September 2013 Environmental Update for SLEMA Board

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Outline

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

Acronyms

- AANDC – Aboriginal Affairs and Northern Development Canada (previous INAC – India and Northern Affairs Canada)
- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- EC – Environment Canada
- ENR – Department of Environment and Natural Resources, GNWT
- 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
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1.1 Mine Update – August 2013

- Production rate: 103.3% of its capacity (100,840 tonnes of kimberlite processed)
- 2,761 m^3 of water withdrawn from Snap Lake
- 995,624 m^3 of treated water discharged into Snap Lake
- 83,567 tonnes of coarse reject and 61,430 m^3 of slimes deposited in the North Pile
- 2 surface spills (0 reportable)
  - 144 underground hydrocarbon spills (5,844 L)
- Water sampled in 13 monitoring stations
  - The monthly average for all parameters met compliance except
    - There were several exceedances in Faecal Coliforms in house testing for SNP 02-26ion August 4, 9, 11, 12 and 22
    - Exceedances in SNP 02-04.1 (Aluminum), 05 (Copper), 06 (Nitrate and Aluminum), 09.4 (Ammonia and Nitrate), 09.5 (TSS and Aluminum)
- One regulatory inspection on August 21-22 by AA[illegible] Inspector

1.2 Spill Reporting in September 2013

Date	Location	Waste Spilled	Amount (L)	Cause
September 20	Larger crusher rock, by Jumbo 203	Hydraulic oil	70 (revised on October 3, originally reported number was 177)	Hose broken

1.3 2012 Environmental Agreement Annual Report (Draft)

- Submitted on September 2, 2013
  - Awaited the translation section of the EAAR
  - The final version of the EAAR will be submitted when the translation is received

1.4 Commissioning and Relocation of New Sewage Treatment Plant

- Dated September 4, 2013
  - Further to the letter dated August 24, the context to this notification and history leading up to the relocation are provided
  - The new sewage treatment plant information will be incorporated into the Waste Management Plan, which will be submitted on January 31, 2014

1.5 Revised Version of the Acid/Alkaline Rock Drainage and Geochemical Characterization Plan

- Originally sent out on August 27, 2013, re-sent out on September 6
  - In response to the request from the MVLWB
    - "It would be helpful to our review process if you could identify where changes have been made in the Plan (in section 10 of the Plan and/or by highlighting changes throughout the Plan). Please also note that as per Part E, Item 12 of the Water Licence, updates to the Plan are for Board approval."
  - A section included with the revision history to reflect the change to allow PAG overburden to be used in pile construction

1.6 Chronic Toxicity Testing

- Date September 24, 2013
  - Water Licence requires that a once yearly early life stage (egg/alevin) chronic toxicity test must be carried out at SNP 02-20
    - Water samples were taken on July 7
    - The results of 7-Day Test: Pass
    - The results of 30-Day Test: Invalid
    - Upon receipt of the invalid results, De Beers collected a new set of samples for testing on September 10. The results were invalid again
    - De Beers selected Nautilus Environmental for t third round testing

2. Inspection Update

- AANDC Inspector – Patrick Kramers
- No Inspection reports received in September 2013

3. Regulators' Update

- MVLWB
  - Invited reviewers to submit comments on De Beers "Follow up to Starter Cell Raise Request" on September 3, 2013
    - Comments due on September 13
    - De Beers Request was approved on September 25
    - Proposed first Quarterly Update Meeting (October 16)
  - Invited reviewers to submit comments on the Revised Acid/Alkaline Rock Drainage and Geochemical Characterization Plan on September 9

    Comments due on October 4

3.1 MVLWB Staff Comments on Follow up to Starter Cell Raise Request (I)

- Please indicate where the maximum height of 35m could be expected to be reached in the North Pile. Also, given that the Starter Cell is located on the south side of the North Pile, and the maximum elevation of the 35m was predicted to be reached on the north side, please indicate what the maximum height on the south side was expected to be, or could be expected to be if the maximum height of 35m is reached at some point on the north side of the pile. If available, diagrams would be helpful to illustrate the relative heights of the various parts of the North Pile. Please describe how the height of the Starter Cell after the proposed Phase IV Rais compares to the expected maximum height of the south side of the North Pile

3.1 MVLWB Staff Comments on Follow up to Starter Cell Raise Request (II)

- Please provide clarification on what is meant by "original design" and "2nd raise" for the East and West Cells, and indicate whether the final heights of these two cells will be within what was contemplated during the MVEIRB EA

3.2 EcoMetrix Comments on AEMP Action Levels

- EcoMetrix was retained by the MVLWB to review the Revised Action Levels for the Snap Lake Diamond Mine
- EcoMetrix comments were submitted on September 16, 2013
  - Overall, the revised action levels are much improved
  - In general, the criteria defining the action levels are clear and should be workable, except as noted herein, and subject to further development of several criteria, including definition for “normal range” for metals in fish, and “change” in fish catch per u effort, which are promised in the Draft

3.3 Phase IV Starter Cell Embankment Raise

- The MVLWB approved the modification request for the Phase IV Raise
  - The maximum height of the Starter Cell to 21 m (489.5 masl), not including the required placement of four meters of non-acid generating cover material
- De Beers is to submit an updated North Pile Management Plan for approval
- The MVLWB will take the lead on organizing regular meetings with the interested parties on the paste research and other regulatory related activities

4. Aboriginal Update

- Comments on ICRP, Version 3.2 by
  - NSMA on September 3, 2013
  - YKDFN September 3
- Comments on AEMP Design Plan - revised Section 6 and 7 by
  - NSMA on September 9
- Comments on Follow Up to Starter Cell Raise Request by
  - YKDFN on September 6
- Comments on De Beers Request on Strontium Response Plan by
  - NSMA on September 27

4.1 NSMA Comments on ICRP (I)

- The NSMA recommends refining the definitions of the site categories to include the full area of mine impact. The NSMA encourages De Beers to ensure that the goal of leaving a positive legacy goal is given priority when considering pre and post-mine conditions, and including the broad extent of mine influences is critical to meeting this goal
- The NSMA believes that finding a suitable way to encourage revegetation of the North Pile should be viewed as critically important to meeting the goal of "positive legacy" and that this requires further integration into the ICRP

4.1 NSMA Comments on ICRP (II)

- The NSMA recommends an explicit statement that the North Pile slopes will not be sloped at a grade obtrusive to the passage of migrating Caribou herds and other wildlife. Research should be conducted in this area if it has not been already
- The NSMA requests that this section include the number of streams or wetlands that were affected, with a map, to better understand what may be required post-closure to manage surface runoff and restore the land

4.1 NSMA Comments on ICRP (III)

- The NSMA seeks clarification on the statement that "[a] combination of two revegetation approaches may be employed" and encourages priority be given to active revegetation methods while CRP development continues. Effective revegetation is critical to mitigating unnecessarily enduring impacts as per De Beers Sustainable Development Policy (2009) which states the goal of "reducing long term environmental and community impacts", as well as in Section 2.1.2 with the goal to "leave a positive legacy behind"

4.1 NSMA Comments on ICRP (IV)

- The NSMA seeks additional statements from De Beers on how items are labeled "non-hazardous" or "inert" and within what established criteria this has been determined applicable over the long term. Additionally, the NSMA requests that sampling be conducted post-burial in the trench area to ensure that the non-PAG granitic rock is working as an effective cap. Additionally clarification on the purpose of the PAG granitic rock usage should also be included

