Re: W2015L2-0001 – Information Request #5, #9, #10 and #11

Please find attached the Diavik Diamond Mines (2012) Inc. (DDMI) response to:

IR#5 – Emergency Response and Preparedness
IR#9 – Diavik Geotechnical Review Board
IR#10 – Dam Safety Review Reports
IR#11 – Dam Safety Management

These responses are provided as follow-up to the Water License Renewal Application technical session held on March 23, 2015.

Please let me know if you require any additional clarification.

Regards,

[Signature]

Gord Macdonald

cc  Sarah Elsasser (WLWB)
    Patty Ewaschuk (WLWB)
    Ryan Fequet (WLWB)

Attached: Responses to IR#5, #9, #10 and #11 – Dam Safety
DDMI has been asked to respond to four Information Requests (IRs) related to dam safety:

**Dam and Dike Reviews**
- IR#10 – Dam Safety Review Reports
- IR#9 – Diavik Geotechnical Review Board

**Policies and Practices**
- IR#5 – Emergency Response and Preparedness
- IR#11 – Dam Safety Management

Before providing the requested information it is important to put this information into the overall context of how dam safety is regulated and reviewed at Diavik.

Under the *Mackenzie Valley Resource Management Act*, the jurisdiction of the Wek’èezhii Land and Water Board (WLWB) is, in part, to regulate the use of waters and deposits of waste in its management area, including any diversion or obstruction of waters by dams or dikes. In carrying out its mandate, the Board has the power to require any information necessary to evaluate the qualitative and quantitative effect of the use on the waters within its management area and to impose monitoring programs as a condition of issuing a license. The Board’s ultimate objective is to protect the waters within its jurisdiction from environmental deterioration, especially where a structure can have a significant qualitative or quantitative effect on waters.

The WLWB’s jurisdiction over dams and dikes overlaps with that of the Workers’ Safety and Compensation Commission (the WSCC) which, under the *Mine Health and Safety Act* and the regulations adopted thereunder, has the more specific authority to approve dam designs, to conduct dam and dike safety inspections and to order mine operators to obtain independent reports on the safety of mine structures such as dams or dikes. The WSCC’s ultimate objective is to protect the health and safety of mine workers. The WSCC conducts regular inspections at all mining operations in the Northwest Territories, measuring compliance to the Northwest Territories Mine Health & Safety Act and Regulations. This Act and Regulations prescribe that owners “take every reasonable measure and precaution to protect the health and safety of employees and other persons at the mine” and “implement and maintain work practices that are safe and that do not present undue risk to health and provide and maintain healthy and safe worksites”. In addition to the general provisions to provide a safe workplace, there are several sections in the Act and Regulations related to dams and impoundments. The WSCC regularly conducts geotechnical inspections at Diavik, drawing on their internal expertise and external geotechnical experts to inspect ground conditions/support, slope stability and dam/dike performance. Three Geotechnical inspections have been conducted by the WSCC at Diavik since 2011 (14-Sept-2011, 14-August-2012 and 12-August-2014). As a result, the WSCC has acquired significant expertise in monitoring and evaluating the safety of the relevant structures.

Specific terms and conditions of the current Water License (W2007L2-0003) of direct relevance to dam and dike safety include:
"Canadian Dam Safety Guidelines" means the Canadian Dam Association’s Dam Safety Guidelines (January 1999) or subsequent approved editions. The scope and applicability of the DSG referred to in this Licence, is presented in Section 1 of the DSG.

Part C Item 1

At least forty-five (45) days prior to the start of construction of any dams, dikes, or structures intended to contain, withhold, divert or retain water or wastes, the Licencee shall submit to the Board for approval, design drawings stamped by a Geotechnical Engineer. The Licencee shall ensure that such facilities are designed and constructed to engineering standards such that at a minimum they comply with the Canadian Dam Safety Guidelines.

Part C Item 13

The Licencee shall ensure that all construction of engineered structures is supervised by a Geotechnical Engineer and/or Engineering Geologist. The Licencee shall also ensure that construction records of engineered structures are maintained and made available at the request of the Board and/or Inspector.

Part C Item 14

The Licencee shall, within ninety (90) days after completion of any structure designed to contain, withhold, divert or retain waters or wastes, submit to the Board a geotechnical engineering report prepared by a Geotechnical Engineer and/or Engineering Geologist that shall include as-built drawings, documentation of field decisions that deviate from original plans and any data used to support these decisions.

