



February 2015 Environmental Update for SLEMA Board

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February 28, 2015

Outline

1. Mine Update
2. Inspection Update
3. Regulators' Update
4. Aboriginal Update
5. Stakeholders' Update
6. Agency's Activities
7. SLEMA Reviews
8. Water Licence Amendment Application



Acronyms

- AANDC – Aboriginal Affairs and Northern Development Canada
- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- CCME – Canadian Council of Ministers of the Environment
- CEQG – Canadian Environmental Quality Guidelines
- EC – Environment Canada
- ENR – Department of Environment and Natural Resources, GNWT
- EQC – Effluent Quality Criterion
- GNWT – Government of the Northwest Territories
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- SSWQO – Site-Specific Water Quality Objective
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond



1.1 Mine Update – January 2015

- Production rate: 95.5% of its capacity (93,300 tonnes of kimberlite processed)
- 5,711 m³ of water withdrawn from Snap Lake
- 1,410,001 m³ of treated water discharged into Snap Lake
- 75,866 tonnes of coarse reject and 50,303 m³ of slimes deposited in the North Pile
- No reportable spills
- Water sampled in 7 monitoring stations
 - The monthly average for all parameters met compliance



1.2 Spill Reporting in February 2015

- No spill reports received in February 2015



1.3 2014 Snap Lake Drinking Water Sampling Annual Summary

- Addressed to Stanton Territorial Health Authority on February 5, 2015
 - The Potable Water Treatment Plant was relocated in the Utilities Building in 2014. All parameters met the Canadian Drinking Water Guideline criteria except for two elevated hardness samples collected in February and July 2014



1.4 Responses to YKDFN's Information Request on Thallium and Cesium Response Plan

➤ Dated February 6, 2015

- YKDFN proposed 6 Information Requests (IR) via e-mail on December 4, 2014
- De Beers responded to all IRs



1.5 Exceedance of AEMP Action Low Levels for Toxicity in Snap Lake

➤ Letter dated February 13, 2015

- De Beers presented the Table of Content (TOC) “that will provide a framework for the Ceriodaphnia toxicity Low Action Level Response Plan and investigation.”
- “Pending comment and approval of the ToC, De Beers will undertake and complete the response plan follow-up testing and investigation for submission to the MVLWB on or before April 30, 2015.”



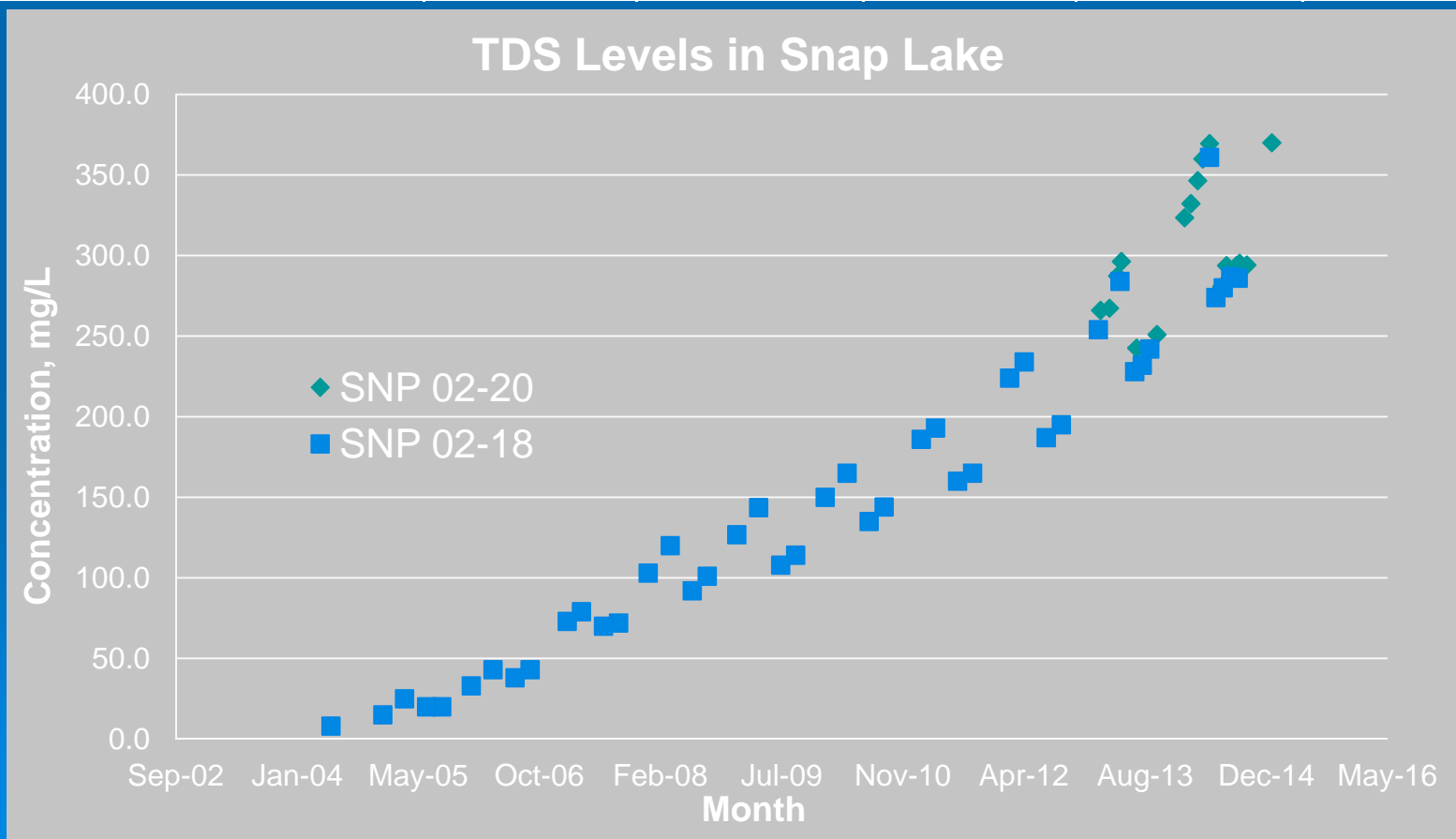
1.6 Drinking Water Aesthetic Objective Guideline Low Action Level Triggered

