GOVERNMENT OF THE NORTHWEST TERRITORIES

TECHNICAL INTERVENTION

FOR

DE BEERS CANADA MINING INC.
GAHCHO KUE DIAMOND MINE
WATER LICENCE AMENDMENT
MV2005L2-0015

Submitted to:

Mackenzie Valley Land and Water Board
7th Floor – 4910 50th Avenue, Box 2130
Yellowknife, NT X1A 2P6

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List of Acronyms

Aquatic Effects Monitoring Program	AEMP
Canadian Council of Ministers of the Environment	CCME
Canadian Council of Resource and Environment Ministers	CCREM
Coarse Processed Kimberlite and Mine Rock Pile	CPKMRP
Collection Pond 1	CP1
Contaminant of Potential Concern	COPC
Effluent Quality Criteria	EQC
Environment and Climate Change Canada	ECCC
Government of the Northwest Territories	GNWT
Information Request	IR
Maximum Average Concentration	MAC
Mackenzie Valley Land and Water Board	MVLWB
Parameter of Potential Concern	POPC
Potentially Acid-Generating	PAG
Site Specific Water Quality Objectives	SSWQO
Surveillance Network Program	SNP
Total Dissolved Solids	TDS
United States Environmental Protection Agency	USEPA
Water Management Pond	WMP
Water Quality Guideline	WQG

1.0 Introduction

The following concerns and issues have resulted from the Government of the Northwest Territories (GNWT) and their retained experts' review of plans, proposed monitoring programs and submissions as part of the De Beers Canada Incorporated's (De Beers) Gahcho Kue Mine Water Licence Amendment Application MV2005L2-0015. This technical intervention explains GNWT's concerns and provides recommendations for the Mackenzie Valley Land and Water Board's (MVLWB) consideration. Of note, this submission takes into consideration all of the documents provided during the renewal process up to July 31, 2020.

GNWT appreciates the opportunity to express its concerns and provide recommendations and suggestions to the MVLWB. GNWT and its retained experts intend to provide technical input at the public hearing on September 30 – October 1, 2020 to assist the MVLWB in making a decision related to the Water Licence Amendment Application.

1.1 Report Outline

This technical intervention is structured to discuss components included within the Water Licence Amendment Application and supporting documents. The intervention is divided into the following sections:

Section 1 – Introduction to the technical intervention and GNWT's involvement in the regulatory review;

Section 2 – Discussion of GNWT recommendations related to effluent quality criteria and site-specific water quality objectives;

Section 3 – Discussion of GNWT recommendations related to water management, and the removal of conditions from the Water Licence related to Area 8;

Section 4 – Discussion of GNWT recommendation on water licence conditions related to potentially acid generating waste rock reporting;

Section 5 – Discussion of GNWT recommendation on quantifying potentially acid generating waste rock in the Coarse Processed Kimberlite and Mine Rock Pile;

Section 6 – Discussion of GNWT recommendations related to security estimates including review of De Beers' estimate.

2.0 Effluent Quality Criteria and Site-Specific Water Quality Objectives

This section discusses recommendations made by GNWT on the topic of effluent quality criteria (EQC) and site-specific water quality objectives (SSWQO). In the Water Licence Amendment Application, De Beers has proposed several changes to SSWQO and EQC and in one case has proposed to maintain the EQC despite projections that the SSWQO will be exceeded.

GNWT would like to highlight that one of the objectives outlined in Section 6.0 of the Water and Effluent Quality Management Policy (MVLWB, 2011) is the maintenance of water quality in the receiving environment that allows for current and future water uses. This section states that "Protection of water quality in the receiving environment is the primary objective. The level of protection will be defined by the water quality standards that have been set site-specifically for the receiving environment in question. Effluent Quality Criteria (EQC) will be set for a project to ensure that water quality standards will be met". This policy notes that the terms "water quality standard" and "water quality objective" are interchangeable. As well, Part G, Condition 35 of the Water Licence states, "The objective of the report is to evaluate whether the EQC in Part G, item 30 will continue to ensure that water quality objectives in the Receiving Environment are maintained if Discharge continues to Lake N11." Overall, GNWT is of the opinion that SSWQO should not be set higher than is reasonable, while still being achievable, and EQC should be set such that SSWQO are met in the receiving environment. GNWT's specific recommendations in this section are summarized here and discussed in detail in the following subsections.

