall assessment of effects and changes over time. It would be additionally useful to incorporate key findings and conclusions from the plankton component within the discussion of eutrophication effects, including but not necessarily limited to taxonomic composition and supporting variables that may affect plankton (e.g., water temperature). In addition, Section 4.5.4 would benefit from a description of how phytoplankton biovolume data will be incorporated into reporting moving forward.	Consider inclusion of additional information within discussion of results. Provide description of analysis of phytoplankton biovolume data for future reporting.
Water and Sediment Benchmark Derivations, Water Turbidity (Appendix B, Section 9.0, p. 34/35 to 35/35)	Diavik proposes the use of the CCME guidance for turbidity (CCME 1999; updated to 2016), which is based on a static assumed ratio of 3:1 for turbidity to total suspended solids (TSS) concentrations. As the relationship between TSS and turbidity is site-specific, ideally the benchmark for turbidity should be based on a site-specific relationship. It is recognized, however, that existing data may be insufficient to develop a reliable regression for Lac de Gras due to low ranges for both variables.	If feasible, develop a site-specific regression between TSS and turbidity and incorporate this information into the turbidity benchmark.
Alignment of AEMPs in Lac de Gras, Data Analysis Approach to Detect Cumulative Effects in Lac de Gras (Section 6.1, p. 93); Evaluation of Cumulative Effects in Lac de Gras (Appendix A, Section 51.0, p. A-71 to 73)	Diavik's approach for assessing the potential for cumulative effects related to the Diavik and Ekati Projects is focused on the northwestern area of the lake where cumulative effects are most likely to overlap in time and space. The proposed approach seems reasonable, however, it is unclear whether the analysis and reporting would consider all water quality and eutrophication variables or would be subject to the Substances of Interest (SOI) screening procedure and subsequent Response Framework triggers.	Please clarify whether all water quality and eutrophication variables will be assessed and if not, how metrics will be selected for detailed analysis and reporting. Please clarify what Response Framework triggers would be applied, notably for eutrophication metrics.

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Updates to Analytical Detection Limits for Chemistry Components (Appendix A, Section 17.0, p. A-26 to27); Water Quality Laboratory Methods (Section 4.3.3, p. 38-39)	While it is acknowledged that analytical detection limits change over time and that in some cases they may in fact increase, the detection limit noted for total mercury in water (10 ng/L) is notably higher than that used in 2014 (2 ng/L). Although 10 ng/L is lower than the Canadian Council of Ministers of the Environment (CCME) protection of aquatic life (PAL) guideline for inorganic mercury and the AEMP benchmark (both 26 ng/L), the lower DL would be more sensitive and therefore useful for tracking changes over time. All but one sample analysed from Lac de Gras in 2014, for example, would have been reported as below detection if the proposed new higher DL were used; for context about 85% of samples from the open-water season were above detection in 2014. Diavik's QAPP (Version 3.0) indicates: "Alberta Environment and Sustainable Resource Development (AENV 2006) recommend that, if possible, DLs be 10 times lower than the applicable benchmark; British Columbia Ministry of Environment (2009) recommend that DLs be at least five times lower than benchmarks." (QAPP, Section 4.1.2, p. 43). It is understood that practical constraints often limit the ability to take advantage of some analytical methodologies and options, however, if feasible a lower DL would be preferred for this parameter.	If feasible, a lower detection limit for total mercury in water would be preferable to increase the sensitivity of the program. It is our understanding that at least some commercial analytical laboratories can provide services with lower analytical detection limits than proposed by Diavik (i.e., lower than 10 ng/L) with reasonable analytical hold times to make this a feasible option for sample analysis.
Modification to the Statistical Approach Used to Assess Differences Among Sampling Areas (Appendix A, Section 23.0, p. A-43 to 44)	Appendix A, Section 23.0 (p. A-43 to 44) describes a modification to the spatial analyses for sediment quality (SQ) and benthic invertebrate (BI) components. Where there are statistical differences for a SOI among FF areas, comparisons between NF and FF data would be considered to indicate a Mine effect only if the concentration in the NF area is greater than the highest FF area mean value (SQ) or lower than the lowest FF area mean value (BI).	It is understood that total organic carbon and grain size may have a large influence on sediment chemistry; however the rationale for the proposed change is not clear. Please provide further discussion of the reason(s) for limiting the comparisons to the FF dataset with the largest extremes.

