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April 20, 2017

File: W2015L2-0001

Mr. Dave Wells
Diavik Diamond Mines (2012) Inc.
P.O. Box 2498, 300-5201, 50th Avenue
Yellowknife, NT X1A 2P8

Dear Mr. Wells,

Re: DDMI's Proposed Modification to the Processed Kimberlite Containment Facility design and Revision to the Minimum Freeboard Limit

The Wek'èezhii Land and Water Board (WLWLB or the Board) met on April 12, 2017 to consider DDMI's revised request for a modification to the spillway of the Processed Kimberlite Containment (PKC) Facility. The Board approved the modification and approved the following revised minimum freeboard limit, in accordance with Part H, Item 21a of the Water Licence:

The Licensee shall operate and maintain the Processed Kimberlite Containment Facility to engineering standards such that a minimum Freeboard limit of 0.4 metres below the lowest surveyed point of the dam crest liner shall be maintained at all times; or as recommended by a Geotechnical Engineer and as approved by the Board.

Approval of the modification and revised freeboard limit is conditional upon approval of a revised PKC Facility Plan and a revised Water Management Plan.

See the Board's Reasons for Decision (attached) for more information.

If you have any questions, please contact Ryan Fequet at rfequet@wlwb.ca or by phone at (867) 765-4589.

Sincerely,

A handwritten signature in blue ink that reads "Joseph Mackenzie".

Joseph Mackenzie
Acting Chair, Wek'èezhii Land and Water Board

Copied: DDMI Distribution List



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Reference/File Number: W2015L2-0001 (Type A Water Licence)
Licensee: Diavik Diamond Mines (2012) Inc. (DDMI)
Subject: DDMI's Request for Approval of a Modification to the Processed Kimberlite Containment (PKC) Facility and a Change to the Minimum Freeboard Limit

Decision from the Wek'èezhìi Land and Water Board Meeting of April 12, 2017

1.0 Decision

On April 12, 2017, the Wek'èezhìi Land and Water Board (the Board) met to consider a request by Diavik Diamond Mines (2012) Inc. (DDMI) for the approval of a modification to the Processed Kimberlite Containment (PKC) Facility and a change to the minimum freeboard limit stipulated in Part H, Item 21(a). The Board decided the following:

1. To approve, under Part G, Item 2, DDMI's request for approval of a modification to the spillway design, conditional upon approval of a revised PKC Facility Plan and a revised Water Management Plan, as described in Attachment #1. DDMI must submit these plans at least 90 days prior to implementing the modification.
2. Under Part H, Item 21(a), the Licensee shall operate and maintain the Processed Kimberlite Containment Facility to engineering standards such that a minimum Freeboard limit of 0.4 metres below the lowest surveyed point of the dam crest liner, shall be maintained at all times; or as recommended by a Geotechnical Engineer and as approved by the Board.

The rationale for the Board's decisions is outlined in the Reasons for Decision section below.

2.0 Background

On December 10, 2015, DDMI submitted a request, to the Wek'èezhìi Land and Water Board for approval of a modification to the PKC Facility spillway design and a revised freeboard limit.¹ On May 18, 2016, the

¹ See WLWB Online Registry for [Diavik - Modification - Processed Kimberlite Containment Facility - Spillway and Freeboard Limit - Dec 10 15.pdf](#).

Board decided not to approve the modification, for the reasons described in the Board's May 30, 2016 Directive and Reasons for Decision,² and discussed further below. Within those Reasons for Decision, the Board identified the information that DDMI must submit if the company wished to re-submit the modification. On August 12, 2016, DDMI submitted the information required by the Board (referred to here as the revised modification request).^{3,4} At staff's request, DDMI also submitted a conformance table to locate the required information in DDMI's submission.⁵

3.1 Review Process

Board staff distributed DDMI's revised modification request for public comment on August 26, 2016. The reviewer deadline was October 14, 2016 and the proponent deadline was October 21, 2016. The GNWT Inspector, the GNWT's Department of Environment and Natural Resources (ENR), and Board staff commented on the submission. Public comments and DDMI responses are in the Review Summary and Attachments.⁶

3.0 Reasons for Decision

3.1 Approval of the Modification

Under Part G, Item 2, the Board approved DDMI's request for approval of a modification to the spillway design, conditional upon approval of a revised PKC Facility Plan and a revised Water Management Plan, as described in Attachment #1. DDMI must submit these plans at least 90 days prior to implementing the modification.