- GNWT recommends that Lake N11 and Area 8 baseline water hardness continue to be used in the calculation of metal parameters that have a hardness-dependent SSWQO.
- GNWT recommends that if additional mitigation is needed to meet SSWQOs or EQC, De Beers investigate all potential options for minewater management.
- GNWT recommends the EQC for fluoride, ammonia as N, total aluminum, total cadmium, total chromium and total iron remain in the Water Licence as currently authorized for the discharge from the WMP to Lake N11.
- GNWT recommends the total phosphorus EQC that applies to discharge from the water management pond (WMP) to Lake N11 remain in the Water Licence as requested by De Beers.
- GNWT recommends maintaining the total phosphorus SSWQO that is currently approved for Lake N11 and Area 8, as requested by De Beers. GNWT will continue to provide feedback through the Aquatic Effect Monitoring Program

(AEMP) to ensure action levels and responses related to nutrient enrichment are appropriate.

- GNWT recommends the SSWQO for fluoride in Lake N11 and Area 8 be revised to 1.19 mg/L.
- GNWT recommends that the existing cadmium EQC that applies to discharge from the WMP to Lake N11 be maintained in the amended Water Licence given the increasing trend observed in 2018, 2019, and 2020.
- GNWT recommends that total manganese be included in the list of parameters of potential concern (POPC) for Lake N11 and that an EQC for manganese be established at 0.11 mg/L for the discharge from the WMP to Lake N11.
- GNWT recommends the revised aluminum SSWQO calculation methodology, provided in response to IR #8 be approved for Lake N11 and Area 8. As stated in recommendation #1, baseline hardness should be used.

2.1 Baseline Hardness for Hardness-Dependent SSWQO

De Beers requests the application of ambient hardness concentrations rather than baseline hardness concentrations in the calculation of SSWQO. For the reasons outlined below, GNWT believes metal parameters that have a hardness-dependent SSWQO should continue to be calculated using baseline hardness in the receiving environment rather than mine-influenced ambient hardness.

In review comment ENR #31 submitted May 4, 2020, GNWT recommended that De Beers provide additional rationale for changing the hardness values used to calculate hardness dependent SSWQO from the currently approved values (Review Comment Table, 2020). De Beers responded that the use of ambient exposure and toxicity modifying factors in the calculation of the nitrate SSWQO was approved by the MVLWB in the 2018 Water Licence Amendment. De Beers further explained that by approving the use of hardness-dependent SSWQO for nitrate, they assume that the hardness concentration range over which the toxicity tests were performed is also approved to calculate SSWQO for the mine. De Beers also referenced consistency with Canadian Council of Ministers of the Environment (CCME) (2007) as additional rationale.

During the Technical Session (July 7-9, 2020), GNWT raised concern that the proposed approach does not take the whole picture into account, and only considers the direct toxicity in the water column at the time of release. By using water hardness influenced by the mine, incremental increases in metals loading into the system are permitted, which may result in adverse effects to aquatic life as metals may partition to sediments and be remobilized in the future under changing environmental variables (Technical Session, 2020a, pp. 125-129).

To demonstrate which parameters would exceed the SSWQO using baseline hardness, GNWT asked if De Beers could provide the figures in Appendix C of the Water Quality Model Report (Golder, 2020) with SSWQO calculated using baseline rather than ambient hardness. This request led to the development of IR #4.

In response to IR #4, De Beers states that chloride, cobalt, copper, and zinc would exceed SSWQO in Lake N11 if baseline hardness was used in the calculation (De Beers, 2020b). In addition, De Beers states that if EQC had to be lowered to ensure that SSWQO were met, the resultant EQC could not be consistently achieved. However, Figures 4-3 and 4-5 in the response to IR #4 do not support this conclusion about cobalt, copper and zinc for the following reasons:

- Figure 4-3 shows cobalt projections in the South Basin of Lake N11 below the baseline hardness calculated SSWQO throughout the life of mine.
- Figures 4-3 and 4-5 show copper and zinc projections in the South Basin of Lake N11 in the winter of 2023 approach (and may exceed) the baseline hardness calculated SSWQO. However, the projected maximum concentrations in the WMP are roughly 75% (for copper) and 83% (for zinc) of the maximum average concentrations (MAC) EQC suggesting that a lower EQC could be consistently achievable (Golder 2020).

As well, De Beers has stated that the assumptions from the water quality model are conservative since it assumes 100% solute exclusion during ice formation (Golder, 2020). When considering the data measured in the WMP and Lake N11, water quality for the three metals (i.e., cobalt, copper, and zinc) are typically over-predicted by the water quality model. Therefore, the model projections are likely to be higher than what will be observed. For these reasons, it appears likely that using baseline water hardness in the calculation of SSWQO as previously approved for metal parameters that are hardness-dependent would be consistently achievable considering the current understanding of the receiving environment.