- Notice dated February 25, 2015
 - TDS levels at SNP 02-20e and SNP 02-20f were above 75% of the Aesthetic Objective of 500 mg/L on January 18 and 20, and triggered the low action level in the AEMP
 - De Beers suggested that addition investigation as to the cause of the action level exceedance was unnecessary due to no harmful effects to the aquatic environment or to human health, and the regulatory review two amendment applications



Comments from the Environmental Analyst (I)

SNP Station	02-20d	02-20e	02-20f	02-20g	Average
Calculated TDS, mg/L	353	380	376	371	370



Comments from the Environmental Analyst (II)

- Based on what happened in SNP 02-20 and SNP 02-18 (Whole Lake Average) last May, it is believed that TDS level at SNP 02-18 might exceed the current water licence limit of 350 mg/L

TDS, mg/L	SNP 02-20	SNP 02-18
May 2014	369.5	361
January 2015	370	?

- It is recommended that De Beers provide an update on De Beers' attempt to conduct sampling in January and February 2015 to obtain relevant TDS data within Snap Lake



2. Inspection Update

- Inspector – Jamie Steele
- Water Licence Inspection
 - January 14-15, 2015



2.1 Water Licence Inspection

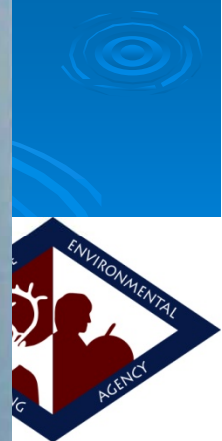
- Dated January 14-15, 2015
- Inspected the North Pile Water Management Structure Waste Management Yard, Landfill, Water Treatment Plant, Fresh Water Intake, Sewage Treatment Plant, Construction Site for new accommodations wing
- No concerns were noted



North Pile Permanent Sump 4 - Ice build-up being removed by an excavator. Ice is being deposited on the uphill slope so that it will flow back into the sump after it melts in the spring



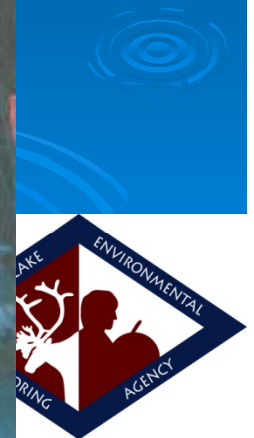
Waste Management Yard - Well organized and waste was being staged for backhaul off site



Landfill - Landfill was well maintained with no evidence of misdirected waste. The landfill only contained inert wastes such as metal and plastic



Landfill - Unlabeled bags in the landfill contained concentrated sewage sludge from the sewage treatment plant. This is an approved disposal method as per the approved Snap Lake Mine Waste Management Plan however the bags should be labeled to identify their contents



Water Treatment Plant - Filter feeder tanks receive water from the freshwater dilution line that was being proposed through an update the Snap Lake Mine Water Management Plan



Sewage Treatment Plant STP 1-This facility is currently not operational. No concerns were noted during the inspection



Accommodation Construction - A new 49 person accommodation is being constructed to handle overflow from the main camp accommodations. This structure will be heated electrically and will have water and sewer services tied into the main camp accommodations. Completion of construction anticipated by the end of March 2015



Sewage Treatment Plant STP 2 - Facility was functioning properly with no issues for capacity or discharge quality



3. Regulators' Update – MVLWB (I)

- On February 12, 2015, approved the Water Management Plan as submitted, and provides the follow directive:
 - “The Board approves the use of freshwater as a mitigation measure until the regulatory processes for the December 2013 and November 2014 Amendment Applications have been completed and receive Ministerial approval. De Beers is still required to adhere to the maximum annual volume of freshwater use of 188,000 m³, as stated in Water Licence MV2011L2-0004.”



Recommendation in the Staff Report

- “Board staff believes that Snap Lake needs an updated WMP as part of their Licence. The majority of the WMP has been reviewed and accepted by reviewers. The outstanding issue regards whether or not De Beers can use their freshwater intake to directly dilute their effluent. Board staff recommends that the use of direct dilution of the effluent as a mitigation measure to enable De Beers to maintain compliance with current Licence limits be accepted. Board staff caution that De Beers’ request to maintain this dilution as a potential life of mine mitigation, as pointed out by the Inspector in his comment above, does have the potential to set a precedence and requires due consideration by the Board.”



Comments from the Environmental Analyst

- SLEMA noted that Board staff expressed caution in the staff report
- SLEMA is disappointed that the approval letter does not include the Inspector's recommendation:
 - *“Recommend De Beers Canada demonstrate how sample integrity at SNP Station 02-17b will be maintained with the proposed water use to ensure that samples taken will be representative of continuous mine effluent.”*



3. Regulators' Update – MVLWB (II)

- Invited reviewers to submit comments on AEMP Action Level Exceedence (C. dubia) Table of Contents, on February 27, 2015
 - Comments due on March 9



3. Regulators' Update – ENR (I)

- Issued a letter about 2013 Environmental Agreement Annual Report on February 5, 2015, and requested De Beers to address related issues within sixty days of receiving the letter
 - “The Annual Report can be deemed satisfactory once De Beers addresses the issues raised by the GNWT outlined below. The GNWT directs De Beers to provide a revised Annual Report or an addendum that



3. Regulators' Update – ENR (II)

- “More comprehensively compares the results predicted in the environmental assessment to the actual performance of the Project for all environmental components. A more thorough rolling summary and analysis of environmental effects data over the life of the Project is needed to illustrate trends as required under Article 10.1(b) of the EA.”



