1. Purpose/Report Summary

The purpose of this Report is to present to the Mackenzie Valley Land and Water Board (MVLWB/the Board) a Technical Memo from the Engineer of Record at the Snap Lake Mine (Technical Memo) submitted by De Beers Canada Inc. (De Beers) in support of zero occupancy periods on site as described in the Extended Care and Maintenance Plan, Version 3, and associated management plans. The Extended Care and Maintenance Plan is submitted under Section 7.0 of the Interim Closure and Reclamation Plan, which is required by Part I, condition 1 of Licence MV2011L2-0004.

2. Background

- February 22, 2018 – Decision on Extended Care and Maintenance Plan V.2 deferred; Board requested additional information on remote technology;
- March 13, 2018 – Extended Care and Maintenance Plan V.3 and associated management plans received;
- April 12, 2018 – Board Decision Letter on the North Pile Management Plan requesting a report from the Engineer of Record on inspection frequency;
- June 11, 2018 – Technical Memo received;
- June 27, 2018 – Technical Memo review commenced;
- July 17, 2018 – Reviewer comments and recommendations due and received;
- July 23, 2018 – Responses due and received; and
- August 16, 2018 – Technical Memo presented to the Board for decision.

3. Discussion

Submission Description

1. Extended Care and Maintenance Plan

On December 14, 2017, De Beers submitted an updated Extended Care and Maintenance Plan, Version 2 (ECMP V2), and associated management plans for Board approval. The ECMP is submitted under Section 7.0 of the Interim Closure and Reclamation Plan, which is required under Part I,
condition 1 of Licence MV2011L2-0004, and Condition 71 of Permit MV2017D0032. The previously approved ECMP Version 1.1 was approved by the Board on June 22, 2016, with the requirement that any changes or updates, including proposals for passive treatment, as well as a shift to ‘remote monitoring’, would require resubmission of the plan for approval by the Board. Therefore, the ECMP was revised and resubmitted to the Board as ECMP V2.

On February 22, 2018, the Board decided to defer making a decision on the ECMP V2 and associated management plans because Condition 52 of Permit MV2017D0032 required daily examinations of all Fuel Storage Containers and Tanks, which did not align with monthly site visits during periods of zero occupancy, as described in the ECMP V2. The Board also required a list of updates to the ECMP V2 based on a variety of reviewer comments. To address reviewer comments, De Beers submitted an updated Extended Care and Maintenance Plan, Version 3 (ECMP V3), and associated management plans on March 13, 2018 (attached).

On June 20, 2018 the Board amended Condition 52 to a frequency of ‘monthly’ examinations of all Fuel Storage Containers and Tanks during periods of zero occupancy. With this amendment issuance letter, the Board also approved the ECMP V3, and associated management plans under the Permit authorization only. The Board has not yet approved the ECMP V3 under the Licence MV2011L2-0004 authorization because of Licence condition ‘Part E, condition 5’, states:

"The Licensee shall maintain all structures designed to contain, withhold, retain, or divert Water or Waste in a manner consistent with the Geotechnical Engineering Report referred to in Part D, item 11 of this Licence, the geotechnical and geochemical reports referred to in Part E, item 3, the approved North Pile Management Plan referred to in Part E, item 7, and the approved Acid Rock Drainage and Geochemical Characterization Plan referred to in Part E, item 10 so as to prevent the escape of Waste. Weekly inspections of these structures shall be conducted, and the records of these inspections shall be kept for review as requested by an Inspector. The Licensee shall perform more frequent inspections at the request of an Inspector."

Before approving the ECMP V3 under the Licence authorization, De Beers had to provide evidence to the Board from the Engineer of Record that: a) a frequency of monthly in-person inspections, and b) the use of remote technology for the required weekly inspections, is sufficient for all structures designed to contain, withhold, retain, or divert Water or Waste.

As such, this evidence was provided in the form of a two-part Technical Memo from De Beers on June 11, 2018 (attached) to support the ECMP V3 and associated management plans.