Part F Item 1

The Licencee shall implement the Processed Kimberlite Containment Facility Operation Plan as approved under Licence N7L2-1645. The Plan shall be in accordance with the NWT Water Board’s "Guidelines for Tailings Impoundment in the Northwest Territories, February 1987", or subsequent editions, and with Schedule 3, Items 1 and 2.

Part G Item 1

The Licencee shall operate and maintain the Water Retention Dikes to engineering standards such that at a minimum they comply with the Canadian Dam Safety Guidelines, and in accordance with the following:

a) the lowest point on the upper edge of the diaphragm wall shall not be lower than 419.0 metres above mean sea level, or as recommended by a Geotechnical Engineer and as approved by the Board;

b) the Licencee shall install and maintain geotechnical instrumentation in the Water Retention Dikes as described in the Water Retention Dikes Final Design Report, dated July 1999;
c) a schedule of reading the instrumentation shall be submitted to the Board for approval not less than three (3) months before dewatering is scheduled to commence. The Licencee shall carry out instrumentation reading schedule upon approval of the Board;
d) weekly inspections of the Water Retention Dikes shall be conducted and the records of these inspections and all monitoring records shall be kept for review upon request of an Inspector;
e) any seepage through the Water Retention Dikes that does not meet the effluent quality criteria Part H, Item 6 shall be collected and directed to the North Inlet and through the treatment facilities prior to discharge, and measures shall be employed to reduce seepage;
f) any deterioration or erosion of any engineered structures associated with the Water Retention Dikes shall be reported to an Inspector and repaired immediately; and
g) an inspection of the Water Retention Dikes shall be carried out annually in August by a Geotechnical Engineer. The Engineer’s report shall be submitted to the Board within ninety (90) days of the inspection, including a covering letter from the Licencee outlining an implementation plan for addressing each of the Engineer’s recommendations.

Part H Item 1

The Licencee shall operate and maintain the Processed Kimberlite Containment Facility to engineering standards such that:

a) a minimum freeboard limit of 1.5 metres below the lowest surveyed point of the liner or of the engineered emergency spillway, whichever is lower, shall be maintained at all times; or as recommended by a Geotechnical Engineer and as approved by the Board;
b) if seepage from the Processed Kimberlite Containment Facility occurs, the Licencee shall collect and return the seepage to the Processed Kimberlite Containment Facility and measures shall be undertaken to eliminate the seepage;
c) any deterioration or erosion of any engineered structures associated with the Processed Kimberlite Containment Facility shall be reported to an Inspector and repaired immediately;
d) the solids fraction of all Processed Kimberlite shall be deposited and permanently contained within the Processed Kimberlite Containment Facility;
e) weekly inspections of the Processed Kimberlite Containment Facility dams, emergency spillway(s), pipeline(s), and catchment basin(s) shall be conducted and the records of these inspections shall be kept for review upon the request of an Inspector; and,
f) an inspection of the Processed Kimberlite Containment Facility shall be carried out annually in July by a Geotechnical Engineer. The Engineer’s report shall be submitted to the Board within ninety (90) days of the inspection, including a covering letter from the Licencee outlining an implementation plan for addressing each of the Engineer’s recommendations.

The A154 and A418 Water Retention Dikes and the PKC Dams each have designated Engineers of Record. The Engineer of Record for the PKC Dams is Golder Associates Ltd. represented by John Cunning, P.Eng. The Engineer of Record for the A154, A418 Dikes is SNC Lavalin represented by Anthony Rattue P.Eng and Francois Ferland P.Eng. The Engineer of Record is responsible for the design and annual inspections as per Water License Part G Item 1(g) and Part H Item 1(f). Attachments 2 and 3 are
letters from each Engineer of Record further elaborating on their roles and responsibilities with regard to the Water Retention Dikes and PKC Dams.

Diavik also undertakes additional reviews and inspection that are not specifically required under the Water License or the WSCC. Diavik has an internal expert review panel (Diavik Geotechnical Review Board) that meets at least annually to review the Water Retention Dikes and PKC Dams (see response to IR#9). Separately, every two years, RioTinto conducts an independent review of Major Tailings and Water Storage Facilities that includes the PKC.
IR#10 DDMI – Dam Safety Review Reports

Submit the most recent Dam Safety Reviews (DSRs) performed for the PKC dams and the open-pit dikes.