3. Regulators' Update – ENR (III)

- “Provides a determination of effectiveness of mitigation measures, as required under Article 10.1(c)(viii). A list of mitigation measures is included in the Annual Report (Section 7) but an evaluation of effectiveness is also required.
- Provides a more comprehensive summary of public concerns and responses to public concerns, as required under Article 10.1(c)(x).”



3. Regulators' Update – ENR (IV)

- “Provides a comprehensive summary of the new technologies investigated, as required under Article 10.1(c)(xi). A list of new technologies being researched is included in the Annual Report (Section 10) but a summary of the technology and outcome of the research are also required.
- Includes the Minister's comments on the previous Annual Report as required under Article 10.1(c)(xii). Section 1.2 of the Annual Report submitted by De Beers should describe how De Beers' responded to comments from the GNWT and Yellowknives Dene First Nation and reflect the satisfactory determination from the Minister



4. Aboriginal Update

- No Comments received from the Aboriginal Parties in February 2015 except for the Water Licence Amendment Applications



5. Stakeholders' Update

- No Comments received from the other stakeholders in February 2015 except for the Water Licence Amendment Applications



6. Agency's Activities

- No board activities in February 2015



7. SLEMA Reviews

- Thallium and Cesium in Fish Tissue Response Plan
- Incinerator Stack Testing Summary
- 2014 Plume Characterization Study
- Exceedance of AEMP Action Low Levels for Toxicity in Snap Lake



7.1 Thallium and Cesium in Fish Tissue Response Plan

- The concentration of metal in large-bodied fish were assessed in Snap Lake in 2013 as part of AEMP
- Concentration of cesium and thallium, which are very low in Snap Lake surface waters and are not increasing in sediment, were found to be increasing in fish tissues. The Low Action Level was triggered
- The Response Plan was developed to determine what the results mean and whether management action are required



Cesium and Thallium

- Cesium and Thallium are non-essential metals that can leach from rocks as water runs off them
- Cesium and Thallium are not metals with high toxicity. Fish remain healthy in Snap Lake, and the fish taste will not be affected
- The observed concentrations will not harm humans eating fish



Management Actions

- The Mine's follow-up responses are focused on continued monitoring
- The Medium and High Action Levels will be set, if necessary, after the next fish tissue program in 2015 and 2016



Comments from the Environmental Analyst

- No concerns are raised



7.2 Incinerator Stack Testing Summary

- Two Keteck incinerators (model CY-100-CA) installed at the mine site in 2013
- Incineration stack testing conducted by A. Lanfranco and Associated of Surrey British Columbia in 2014
 - Dioxin and furan emission above the CCME Canada Wide Standard (CWS) (80 pg/m^3)
 - Mercury emissions below CWS ($20 \text{ }\mu\text{g/m}^3$)



Stack Testing Results

Table 1: Stack Testing Results- Snap Lake Mine Camp Waste Incinerators

Parameter	Units	Incinerator 1				Incinerator 2			
		Trial 1	Trial 2	Trial 3	Average	Trial 1	Trial 2	Trial 3	Average
Mercury (corrected to 11%O ₂)	ug/m ³	0.02	0.03	0.07	0.04	0.04	0.04	0.04	0.04
Temperature (Secondary Unit)	°C	996	1003	980	993	997	994	1005	999
Dioxins and Furans TEQ (corrected to 11%O ₂)	pg/m ³	84	580	902	522	1482	7921	6258	5220



Responses to the Elevated Dioxins and Furans Emissions

- An adaptive management response has been triggered consisting of evaluation of results and adjustment of management practices to implement solutions
 - Both incinerators had undergone a routine inspection by the manufacturer one week prior to stack testing
 - The root cause was identified as “not following standardized work practice”
 - All site services staff with responsibilities for the camp incinerator were retrained, and detailed instructions were incorporated into the operators Safety Health and Environment Operating Procedure (SHEOP)



Requirement from the Land Use Permit MV2010D0053

- Item 54. *The Permittee shall use a forced, fuel-fired incinerator to burn all combustible garbage except plastics. The Permittee shall select a unit that is **capable** of meeting an emission concentration limit on dioxins and furans of 80 pg TEQ/m³*
 - De Beers installed the two incinerators capable of meeting the emission concentration limit on dioxins and furans of 80 pg TEQ/m³ (Canada Wide Standard, CWS)



Comments from the Environmental Analyst (I)

- The results of stack testing show that the average emissions of dioxins and furans are 6 to 65 times higher than the CWS, even if one testing result (84 pg TEQ/m³) is very close to the CWS
- As De Beers pointed out in the Summary, there are currently no regulated emission standards, or enabling legislation in the Northwest Territories for incinerators. De Beers has not had any non-compliance issues for dioxins and furans so far



Comments from the Environmental Analyst (II)

- Inquiry was made via e-mail on adaptive management response and stack testing
 - Whether De Beers checked out the garbage sent to be burned in the incinerators – Is all of the garbage combustible? Is there plastics contained in the garbage?
 - Does De Beers have a plan to make dioxins and furans emission meeting the CWS? Does De Beers have a plan for another stack testing to confirm the incinerators' capacity?