2. Technical Memo – To support the Extended Care and Maintenance Plan, Version 3

As outlined above, the Technical Memo was submitted to the Board in support of zero-occupancy periods at Snap Lake Mine as described in the ECMP V3, and associated management plans. This Technical Memo submission presents recommendations from the Engineer of Record on performance monitoring instrumentation and monitoring frequency for extended care and maintenance at the North Pile facility, the Water Management Pond dams, and perimeter sumps. The Technical Memo submission also presents a response framework recommended by the Engineer of Record. The response framework includes quantitative performance objectives for the North Pile and the Water Management Pond dams, which are a series of threshold values (upper bound) of four categories from normal to out of compliance situations. Threshold values are provided for engineering criteria for four situations: normal, concern, buffer, and unsafe or out of compliance.
The Engineer of Record has recommended monthly and quarterly monitoring frequencies for the North Pile, Water Management Pond dams, and sumps, as long as all the recommendations and criteria as specified in the Technical Memo submission are adhered to by De Beers.

4. Comments

On April 12, 2018, the Board approved the 2018 North Pile Management Plan (2018 NPMP) on an interim basis and required a variety of updates based on reviewer comments with confirmation of conformity to be determined by Board staff. In that same April 12, 2018 decision letter, the Board required that De Beers submit a report, for approval, from the Engineer of Record confirming that a reduction in inspection frequency to monthly is suitable and include appropriate rationale, prior to implementation. Therefore, this Technical Memo submission is also meant to address this request from the Board and is for Board approval.

5. Reviewer Comments

By July 17, 2018, comments and recommendations on the Technical Memo were received from 3 reviewers:

- Government of the Northwest Territories – Environment and Natural Resources (GNWT-ENR);
- Government of the Northwest Territories – Department of Lands (GNWT-Lands) Inspector; and
- Snap Lake Environmental Monitoring Agency (SLEMA).

De Beers responded on July 23, 2018. The Review Summary and Attachments (attached) presents the concerns identified through this review.

Environment and Climate Change Canada (ECCC) also submitted 1 review comment after the due date on Friday July 20, 2018. As such, De Beers did not provide a response.

The following summarizes the main issues raised during the review:

GNWT-ENR comment-4 noted that the Technical Memo refers to monitoring frequencies of monthly or quarterly, when the Licence requires weekly inspections of all structures designed to contain, withhold, retain or divert water or waste. GNWT-ENR recommended that the proposed monitoring frequency must align with the conditions of the Water Licence. De Beers responded that they are monitoring these structures through installed instrumentation and remote cameras which collect observations continually and provide that information via satellite feed. De Beers stated that this monitoring is occurring more frequently than weekly, and therefore the Licence condition is met.

The GNWT-ENR requested further information from De Beers on how the remote visual observation techniques are capable of detecting the thresholds identified in the Technical Memo (GNWT-ENR comment-1). Similar to this, the GNWT-Lands Inspector commented (GNWT-Lands comment-3 and -4), asking De Beers to identify what reporting mechanism will be in place so that the Inspector and other stakeholders will be able to ensure the recommendations made by the Engineer of Record are being followed, and that Permit and Licence conditions are being met during periods of zero occupancy. In order to address these concerns, the Board could require De Beers to submit monthly remote monitoring reports indicating how De Beers met the recommendations of the Engineer of Record, and how weekly inspections referred to in Part E, condition 5 of Licence MV2011L2-0004 were conducted. This would allow stakeholders and the inspector to be assured that the recommendations made by the Engineer of Record in the Technical Memo, and the Permit and
Licence conditions, are being met. These monthly reports could also highlight any issues detected and any management responses taken. These reports could be submitted with the Surveillance Network Program (SNP) monthly report, or as a separate submission that follows the same reporting schedule as the SNP reports.

The Board could also request that as part of the Annual Water Licence Report submission, required by Part B, condition 7 of Licence MV2011L2-0004, De Beers submit a summary of remote monitoring activities, including which technology proved to be most effective and will continue to be used in the future. The Board could also remind De Beers that any new remote monitoring technology not recommended by the Engineer of Record in the June 11, 2018 Technical Memo should be submitted for review and Board approval.

6. Security

The GNWT currently holds $60,401,918.00 in reclamation liability security for the Snap Lake Mine under both the Permit (MV2017D0032) and Licence (MV2011L2-0004) authorizations.