Response

Attachment #4 includes copies of the following CDA Dam Safety Reviews:

• A154 Dike DSR – 2013
• A418 Dike DSR – 2012
• PKC Dams (North, South, East, West) DSR – 2010
Under DDMI’s Water Licence (Part A, Item 2), the DDMI Dike Review Board is defined as “the Expert Review Board established by DDMI to review the dike designs”. It is understood that DDMI now refers to this Board as the Diavik Geotechnical Review Board (DGRB). With regards to the DGRB:

a. Describe, in detail, all of the DGRB’s duties, including those related to dikes, processed kimberlite containment (PKC) dams, the north inlet dams, pit walls, and any other structures;

b. Provide a list of reports submitted by the DGRB to DDMI, with dates; and,

c. Describe how the DGRB maintains its independence from DDMI.

Response

The Diavik Geotechnical Review Board (DGRB) as it is currently known, developed from the Dike Review Board (DRB) established by DDMI in 1999. At that time DDMI created a panel of experts to provide third party review and advice to the designers, Nishi-Khon SNC-Lavalin (NKSL) during the design development of the A154 dike. The mandate of the Dike Review Board (DRB) was to act as an independent third party panel to verify that the engineering of the Dikes was complete and to the highest standards of practice.

The Dike Review Board consisted of five pre-eminent engineering experts, selected to collectively bring the highest levels of engineering experience in the design and operation of water retaining structures. The DRB also reviewed the A418 and A21 dike designs through a three member panel.

Pit wall stability was not originally part of the mandate of the DRB except to the extent that the dikes and pits were expected to interact and influence dike behavior. As the depths of the pits advanced, the stability of the pit walls and effects of pit dewatering became part of the regular review.

The review of the PKC dams and facility were also not initially part of the DRB mandate. DDMI added the PKC facility to the scope around 2007. The name change to Diavik Geotechnical Review Board (DGRB) reflected this change in scope. In more recent years, as mining progressed underground, aspects of the underground stability became part the DGRB review. This review is substantially directed to underground stability that has effect on wall stability and groundwater depression, and resulting effects on dike performance. Increasingly the effects of rock wall performance and the risks imposed by rockfall and groundwater depression has become review topics for the DGRB. This change in the scope of review by the DGRB is reflected in the addition of a rock mechanics expert and mine water expert to the panel in 2013.

The present mandate of the board is as follows:

- Provide expert geotechnical and hydrogeological technical reviews of the design, performance, and monitoring systems associated with the following facilities:
  - A154 Dike, A154 Open Pit, and A154 underground as it pertains to the integrity of the A154 open pit and dike
  - A418 Dike, A418 Open Pit, and A418 underground as it pertains to the integrity of the A418 open pit and dike
Processed Kimberlite Storage Facility – including the deposition plan, monitoring system, and dam design

The reviews include a one to two day field inspection for all of the above facilities.
The reviews also include a three to four day detailed review and assessment of monitoring data collected and presented by DDMI personnel.
Upon completion of the board’s inspection and assessment of monitoring performance, a close out presentation is held for the meeting participants as well as DDMI management.
After compilation of the board’s findings a draft report is submitted the DDMI project manager handling the review.

A final signed report is submitted by the board members after receiving comments from DDMI on the draft report.

Following are excerpts from DGRB reports to Diavik since 2007 that describe the scope of review completed at each meeting.

Report no. 7-April 2007:
The 7th meeting of the Diavik Geotechnical Review Board (the DGRB) convened on site over the period April 9-12, 2007. The primary objectives of the meeting were to review the following:

- The A154 Pit behavior and proposed A154N pipe mining
- The status of the A418 Pit development
- The conditions of the rock in the A21 decline
- The performance of the A418 Water Retention Dyke
- The operations, performance and future development plans of the PKC storage facility.

Report no. 10-October 2007:
The 10th meeting of the Diavik Geotechnical Review Board (the DGRB) convened over the period October 10-12, 2007. The primary objectives of the meeting were to review the following:

- The A154 Pit behaviour, particularly after partial mining of the A154N pipe
- The status of the A418 Pit development
- The A418 Pit/Underground interaction design
- The performance of both the A154 and A418 Water Retention Dikes
- The Construction and life-of-mine plans for the PKC Storage Facility.