4.2 YKDFN Comments on ICRP

- YKDFN are still not satisfied with the project closure vision. YKDFN believe that the vision should read
  - "the overarching goal for the closure and reclamation of the Snap Lake Mine is to return the mine site to a self sustaining healthy environment"
- YKDFN remain steadfast in their rejection of the De Beers approach to criteria where the company relies on the approval from someone that is in their employ rather than based on transparent metrics
- Specific comments are also provided for Reclamation Research Plans, Community Engagement, Revegetation, Closure Criteria, North Pile, Underground, Infrastructure, and Contaminated Soils

4.3 NSMA Comments on AEMP Design Plan - revised Section 6 and 7 (I)

- Action levels for 'key indicators' reference "possible significant adverse effects". It has not been stated how these key indicators were determined. The NSMA would prefer elaboration on "key indicators“
- The NSMA recommends organized engagement and consultation between the developer and Aboriginal parties to increase Traditional Knowledge (TK) integration

4.3 NSMA Comments on AEMP Design Plan - revised Section 6 and 7 (II)

- The NSMA encourages the developer to re-word these examples of what constitutes significant adverse effects as clearly as possible, as they are a critical foundation for management and mitigation
- 10 more specific comments provided for ecological functions, AEMP response plan, weight of evidence integration

4.4 YKDFN Comments on Follow Up to Starter Cell Raise Request (I)

- YKDFN don't support haphazard or unplanned environmental management in the Chief Drygeese Territory, including at Snap Lake
- The central issue for De Beers is that paste backfill is a fundamental part of the mine plan at Snap Lake and YKDFN have little faith that the research initiatives currently under way will be any more successful than efforts of the past were.

4.4 YKDFN Comments on Follow Up to Starter Cell Raise Request (II)

- It may be that the Paste Backfill approach will never succeed and a full contingency for that eventuality and the consequences need to be concluded as soon as possible, as future changes to the original mine description are likely

4.4 YKDFN Comments on Follow Up to Starter Cell Raise Request (III)

YKDFN are asking the board for three things:

1) To clearly establish the consequences of the failure of the paste backfill system to the long term management of the site. At this point, we have little idea what implications the failure of the paste backfill holds with regards to the original project description. YKDFN will not accept this application for cell raise as the first of many potentially leading to a piecemeal response to paste management.
2) If the Board accepts the projects' rationale in this instance, the Board must provide clear guidance on what future mitigations will constitute a change of scope for this project.
3) Should any modifications or amendments to the license be considered, they must be accompanied by conditions with clear milestones compelling the timely submission of information and reports.

4.5 NSMA Comments on De Beers Request on Strontium Response Plan (I)

- The NSMA recommends that De Beers develop a solution that recognizes and takes ownership of the fact that strontium in Snap Lake is at a significantly higher level than that of pre-operation/ reference lake levels - a change solely attributable to mine operation. This change may have long term, cumulative effects on the ecosystem, and a relatively minimal amount is clearly understood through studies. It is recommended that De Beers continue to work on source solutions

4.5 NSMA Comments on De Beers Request on Strontium Response Plan (II)

- The NSMA recommends that De Beers recognize the need for reduction of total dissolved solids, and strontium levels in general as the first priority for Snap Lake mine in order to ensure long term health of the aquatic system, given that relatively little is still known on an established safe level of strontium
- The NSMA suggests that De Beers conduct further and more frequent strontium specific monitoring between Snap Lake and reference lakes, as there seem to be many unknowns regarding toxicity levels of strontium, yet there is a known risk of further increases in the aquatic environment

5. Stakeholders' Update (I)

- Comments on ICRP, Version 3.2 by
  - Environment and Natural Resources (ENR), GNWT on August 30, 2013
  - AANDC on August 30
  - Environment Canada (EC) on September 3
- Comments on Follow Up to Starter Cell Raise Request by
  - EC on September 10
  - GNWT/ENR on September 13
  - AANDC on September 13

5. Stakeholders' Update (II)

- Comments on AEMP Design Plan –Sections 6 and 7 by
  - DFO on September 19, 2013
  - EC on September 20
  - AANDC on September 20
  - GNWT/ENR on September 20
- Comments on De Beers Request on Strontium Response Plan by
  - AANDC on September 26
  - GNWT/ENR on September 27
  - EC on September 28

5.1 ENR Comments on ICRP (I)

- The proponent should be commended on its site specific closure and reclamation plan based upon the individual features of the Snap Lake Mine. However, the proponent should also consider a global site wide study and design to link all remedial activities for mine water management. This will ensure that the future usage objective can be achieved and that all engineered civil works will return the site drainage to the near natural pre-mining levels. If this model already exists the proponent should include a description of the plan and how it relates to the individual closure and reclamation options within the ICRP

5.1 ENR Comments on ICRP (II)

- In the event that permafrost does not aggrade as anticipated for the North Pile or is shown to be warming during post-closure monitoring, please provide further rationale that the only remedial option is to treat seepage/accumulated pore water until it meets discharge targets or alternatively provide secondary remedial options to amend the North Pile design;
- The proponent should define the geochemical makeup of the PK slurry and include a description of the PK within the document. It should also be noted in the PK discussion whether the PK is causing freezing point depression and whether it will affect the aggradation of permafrost (i.e. Chlorides, major ions, etc.);
- In the North Pile design, please reference the MEND Cold Regions Cover System Design Technical Guidance Document (AANDC 2012) as it provides technical guidance for closure and desi
northern climates

5.1 ENR Comments on ICRP (III)

- Please provide evidence that the groundwater upon mine flooding will be encapsulated (or limited) within the underground or provide closure designs (options) for how contaminants will be limited within the mine (hydraulic barriers, passive water treatment etc.);
- Please clarify if DeBeers has updated its water balance to include the new estimates for mine flooding. The proponent should also provide a rationale on how this influx of water that was not anticipated will affect the groundwater regime and the influx into the watershed

5.1 ENR Comments on ICRP (IV)

- 11 more specific comments provided
  - Closure objectives
  - Underground mine sections
  - infrastructure
  - Surface, process, and solid waste facilities
  - Water and Waste management
  - hydrology
  - Fish health

5.2 AANDC Comments on ICRP (I)

- AANDC recommends DeBeers continue to gather, report and update closure information to address areas of uncertainty. The research results are required to prepare a detailed closure plan for each component. AANDC recommends that annual progress reports provide the results of all information gathering initiatives and reclamation research fo
  each componen

5.2 AANDC Comments on ICRP (II)

- AANDC recommends the Board require DeBeers to provide additional detail regarding the timeframe for post-closure monitoring and the anticipated monitoring that would occur (e.g. thermal monitoring in North Pile, seepage quality and quantity monitoring, stability monitoring, dust/air monitoring, AEMP monitoring, etc.)

5.2 AANDC Comments on ICRP (III)

- AANDC recommends that specific closure criteria be added to the plan as part of revisions to the ICRP. Criteria should be developed specific to mine components. Note, in some instances, specific objectives, activities and criteria may be required for different areas within the same component. AANDC recommends reclamation research be initiated for the North Pile as soon as possible. Results should be made available to the Board and reviewers as soon as they are available

5.2 AANDC Comments on ICRP (IV)

- AANDC recommends that the Board require DeBeers to further discuss the deposition of PK in the plan and that the Project Description section be updated to include this detail (e.g. Section 4.4.2.1). AANDC recommends that a schedule be included in the plan that includes the date when paste will be deposited into the North Pile. Note, the company has indicated on the public record over several years now that paste would be used to deposit PK in the North Pile (i.e. during water licence renewal in 2011, during the summer of 2012, etc.)