After assessing DDMI's first modification request (December 2015), the Board accepted the calculations related to the influence of the inflow design flood (IDF) on the spillway design and minimum freeboard (Section 4 of the Golder memo).⁷ The reasons the Board accepted those calculations are explained in the Board's May 30, 2016 Reasons for Decision. Although not repeated here, those reasons are central to the Board's decision to approve the modification and revised freeboard limit. In addition, DDMI's Engineer of Record developed the modified spillway design and freeboard limit, and the Board accepts them provided that DDMI makes the revisions to the PKC Facility Plan as described in Attachment #1. Acceptance of Section 4 of the Golder memo is contingent on approval of a revised Plan.

However, the Board rejected DDMI's first modification request for two reasons:

² See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Directive and Reasons for Decision - May 30 16.pdf](#).

³ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Re-submission - Aug 15 16.pdf](#).

⁴ The Board notes that the submission was originally made on August 12, 2016, however, an updated submission with revised cover letter was submitted by DDMI on August 15, 2016.

⁵ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Conformance Table - Sept 27 16.pdf](#).

⁶ See WLWB Online Registry for [Diavik - Modification - PKC - Follow-Up - Spillway and Freeboard Limit - Review Summary and Attachments - Oct 21 16.pdf](#).

⁷ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Directive and Reasons for Decision - May 30 16.pdf](#).

1. DDMI did not demonstrate that the one-in-100 year storm is an appropriate basis for the environmental design flood (EDF); and
2. DDMI did not demonstrate that Pond 3 will be able to contain the EDF.⁸

These two issues, and how DDMI addressed them in the company's revised modification request are discussed below.

4.1.1 The Environmental Design Flood

After reviewing DDMI's first spillway modification request, the Board determined that DDMI had not provided enough information to support a change to the EDF from the 1-in-500 year event to the 1-in-100 year event, and pointed DDMI towards the Canadian Dam Association's (CDA) Dam Safety Guidelines,⁹ which outline the types of information required to support a change to the EDF.

In its revised modification, DDMI no longer proposed to change the EDF; in other words, the PKC Facility would continue to be designed for the approved EDF, i.e., the one-in-500 year 24-hour flood. Therefore, DDMI did not need to submit the information outlined in the Dam Safety Guidelines.

In its comments, the GNWT-ENR recommended that the EDF be increased to a storm of a longer duration than 24 hours:

Given that the PKC facility has been assessed as having the capacity to contain the 1:500, 30-day return period event without release of water, ENR recommends that the 1:500 year, 30-day return period be considered as a more conservative, and appropriate, EDF design criteria than the 1:100 year, 24-hour return period. (GNWT-ENR comment #1)

DDMI responded as follows:

The WLWB Reasons for Decision (May 30, 2016) provided an indication of the type of information that would be required to change the event frequency from the currently approved 1:500, 24-hr to the Engineer of Record recommended 1:100-year event. DDMI elected to retain the previously-approved 1:500 year event (refer to WLWB approval of PKC Dam Raise Phase VI Design Report - Mar 12, 2013) as the PKC Spillway design event for the spillway modification. With regard to using "longer term wet periods" as the basis for the spillway design, DDMI previously provided that "longer-term wet events would provide a larger flow volume, but a smaller peak design flow, which would not be appropriate to use for designing the PKC spillway" (DDMI Comment Responses, GNWT-1, March 1, 2016). The WLWB Reasons for Decision (May 30, 2016, page 5) acknowledged that DDMI's response to GNWT-1 addressed the spillway design.

⁸ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Directive and Reasons for Decision - May 30 16.pdf](#).

⁹ The Guidelines are defined in the Definitions section of the Water Licence.

The Board accepts the EDF in the revised modification, because it has not been changed from the approved EDF and no evidence was presented to warrant a change. The GNWT-ENR stated that the one-in-500 year, 30-day return period is a more appropriate EDF design criteria than the one-in-100 year, 24-hour return period. It is not clear why the GNWT referred to the 1-in-100 year event, since DDMI no longer proposes to change the EDF to that event. The GNWT-ENR did not provide a reason why the approved EDF (the one-in-500 year 24-hour event) is not conservative enough, and did not provide any of the type of information that the Board told DDMI to provide if DDMI wished to change the approved EDF. Therefore, the Board did not adopt the GNWT-ENR's recommendation. Nonetheless, in its revised modification request, DDMI indicated that Pond 3 can hold the one-in-500 year 30-day event, without pumping to the North Inlet. Therefore, in practice, DDMI can meet the objective proposed by the GNWT-ENR, provided the company properly manages water leading up to and during the storm event. Water management issues are the second reason the Board initially rejected DDMI's proposed modification, and are discussed below.