GNWT understands that chloride would exceed the SSWQO if baseline water hardness is used to calculate the SSWQO. GNWT also acknowledges that chloride is not likely to partition into sediments as readily as cobalt, copper, or zinc. Therefore, the potential for adverse effects beyond the time of discharge is less likely. The protection of Lake N11 was a major discussion topic during the Environmental Assessment for the Gahcho Kue Mine. To address this issue, De Beers proposed that discharge from the Water Management Pond would be limited to three years (after initial drawdown), but that discharge might continue beyond three years if the EQC could still be met (MVLWB, 2014).

GNWT concludes that De Beers has not provided sufficient rationale to support the application of ambient hardness instead of baseline hardness in the calculation of hardness-dependent SSWQO for metal parameters. Further, the GNWT cautions that using ambient hardness to discharge ever increasing amounts of Contaminants of Potential Concern (COPCs) to the natural receiving environment will result in shifts in ecosystems within Lake N11 over time.

Recommendation:

1. GNWT recommends that Lake N11 and Area 8 baseline water hardness continue to be used in the calculation of metal parameters that have a hardness-dependent SSWQO.
2. GNWT recommends that if additional mitigation is needed to meet SSWQOs or EQC, De Beers investigate all potential options for minewater management.

2.2 EQC for Discharge from the WMP to Lake N11

De Beers has proposed to remove several parameters from the list of currently approved EQC for the discharge from the WMP to Lake N11. The parameters that are proposed to be removed include fluoride, ammonia as N, total aluminum, total cadmium, total chromium and total iron.

In addition to GNWT's recommendation in Section 2.5 herein to retain total cadmium in the list of EQC for the discharge from the WMP to Lake N11, GNWT is of the opinion that all parameters currently included in the currently approved list of EQC for the discharge from the WMP to Lake N11 should remain in the Water Licence. According to the EQC Report (De Beers 2020e), these EQC are consistently achievable. As well, maintaining the regulation of these parameters as EQC in the Water Licence provides assurance that concentrations in the effluent are in accordance with the model predictions, as was noted by ECCC #6 (Review Comment Table, 2020). GNWT notes that this is in accordance with the objective to minimize waste to be deposited to the receiving environment (MVLWB, 2011).

Recommendation:

3. GNWT recommends the EQC for fluoride, ammonia as N, total aluminum, total cadmium, total chromium and total iron remain in the Water Licence as currently authorized for the discharge from the WMP to Lake N11.

2.3 Total Phosphorous EQC and SSWQO

De Beers requests that the total phosphorus EQC and SSWQO in Lake N11 be maintained as currently authorized, despite the fact that total phosphorus concentrations are predicted to exceed the SSWQO in Lake N11. The following outlines GNWT's concerns that, given the rationale provided below, the EQC and SSWQO for total phosphorus in Lake N11 should be maintained as currently authorized.

In the EQC Report, De Beers requests that despite the fact that total phosphorus concentrations are predicted to exceed the SSWQO (0.0109 mg-P/L) in Lake N11 during ice cover, the EQC does not need to be updated (De Beers, 2020e). The model predicted that with a constant total phosphorus concentration of 0.022 mg-P/L discharge, the SSWQO during ice cover periods would be exceeded in 2021, 2022, 2023 and 2024. The EQC report includes the following rationale to maintain the currently approved EQC:

- the SSWQO for total phosphorus is not a toxicity-based guideline;
- the water quality model conservatively assumes that the development of ice completely excludes phosphorus (and other ions; i.e., cryo-concentrates);
- exceedances of phosphorus are for a short period and are expected to decrease below the SSWQO when the ice thaws; and,
- the risk of increasing primary productivity in the system is low because phytoplankton growth rates are limited by reduced light penetration and lower water temperatures.

In review comment ENR #42 submitted May 4, 2020, GNWT noted that the oligotrophic status in Lake N11 must be maintained even during periods of ice cover (Review Comment Table, 2020). This recommendation was made to prevent:

- increases in algal productivity relative to the reference condition (i.e., nutrient enrichment), especially in the early spring where solar irradiation under ice increases quickly as snow begins to melt (Kalff, 2002; Willemse, 2004; Bondarenko *et al.,* 2020); and,
- greater extents (both temporally and spatially) of suboxic or anoxic conditions that stem from respiration and the breakdown and decay of organic matter under ice (i.e., with little to no oxygen flux into the lake).