De Beers Response on February 11, 2015

- *“We are currently working with EC and GNWT to develop a process for improving incinerator management, based on our review of the current operational practices as indicated in the letter. Since De Beers has a formal letter from Ketek that the incinerator is capable of meeting the emissions standards, we don’t plan to undertake further testing – only to improve upon its operation.-Following any discussions with EC and GNWT, we will submit a follow up letter discussing the findings and path forward. The distribution for this will include SLEMA”*

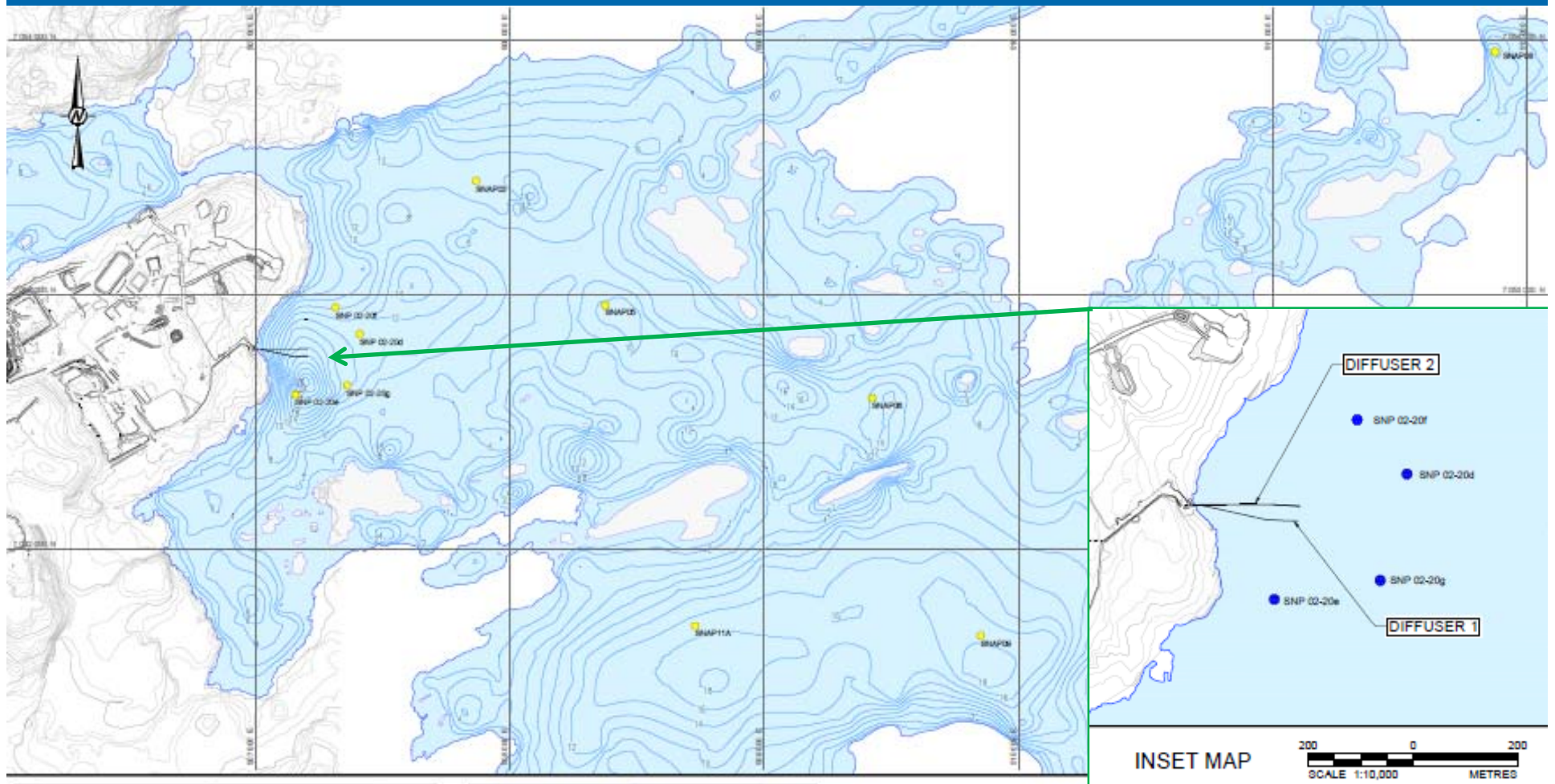


7.3 2014 Plume Characterization Study

- The Mine discharges treated effluent from the Mine's water treatment plant to Snap Lake via two outfalls (diffuser 1 and diffuser 2). Diffuser 1 was installed in 2011 to replace the original permanent diffuser. Diffuser 2 was installed parallel to diffuser 1 in 2013 to accommodate increases in flows discharged from the Mine. The two diffusers are designed to maximize initial mixing of the treated effluent discharged to Snap Lake and to reduce effluent concentrations in the near-field mixing zone around the diffusers
- The Plume Characterization Study was completed in 2014 to meet the MVLWB's requirement



Diffusers, SNP Stations and AEMP Stations



Results

- The measured minimum dilution factor (16) during ice-covered conditions in 2014 was greater than the predicted dilution factor (12) for ice-covered conditions in the Environmental Assessment Report (EAR)
- The measured and modeled results of the Plume Characterization Study indicate that the dilution factor of 12 used for developing the EQC is, overall, an adequate estimate for both present and future mixing performance of the two diffusers in Snap Lake



Low Dilution Factors during Early Open-water Conditions

- The minimum measured dilution factors in 2014 were 5 during July. They are not expected to affect the development of the EQC, because they are expected to
 - be limited to early open-water conditions;
 - occur at a time when concentrations in Snap Lake are lower than the critical period of late ice-covered conditions; and,
 - represent localized anomalies that occur only in deep locations near the diffuser



Report Recommendations

- Dilution factors should continue to be calculated using the Snap Lake data collected quarterly during routine AEMP fieldwork
- Minimizing air in the effluent discharge should continue by maximizing air release through the air valves along the outfall and by maintaining full pressure in the outfall system whenever possible. Any additional potential sources of air entrainment should be eliminated where feasible



Comments from the Environmental Analyst

- The justifications for low dilution factors during early open-water conditions not affecting the EQC development are reasonable
- The report recommendations are supported
- No concerns are raised



7.4 Exceedance of AEMP Action Low Levels for Toxicity in Snap Lake

- De Beers presented the Table of Content (TOC) “that will provide a framework for the Ceriodaphnia toxicity Low Action Level Response Plan and investigation.”
- “Pending comment and approval of the ToC, De Beers will undertake and complete the response plan follow-up testing and investigation for submission to the MVLWB on or before April 30, 20