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Fish Health Field Methods (Section 4.8.2, p. 58); Fish Health Data Analysis and Interpretation (Section 4.8.4, p. 61); Tables 4.10-1 and 4.10-2	Section 4.8.2 (p. 58) indicates that ageing structures are to be archived. However, age is described as one of the biological variables to be included in the statistical analysis (p. 61) and will be used to estimate age structure. As well, the abundance of young of the year and age-1 sculpin is described as an indicator of reproductive performance (p. 61) and Growth-Size at Age is also listed as an endpoint for weight of evidence (WOE) analyses (see Tables 4.10-1 and 4.10-2).	Please clarify determination of fish ages (for endpoints) as structures are being archived.
Changes to the Frequency of Sampling in the Far-Field Areas (Appendix A, Section 11.0, p. A-21 to 22)	The sampling program in 2014 indicated substantive increases in chlorophyll a and TN that extended to the MF areas. Due to the lack of concurrent FF sampling, calculation of the spatial extent of effects could not be completed with accuracy. The 2014 AEMP report stated: "For chlorophyll a, the extent of effects during the open-water season encompassed all stations among the three MF areas (Figure 4-3), indicating the effect may extend beyond the stations sampled in 2014. Based on these results, the extent of effects on chlorophyll a was estimated as greater than or equal to 234.1 km2." TN exceeded the normal range at site LDG-48 (the furthest site sampled in 2014); chlorophyll a was not analysed at this site. Diavik notes in Appendix A, Section 11.0 (p. A-21 to 22 that "the extent of effects are spreading (e.g., chlorophyll a and total nitrogen)." Section 4.5.4 (p. 51) indicates: "For the Aquatic Effects Re-evaluation Report, the size of the affected area of the lake will be compared to the affected areas calculated in previous years (Golder 2011a, 2016b)." Based on the 2014 results, without annual FF data, these comparisons may not be adequate. Action Level 3 was exceeded in an estimated 13.2% of the lake but the actual area affected may have been larger (i.e., FF sites not sampled).	Given the recently observed increases in effects, it may be warranted to expand the frequency of sampling in FF areas to assist with defining the spatial extent of effects on a more frequent basis and to allow for a more accurate estimate of the area affected and comparison to the Action Level 3 trigger. Alternatively, the Response Framework could be modified to provide a mechanism for increased monitoring in FF areas if NF/MF results suggest this is warranted. Could DDMI comment on the results of the 2015 and 2016 AEMP (i.e., were similar effects observed in 2015 and 2016)?

TOPIC	COMMENT	RECOMMENDATION
Be as specific as you think is appropriate; for example a section or page of the document, a recommendation #, general comment, etc.	*Comments should contain all the information needed for the proponent and the Board to understand the rationale for the accompanying recommendation.*	*Recommendations can be for the proponent or for the Board. Recommendations should be as specific as possible, relating the issues raised in the "comment" column to an action that you believe is necessary.*
Revision to the Water Quality Action Level 2 (Appendix A, Section 36.0, p. A-50 to 58)	Diavik identified an issue with the previously developed action level triggers for the water quality assessment and it is clear that a revision is required (Appendix A, Section 36.0, p. A-50 to 58). The key issue was the occurrence of triggers to Action Level 2, when Action Level 1 was not triggered. Diavik provides a suggested modification to the Action Level 2 trigger, while maintaining the existing Action Levels 1 and 3 triggers. The suggested change eliminates the existing issue but also generates few occurrences of Action Level 2 exceedances (i.e., less conservative/cautious). One potential alternative solution is to modify Action Level 1 to specify EITHER an exceedance of 2 x the median reference condition OR an exceedance of the normal range of reference conditions. Using the example data provided, this change would also eliminate the identified issue but would result in a higher number of Action Level 1 and Action Level 2 exceedances (i.e., more conservative/cautious). No change would occur to Action Level 3 exceedances.	Please provide discussion of consideration given to alternate modifications of the Action Level triggers.
Water Quality Substances of Interest (Section 4.3.4.3, p. 42)	Section 4.3.4.3 indicates: "The process of selecting SOIs will consider concentrations in final effluent (Stations SNP 1645-18 and 1645-18B) and in the NF and MF exposure areas: * Effluent chemistry data collected at stations SNP 1645-18 and 1645-18B will first be evaluated. Analytes with maximum average and maximum grab sample concentrations greater than Effluent Quality Criteria (EQC) defined in the Water Licence (Section 4.3.4.4) will be included as SOIs. * Variables that trigger Action Level 1 or greater in the Response Framework (Section 5.2.1) will be included as SOIs. * Variables that trigger an effect equivalent to Action Level 1 at MF stations that fall within the zone of influence from dust deposition in Lac de Gras (i.e., within approximately 1 km of the Mine boundary: Stations MF1-1, MF2-1, MF3-1 and MF3-2; Section 4.3.4.8) will be included as SOIs."	Consider specifying that data collected at sites to address potential cumulative effects would also be subject to screening and variables that exceed Action Level 1 would be included as SOIs. Please clarify if bullet 2 is intended to be applied to NF data or data collected from all areas.

3.0 REVIEW MATERIALS

ERM. 2016. Ekati Diamond Mine: 2015 Aquatic Effects Monitoring Program Re−evaluation and the Proposed 2017 to 2019 AEMP Plan. Prepared for Dominion Diamond Ekati Corporation by ERM Consultants Canada Ltd.: Yellowknife, Northwest Territories.

Golder (Golder Associates Inc.). 2016a. Diavik Diamond Mines (2012) Inc. Aquatic Effects Monitoring Program Study Design Version 4.0. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, July 2016.

Golder. 2016b. Diavik Diamond Mines (2012) Inc. Quality Assurance Project Plan Version 3.0. Submitted to Diavik Diamond Mines (2012) Inc. Yellowknife, NT, June 2016.

WLWB (Wek'èezhìi Land and Water Board). 2016. Board Directive and RFD – Diavik 2011 to 2013 Aquatic Effects Re-evaluation Report, Version 3.1 – May 26, 2016.