Because De Beers requested support of an EQC for total phosphorus that is predicted to result in the exceedance of a water quality objective, and an increase to the EQC for nitrate, further discussion occurred at the Technical Session (July 7-9, 2020).

During Day 1 of the Technical Session, GNWT asked De Beers about the sensitivity of the water quality model to relatively minor changes in ice depth from year to year (i.e. 1.3 m to 1.7 m thickness) (Technical Session, 2020a, p. 109). De Beers responded that concentrations would be predicted to increase with increasing ice thickness because of the assumption in the model that 100% of the mass is excluded from the water that forms ice (Technical Session, 2020a, p. 111).

De Beers agreed to conduct a water quality model sensitivity analysis to report total phosphorous concentrations in Lake N11 and Area 8 at an estimated upper-limit ice depth (IR #3). GNWT is satisfied with the response from De Beers and supports the application of the average ice thickness of 1.3 m in the water quality model (De Beers, 2020b). This provides an appropriately conservative assumption to support the back-calculation of EQC for effluents discharged from the WMP when considering the level of conservatism applied in the water quality model, as discussed below.

GNWT agrees that the water quality model assumption that the development of ice completely excludes phosphorus is likely conservative, due to the calibration for the water quality model (Golder, 2020). However, in a study in the Northwest Territories, Pieters and Lawrence (2009) showed solute exclusion up to 99%, which led to the development of a spring halocline, preventing turnover (i.e., mixing) until the fall with implications on the extent and duration of hypolimnetic anoxia. In another study, Belzile *et al.* (2002) found estimates of dissolved carbon exclusion between 78% and 99%. These studies suggest that other mechanisms besides cryoconcentration may be influencing the deviations in the monitoring data relative to the water quality model, or that site or interannual differences (e.g., rate, relative volume, and method of ice formation) play a significant role in the degree of cryoconcentration. Regardless of the mechanism, GNWT notes that it appears the water quality model currently over predicts phosphorus concentrations in the WMP. Accordingly, the probability of exceedances is likely to be low if loadings of nutrients (i.e., phosphorus and nitrogen) from the WMP are consistent with current monitoring results.

At the Technical Session, GNWT also asked De Beers if they have quantified relative primary productivity or solar radiation of the under ice conditions at the depths that were used in the model. This is because, during early spring, solar radiation can increase rapidly and De Beers assumes primary productivity is only associated with open water conditions. In response, De Beers noted that the Goldsim model does not consider any meteorological inputs, and does not consider phytoplankton growth or growth rates (Technical Session, 2020a, p. 122).

GNWT notes the importance of maintaining the oligotrophic status in Lake N11 is also highlighted by results of the AEMP. Specifically, results in Lake N11 and Area 8 have shown variations in primary productivity and benthic invertebrate community structure in

both of the core lakes (e.g., reduced total density and reduced nematoda density in Lake N11 compared to one of the reference lakes). De Beers has hypothesized that low dissolved oxygen concentrations under ice may have contributed to the observed changes in Area 8 (De Beers, 2020c).

Based on the rationale provided by De Beers, GNWT acknowledges that the predictions are believed to be conservative, and effects in the receiving environment will be monitored in accordance with the AEMP. GNWT will continue to review and provide recommendations on the AEMP to assist in ensuring the appropriate monitoring and mechanisms of adaptive management are in place.

Recommendation:

4. GNWT recommends the total phosphorus EQC that applies to discharge from the WMP to Lake N11 remain in the Water Licence as requested by De Beers.

5. GNWT recommends maintaining the total phosphorus SSWQO that is currently approved for Lake N11 and Area 8, as requested by De Beers. GNWT will continue to provide feedback through the AEMP to ensure action levels and responses related to nutrient enrichment are appropriate.

2.4 Fluoride SSWQO

After a review of the literature, De Beers has proposed an updated SSWQO for fluoride of 1.19 mg/L.

In the 2018 Water Licence Amendment proceeding, the SSWQO for fluoride was updated from the interim, generic water quality guideline (WQG) for the protection of aquatic life of 0.12 mg/L (CCME, 2002) to the maximum acceptable concentration in drinking water of 1.5 mg/L (Health Canada, 2019) (MVLWB, 2018).

During the Technical Session, Environment and Climate Change Canada (ECCC) noted that there is evidence in the literature that 1.5 mg/L would be higher than acceptable from an aquatic protection perspective, and ECCC requested that this value be revisited. ECCC noted that the reviewed literature suggested that 0.5 mg/L was more appropriate as an objective (Technical Session, 2020b, pp. 40-44).