4.1.2 Water Management: Ability of Pond 3 to Hold the Environmental Design Flood

DDMI proposes to pass the EDF from the PKC Facility, out of the spillway, to Pond 3, where it would be stored. The previously-approved PKC Facility design was based on storing the EDF in the PKC Facility without passing it to Pond 3. DDMI's proposal to pass the EDF to Pond 3 and store it there would allow an increase to the normal operating water level in the PKC Facility, which would increase the capacity to store more tailings and water within the PKC dams. To achieve this, the movement of water amongst these water storage facilities during a storm event must be managed to ensure that water that does not meet EQC is not released to the environment.

After reviewing DDMI's initial modification request, the Board required additional information about water management to confirm that Pond 3 could hold the EDF. DDMI provided this information in its revised modification request, conformance table, and responses to public comments. For example, DDMI explained that no other sources of water (e.g., Pond 4, which is sometimes pumped to Pond 3) should contribute to Pond 3 during the event. DDMI corrected some information that was out of date in the original modification request regarding how water is pumped between ponds. DDMI also identified the possibility of pumping Pond 3 water to the North Inlet, and identified that in the unlikely event that the North Inlet reached its storage capacity, DDMI could stop underground dewatering. DDMI confirmed that Pond 3 can hold not only the one-in-500 year 24-hour or 30-day events, but it can almost hold the one-in-500 year 60-day event. Again, this would rely on proper water management leading up to and during a storm.

The information about water management is best housed in the Water Management Plan, where the relationships between water management facilities (e.g., the collection ponds, the North Inlet, etc.) can be fully understood. DDMI proposed that approval of the spillway modification be contingent on approval of a revised Water Management Plan, and the Board agrees. DDMI should describe in the Water Management Plan how the company will ensure that water from the PKC Facility will not be released during the one-in-500 year 24-hour storm, and how DDMI will manage the one-in-500 year 30-day event.

DDMI should include a requirement in the Water Management Plan and the PKC Facility Plan that water cannot be pumped from collection ponds to the PKC pond when water levels in the PKC Facility are at or above the normal operating water level (464.6 m). Also, DDMI's responses to WLWB staff comments #3, 4, and 5 provide more detail about how DDMI would manage water during storm events, and the relevant aspects of these responses should be included in the Water Management Plan. Finally, DDMI should verify that information in the Water Management Plan about how water moves between water management facilities (i.e., the collection ponds, PKC Facility, the North Inlet, etc.) is current. The required information has been compiled in Attachment #1.

To be clear, even though the Board approves a design based on a particular EDF, this does not constitute approval to release water that doesn't meet EQC during the EDF. It is DDMI's responsibility to ensure it does not exceed EQC at any time.

Finally, it is understood that these design changes will not come into effect until the elevation of the tailings (and therefore the pond water) is much higher, perhaps the last couple of years of operation. For now, the pond water level is well below the bottom of the spillway, and the PKC Facility can hold both design floods.

4.2 Change to the Minimum Freeboard Limit

The Board also approved the following minimum freeboard limit under Part H, Item 21(a):

A minimum Freeboard limit of 0.4 metres below the lowest surveyed point of the dam crest liner, shall be maintained at all times; or as recommended by a Geotechnical Engineer and as approved by the Board.

Part H, Item 21(a) gives the Board the authority to change the minimum freeboard limit; therefore, the Board can change the limit without amending the Water Licence.

The Board previously accepted the calculations related to the influence of the IDF on the spillway design and minimum freeboard (Section 4 of the Golder memo).¹⁰ Those calculations resulted in a significantly smaller freeboard limit of 0.2 m or 0.4 m (depending on how it is defined, as discussed below).

In its first modification request, DDMI identified that 0.2 m of freeboard is required to hold the IDF, and another 0.2 m is required to accommodate wind and wave action to prevent overtopping in a storm, for a total of 0.4 m. In its May 30, 2016 Reasons for Decision, the Board asked DDMI to clarify which freeboard it proposed to have regulated, so that "the Board, DDMI, the Inspector, and all other parties will share the same understanding of the minimum freeboard limit". In response, DDMI proposed the following wording to describe more precisely its proposed freeboard limit: "a minimum Freeboard limit

¹⁰ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Directive and Reasons for Decision - May 30 16.pdf](#).

of 0.4 metres from the normal operating water level to the lowest surveyed point of the dam crest liner".¹¹

The Inspector objected to DDMI's proposed wording (GWNT-ENR comment #1):

The current wording is clear and simple to determine compliance with. The proposed wording also adds one more fact in issue to determine before compliance can be assessed (i.e., the Inspector would have to rely on DDMI's provision of "the normal operating water level" in addition to the lowest surveyed point of the dam crest liner.)