As per the Board’s June 20, 2018 decisions on security, security under Licence MV2011L2-0004 is now set at $27,844,664.00 and under Permit MV2017D0032 at $51,118,424.00. De Beers is required to update the amount of security posted with the GNWT 90 days from the Board’s June 20, 2018 decision letter, which is by September 18, 2018. At that time the GNWT will hold $78,963,088.00 in reclamation liability security for the Snap Lake Mine under both authorizations.

7. Conclusion

Board staff conclude that as long as all of the recommendations as described in the Engineer of Record’s Technical Memo are followed, and all Licence and Permit conditions are adhered to, all reviewer concerns should be addressed.

8. Recommendation

Board staff request the Board consider accepting the late review comment from ECCC.

Board staff recommend the Board:

a) Make a motion to approve the Technical Memo submitted June 11, 2018 as directed by the Board on April 12, 2018, and to support the Extended Care and Maintenance Plan, Version 3; and

b) Make a motion to approve the Extended Care and Maintenance Plan, Version 3, and associated management plans submitted March 13, 2018 under Section 7.0 of the ICRP which is required by Part I, condition 1 of Licence MV2011L2-0004. The associated management plans include:

- Waste Management Plan for Extended Care and Maintenance, Version 3;
- Water Management Plan for Extended Care and Maintenance, Version 3;
- Spill Contingency Plan for Extended Care and Maintenance, Version 3; and

A draft decision letter is attached.
Board staff recommend including the following text in the decision letter:

- De Beers shall submit monthly remote monitoring reports indicating how De Beers has met the recommendations of the Engineer of Record, and how weekly inspections referred to in Part E, condition 5 of Licence MV2011L2-0004 were conducted. The monthly reports shall highlight any issues detected and any management responses taken. These reports could be submitted with the Surveillance Network Program (SNP) monthly report, or as a separate submission that follows the same reporting schedule as the SNP reports.
- The Board also requires, as part of the Annual Water Licence Report submission (Part B, condition 7 of Licence MV2011L2-0004), that De Beers submit a summary of remote monitoring activities, including which technologies proved to be most effective and will continue to be used in the future.
- The Board reminds De Beers that they shall adhere to all of the recommendations and requirements as described by the Engineer of Record in the June 11, 2018 Technical Memo, and all of the conditions outlined in Water Licence MV2011L2-0004 and Land use Permit MV2017D0032.
- The Board reminds De Beers that any new remote monitoring technology, not recommended by the Engineer of Record in the June 11, 2018 Technical Memo, should be submitted for review and Board approval.

9. Attachments
   - Technical Memo
   - ECMP V3
     - ECMP V3 – Waste Management Plan
     - ECMP V3 – Spill Contingency Plan
     - ECMP V3 – Water Management Plan
     - ECMP V2 – Emergency Response Plan
   - Review Summary and Attachments
   - Draft Decision Letter from the Board

Respectfully submitted,

Kierney Leach
Technical Regulatory Specialist
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<td>Proponent:</td>
<td>De Beers Canada Inc. - Snap Lake</td>
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<td>July 17, 2018</td>
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<tr>
<td>Proponent Responses Due By:</td>
<td>July 23, 2018</td>
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On June 12, 2018, De Beers Canada Inc. (De Beers) submitted a Technical Memo to the Board entitled, “Instrumentation and water level monitoring frequencies for the North Pile and Water Management Pond Dams during Extended Care and Maintenance.” As outlined in De Beers’ Extended Care and Maintenance Plans, De Beers has proposed monthly in-person site visits to Snap Lake during the winter months (also known as periods of zero-occupancy), rather than maintaining staff on site continuously all year.

De Beers’ Water Licence and Land Use Permit contain conditions that require inspections of a variety of features on site. For example, Part E, condition 5 of the Licence MV2011L2-0004 states:

> “The Licensee shall maintain all structures designed to contain, withhold, retain, or divert Water or Waste in a manner consistent with the Geotechnical Engineering Report referred to in Part D, item 11 of this Licence, the geotechnical and geochemical reports referred to in Part E, item 3, the approved North Pile Management Plan referred to in Part E, item 7, and the approved Acid Rock Drainage and Geochemical Characterization Plan referred to in Part E, item 10 so as to prevent the escape of Waste. Weekly inspections of these structures shall be conducted and the records of these inspections shall be kept for review as requested by an Inspector. The Licensee shall perform more frequent inspections at the request of an Inspector.”