5.2 AANDC Comments on ICRP (V)

- AANDC recommends that the ICRP account for all potential PK deposition methods (i.e., slurry, paste, combination) as the different methods will have a direct bearing on the closure option, activity, criteria and performance monitoring for any cell that does not receive PK as a paste only

5.2 AANDC Comments on ICRP (VI)

- AANDC recommends that DeBeers include the anticipated date for the deposit of PK as underground backfill in this section of the ICRP. Also, DeBeers should describe if there are any consequences from an operational standpoint if PK is not deposited underground as backfill for the remainder of the mine life. AANDC recommends that DeBeers prepare a schedule, similar to Figure 4.4 that outlines the schedule and total anticipated volume of PK deposited underground for the remainder of the mine life. This schedule should be included in the ICRP.

5.2 AANDC Comments on ICRP (VII)

- AANDC recommends that Section 4 Project Description - 4.4.2.3 Infrastructure - Water Management System include aspects of the water management system that DeBeers is contemplating to improve such as expansion to the Water Management Pond, Raise to the Starter Cell, addition of external ponds, trenches and sumps to collect water that escapes the North Pile, the additional outfall line, etc

5.2 AANDC Comments on ICRP (VIII)

- AANDC recommends that a further description of the quarry and quarry sequencing be included in the ICRP. Specifically describe the sequencing of accessing cover material and covering of all infrastructure in the West Cell (particularly the landfill which is assumed to receive nearly 80,000 m3 of waste up to 2 years following mine closure)

5.2 AANDC Comments on ICRP (IX)

- AANDC recommends that the ICRP include a schedule and anticipated volumes of hydrocarbon impacted soil expected during the remaining operation of the mine. This data should be based on information from previous years. This data would be used to determine the amount of available construction material and or cover material that may be available at the end of operations after successful bioremediation

5.3 EC Comments on ICRP

- It is not clear how the unknowns related to the objective of Underground (UG1) will be addressed by the reclamation research looking at post closure groundwater conditions. The objective deals with surface waters, while the research deals with groundwaters
- EC recommends that the unknowns related to UG1 are clarified and that it is further elaborated how the research in Section 4.1 of the Reclamation Research Plan will address these unknowns

5.4 EC Comments on Follow Up to Starter Cell Raise Request

- "EC has no comments at this time"

5.5 ENR Comments on Follow Up to Starter Cell Raise Request (I)

- More rationale should be provided, with evidence of consultation and agreement with stakeholders, of changes to the aesthetic objectives which was initially defined in the EA. While this is an aesthetic objective (484 masl), the cell should still be constructed as per industry best practices to ensure slope stability, and also consistent with Interim Closure and Reclamation Plan commitments agreed to in the EA

5.5 ENR Comments on Follow Up to Starter Cell Raise Request (II)

- In the event that the Board approves the raise, the proponent should provide a refined long-term disposal Plan for all kimberlite tailings that includes a timeline marking definitive milestones on the development of a successful PK slurry/paste, and alternate plans/contingencies if optimization for slurry/paste stabilization (tailings stabilization) is not achieved. The Plan must provide the new estimated life span of the North Pile, and rationale on how the current footprint of the surface cells will be maintained, or not, ar demonstrate

5.6 AANDC Comments on Follow Up to Starter Cell Raise Request (I)

- AANDC recommends that DeBeers clearly communicate the difference in height between that identified in the EA with Aboriginal groups and interested parties. DeBeers should clearly indicate what the exact elevation above sea level will be if the starter cell is raised to a height of 35 m

5.6 AANDC Comments on Follow Up to Starter Cell Raise Request (II)

- AANDC recommends the Board require DeBeers to provide a timeline and targets for the upcoming paste studies and trials and quarterly updates on the progress of the paste studies and trials. These quarterly reports must identify and evaluate the significance of any missed paste backfill targets for the size of the North Pile

5.6 AANDC Comments on Follow Up to Starter Cell Raise Request (III)

- AANDC recommends that the Board require DeBeers to develop appropriate alternatives for PK storage in the event that underground paste deposition proves not to be feasible. These alternative should be developed soon , so as to provide sufficient time for any significant changes to go through the required consultative and review processes. AANDC understands that the Phase 4 raise will provide DeBeers with 16 months of containment. AANDC suggests that a draft concept of the alternatives should be presented to the Board within 4 months. The draft submissions should include conceptual design drawings and identification of affected plans and how the plans would need to be modified (deposition, water management/quality alterations, ICRP, etc.)

5.7 DFO Comments on AEMP Sections 6 and 7 (I)

- DFO has reviewed DeBeers correspondence dated August 9, 2013 re: Response to Development of a Quantitative Food Web Model for Snap Lake, as well as the revised AEMP Sections 6 and 7 posted by the Water Board for review on August 2, 2013.
- DFO agrees that the current monitoring program adequately assesses fish and food for fish within Snap Lake. While the development of a quantitative food web model would be valuable in considering ecosystem impacts and useful in developing Action Levels for the AEMP, it is not required by DFO

5.7 DFO Comments on AEMP Sections 6 and 7 (II)

- With regard to the AEMP Action Levels related to fisheries, we are unable to provide comments at this time as they are not fully developed (ie. AEMP, Section 6, page 22 states that "*Change as it relates to fish community and a change in the relative abundance of a fish species relative to reference lakes has not yet been defined, and is currently under development pending completion of the 2013 fish community program on Snap Lake and the reference lakes*".)

5.8 EC Comments on AEMP Sections 6 and 7

- “EC is unable to provide comments at this time”

5.9 AANDC Comments on AEMP Sections 6 and 7 (I)

- Proposed Action Levels - General Comment
  - AANDC recommends that temporal trend analysis is included as an action level separate from other applicable benchmarks. i.e. If temporal trends indicate that an action level will be reached, a Low Action Level should be initiated. This should not be limited to water, but inclusive of sediment data as well

5.9 AANDC Comments on AEMP Sections 6 and 7 (II)

- Sediment - Significance Threshold
  - AANDC recommends that the significance threshold related to sediment would be better indicated by a Lowest Effects Level given its location at the outlet of Snap Lake. Alternately, a PEL could be used at a location closer to the diffuser outfall
  - AANDC recommends that clarity is provided regarding proposed action levels related to sediments, similar to those outlined for w[illegible]er quality levels

5.9 AANDC Comments on AEMP Sections 6 and 7 (III)

- Fish Consumption
  - AANDC recommends that a risk assessment regarding fish consumption be initiated to aid in determining actual significance thresholds related to these endpoints

5.9 AANDC Comments on AEMP Sections 6 and 7 (IV)

- Fisheries Metrices - Metals in Edible Fish Tissue, Normal Range
  - AANDC recommends that timelines for calculating normal range be provided and that it be completed as soon as possible since this information is required for assessing whether the negligible and low action levels are met. This work could be done in conjunction with the risk assessment required to set significance thresholds, noted above

5.9 AANDC Comments on AEMP Sections 6 and 7 (V)

- Fisheries Metrices - Metals in Edible Fish Tissue, 75% of normal range
  - AANDC recommends that additional detail be provided on the sample size that would trigger the action level - similar to those outlined for water quality

5.9 AANDC Comments on AEMP Sections 6 and 7 (VI)

- Plankton
  - Table 6.4.2 - Neglibible level for plankton references "no persistent decline" however Low Action Level simply references "a decline". "Persistent" should be added under Low Action Level to ensure consistent wording