DDMI responded as follows:

The DDMI proposed wording is more specific than the existing wording as it specifies where the lowest survey point is (i.e. the dam crest liner) rather than the existing wording that provides an option (i.e. the liner or the engineered emergency spillway, whichever is lower). DDMI's proposed wording also more specifically includes reference to the "normal operating water level" rather than the existing wording of "at all times". The existing wording of "at all times" does not differentiate between normal operating water levels and water levels that would occur during a rainfall/flood event. By design, a freeboard limit is not intended to apply during an event.

Even though the Board agreed that the modified spillway design is sound (on condition that the relevant management plan revisions are approved, as described above), the modified design presents a contradiction from a regulatory perspective. On one hand, the design requires 0.4 m of freeboard to accommodate the IDF (including volume and wind/wave action; this sum is referred to as the "total freeboard" for purposes of these Reasons for Decision). On the other hand, the design allows for water to impinge on this freeboard during the EDF, and potentially other circumstances. This situation arises in part because DDMI's revised spillway design sets the normal operating water level, the spillway invert, and the total freeboard limit all at one elevation (464.4 m). In the approved design (prior to the modification request), these three parameters were at three different elevations.

To resolve this, DDMI has proposed to eliminate the words "at all times" from the freeboard limit. However, even without explicitly stating "at all times", it is implicit that the freeboard must be maintained at all times. Many other Water Licence conditions do not include the words "at all times" but it is understood that the company cannot contravene the condition. Regardless, DDMI proposes to eliminate "at all times", apparently to enable the company to use some of the freeboard, at its discretion. DDMI's interpretation appears to be that if "at all times" is eliminated from the condition, there are times when the condition won't apply. Assuming, for the sake of argument, that DDMI's interpretation is correct, eliminating the words "at all times" would mean that the company could regularly use some of the total freeboard and remain in compliance. Yet, any time this freeboard is impinged upon, if the IDF occurs, there is risk of overtopping and dam failure. While the odds of an IDF occurring, are by definition very low,

¹¹ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Re-submission - Aug 15 16.pdf](#).

the consequences of dam failure are high.¹² Further, it is not clear how the Inspector would determine compliance with DDMI’s proposed freeboard limit, since there is no description of when the limit applies and when it doesn’t. Although it is understood that the company will operate the PKC Facility responsibly, and will take immediate action to lower the water level if water is spilling,¹³ the freeboard limit condition (Part H, Item 21a) provides additional regulatory oversight for this critical design parameter, and it must be clear and enforceable.

Board staff attempted to resolve this issue in follow-up correspondence and the company proposed possible solutions.¹⁴ For example, DDMI proposed the possibility of regulating only the freeboard required for the wind/wave run-up (0.2 m). This would represent a reduction in environmental protection from the current regulatory requirement, which requires that the total freeboard be maintained at all times, not just the freeboard for wind-wave action. Further, the modified value for the wind-wave run-up (0.2 m) is very small and leaves little room for error. Staff also asked if DDMI could define the circumstances when it would use some of the freeboard, but the company declined. In short, while the Board appreciates DDMI’s attempts to propose a workable solution, none of its suggestions would achieve the clarity, inspectability, and level of conservatism (namely that there is always room for the IDF, even during freshet or an EDF)¹⁵ as currently achieved in the Water Licence. To maintain these principles, the total freeboard of 0.4 m is required to be maintained at all times.

Attachments:

Attachment #1: Required Revisions to the PKC Facility Plan and the Water Management Plan

Signed the 13th Day of April, 2017, on behalf of the Wek’èezhìi Land and Water Board

Witness

Joseph Mackenzie
Chair, Wek’èezhìi Land and Water Board

¹² The consequence of dam failure is “high”, as defined by the Dam Safety Guidelines. DDMI provided the consequence classification in [Diavik - WL Renewal - Application - Jan 16 15.pdf](#) on page 10.

¹³ See email correspondence between Board staff and DDMI, attached.

¹⁴ See WLWB Online Registry for [Diavik - Modification - PKC - Correspondence - Spillway and Freeboard Limit - Mar 16 17.pdf](#).

¹⁵ See WLWB Online Registry for in the PKC Facility Phase 6 Design Report, pages 13 and 14. As described in that report, there is 0.7 m from the NOWL to the spillway invert to hold the EDF, and 1.6 m (i.e., slightly more than the required 1.5 m) from the invert to the top of the crest. This 1.6 m provides room for a 0.2 m increase in water level during the IDF and 1.4 m for wind and wave run-up.