De Beers’ Technical Memo indicates that the Engineer of Record, Jeffrey Kwok of Golder Associates Ltd. (Golder), has identified a list of recommendations for De Beers on the implementation of remote technologies and/or instrumentation to act as a surrogate to in-person inspections, to satisfy Licence and Permit inspection/monitoring requirements. Board staff are seeking input from reviewers on whether the proposed recommendations are a sufficient surrogate to in-person inspections, and any other comments or recommendations on the Technical Memo.

Reviewers are invited to submit questions, comments and recommendations using the Online Review System (ORS) on the Technical Memo by the review comment deadline specified below.
If you have any questions or comments regarding this Technical Memo or using the Online Review System, please contact Kierney Leach at 867-766-7470 or kleach@mvlwb.com.

### General Reviewer Information:

In addition to the email distribution list, the following organizations received review materials by fax:

- Northwest Territory Métis Nation - Tim Heron, NWTMN IMA Coordinator (867) 872-3586

### Contact Information:

Angela Love 867-766-7456  
Jen Potten 867-766-7468  
Kierney Leach 867-766-7470

### Comment Summary

#### Environment and Climate Change Canada: Gabriel Bernard-Lacaille

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<td>ECCC 1 - Recommended Inspections and Monitoring Frequency for North Pile and Water Management Pond during Times of Zero Occupancy at the Snap Lake Mine - Golder Recommendations</td>
<td>Comment <em>(Submitted after Due Date)</em> In the Technical Memo, one of the recommendations is to &quot;Carry out monthly visual inspections of the facilities and monitor the perimeter sumps and WMP (Water Management Ponds) water levels during the times of zero occupancy. Visual observations can be done on site, remotely, by drone or aerial flyover observations, or near real-time land-satellite imagery. ECCC notes that no choice of remote monitoring method was recommended. In addition, ECCC wonders how fast can De Beers Canada (the Proponent) respond to any issues if detected by the monitoring. Also, the area will be snow covered most of the year. How does the aerial monitoring detect issues under snow cover? Recommendation ECCC recommends that the Proponent clarify how any chosen aerial monitoring method can detect issues under snow cover and, if an issue is detected how fast can the</td>
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<td>Submitted after the due date. Late comments could be acknowledged by the Board.</td>
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Proponent respond to and mitigate any detected issues.