Comments from the Environmental Analyst

- No concerns are raised



8. Water Licence Amendment Application (I)

- The Pre-hearing Conference was held on February 2, 2015
- The MVLWB distributed the Instructions for Applicant and Interveners for Public Hearing on February 3
- EcoMetrix Inc. completed their review of the Amendment Applications as requested by the MVLWB on February 4



8. Water Licence Amendment Application (II)

- The MVLWB confirmed, on February 12, 2015, that the December 2013 and November 2014 Amendment Applications were exempt from preliminary screening
- YKDFN (on February 12), and GNWT, EC, DKFN and LKDFN (on February 13) submitted the written interventions
- NSMA indicated they would like to become a registered speaker at the hearing



8. Water Licence Amendment Application (III)

- De Beers, on February 18, 2015, requested and was granted an extension to their written intervention submission deadline from February 20 to February 23, at noon
- De Beers responded to SLEMA question about the comparison of TDS concentrations to Health Canada's Aesthetic Objective and Classification on February 20
 - De Beers provided a Technical Memorandum by Golder
- De Beers responded to interventions by YKDFN, GNWT, EC, DKFN and LKDFN on February 23
 - De Beers maintained its positions



8. Water Licence Amendment Application (IV)

- GNWT, EC, DKFN, and LKDFN submitted Public Hearing presentations on February 27, 2015
- The NSMA, on February 27, submitted speaking notes they intend to present at the hearing as a registered speaker



8.1 Instructions for Applicant and Interveners for Public Hearing

- Interveners should submit their written intervention to the MVLWB by 5pm February 13, 2015. Public hearing presentations should be submitted to the MVLWB by 5pm February 27, 2015
- De Beers is requested to submit to the MVLWB one (1) written response to the interventions by 5pm February 20, 2015, and one (1) presentation for the public hearing by 5pm March 6, 2015
- The public hearing will be held March 11 and 12, 2015 in Dettah, NT at the Chief Drygeese Centre



8.2 EcoMatrix' Review (I)

- The Proposed Long-Term SSWQO
 - *In setting a SSWQO we must balance the benefit of avoiding possible effects in a minor component of the aquatic invertebrate community, and the economic cost of doing so*



8.2 EcoMetrix' Review (II)

- The Proposed Long-Term SSWQO for TDS
 - Overall, there seem to be several lines of evidence suggesting *C. dubia* response at TDS levels around 388 mg/L. As noted by Chapman (2014), *C. dubia* is not a resident daphnid, but it may be a reasonable surrogate for sensitive resident daphnids that have not been tested. The IC20 range of 684 to >1510 mg/L for resident species *D. magna* also suggests that reproductive effects on daphnids are possible at TDS concentrations below the proposed SSWQO of 1000 mg/L, even though the geometric mean of IC20s for *D. magna* is slightly above this level



8.2 EcoMetrix' Review (III)

- The Proposed Long-Term SSWQO for Chloride and Sulphate
 - *Retaining the SSWQO of 388 mg/L for chloride while increasing the SSWQO for TDS to 1000 mg/L will result in frequent exceedance of the chloride objective. On the other hand, if the TDS objective was around 825 mg/L, the two objectives would be consistent, assuming 47% of TDS is chloride*
 - *Regulating TDS at any of the suggested levels (684 to 1000 mg/L) will be protective as regards sulphate, unless there is a drastic increase in the sulphate proportion of TDS*



8.2 EcoMetrix' Review (IV)

➤ The Proposed Long-term EQCs for TDS and Constituents

- *Overall, the calculations of the updated EQCs appear to be consistent with the method presented in DBCI (2013) and appear to have been correctly executed. The updated EQCs are based on achieving the updated SSWQOs which serve as the starting points for the EQC calculations. If the Board imposes different SSWQOs than those now proposed by DBCI, the EQCs will have to re-calculated*



8.2 EcoMetrix' Review (V)

➤ Implications for Water Quality and Aquatic Life in Snap Lake

- *The EAR predicted minor changes in the zooplankton community, but no loss of species. There is currently no evidence that TDS effects at the highest predicted exposure levels will extend beyond this threshold of significance. However, forecasting of community dynamics is an uncertain science*



8.2 EcoMetrix' Review (VI)

- Implications for Water Quality and Aquatic Life in Snap Lake
 - *Water taste will be affected by increasing TDS concentrations in Snap Lake, DSL1 and DSL2. The Health Canada (2012) palatability rating system (Machtans, 2014, Table 4) and the maximum modelled TDS concentrations (Table 1) suggest that taste will be “fair” for the lower bound flows and “poor” in Snap Lake if upper bound flows occur. In the North Arm of Snap Lake where the water intake is located, taste will be “good” and TDS will meet the Health Canada aesthetic objective of 500 mg/L*



8.2 EcoMetrix' Review (VII)

➤ Perspective on Interim EQCs

- *The DBCI request for interim EQCs (12 November, 2014) was intended to allow the mine to operate while the Board deliberates on long-term EQCs. This concept makes sense, since exceedance of the previous whole-lake average limit of 350 mg/L TDS is imminent*
- *Over the interim period, the Board will have to decide whether to approve 850 mg/L, or the higher request of 960 mg/L (based on an SSWQO of 1000 mg/L) on a long-term basis. This will involve weighing the implications for aquatic life and water use (see above) against the economic implications of each limit*



8.3.1 YKDFN's Intervention (I)

- “YKDFN believe that the proposed TDS 684 mg/L represents a tolerable compromise for a license limit, as long as it can be demonstrated that it is in conformity with the Measures of the MVEIRB.”



8.3.1 YKDFN's Intervention (II)

- “YKDFN believe that the Whole Lake Average method should be preserved.”



8.3.1 YKDFN's Intervention (III)

- “YKDFN believe that the Chloride EQC should be preserved.”



8.3.1 YKDFN's Intervention (IV)

- “YKDFN believe that a proposed WQO that is conservative should be utilized until there is additional certainty on the impacts to water quality downstream and it can be demonstrated that the project is likely to meet the MVEIRB Measures. While uncertain, it seems likely that water quality objective of 684 mg/L would accomplish this.”