5.9 AANDC Comments on AEMP Sections 6 and 7 (VII)

- Proposed Action Levels - Nutrient Enrichment, Table 6.4-3
  - The Comments/Rationale section states that "Comparisons to new predictions will be made; however, the comparisons to the EAR predictions will be the focus." The meaning of this statement is not clear - i.e. AANDC would have expected DeBeers would replace old predictions with new predictions, but this statement seems to imply that old predictions would still be considered? AANDC recommends the Board obtain clarity on the intent of this statement

5.9 AANDC Comments on AEMP Sections 6 and 7 (VIII)

- Weight of Evidence Approach
  - While Section 7.0 is very detailed, application and linkages to the AEMP monitoring results remain theoretical. It was not clear to AANDC how the weight of evidence approach would be used to influence decision making related to triggered action levels. AANDC recommends that the specific details of applying the WOE approach be reviewed on a case-by-case basis if and when it is implemented

5.10 ENR Comments on AEMP Sections 6 and 7 (I)

- Nutrient Enrichment Action Levels
  - The proponent routinely tests in the AEMP program for all macronutrients within Snap Lake. With the absence of a benchmark, temporal and spatial trend analysis should be the primary method for action level triggers until such time as a benchmark is established. Due to the effect of macronutrients on the benthic and invertebrate communities, any trending would indicate an early warning prior to higher level trophic affects. Please consider a revision of the nutrient enrichment action level to have a pre-warning for all macronutrients

5.10 ENR Comments on AEMP Sections 6 and 7 (II)

- Nutrient Enrichment Action Levels
  - The proponent must define a maximum acceptable nutrient increase as per the Environmental Assessment Report (EAR). This level should be set as the maximum acceptable level allowed over the lifespan of the mine. The AEMP response plan should allow for minimal increases as indicated in the current document but this must reflect the long term cumulative effects of the mine. Action thresholds should be based upon a lower level based upon a yearly allowable average. If an increase is seen within a 3-year period this may indicate a greater problem compared to a 10-year temporal trend, as it is dependent on where the project is in the mine life cycle

5.10 ENR Comments on AEMP Sections 6 and 7 (III)

- Toxicological Impairment Action Levels
  - The proponent must define what it considers a “statistically significant difference” and include it within its action levels
  - The proponent must define “downward trend” and indicate within the response framework threshold values for each action level

5.10 ENR Comments on AEMP Sections 6 and 7 (IV)

- Fish Health and Fish Community
  - Please clarify and identify how the proponent intends to account for spatial trending away from the Site when analyzing the entire fish population. If fish are exposed and show elevated chemical parameters close to the Mine it may indicate an early warning for further impacts. A spatial component of the analysis should be considered even if 50% of the population were below DLs
  - Please indicate how the mercury analysis will differ and how thresholds are established to meet the response framework
  - Please clarify and provide further information as to what the proponent will consider as a statistically significant difference. This should also be highlighted in the action levels

5.10 ENR Comments on AEMP Sections 6 and 7 (V)

- Suggested Types of Actions to be Taken if an Action Level is Exceeded
  - The proponent's action levels appear (as written) to attempt to alter threshold levels and conduct studies once a trigger is hit. If the Mine is impacting the environment the proponent must commit to altering processes and minimizing impacts to the environment

5.10 ENR Comments on AEMP Sections 6 and 7 (VI)

- Suggested Types of Actions to be Taken if an Action Level is Exceeded
  - The first response, after an impact has been shown to be altering the aquatic environment, is to identify the mine practice that has caused the impact and determine a solution to reduce or mitigate the impact into the future. While the studies and increased monitoring frequency are required, the proponent must commit to altering mine processes in the event of an impact. Action levels should be set and be based on sound scientific principals and should only be altered through Board and regulatory approval or upon further study over the course of AEMP monitoring as a refinement. All changes should be completed as further information is gained prior to reaching an impacted state. Action levels should be determined prior to ever reaching an upper threshold (medium/high) level. This should not be a goal of t process once a trigger occurs

5.10 ENR Comments on AEMP Sections 6 and 7 (VII)

- Priority Weighting-Field vs. Laboratory Analysis
  - The proponent indicates that the field-based effect studies should be weighted higher than laboratory and chemistry based analysis due to laboratory analysis being more conservative
    - This may be an inappropriate statement as the goal of the AEMP is to take a conservative approach and ensure that the aquatic environment is protected.

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (I)

- AANDC is concerned that the Water Quality Objective for Strontium proposed by De Beers will not adequately protect the aquatic ecosystem in Snap Lake from long term chronic impacts
  - De Beers calculation does not adequately reflect the most likely impact mechanism or temporal scale for Strontium
    - More focus to be on the presence of skeletal deformities
    - Longer period to be covered

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (II)

- It is understood that increased Calcium concentrations in Snap Lake may provide some protection to the aquatic ecology, but additional work is required to determine whether a Calcium:Strontium ratio exists that will provide adequate protection to all exposure/receptors in fish

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (III)

- Given the documented information regarding the potential impacts of elevated strontium in a northern ecosystem, AANDC does not support De Beers request to replace the report required under Part F, Section 15 of the Water Licence with the proposed Strontium benchmark of 14,130 µg/L
- AANDC further recommends that additional studies, specifically designed to identify long term impacts to bony tissues in fish, as required before a suitable Strontium response plan can be developed for Snap Lake

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (IV)

- AANDC requests clarification on the extent of the modification to Schedule 5, Item 2. AANDC request clarification on the implementation of any proposed Benchmark in the larger context of the Aquatic Effects Monitoring Plan
- Similar to water quality, AANDC recommends that De Beers provide information on potential sediment trends for strontium to compare with any potential action levels within the AEMP

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (V)

- Given the presence of elevated strontium concentrations and similarities between study species in Moiseenko and Kudryavtseva (2001) and Snap Lake, AANDC recommends that additional studies be undertaken to determine if similar effects to whitefish are present at Snap Lake. Note this assessment can not be completed by testing fish tissue concentrations only. While AANDC appreciates that calcium content in water may reduce the impacts of strontium, field verification of this assumption should be conducted

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (VI)

- Although, in part, WQOs may be derived using toxicity test results, AANDC is concerned that potential impacts resulting from the concentration and spatial extent of strontium concentrations in Snap Lake may not be accurately captured by the toxicity testing referenced by De Beers. While species at Snap Lake may be exposed to a lower concentration than those outlined in the results of the toxicity studies, the exposure time is much longer in Snap Lake. AANDC recommends that field studies be implemented to verify predictions regarding impacts to aquatic species, including but not limited to whitefish

5.11 AANDC Comments on De Beers Request on Strontium Response Plan (VII)

- There appears to be inconsistencies throughout the report regarding recent toxicity studies relating to rainbow trout. Section 5.0 details survival during acute toxicity tests (LC10, 20 and 50) whereas the corresponding Table 2 denotes the toxicity test as chronic testing (EC10, 20 and 50). A summary table (Table 6) again lists the testing as acute (LC10). AANDC requests clarification regarding the toxicity testing regarding rainbow trout conducted by Nautilus in 2013

5.12 ENR Comments on De Beers Request on Strontium Response Plan (I)

- ENR commends DeBeers on the research conducted to verify the critical effect benchmark (CEB) for strontium at the Snap Lake Mine. ENR recommends that the strontium critical effect benchmark be included in the Sites AEMP as an item that is monitored