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<td>Topic 1: Remote Visual Observations - Scale</td>
<td><strong>Comment</strong> The technical memo submitted by De Beers recommends visual observations be carried out on site, remotely, by drone or aerial flyover observations, or near real-time land satellite imagery as a surrogate to in-person inspections. ENR notes in the Response Framework provided by Golder Associates, it is indicated in Table 1 Response Framework - North Pile Facility, that cracking of perimeter embankment crest and downstream slope less than or equal to 1.0 m depth and less than or equal to 25 mm width would trigger category yellow, concern situation. As well, according to Table 4 Response Framework - Water Management Pond Dams, cracking of dam crest and downstream slope with a depth less than 0.5 m and a width less than or equal to 25 mm would trigger category yellow, concern situation. It follows then that the remote visual observation techniques noted above must be capable of detecting changes at the scale listed in Table 1 and Table 4 (i.e. 25mm wide cracks). <strong>Recommendation</strong> 1) ENR recommends De Beers provide the scale to which the remote visual observation techniques listed above are capable of monitoring and confirm that the remote visual inspections will be able to accurately and precisely detect the thresholds for each category listed in Table 1. DeBeers should identify examples of other locations where this has been implemented successfully.</td>
<td><strong>July 23:</strong> To remain in compliance with the Engineer of Record’s recommendations regarding monitoring frequency of a zero occupancy camp, a camera will be installed at each of the water control structures and Water Management Pond to provide a minimum of monthly visual imagery of surface water levels. The images will be transmitted remotely, via satellite, to an offsite server to be accessible for De Beers’ employees. Further, to provide a clearer indication as to the water/ice level inside of the water control structures, staff gauges will be installed with color bands that indicate volume thresholds. Embankment monitoring will be carried out monthly during snow-free conditions until a remote system is trialed and proven and acceptable by the Engineer of Record.</td>
<td>Acceptable response. Board staff recommend that De Beers submit monthly report updates on remote monitoring of the waste and water storage facilities, including a table indicating the date of downloads from the instruments, and records of the remote camera monitoring of the gauges in the sumps. This would allow stakeholders and the inspector to see if the recommendations made by the Engineer of Record in the Technical Memo, and the Permit and Licence conditions are being met/achieved. These monthly reports should also highlight any issues detected and any management responses taken. These reports could be submitted with the SNP report, or as</td>
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| 2 | None | **Comment** None  
**Recommendation** 2) ENR recommends De Beers indicate with rationale, if only one or a combination of drone, aerial flyover observations or near real-time land satellite imagery is the preferred monitoring technique to complete the visual observations. | **July 23:** De Beers will utilize any one of the various methods for visually observations. At this time, there is no preference for one method over the other. De Beers wishes to note that we require flexibility to use any of these methods to collect visual inspections so long as they remain effective in providing the visual observations necessary. | Acceptable response. |
|---|---|---|---|---|
| 3 | Topic 2: Response Framework Table 1 | **Comment** ENR notes that sloughing or bulging will have to be in the range of 3 to 4 m in the North Pile embankment crest and downstream slope before prompting a classification of "unsafe or out of compliance". This magnitude of change seems large. In comparison, the criteria for the Water Management Pond dams for the same category are 1 m. Any visual or measurable displacements, bulging, sloughing will prompt a response in the lower threshold categories of "concern" and "buffer" and this response would include a review by the EOR and De Beers. Therefore displacements, bulging or sloughing will likely have been reviewed before they reach 3 to 4 m magnitude. However, ENR is not certain that displacements of the North Pile perimeter embankment of up to 3 m or 4 m would maintain containment and potentially not be considered "unsafe or out of compliance" during extended care and maintenance.  
**Recommendation** 1) ENR recommends DeBeers review the magnitude of sloughing or bulging at the North Pile | **July 23:** The "unsafe or out of compliance" sloughing or bulging magnitude was defined relative to the structure heights. The perimeter embankments are higher than the water management pond dams, and therefore have thresholds with higher magnitude of sloughing or bulging. There is no need for adjustment of Table 1. De Beers will continue to monitor and maintain facilities as per the design of the facilities and recommendations made by the Engineer of Record. | Acceptable response. |
displacement that would maintain containment during extended care and maintenance, and update the Table 1 thresholds if required.

### Topic 3: Monitoring Frequency

**Comment** ENR notes that the monitoring frequency identified in the technical memo refers to monitoring frequencies of monthly or quarterly. Water Licence condition E 5 requires weekly inspection of all structures designed to contain, withhold, retain or divert water or waste. The proposed monitoring frequency must align with the conditions of the Water Licence.

**Recommendation** 1) ENR recommends that the proposed monitoring frequency for the North Pile and Water Management Pond Dams must align with the frequency specified in the conditions of the Water Licence.

**July 23:** De Beers is monitoring these structures through installed instrumentation and remote cameras which collect observations continually and provide that information via satellite feed. This is actually more frequent monitoring than weekly visual inspections. There is no requirement in Part E item 5 for the weekly inspection to be visual or in fact for it to be performed by a human. De Beers asserts strongly that our monitoring plan meets the intent of the clause. Maintaining a weekly monitoring frequency for human visual observations during a period when no new material will be placed on the piles, and the site is unoccupied, is unreasonable. De Beers will visit the site monthly to obtain visual observations of the structures in alignment with the recent land use permit amendment.