Attachment #1: Required Revisions to the PKC Facility Plan and the Water Management Plan

Required Revisions to the PKC Facility Plan

- a. ***A statement that the windrows (“shoulder berms”) which extend along the upstream edge of the dams that define the entire perimeter of the PKC facility shall be maintained with a crest elevation of not less than 465.8 m.***

Establishing the minimum crest elevation of the upstream shoulder berms at 465.8 m will provide 1 m of freeboard above the maximum extreme water level during passage of the inflow design flood (464.8 m). This effectively means that the minimum freeboard would increase by 0.8 m and would address the issue of engineering judgement regarding the calculated minimum freeboard of only 0.2 m.

- b. ***A statement that, when the pond reaches an elevation of 462 m, DDMI will maintain the PKC Pond in a centralized location with fine processed kimberlite (FPK) beaches around the PKC Facility’s entire perimeter that are at least 10 m long.***

This requirement was recommended by Golder (page 7 of the Golder memo) and DDMI affirmed its commitment to this requirement in its response to GNWT-Lands Comment #1.

- c. ***A statement that DDMI will maintain PKC Facility dam slopes at a beach slope of about 3%.***

As explained in the Golder memo, the minimum freeboard calculations are only valid when the slopes are at 3% (pages 5 and 7 of the Golder memo). This requirement is necessary to ensure the PKC Facility can store the inflow design flood.

- d. ***A commitment to review FPK beach development as the pond exceeds an elevation of 462 m to confirm beaches are developed and maintained, or can be developed and maintained to meet the assumptions used to calculate freeboard presented in Table 4 of the proposed modification.***

This review is necessary to ensure the basis for the spillway design remains valid as the tailings elevation increases, and is recommended by Golder (Golder memo, page 7).

- e. ***A commitment to review the Pond 3 spillway to verify that it can pass the same inflow design flood as the PKC Facility. Review of the Pond 3 spillway is to be completed before the PKC pond exceeds an elevation of 462 m.***

If the inflow design flood occurs, it will pass through the PKC spillway, into Pond 3, and out the Pond 3 spillway. Golder recommended that DDMI confirm the Pond 3 spillway design will accommodate this event, and DDMI committed to this review in its cover letter.

- f. ***An updated stage-volume curve for the PKC Facility, showing the current and predicted tailings levels, current and predicted pond water levels, and current and predicted freeboard volumes. Additionally, the PKC Facility Plan should include a commitment to provide an updated stage-volume curve for the PKC Facility in the Annual Water Licence Report required by Part B, Item 7, or the annual Geotechnical Inspection report required by Part H, Item 21(f).***

This will allow the Board and reviewers to understand when restrictions on the normal water operating water level will be of operational consequence, and when the requirements for beach slope, beach length, and other design features must be re-assessed.

- g. A commitment to confirm the available storage volume in Pond 3 after dredging of A21 is completed, and a commitment to report completion of this requirement in the annual report.**

This is a Golder recommendation, supported by the GNWT-ENR (GNWT-ENR Comment #2). It is necessary to confirm this, to be confident that Pond 3 can hold the environmental design flood (EDF).

- h. A statement that water cannot be pumped from collection ponds to the PKC pond when water levels in the PKC are at or above the normal operating level of EI 464.6 m.**

This will prevent Pond 3 from being unable to handle the EDF. DDMI suggested that this information be included in the PKC Facility Plan.¹⁶

- i. Incorporate all other relevant information from the two modification requests.**

This will ensure the PKC Facility Plan is up to date.

Required Revisions to the Water Management Plan

- a. A statement that water cannot be pumped from collection ponds to the PKC pond or Pond 3 when water levels in the PKC are at or above the normal operating level of EI 464.6 m.**

This will help to ensure Pond 3 can handle the EDF.¹⁷

- b. A complete description about how DDMI will ensure that Pond 3 can hold the EDF.**

Additional explanation for this requirement is in Section 4.1.2 in the supporting Reasons for Decision. This should include information provided in DDMI's modification requests and in the response to WLWB Staff Comments #3, 4, and 5.

- c. A description of the water management activities necessary to hold a one-in-500 year 30-day event.**

Although strictly speaking, this event is not the design basis for the PKC Facility, DDMI has indicated that Pond 3 can store this event, and the GNWT-ENR advocated for consideration of this event. The Water Management Plan should include information about how this event would be handled.

- d. Verify that all descriptions of how water moves between water management facilities is current, and in general, ensure all aspects of the Water Management Plan are up-to-date.**

As discussed in Section 4.1.2 of the Reasons for Decision.

¹⁶ See WLWB Online Registry for [Diavik - Modification - PKC - Spillway and Freeboard Limit - Conformance Table - Sept 27 16.pdf](#).

¹⁷ Ibid