5.12 ENR Comments on De Beers Request on Strontium Response Plan (II)

- The CEB should be set as a maximum concentration that should not be exceeded. An action response framework should be established for strontium levels below the CEB. ENR notes that there is evidence of an increased rate of strontium deposition based upon the increased anticipated deposition into Snap Lake, 1,600 ppb as defined in the EA compared to the current model of 3,100 ppb. By developing action levels below the CEB this will ensure that Snap Lake Mine is protected and that operational change occur prior to any lasting impacts associated with mining effluent. While an increase in strontium concentrations was predicted in the EA, biological function may be impacted regardless of the predicted increase. If strontium is shown to be causing impacts due to mine related effluent, regardless of the EA prediction, an action plan should be enacted to protect Snap Lake

5.12 ENR Comments on De Beers Request on Strontium Response Plan (III)

- ENR notes that DeBeers should still complete the Strontium Response Plan defined in the water license under Schedule 5, Part F, Item 2 subsections a, b and d, as it will allow for the development of action items in advance of a mine effect from strontium being observed

5.13 EC Comments on De Beers Request on Strontium Response Plan (I)

- EC notes that the development of a CEB for Snap Lake takes into account a reasonable range of aquatic species and the methodology appears to follow accepted standards. However, EC further notes that the proposed CEB is greater than 900x the background / baseline concentration of strontium in Snap Lake. The resident aquatic species have historically been exposed to background concentrations of <15 µg/L strontium
  - The laboratory test species are surrogates for the native species in Snap Lake, and it is not known whether they are comparable in sensitivity. EC recommends that the Proponent monitor receiving environment concentrations in water and sediments and evaluate any changes to or effects on resident species in the annual AEMP report

5.13 EC Comments on De Beers Request on Strontium Response Plan (II)

- EC recommends that the Proponent evaluate whether sediment concentrations in Snap Lake could potentially reach levels of concern
- Schedule 5, Item 2a) of the Water Licence requires that the Strontium Response Plan include a quantitative description of strontium sources and forms of strontium in the effluent stream from different mine activities. EC notes that the April 9, 2013, report Development of Strontium Benchmark for Aquatic Life for the Snap Lake Mine does not include this information, and it does not appear to be provided elsewhere.
  - EC recommends that item 2a) be retained in Schedule 5

5.13 EC Comments on De Beers Request on Strontium Response Plan (III)

- Item 2b) requires that the Strontium Response Plan include a review of potential mitigation and treatment technology to establish the feasibility and costs of reducing strontium loading to Snap Lake from the Project
  - EC is of the opinion that it would be premature to remove item 2b) from Schedule 5 at this time. EC recommends that the timeframe for this requirement be extended, with the review to be done when/if warranted by increasing strontium concentrations or by environmental changes

5.13 EC Comments on De Beers Request on Strontium Response Plan (IV)

- Item 2d) requires that the Strontium Response Plan include recommendations for further actions to be taken in response to increasing levels of strontium in Snap Lake and a timeline for implementation
  - EC recommends that item 2d) of Schedule 5 be revised to read: "If warranted by increasing levels of strontium, recommendations for further actions to be taken in response to increasing levels of strontium in Snap Lake and a timeline for implementation."

5.13 EC Comments on De Beers Request on Strontium Response Plan (V)

- Strontium is reactive in water. The summary of strontium concentration measurements in Snap Lake would benefit from a discussion of the current and predicted future speciation of this chemical in the lake, taking into account any toxicity modifying factors
  - EC recommends that the Proponent expand the discussion of this section to include information regarding the speciation of strontium in Snap Lake under both current and predicted future conditions

5.13 EC Comments on De Beers Request on Strontium Response Plan (VI)

- EC notes that the water licence requirements include chronic toxicity tests (using rainbow trout early life stages, Ceriodaphnia, and algal species) on effluent and at the edge of the mixing zone. Ongoing review of these test results will help to address uncertainty regarding the effects of mixtures of contaminants and in the receiving environment. EC recommends that if test results consistently show any chronic effects, further study be undertaken

6. Agency's Activities

- SLEMA Environmental Analyst observed the 2013 Fish Tasting Event on site on September 12, 2013
- SLEMA Core Group Meeting held on September 20

7. SLEMA Reviews

- Follow Up to Starter Cell Raise Request
- De Beers request to remove Strontium Response Plan Requirement
  - Development of Strontium Benchmark for Aquatic Life for the Snap Lake Mine
- Revised Version of the Acid/Alkaline Rock Drainage and Geochemical Characterization Plan

7.1Technical Memo for SLEMA Board on "Follow Up to Starter Cell Raise Request"

- "Follow Up to Starter Cell Raise Request" Submitted by De Beers on August 30, 2013
  - This is a follow-up to the letter from the MVLWB on July 18, 2013 informing De Beers that an amendment was required for the Phase IV Starter Cell Embankment Raise

Follow Up to Starter Cell Raise Request

- De Beers provided further information to address the MVLWB's concerns
  - Clarification on the height requirements defined during Environmental Assessment
  - Geotechnical Memorandum on considerations for seepage and stability
  - Technical Memorandum on Current and Plan Paste Research Initiatives
  - Interim North Pile As-Built Drawings
  - Engagement Plan – Current and Planned
  - Short and Long-Term Plans for the North Pile

Current Status – Height of North Pile

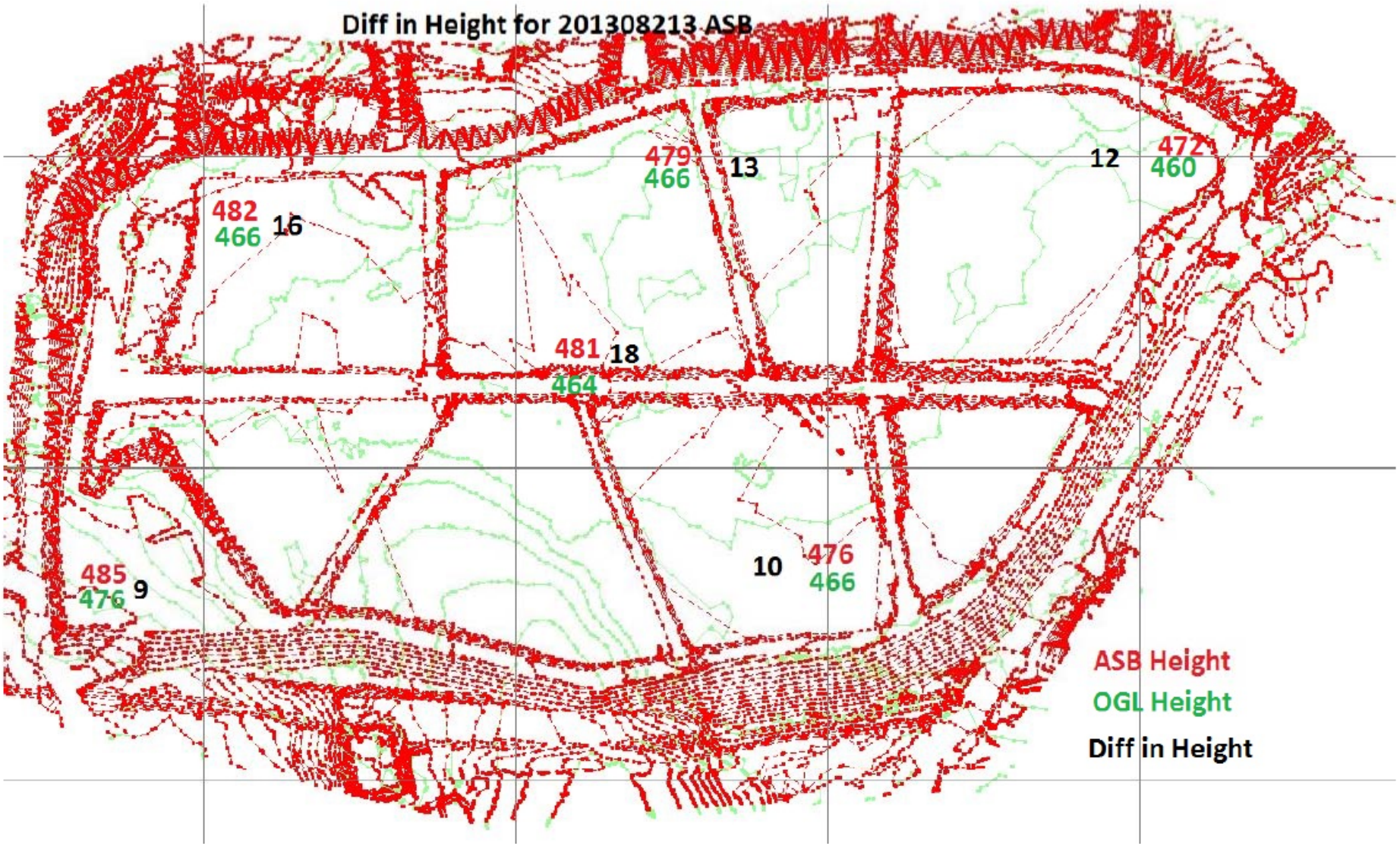
	South West	North West	North Centre	North East	South East	Centre
As-Built (ASB) Height (masl) (surveyed)	482	479	472	476	485	482
Ground Level (OGL) Height (masl) (surveyed)	***466***	***466***	***460***	***466***	***476***	***464***
Difference in Height (m)	**16**	**13**	**12**	**10**	**9**	**18**