**Acceptable response.**

Please also see Board staff analysis to GNWT-ENR comment ID-1.
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<tr>
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<th>and/or instrumentation to act as a surrogate to in-person inspections to satisfy Licence and Permit inspection/monitoring requirements</th>
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<td></td>
<td>remote instrumentation is capable of meeting Permit/Licence monitoring and inspection requirements in field-tested situations. <strong>Recommendation</strong> Pending field testing that demonstrates the effectiveness of remote sensing in meeting monitoring/inspection requirements of the License/Permit, the MVLWB should accept the EORs technical memo/Recommended Inspections and Monitoring Frequency report to be grounds to change the Water License condition E (5).</td>
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<td>will adaptively manage our monitoring as required to ensure it’s continued effectiveness. De Beers does not require Part E item 5 of the water licence to be amended or changed at this time. We believe the continual visual monitoring that we have put in place addresses the intent of the item already as described in response to ENR-4. The Engineer of Record has been involved in reviewing instrumentation data collected by the remote sensing system, and considers this method to be effective.</td>
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<td><strong>Comment</strong> To effectively monitor compliance with quarterly sampling requirements, the Inspector needs to know the starting date of that quarterly sampling regimen (i.e., which month, or which 30 day period [if not falling on a calendar month] will the sampling occur within). <strong>Recommendation</strong> Select a starting date (thereby, compliance dates will occur every 4 months (+/- 15 days) of that starting date.</td>
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<td><strong>July 23:</strong> In general, De Beers anticipates that quarterly sampling will occur once between January 1 and March 31, once between April 1 and June 30, once between July 1 and September 30, and once between October 1 and December 31, however De Beers appreciates the Inspectors suggestion of +/- 15 days as some flexibility is required.</td>
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<td>Acceptable response. Board staff encourage De Beers and the inspector to work together to determine what flexibility is acceptable for quarterly sampling requirements.</td>
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<th>Table 1, 2, 4. &quot;See Note a&quot;</th>
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<td><strong>Comment</strong> The line determining non-compliance needs to be quantified and clearly indicated to both proponent and inspector. The line at which non compliance should be set at probably can be most accurately established during each high risk situation. However, the Inspector needs some agreed upon non-compliance level established prior to such events. This non-compliance point should be established at a conservative level which will trigger prior-to events which would/could reasonably lead to failure of the structures. <strong>July 23:</strong> The Engineer of Record (EoR) has recommended that the key performance instrumentation at the North Pile and water management pond (WMP) dams is to be monitored as a critical control and response action for physical stability of the structures. De Beers will monitor and respond as recommended, and as presented in the Technical</td>
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<td>Acceptable response. Please also refer to Board staff analysis in GNWT-ENR comment ID-1. Any issues detected, and Engineer of Record recommended threshold values can be communicated through the monthly</td>
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North Pile facility objectives (both structural and chemical in nature).

**Recommendation** Establish threshold values for all categories currently labelled as ‘see Note A’ in Tables 1, 2, 4.

Memo. The accumulation and combination of factors that may affect safety and stability at any given time requires an assessment of the risk situations on a case by case basis by a qualified engineer. This approach is considered reasonable by the EoR. It is not reasonable or possible to pre-determine various permutations of situations to be pre-classified as in compliance or out-of compliance by an Inspector.

### General comment.

**Comment** Where will field data collected for the response frameworks in Table 1-5 be reported (so the Inspector and others can track De Beers status & actions taken as per the response frameworks)? Perhaps in the monthly SNP report? It is noted that this information must be reported in a timely manner to be of any practical use to the Inspector in determining compliance/reporting on developments associated with the Response Frameworks.

So reporting this Response Framework data in an annual report would not be timely enough to be of much use in assessing compliance (some of the data could be as much as 11 months old).

**Recommendation** Identify where field data collected for the response frameworks in Table 1-5 will be reported.

**July 23:** Field data is reviewed collected and assessed by De Beers together with the EoR. De Beers will continue to report to the MVLWB and to the Inspector as per the requirements of the water licence and land use permit including the monthly SNP reports and the annual water licence report.

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**Snap Lake Environmental Monitoring Agency - SLEMA: Zhong Liu**

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<td>1</td>
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<td><strong>Comment</strong> (doc) SLEMA comments</td>
<td>De Beers would like to thank SLEMA for providing their comment. De Beers believes that the information provided regarding the monthly monitoring data is useful.</td>
<td>Acceptable response. Please also see Board staff analysis</td>
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<td></td>
<td></td>
<td><strong>Recommendation</strong></td>
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visual monitoring is complete. We will continue to monitor and report to the MVLWB as per our land use permit and water licence requirements throughout the period of zero occupancy.

in GNWT-ENR comment ID-1.

Board staff also note that any new remote technology not identified or recommended by the Engineer of Record in this Technical Memo submission would need to be submitted for review and Board approval, as outlined in the Board’s February 22, 2018 Decision Letter to De Beers.