ECCC's comments led to IR #5 - De Beers to review the peer-reviewed and academic papers for fluoride toxicity referenced by ECCC and complete a comparison with the rationale used to develop SSWQO for fluoride in the 2018 GK Amendment.

In response to IR #5, De Beers provided summaries of four references for consideration with respect to the fluoride SSWQO (De Beers, 2020b). In reviewing the discussion on model selection, De Beers reconsidered the conservatism in the aquatic chronic effects

benchmark of 1.94 mg/L and proposed that the model-derived aquatic benchmark be revised to 1.19 mg/L.

The current aquatic life guideline is 0.12 mg/L but is broadly recognized as being unduly conservative. CCME (2002) derived the aquatic life guideline by applying a safety factor of 100 to the most sensitive LC_{50} estimate from short-term exposures. The guideline was challenged by MacPherson *et al.* (2014) and a new benchmark of 1.94 mg/L was proposed by the authors. Sinclair and MacDonald (2015) raised concerns with the approach to benchmark derivation used by Macpherson *et al*. (2014) and proposed a benchmark of 1.03 mg/L. GNWT supports the Sinclair and MacDonald (2015) proposed benchmark for fluoride of 1.03 mg/L, but recognizes that the benchmark proposed by De Beers (1.19 mg/L) results in a similar level of protection of aquatic life. Therefore, GNWT supports De Beers' revised proposal of 1.19 mg/L for the SSWQO for fluoride.

Recommendation:

6. GNWT recommends the SSWQO for fluoride in Lake N11 and Area 8 be revised to 1.19 mg/L.

2.5 Cadmium EQC

De Beers requests that the cadmium EQC for the discharge from the WMP to Lake N11 be removed from the Water Licence. GNWT disagrees with De Beers' request for the reasons discussed below.

In review comment ENR #38 submitted May 4, 2020, GNWT sought additional rationale to support the removal of cadmium as a POPC (Review Comment Table, 2020). In response, De Beers stated that although cadmium was no longer considered a POPC, De Beers is proposing to update the MAC and maximum grab concentration EQC for total cadmium discharge from the WMP to Lake N11. De Beers' rationale included the fact that cadmium concentrations in the WMP peaked at concentrations higher than those predicted by the site water quality model during the ice cover season in 2018, 2019, and 2020. Total cadmium concentrations in the WMP peaked at approximately the existing MAC EQC in April 2019 and exceeded the MAC EQC in April 2020. Collection Pond 1 (CP1) also peaked at concentrations higher than those predicted by the site water quality model during the ice covered season in 2020 and were greater than the existing EQC for the WMP. This was confirmed through discussions at the Technical Session.

However, in response to IR #7, De Beers stated that additional monitoring data collected since the response to GNWT #38 was submitted show that total cadmium concentrations in the WMP have decreased with the thawing of ice and are matching site water quality model predictions that were presented in Appendix C of the Water

Quality Model Report (De Beers, 2020b). Specifically, De Beers states that they have "more confidence in the site water quality predictions for total cadmium presented in Appendix C of the Water Quality Model Report" and that "the updated site water quality model predictions are no longer applicable." De Beers also states that "total cadmium is not considered a POPC that requires EQC in the Water Licence" and "is requesting to have total cadmium removed from the amended Water Licence."

GNWT notes that the 2020 data exceeded the existing MAC EQC, and the increasing trend observed in 2018, 2019, and 2020 is higher than site model predictions. Even with concentrations decreasing with thawing ice, the overall trend from 2018 to 2020 has not been altered with this additional data, and does not demonstrate better correlation with the model predictions. As well, the source of the elevated concentrations observed during the winter season has not yet been identified. The results show a greater magnitude of increase than expected from solute exclusion (i.e., cryoconcentration) alone when comparing the results with other similar metals (e.g., copper and zinc), which show no change between open-water and under-ice periods. This introduces uncertainty with respect to the source and behaviour of cadmium in the WMP as well as whether effluent discharged from the WMP will result in exceedances of the SSWQO. As a result, GNWT notes that the rationale provided by De Beers is insufficient to support the removal of the cadmium EQC and maintaining the existing cadmium EQC will ensure the SSWQO will continue to be met at the edge of the mixing zone in Lake N11.

Recommendation:

7. GNWT recommends that the existing cadmium EQC that applies to discharge from the WMP to Lake N11 be maintained in the amended Water Licence given the increasing trend observed in 2018, 2019, and 2020.

2.6 Manganese EQC

In the EQC Report, manganese is not identified as a POPC and therefore De Beers does not propose an EQC for manganese (De Beers, 2020e). During this review process, GNWT has raised concerns about manganese and maintains the position that it be included as a POPC and that an EQC for manganese be developed for the discharge from the WMP to Lake N11.