EA Assumption - Ground Level Elevations in North Pile of 450 masl measured from topographic maps not surveyed data (450 masl + 34 m = 484 masl)

Surveyed Data – Ground Level Elevation in North Pile ranges from 460-476 masl

Surveyed Data - Current Heights in North Pile ranges from 9 – 18 m above the Ground Level Elevation

Difference in Height (Surveyed Data for the Starter Cell)



De Beers Claim (I)

- The crest elevation mentioned is based on a topographic map point of 450m. Surveyed details later revealed that there were multiple elevations throughout the area. As from the MVEIRB decision report the 35 m requirement is the operational and regulatory requirement

De Beers Claim (II)

- The operational height requirement as identified by De Beers and approved by MVEIRB in the decision report of 35 m is the height requirements needed for the North Pile design and operation. The MVEIRB Decision Report indicates that a modification request to raise the starter cell embankments in the North Pile facility as defined in the Phase IV Report is within the project scope and therefore should not be subject to a preliminary screening

Communication with De Beers

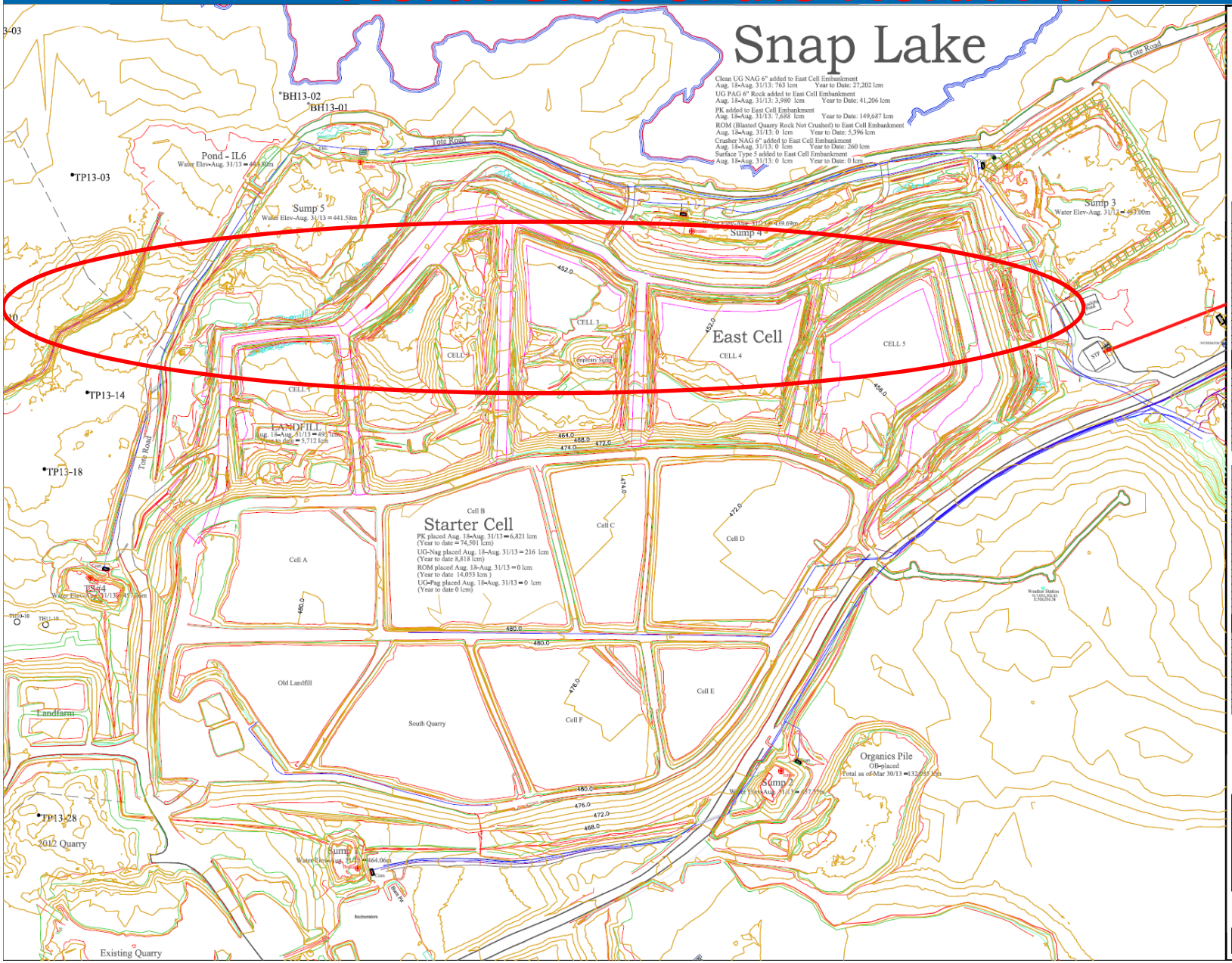
- Via e-mail dated September 9, 2013
  - The statement “Ground Level Elevation in North Pile ranges from 460-476 masl” seems misguiding readers. Those data refer to the Starter Cell, the southern part of the North Pile
  - Starter Cell ground level does not represent the ground level of the north Side of the North Pile
  - The ground level elevation in the East Cell should be lower than that in the Starter Cell