8.3.1 YKDFN's Intervention (V)

- “YKDFN recommend that the Board set an EQC that will allow the project to meet the suggestion of the Review Board, ensuring that TDS is less than 500 mg/L within five years of closure.”
- “YKDFN recommend that the Board direct the next iteration of the Interim Closure and Reclamation Plan to include meeting the MVEIRB suggestion as one of the objectives.”



8.3.1 YKDFN's Intervention (VI)

- “YKDFN recommend that the Board reject the proposed interim license amendment.”



8.3.1 YKDFN's Intervention (VI)

- “YKDFN are reluctantly prepared to support a license amendment for an EQC and WQO of 684 mg/L, so long as it can be demonstrated to both the Board and our satisfaction that this level will meet the MVEIRB Measures and Suggestions. Given that evidence to support this is yet to be provided, the license must provide eventual flexibility to accomplish this. We leave this up to the Board's discretion on how it may be accomplished.”



8.3.2 LKDFN's Intervention (I)

- “LKDFN recommends that the Mackenzie Valley Land and Water Board approve a water license amendment for a life-of-mine TDS limit of no higher than 684 mg/L measured as a whole-lake average.”



8.3.2 LKDFN's Intervention (II)

- “LKDFN recommends that the EQC limit for chloride be maintained to protect aquatic life and traditional livelihoods, as per the MVEIRB conditions.”



8.3.2 LKDFN's Intervention (III)

- “LKDFN recommends that the Mackenzie Valley Land and Water Board ensure that the MVEIRB requirements are fully met, and suggests a conservative approach by maintaining a WQO in Snap Lake no higher than 684 mg/L TDS until rigorous, longer-term studies can confirm that no TDS is detectable in Mackay Lake.”



8.3.2 LKDFN's Intervention (IV)

- “LKDFN recommends that the Mackenzie Valley Land and Water Board reject the interim license amendment.”
- “LKDFN further suggests that it may be valuable to set certain conditions for future interim license amendment applications, requiring documentation of the extra measures taken to meet the original conditions and the reasons for their lack of success.”



8.3.2 LKDFN's Intervention (V)

- “In conclusion, it is LKDFN's opinion that De Beers has not adequately considered the potential impacts of the proposed changes to the water quality of Snap Lake. LKDFN does not believe that De Beers has adequately engaged with affected communities. Lastly, LKDFN does not have confidence in the predictions put forth by De Beers, given that this process is the result of previous predictions proving to be inaccurate.”



8.3.3 DKFN's Intervention (I)

- “As was identified in the environmental assessment the exceedances of these aesthetic-based guidelines will have an impact on the traditional land uses. Members of the DKFN have been and will continue to be impacted by this project and De Beers continues to fail to adequately accommodate our members...we recommend that more stringent requirements for data collection be included in the permit conditions.”



8.3.3 DKFN's Intervention (II)

- “We recommend that the Board take a precautionary approach with this license amendment that the results of these monitoring programs related to mitigation be proven effective before committing on EQCs and SSWQOs, especially for these limits that will be set for the life of the mine.”



8.3.3 DKFN's Intervention (III)

- “It remains unclear what actions will be taken if monitored levels of TDS exceed the model predictions and at what point any action would be triggered. This issue of having contingencies in place and specific triggers for implementing contingencies was also raised by the YKDFN and GNWT during the technical sessions in January 2015. We recommend to the Board that specific contingencies be required as condition of the permit.”



8.3.3 DKFN's Intervention (IV)

- “We recommend that conditions associated with this Special Study (downstream baseline data collection) in the water license stipulate that the study period is of adequate length to achieve meaningful results.”



8.3.3 DKFN's Intervention (V)

- “In closing, we continue to be disappointed that over a decade of monitoring has been conducted at Snap Lake and the issue of increased levels of TDS continues to be forefront. De Beers has had multiple opportunities to demonstrate effective environmental stewardship but has failed to do so. We are concerned that based on the current actions and commitments by De Beers that this issue will continue for the life of the mine.”



8.3.4 GNWT's Intervention (I)

- The GNWT recommends that any amendment to Water Licence MV2011L2-0004 or subsequent licence continue to include the requirement that the AEMP shall include monitoring for the purpose of measuring Project-related effects on the following components of the Receiving Environment:
 - i. Fish health;
 - ii. contaminant levels in fish flesh due to changes in water quality in Snap Lake and/or the NE Lake; and
 - iii. the taste of fish, to be completed with the communities, due to changes in water quality in Snap Lake



8.3.4 GNWT's Intervention (II)

- GNWT recommends that the SSWQO for TDS within Snap Lake be set at 690 mg/L for the reasons outlined above
- GNWT recommends a SSWQO of 3 mg-N/L for nitrate in Snap Lake
- GNWT recommends an SSWQO of 0.06 mg-N/L for nitrite in Snap Lake
- Considering current levels are above the CEQG, the GNWT recommends additional investigation into potential mitigations for the reduction of fluoride in Snap Lake be conducted, with a goal of reducing levels below the CEQG
 - The CEQG for fluoride is 0.12 mg/L and was adopted by the MVLWB during the 2011 license renewal process



8.3.4 GNWT's Intervention (III)

- The GNWT recommends that concentrations of TDS and its constituent ions within Mackay Lake be maintained within the range of natural variability as outlined within the Table 1 and 2, until additional evidence is provided to the MVLWB that better defines this range.