During the Technical Session, GNWT questioned the exclusion of manganese from the list of EQC. GNWT's concern was based on how close this parameter was to screening in as a POPC, the recent exceedance of the low action level for drinking water under the AEMP, and the fact that, in response to comments, De Beers recommended an

EQC for cadmium, despite it not screening in as a POPC (Technical Session, 2020b, pp. 99-101).

In response, De Beers summarized the conclusions of the Response Plan for Drinking Water, which is currently with the Board for approval (De Beers, 2020d). The Response Plan hypothesized that the exceedances of the triggers may be a result of remobilization of manganese from sediments under low dissolved oxygen concentrations and there is supporting evidence to suggest that internal loading of manganese from sediments is playing a role. Therefore, De Beers did not see a need for manganese to be included in the list of EQC for the discharge from the WMP to Lake N11. GNWT notes efforts should be made to control incremental loadings of manganese into Lake N11 until such time that the source of manganese exceedances is determined and an evaluation is undertaken to determine if mine operations are contributing to the trigger exceedances.

As indicated, under-ice concentrations of manganese increased to levels that were higher than expected during the ice-covered season in 2019, leading to an exceedance of the low action level for toxicological impairment in Lake N11 (De Beers, 2020c). As part of the AEMP Re-evaluation Report, De Beers has proposed refinements to the action levels used in the AEMP (De Beers 2019a). While these action levels have not yet been approved by the MVLWB, it is important to note that the 2019 exceedances would have triggered a moderate action level based on the proposed updated action levels. Furthermore, the concentrations were within 1% of the proposed High Action Level (De Beers, 2019a).

Finally, the concentrations of manganese have been increasing in the WMP and are predicted to increase further as mine life progresses (Golder, 2020). Concentrations of manganese are likewise predicted to increase in Lake N11 until 2023 (Golder, 2020). The predicted maximum concentration of manganese in the WMP is 0.106 mg/L which is only 0.014 mg/L below the drinking water quality guideline of 0.12 mg/L. Several manganese concentrations measured at Surveillance Network Program (SNP) station 05 in the WMP were also above the drinking water quality guideline including SNP-05 BOT, 21-Apr-19 = 0.384 mg/L, and SNP-05 TOP, 10-May-19 = 0.139 mg/L. De Beers' rationale for proposing EQC for cadmium, even though it did not screen in as a POPC, was that during ice cover cadmium concentrations were approaching the MAC EQC (Section 2.4). GNWT notes this same rationale applies for manganese, and therefore EQC should be developed for manganese as well.

The inclusion of an MAC EQC for manganese, set at the maximum predicted concentration in the WMP of 0.11 mg/L (Golder 2020) would ensure that incremental loading, beyond what is currently proposed, is limited. Using the information provided in De Beers (2020e), an MAC EQC of 0.11 mg/L would result in concentrations at the

edge of the mixing zone of roughly 0.045 mg/L, or 35% of the SSWQO. Therefore, this EQC is achievable both in the WMP and ensures the SSWQO is met at the edge of the mixing zone in Lake N11.

Recommendation:

8. GNWT recommends that total manganese be included in the list of POPC for Lake N11 and that an EQC for manganese be established at 0.11 mg/L for the discharge from the WMP to Lake N11.

2.7 Aluminum SSWQO

De Beers has proposed a revised SSWQO for aluminum in Area 8 and Lake N11. GNWT supports the updated SSWQO as explained below.

In the Water Licence Application, De Beers requested that the SSWQO for aluminum be updated from the generic WQG for the protection of aquatic life (CCREM, 1987) to the guideline developed by United States Environmental Protection Agency (USEPA) (2018) that considers pH, dissolved organic carbon, and hardness.

During Day 2 of the Technical Session, GNWT pointed out that the methodologies for deriving water quality criteria (USEPA) and guidelines (CCME) differ slightly in both the level of protection considered and the toxicity-based statistical endpoints used to derive the SSWQO (Technical Session, 2020b, pp. 102-103).

De Beers noted that the USEPA guideline is based on more recent science (Technical Session, 2020b, pp. 102-106). From this discussion, IR #8 was for De Beers to provide rationale for selecting the USEPA guideline for calculating SSWQO for aluminum.