Height Requirements defined during Environmental Assessment

- Environmental Assessment Report (Page 3-18)
  - *"At the end of operation, the north pile will have a **maximum height of approximately 34 m (crest elevation 484 m)**. At this elevation, the pile will be approximately the same height as the highest point of natural ground in the immediate area of the project site"*
- Report of Environmental Assessment and Reasons for Decision on the De Beers Canada Mining Inc. Snap Lake Diamond Project (MVEIRB July 24, 2003)
  - "*The maximum height of the North Pile is designed to be approximately **35 m**. This maximum pile height will be reached primarily on **the north side of the North Pile***" (Section 2.3; page 40)

August 31, 2013 Surface Status Map

North Side of the North Pile



DeBeers Snap Lake
Diamond Mine
General Surface Plan
Scale: 1:2500(metric)

N

Grid North- Local

UTM Surface Control

Surface Control Stations

Point #	Northing	Easting	Elevation	Description
100001AEL	7,052,975.023	506,400.678	453.539	AEL Original Control
100003AEL	7,053,163.881	506,675.305	461.737	AEL Original Control
100006CLS	7,052,959.094	506,743.269	466.003	By Comm Modules
1030SAS	7,052,364.711	506,395.999	458.330	On Hill West Dam1
Nmpe001	7,052,639.132	506,714.268	461.004	On Nmpe001
1031SAS			452.549	On Dam1
SAS-AEL-1061	7,052,114.187	504,660.607	477.531	
DH03	7,052,592.386	506,121.495	468.675	South Cell Control
DH10	7,052,500.736	506,891.655	469.295	South Cell Control
DH04	7,052,219.401	505,191.645	480.728	South Cell Control
DH05	7,052,436.889	504,962.632	478.554	South Cell Control
DH07	7,052,692.858	505,175.793	460.494	South Cell Control
DH08	7,053,639.586	505,393.647	469.543	South Cell Control
DH09	7,053,749.138	505,636.679	455.725	South Cell Control
DH02	7,052,685.454	505,894.510	458.521	South Cell Control
DH01	7,052,859.008	506,543.102	458.611	South Cell Control

Surface Parameters WGS84

Calibration Horizontal Adjustment

Translation North: 13.132m	Origin North: 7052597.750m
Translation East: 1.134m	Origin East: 505790.415m
Rotation: 00° 00' 02.08232"	Scale Factor: 0.99999013

Calibration Vertical Adjustment

Constant Adjustment: 10.756m	Origin North: 7052959.087
Slope North: -13.314ppm	Origin East: 506743.275
Slope East: 0.397ppm	

Geoid Model: GSD95

Underground Co-ordinates

Surface Co-ords

Point	Northing	Easting	Elev.	Description
100001AEL	7,052,975.023	506,400.678	453.549	AEL Original Control
100003AEL	7,053,163.867	506,675.311	461.727	AEL Original Control
TP2	7,052,972.970	506,713.361	467.155	Temp nail in ground
TP1B	7,053,163.641	506,514.950	453.120	Temp nail in ground
UG-1 (S-1)	7,052,997.974	506,645.102	461.047	HilN Nail in Conc
UG-2 (S-2)	7,052,988.516	506,582.567	459.384	HilN Nail in Conc

Under Ground Co-ords

Point	Northing	Easting	Elev.	Description
100001AEL	7,052,975.101	506,400.513	453.560	AEL Original Control
100003AEL	7,053,163.939	506,675.316	461.763	AEL Original Control
TP2	7,052,972.936	506,713.323	467.197	Temp nail in ground
TP1B	7,053,163.753	506,514.897	453.152	Temp nail in ground
UG-1 (S-1)	7,052,997.971	506,645.049	461.058	HilN Nail in Conc
UG-2 (S-2)	7,052,988.531	506,582.479	459.384	HilN Nail in Conc

Underground Parameters

Translate Underground to Surface

Calibration Horizontal Adjustment

Translation North: 0.040m	Origin North: 7,052,988.516
Translation East: -0.065m	Origin East: 506,582.567
Rotation:000°-01'-08"	Scale Factor: 1.00042101

Calibration Vertical Adjustment

Constant Adjustment: 0.017m	Origin North:7,052,988.516
Slope North: 85.164ppm	Origin East:506,582.567
Slope East: 63.532mp	

Geoid Model: GSD95

DeBeers Snap Lake
Bi-Weekly Surface Status Map

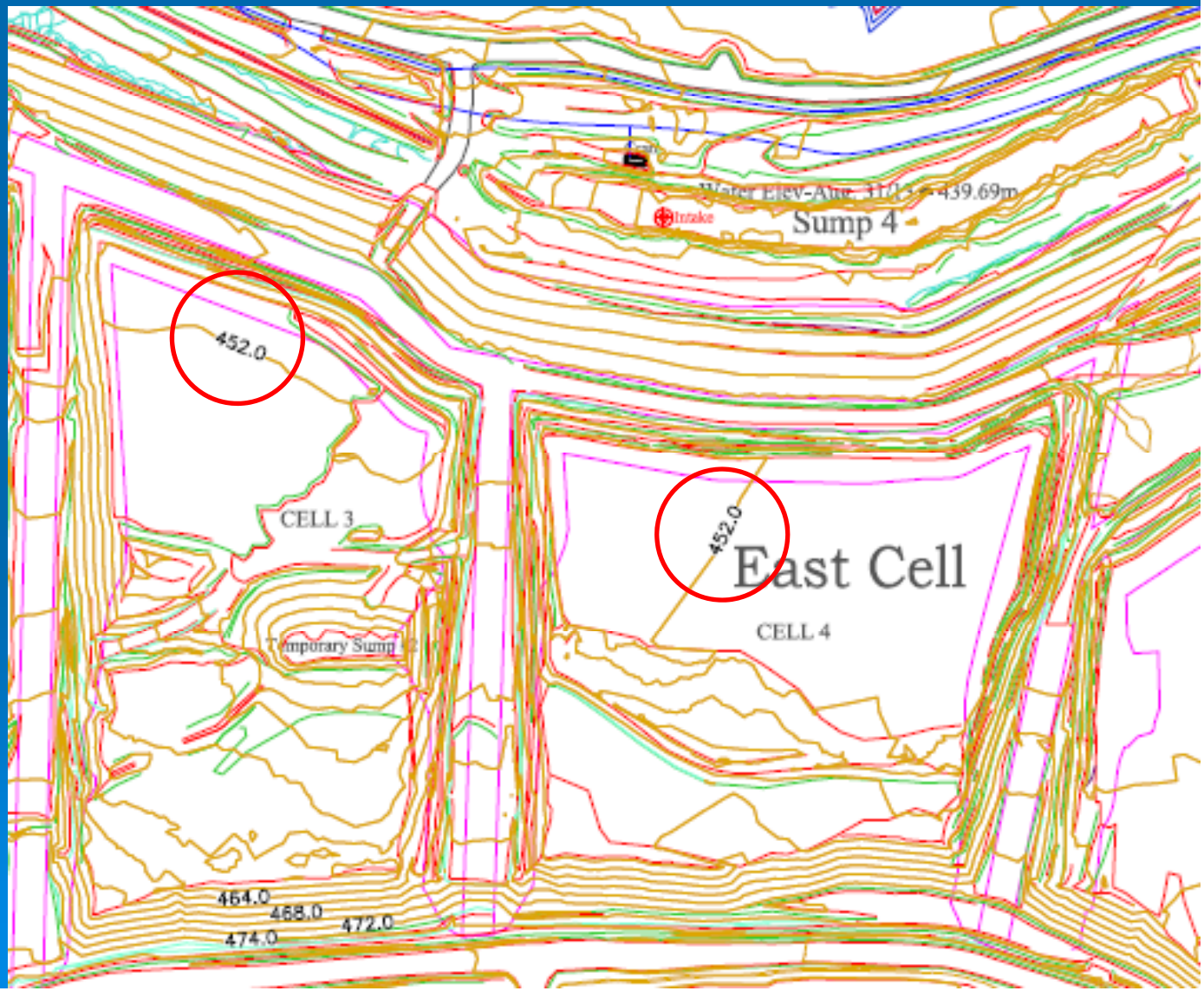
Legend

Date: August 31 - 2013

Dwg File:

East Cell Surface Status (Cell 3&4)

Ground level elevations within the footprint of the East Cell range from 450 to 460 meters above sea level (MASL), and the north side ground level is around 450 MASL



Current Status – Height of North Pile (Starter Cell)

	South West	North West	North Centre	North East	South East	Centre
As-Built (ASB) Height (masl) (surveyed)	482	479	472	476	485	482
Ground Level (OGL) Height (masl) (surveyed)	***466***	***466***	***460***	***466***	***476***	***464***
Difference in Height (m)	**16**	**13**	**12**	**10**	**9**	**18**

EA Assumption - Ground Level Elevations in North Pile of 450 masl measured from topographic maps not surveyed data (450 masl + 34 m = 484 masl)

Surveyed Data – Ground Level Elevation in North Pile ranges from 460-476 masl

Surveyed Data - Current Heights in North Pile ranges from 9 – 18 m above the Ground Level Elevation

Comments from the Environmental Analyst

- The follow up information is helpful to understand the operation of processed kimberlite deposition and the North Pile status
- The EA assumption stands. The height requirements during the Environmental Assessment are
  - Maximum height of approximately 34 m (crest elevation 484 m)
- De Beers claim on the North Pile operational and regulatory requirements – 35 meters (pile height) is questionable
- MVLWB's conclusion dated July 18, 2013 is supported
  - The Phase IV Raise is not a modification but an amendment, and it would be subject to a preliminary screening

7.2 De Beers request to remove Strontium Response Plan Requirement

- Water Licence requires that De Beers submit a Strontium Response Plan by December 31, 2013
- De Beers requested on August 21 that the MVLWB change the requirements to include only a suggested Benchmark to be monitored under the AEMP

Strontium

- A chemical element with symbol **Sr** and atomic number 38. An alkaline earth metal, strontium is a soft silver-white or yellowish metallic element that is highly reactive chemically. The metal turns yellow when it is exposed to air. Strontium has physical and chemical properties similar to those of its two neighbors calcium and barium. It occurs naturally in the minerals celestine and strontianite
- Strontium compounds are today mostly used for the production of cathode ray tubes for televisions. The displacement of cathode ray tubes by other display methods in television sets is changing strontium's [illegible] consumption
  - http://en.wikipedia.org/wiki/Strontium

Effect on the human body

- The human body absorbs strontium as if it were calcium
- The ratio of strontium to calcium in human bones is between 1:1000 and 1:2000 roughly in the same range like in the blood serum
- Due to the chemical similarity of the elements, the stable forms of strontium might not pose a significant health threat – in fact, the levels found naturally may actually be beneficial – but the radioactive ^{90}Sr can lead to various bone disorders and diseases, including bone cancer
- The drug strontium ranelate, made by combining strontium with ranelic acid, was found to aid bone growth, increase bone density, and lessen vertebral, peripheral, and hip fractures

Strontium at the Mine

- Strontium is present in the kimberlite and processed kimberlite. Due to mining, Strontium concentrations have been increasing since mine development in 2005

Year	2004	2006	2011	2013	2030
@Treated effluent, µg/L		4,320	1,500	1,200-2,200	3,100
@Lake, µg/L	<15		500	500-900	1,600

Guidelines for Strontium

- No national water quality guidelines for strontium for protection of freshwater aquatic life in Canada or the United States
- No benchmark established during the Environmental Asssessment
- Ecometrix proposed 500 µg/L as both a water quality objective (WQO) and an effluent quality criterion (EQC)
  - Made no allowance for effluent mixing
  - De Beers claimed it was calculated based on potentially flawed data

Available Toxicity Data for Strontium

Data Range for Acute Toxicity, µg/L	75,000-15,000,000
Data Range for Chronic Toxicity, µg/L	>11,000

- Calcium and Strontium share many common pathways; Strontium uptake and toxicity decrease as Calcium concentrations increase
  - This was evident in the results reported by Nautilus for Rainbow Trout ELS tests at two different water hardnesses; Strontium w
    less toxic at the higher hardness

Proposed Chronic Effects Benchmark (CEB)

- 14,130 µg/L is recommended for Strontium in Snap Lake
- The burden of evidence (tissue burdens of strontium in Snap Lake and reference lake fish; toxicology of Strontium) does not indicate that there is a present or future risk of Strontium toxicity to the aquatic biota of Snap Lake

Comments from the Environmental Analyst

- The elevated Strontium levels in Snap Lake is a concern
  - Current levels in Snap Lake is around one hundred times more than the baseline lake-wide mean concentrations
  - The long term impacts of the elevated Strontium levels to aquatic ecosystem are unclear
- AANDC made great comments
  - It is supported that AANDC does not support De Beers request and additional special study is required

7.3 Revised Version of the Acid/Alkaline Rock Drainage and Geochemical Characterization Plan

- The ARD Plan was revised in August 2013 to allow for the use of non acid generating clean granite from the underground with less than 5% kimberlite content to be used in the construction of embankments within the North Pile
- A section was added in September 2013 with the revision history to reflect the changes after MVLWB staff requeste changes to be highlighted

Background

- Current ARD Plan was submitted by De Beers in January 2013 and was approved by the MVLWB in April
  - Non-potentially acid generating (Non-AG) - containing less than 0.17% sulphur
- SLEMA Environmental Analyst reviewed it in February 2013 (Section 7.3)
  - http://www.slema.ca/wp-content/uploads/2013/02/February-2013-Environmental-Update2.pdf

Communication with De Beers (I)

- Dated September 30, 2013
  - Requesting how Beers defines “small” or “minor” amounts of Kimberlite, PK or metavolcanic rock within the diluted granite
    - De Beers replied that “small” and “minor” are used interchangeably, representing <5% overall content
  - Requesting whether ARD testing will be conducted to confirm the lower than 0.17% of sulphur content for every batch of diluted granite or metavolcanic rocks before they are used for construction on site?
    - De Beers replied that 8 samples per 100,000 tonnes mined are taken, total samples to be collected during 2013 is 90, and that has demonstrated to be efficient at characterizin rock over the last several years

Communication with De Beers (II)

- In the cover letter dated August 26, 2013, it is stated that “(t)he ARD Plan has been revised in August 2013 to allow for the use of non acid generating clean granite from the underground with less than 5% kimberlite content to be used in the construction of embankments within the North Pile”. However, page 23, one sentence is added into the first bullet of last paragraph, and it allows granite with diluted kimberlite **and metavolcanic rock** to be used as **general construction materials on site.** There is inconsistency here. Clarification is requested
  - De Beers replied that if the metavolcanic is non acid generated (sulphur content less than 0.17%) then it shouldn’t be an issue and the two sentences align

Comments from the Environmental Analyst

- There is no concerns on granite with diluted kimberlite to be used as general construction materials on site if sulphur content is less than 0.17%. However, it should be cautious to use granite with diluted metavolcanic rock as general construction materials on site