Table 1. Summary statistics for TDS in samples collected at Mackay Lake

TDS statistics – calculated; mg/L	Mackay Lake	
	1993-2001	2005 and after
Minimum – under ice cover	7.14	9.95
Maximum – under ice cover	13.1	13.4
Mean – under ice cover	9.13	11.9
95 th percentile – under ice cover	12.4	13.2
Minimum – open water	5.79	4.89
Maximum – open water	14.8	10.1
Mean – open water	7.28	8.25
95 th percentile – open water	11.1	9.99



Table 2. Summary statistics for chloride in samples collected at Mackay Lake

Chloride statistics – dissolved; mg/L	Mackay Lake	
	1993-2001	2005 and after
Minimum – under ice cover	<0.2	<0.7
Maximum – under ice cover	0.5	<0.7
Mean – under ice cover	0.2	0.35
95 th percentile – under ice cover	0.42	N/A
Minimum – open water	<0.2	<0.7
Maximum – open water	0.75	<0.7
Mean – open water	0.278	0.35
95 th percentile – open water	0.734	N/A



8.3.4 GNWT's Intervention (IV)

- The Downstream Lakes Model (DLM) should be revised to include model nodes for King Lake (upstream and downstream stations), and the inlet to Mackay Lake (i.e. located in the embayment at the mouth of the Lockhart River, within 100 m of the mouth of the river);
- The DLM should be revised to include predictions of TDS and constituent ions of concern (including, but not limited to chloride, fluoride, and nitrate), at each of the existing and recommended model nodes;
- The DLM should be revised to include lower and upper bounds for the water quality predictions by incorporating additional flow estimates (e.g., 10th and 90th percent outflows) during baseline and operations.



8.3.4 GNWT's Intervention (V)

- The GNWT recommends that for the protection of the aquatic ecosystem within Snap Lake an EQC for TDS within Snap Lake be calculated based on a SSWQO of 690 mg/L.



8.3.4 GNWT's Intervention (VI)

- The GNWT recommends the existing AEMP be reviewed and updated as necessary in order to implement measures recommended in EA 1314-02 and approved by the Responsible Ministers.
- The GNWT recommends including AEMP monitoring locations within Mackay Lake that will be used to ensure that Measure 1(d) is being implemented. The precise locations should be determined in consultation with Aboriginal groups and other interested parties to ensure that the monitoring results will provide a satisfactory confirmation that the intent of Measure 1(d) is met.
- The AEMP should be updated to include the modeling nodes for King Lake (upstream and downstream stations), and the inlet to Mackay Lake (i.e., located in the embayment at the mouth of the Lockhart River, within 100 m of the mouth of the river) as AEMP water quality stations.



8.3.4 GNWT's Intervention (VII)

- The GNWT recommends that the whole lake average sampling program continue to be carried out in Snap Lake.



8.3.4 GNWT's Intervention (VIII)

- The GNWT recommends that the AEMP Response Framework include appropriate action levels and triggers to ensure that the EA Measures will be met in Snap Lake and downstream into Mackay Lake.
 - Three specific recommendations are offered to ensure that the Adaptive Management Plan (AMP) that is ultimately established for the Snap Lake Diamond Mine site provides a basis for identifying and implementing mitigation measures



8.3.4 GNWT's Intervention (IX)

- The GNWT recommends that the definition of Modification not be changed as an expansion may include an alteration of the project footprint which could require an amendment.
- At this time, the GNWT has concern that this condition (Part D: Conditions Applying to Construction) could be misinterpreted and therefore cannot support it. Any construction should be accompanied with an engineering stamped report/as built drawing(s). The liability of approval should not solely reside with an Inspector who may or may not be registered as a professional engineer in the Northwest Territories.



8.3.4 GNWT's Intervention (X)

- The GNWT does not support this request to remove risk assessment for the North Pile from Water Licence.
- The GNWT recommends that the condition (Part E, Item 3 a) - Field Inspection Report, Implementation of Recommendations) remain as is and that all recommendations from the Engineer be addressed. Suggestions may be considered by the proponent for inclusion or exclusion with sufficient rationale. The GNWT suggests that the Field Engineering Inspection Report clearly differentiate between recommendations and suggestions for clarity. It is DeBeers option to prioritize any suggestions from the Engineers Rep



8.3.4 GNWT's Intervention (XI)

- The GNWT does not agree with the proposed amendment of pH at defined "seepage" sites for Part F: Item 9b.
- The GNWT recommends that the condition (Part F, Item 12) remain.
- The GNWT recommends that hydrogeological modeling continue to occur on an annual basis to determine if predictions are validated, and to input into an appropriate response framework, when approved.



8.3.4 GNWT's Intervention (XII)

- The GNWT recommends that SNP Station 02-02 be relocated to in-line monitoring at the pump from Perimeter Sump 5 to the Water Management Pond. This monitoring would include quality and quantity of water reporting from the North Pile Drainage collection ditch. The GNWT recommends that requirements for SNP Station 02-03 be amended from continuous in-line monitoring to monitoring when flows are observed as requested by De Beers.



8.3.4 GNWT's Intervention (XIII)

- The GNWT recommends that the requirement to monitor BTEX, F1 and F2 remain in the SNP. The monitoring frequency for these parameters should be set at a level that is consistent with other operations.



8.3.5 EC's Intervention (I)

- “EC acknowledges and appreciates the effort that De Beers has, and will continue to, invest in monitoring. Furthermore, the additional monitoring requested will ensure that Project-related impacts can be detected and adaptive management decisions are based on accurate baseline information.”



8.3.5 EC's Intervention (II)

- “Site-Specific Water Quality Objectives
 - If the requested licence amendments are granted, EC recommends that De Beers conduct ongoing operational reviews in conjunction with investigation of practices and emerging mitigation measures to minimize the concentrations of TDS in effluent (as stated in the BATEA report, Section 6.2).
 - EC recommends that Project monitoring include ongoing assessment of ecosystem-level effects associated with increasing salinity.”



8.3.5 EC's Intervention (III)

- “Mitigation Measures and Contingencies
 - As previously outlined, EC recommends that De Beers conduct ongoing operational reviews in conjunction with investigation of practices and emerging mitigation measures to minimize the concentrations of TDS in effluent (as stated in the BATEA report, Section 6.2).
 - If the MVLWB decides to approve the amendments, EC recommends that there be specific tracking and reporting of the performance of the TDS mitigation measures.
 - To the extent practicable, redundancy in treatment capacity or in holding capacity should be maintained.