In response to IR #8, De Beers recalculated the USEPA criteria using statistical endpoints that are consistent with the CCME methodology (De Beers, 2020b). The revised SSWQO ranges approximately from 80 µg/L to 160 µg/L in Lake N11 (compared to the original of 140 µg/L to 410 µg/L) and from roughly 80 µg/L to 150 µg/L in Area 8 (compared to the original of 150 µg/L to 330 µg/L). The results presented above are calculated using predictions of ambient water hardness. As recommended in Section 2.1, baseline toxicity modifying factors should be used in the SSWQO calculation.

Recommendation:

9. GNWT recommends the revised aluminum SSWQO calculation methodology, provided in response to IR #8 be approved for Lake N11 and Area 8. As stated in recommendation #1, baseline hardness should be used.

3.0 Area 8 Water Management

De Beers no longer intends to discharge water from CP1 to Area 8 during operations. As a result, the associated conditions and SNP stations related to this discharge are no longer needed in the Water Licence. GNWT is of the opinion that because the Water Licence is currently undergoing an amendment, it is the appropriate time to remove any Water Licence conditions that are no longer relevant, including those related to discharge to Area 8.

In review comment ENR #4 submitted on May 4, 2020, GNWT recommended that De Beers clarify if they are still intending to discharge water from Area 7 to Area 8 as there were several discrepancies between various documents submitted with the application. In response, De Beers confirmed that they do not intend to discharge water from CP1 (also known as Area 7) to Area 8 during operations (Review Comment Table, 2020).

During the Technical Session, on July 7, 2020, GNWT asked De Beers to clarify that De Beers no longer requires authorization to discharge from CP1 to Area 8 during operations. De Beers confirmed that that is correct, and noted that, during closure, De Beers expects the water quality in CP1 to meet the discharge EQC and, in this case, may seek approval to discharge from CP1 to Area 8 in the next water licence renewal, if required (Technical Session, 2020a, pp. 55-56)

GNWT then asked De Beers to further clarify if any water licence conditions such as EQC, or SNP stations associated with CP1 discharge to Area 8 would be removed from the Water Licence. This led to IR #1 in which De Beers provided a list of all conditions and SNP stations proposed to be removed from the existing licence MV2005L2-0015 that are associated with Part G, Condition 31, for discharges from Area 7 to Area 8.

In response to IR #1, De Beers presented two options for the MVLWB's consideration (De Beers, 2020b). The first option was to leave the water licence items related to Area 8 in the licence, and they would become inactive. These conditions would be treated in a similar way to conditions associated with the drawdown of Kennady Lake, which no longer apply during operations. The second option listed the items that could be removed from the licence. GNWT prefers the second option as this will result in a water licence that is simpler for all parties to read and review in the future.

During the Technical Session, the MVLWB staff asked all parties whether there were any concerns with the removal of the regulated mixing zone in Area 8 since De Beers no longer requests authorization to discharge from Area 7 to Area 8 (Technical Session, 2020b, p.112). The MVLWB asked because water will continue to be transferred from Lake N11 to Area 8 for downstream flow mitigation. GNWT notes the SNP 04 status that is written in the Water Licence states, "Active during any Discharge of Water or

Wastewater from Area 7 to Area 8." Accordingly, the 2018 and 2019 Annual Reports (De Beers, 2019b and 2020a) both state that SNP 03 (edge of the mixing zone in Area 8) was inactive. This was despite water being transferred from Lake N11 and Area 1 to Area 8 for downstream flow mitigation. In addition, De Beers noted that the SSWQO in Area 8 will still be compared to data collected as part of the AEMP. For these reasons, GNWT concludes it is appropriate to remove SNP 03, in addition to SNP 04 from the Water Licence.

Recommendation:

10. GNWT recommends that as the Water Licence is currently undergoing an amendment, it is the appropriate time to remove any water licence conditions that are no longer relevant.

11. GNWT recommends that the SNP specify that discharge of water from CP1 (Area 7) to Area 8 is prohibited.

4.0 Water Licence Condition to Track the Management of PAG Waste Rock

In review comment ENR #98 submitted May 4, 2020, GNWT recommended that De Beers confirm the reporting mechanism that will describe the quantity and location of PAG material placed in the CPKMRP, should this be required. De Beers responded that they would report in a similar way to how other waste rock volumes are currently reported in the Annual Report (Review Comment Table, 2020).

During the Technical Session, the Board asked that GNWT provide language for the Water Licence for the reporting of PAG material placed and stored in each designated area (Technical Session, 2020c, pp. 54-59). GNWT has suggested revised wording for Schedule 1, Part B, Item 10, 1. (k) (iii) below.