8.3.5 EC's Intervention (IV)

- “Mackay Lake TDS and Downstream Monitoring
 - EC recommends that De Beers collect further water samples from the inflow to Mackay Lake on a seasonal basis, starting immediately and continuing through life-of-mine.
 - Analysis and comparisons should be done for the full suite of parameters monitored in effluent from the Snap Lake Mine.
 - If the GNWT plans to continue collection of samples from Mackay Lake, De Beers should use that data for ongoing comparisons to the historical data, i.e. change tracked at sampling station Mackay Lake Northeast- Outlet Arm. If sample collection there is to be discontinued by the GNWT, it would be useful for De Beers to maintain periodic data collection at that site as a check point for changes in the lake.”



8.4 De Beers Responses to SLEMA's Analysis on TDS Calculated vs. Measured

- De Beers, on February 20, 2015, responded to SLEMA's question dated January 29 via e-mail about the comparison of TDS concentrations to Health Canada's Aesthetic Objective and Classification
 - De Beers provided a Technical Memorandum by Golder



Summary of Technical Memorandum (I)

- TDS concentrations in the panel study (Bruvold and Ongerth 1969) do appear to be measured rather than calculated TDS; however:
 - Calculated TDS remains the appropriate indicator of TDS in Snap Lake
 - There is variability in the TDS_{meas} vs TDS_{calc} regression for Snap Lake, making extrapolation to over 1,000 mg/L from the regression equation problematic



Summary of Technical Memorandum (II)

- When adjusted to TDS_{calc} , the palatability ratings (aesthetic classifications), from the original taste study change, but the key messages for Snap Lake drinking water do not
- The adjusted classifications are conservative, due to limited information presented in the taste studies
- Follow-up taste studies (Bruvold et al. 1969) were later completed to address gaps in the original study, yielding higher TDS ranges for the aesthetic classifications
- There is considerable variability in the determination of the aesthetic classifications



Table 1: TDS Concentration Bounds for Aesthetic Classifications of Drinking Water Based on Subject's Individual Interpretation of the Water's Taste

Source	Description	Excellent	Good	Fair	Poor	Unacceptable
		A	B	C	D	F
Bruvold and Ongerth (1969)	Measured TDS (mg/L)	≤ 313	314 to 638	639 to 896	897 to 1,129	≥ 1,130
	Measured TDS (mg/L) (rounded)	≤ 300	301 to 600	601 to 900	901 to 1,100 ^(a)	≥ 1,101 ^(a)
Bruvold et al. (1969)	Mean Measured TDS (mg/L) of three taste scales	≤ 397	398 to 755	756 to 1,030	1,031 to 1,282	≥ 1,283
	Mean Measured TDS (mg/L) of five taste scales	≤ 319	320 to 658	659 to 996	997 to 1,332	≥ 1,333
Golder – this technical memorandum	Calculated TDS (mg/L) Method in Bruvold and Ongerth (1969)	≤ 293	294 to 578	579 to 807	808 to 1,012	≥ 1,013
	Calculated TDS (mg/L) Method in Bruvold et al. (1969)	≤ 345	346 to 663	664 to 916	917 to 1,143	≥ 1,144
		≤ 276	277 to 579	580 to 881	882 to 1,182	≥ 1,183

Notes: mg/L = milligrams per litre; TDS = total dissolved solids; ≤ = less than or equal; ≥ = greater than or equal.

a) Although Health Canada (1979) and Bruvold et al. (1975) report this limit as 1,200 mg/L, it is reported as 1,100 mg/L in Bruvold and Ongerth (1969).



Summary of Technical Memorandum (III)

- Regardless of whether TDS_{calc} or TDS_{meas} are used for aesthetic comparisons, the key messages regarding the taste of drinking water are consistent with earlier assessments
 - A TDS concentration of 1,000 mg/L is above an aesthetic drinking water quality guideline. The increased TDS is not expected to change the appearance of the water, but a change in taste may be noted by some people. Most of the northwest arm of Snap Lake, from which the camp drinking water is obtained, will remain at the aesthetic drinking water guideline for TDS of 500 mg/L, but would go above the guideline to 600 mg/L if upper bound flows were to occur. De Beers commented in the Information Responses to the Mackenzie Valley Environmental Impact Review Board that, if necessary, drinking water for workers would be treated separately



Summary of Technical Memorandum (IV)

- Water would be rated as 'fair' to 'poor' for taste from the main body of Snap Lake to the inlet of Lac Capot Blanc, but would still be of 'excellent' quality in the main body of Lac Capot Blanc and downstream to MacKay Lake
- There is no risk to human health at a TDS concentration of 1,000 mg/L. There is no national health-based drinking water guideline for TDS



Comments from the Environmental Analyst (I)

- De Beers responses with in depth analysis are appreciated
- SLEMA's analysis (equivalent 1230 mg/L using TDS-meas vs. 1200 mg/L in the Classifications) appears to still make some sense, because the proposed SSWQO for TDS-calc (1000 mg/L) is very close to the calculated lower bound of unacceptable level (1013 mg/L, using TDS-calc), although the SSWQO does not fall within the unacceptable category



Comments from the Environmental Analyst (II)

- It is appreciated that De Beers acknowledged that there was potentially inconsistent comparison to the Health Canada's Aesthetic Objective and Classifications
- It is agreed that “Calculated TDS remains the appropriate indicator of TDS in Snap Lake”



Comments from the Environmental Analyst (III)

- It is appreciated that, in De Beers' responses to Interveners' Recommendations related to Measure 1d (Table 2-3, page 46-47), De Beers appropriately compared the predictions with baseline data by using calculated TDS concentrations
- However, clarification is still needed for potentially inconsistent comparison of De Beers predictions related to Suggestion 2 to the Health Canada's Aesthetic Objective (500 mg/L)
 - More detail in slide #62 of SLEMA January 2015 Environmental Update