Currently, Schedule 1, Part B, item 10 1.(k) (iii) states: "The monthly and annual quantities in cubic meters (m^3) and tonnes (t) of Waste Rock placed in the South Mine Rock Pile and the West Mine Rock Pile, identifying the classification of quantities of each rock type, geochemical classification, and its disposal location";

GNWT notes that this item could be revised to include the CPKMRP, which would ensure that any waste rock placed there is characterized and tracked.

Recommendation:

12. GNWT recommends that the Board revise the wording of Part B, item 10, 1. (k) (iii) as follows:

"The monthly and annual quantities in cubic meters (m^3) and tonnes (t) of Waste Rock placed in the South Mine Rock Pile, West Mine Rock pile, and **Coarse Processed Kimberlite and Mine Rock Pile**, identifying the classification of quantities of each rock type, geochemical classification and its disposal location."

5.0 Quantifying PAG Material for Contingency Storage in the CPKMRP

De Beers proposes to use the CPKMRP to store small amounts of PAG material, for operational flexibility. GNWT recommends that the CPKMRP not be approved for the storage of PAG material until De Beers has provided an estimated volume of PAG material to be potentially stored, its location and how it will be managed/covered. This information is critical and must be reviewed and approved by the Board.

In review comment ENR #81 submitted May 4, 2020, GNWT recommended that De Beers provide details on the potential to use the CPKMRP as a contingency storage location for PAG material. De Beers responded that the possibility of placing PAG into the CPKMRP is small under the current mine plan, but may occur in the event that the West Mine Rock Pile and the mined-out 5034 pit are not available for PAG rock storage (Review Comment Table, 2020).

During the Technical Session, GNWT asked De Beers to quantify the volume of material that was considered a "small amount". De Beers was unable to provide an estimated quantity, but did note that due to the restrictions on methods and timing of PAG material placement, storing PAG material in the CPKMRP is not a preferred option, and would be avoided if at all possible (Technical Session, 2020c, pp. 43-45).

GNWT notes that without an indication of the volume of PAG material that could potentially be stored in the CPKMRP along with its location and how it would be managed/covered, it is not possible to assess the level of risk associated with this option even on a contingency basis.

Recommendation:

13. GNWT recommends that the CPKMRP not be approved for the storage of PAG material.

6.0 Securities

As part of GNWT's review, an assessment of the current liability associated with the Water Licence was completed to develop an update to the estimate of mine closure cost. To assist in the review, GNWT retained Brodie Consulting Ltd. (BCL) to develop

an updated cost estimate. GNWT has attached the memorandum and the updated RECLAIM cost estimate.

GNWT notes that the De Beers 2020 estimate uses the correct version of RECLAIM (i.e. RECLAIM V 7.0). However, De Beers did not adjust the unit costs in its estimate which were last updated in 2014. The GNWT has adjusted the cost estimate from 2014 unit costs to 2020 unit costs using inflation as per Statistics Canada (8.5%) where appropriate. This is consistent with the jointly released Guidelines for Closure and Reclamation Cost Estimates for Mines (November 2017) and the RECLAIM 7.0 User Manual (GNWT, 2017).

BCL has made the inflation revision to De Beers' year 11 and year 14 estimate (end of mine operations), and the estimated cost of reclamation increases from $94,653,375 to $101,222,765 for year 11, and $92,242,344 to $98,651,203 for year 14.

Note that these increases for both phases represent an overall increase of 6.9%, slightly less than the 8.5% due to inflation from 2014. BCL have updated the unit cost table in RECLAIM, rather than simply multiply the old estimate by 8.5%. However, some of the unit costs used in the Gahcho Kué estimate were site-specific values and/or allowances that were not in the unit cost table. For these values, they were adjusted by 8.5% where appropriate. Some values, such as for rock cover placement were adjusted from 2018, as they were debated at that time and agreement was reached using more recent data than 2014.

Additional information is included in Appendix A which includes the BCL memorandum and the RECLAIM spreadsheets for both phases.

Recommendation:

14. The GNWT recommends that the MVLWB set the overall security for the site (MV2005L2-0015 and MV2005C0032) at $101,222,765.00 for Year 11, and recommends the amount held for the land liability is set at $40,512,054 and for water liability at $58,139,149.

15. The GNWT recommends that the MVLWB set the overall security for the site (MV2005L2-0015 and MV2005C0032) at $98,651,203.00 for Year 14, and recommends the amount held for the land liability is set at $40,512,054 and for water liability at $58,139,149.

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Appendix A: LGL Environmental Ltd. – Technical Memorandum

Appendix B: Brodie Consulting Ltd. – Memorandum and Review of Security Estimate

Appendix C: Technical Expert CVs