Report no. 11-June 2008:
The 11th meeting of the Diavik Geotechnical Review Board (the DGRB) convened over the period June 9-12, 2008. The primary objectives of the meeting were to review the following:

- The A154 Pit behaviour with particular reference to the northwest, granite wedge and northeast walls
- The A418 Pit behaviour
Report no. 12-December 2008

The 12th meeting of the Diavik Geotechnical Review Board (the DGRB) convened in Vancouver over the period December 16-18, 2008. The primary objectives of the meeting were to review the following:

- A154 Pit Update
- A418 Pit Update
- PKC Facility – Status and Leakage Control
- PKC Facility Expansion Studies
- Closure Review Studies
- Dike Status

Report no. 13-June 2009

The 13th meeting of the Diavik geotechnical Review Board (the DGRB) convened at the mine Site and in Yellowknife over the period June 16-19, 2009. The primary objectives of the meeting were to review the following:

- PKC status, performance and leakage control
- PKC closure studies
- Pit performance
- Pit future design and monitoring
- Dike status

Report no. 15-June 2010

The 15th meeting of the Diavik geotechnical Review Board (the DGRB) convened over the period June 14-17, 2010. The primary objectives of the meeting were to review the following:

- Selected geotechnical aspects of the prefeasibility underwater mining study for A21 pipe
- Design, construction and operation of the PKC facility
- Behavior of A154 and A418 pits
- Fatal flaw analysis of the A418 alternative underground mining methods study
- The performance of both the A154 and A418 water retention dikes
- Advances in closure planning.

Report no. 16-June 2011

The 16th meeting of the Diavik Geotechnical Review Board (the DGRB or Board) convened over the period June 26-30, 2011. Prior to this meeting Dr. Norbert Morgenstern had resigned from
the Board. The Board members express their deep appreciation for the many years of exemplary leadership and direction that Dr. Morgenstern provided. The Board looks forward to his continued involvement in Diavik review for the development of the A21 Dike and mine. The primary objectives of the meeting were to review the following:

- design, construction and operation of the PKC facility
- behavior of A154 and A418 pits
- designs and analysis of the A154 and A418 alternative underground mining
- designs and the underground/pit/dike interactions
- the performance of both the A154 and A418 water retention dikes
- Discussions on A21 Dike optimization

Report no. 17-July 2012

The 17th meeting of the Diavik Geotechnical Review Board (the DGRB or Board) convened over the period July 15 to 17, 2012. The primary objectives of the meeting were to inspect and review the following:

- perform inspections of the A154 and A418 dikes and pits and the PKC facility;
- review on-going design, construction and operation of the PKC facility, including the monitoring, control and remediation of seepage;
- review designs, and pit wall behavior of A154 and A418 pits
- review designs and analysis of the A154 and A418 underground mining and the underground/pit/dike interactions
- review the performance of both the A154 and A418 water retention dikes

Report no. 18-November 2013

The Diavik Geotechnical Review Board (DGRB or Board) Meeting No. 18 was held at the Diavik mine site over the period November 18 to 21, 2013. The DGRB has been expanded with the addition of Mr. Bill Forsyth of Rio Tinto, for his mining, mining rock mechanics and underground support specialist knowledge, and Mr. Geoff Beale, for his hydrogeology and mine dewatering/depressurizing specialization. All four members of the DGRB attended the meeting. The primary objectives of the meeting were to inspect and review the following:

- Perform inspections of the A154 and A418 dikes, PKC facility, open pits and underground workings for the mining of the A154 and A418 pipes:
- Review on-going design, construction and operation of the PKC facility, including the monitoring, control and remediation of seepage;
- Review the performance of both the A154 and A418 water retention dikes;
- Review designs and geotechnical performance of underground development, SLR mining and mine/pit wall interaction for the A154 and A418 mines/pits;
- Review the hydrogeology and mine dewatering.
Report no. 19-September 2014

The Diavik Geotechnical Review Board (DGRB or Board) Meeting No. 19 was held at the Diavik mine site over the period September 15 to 18, 2014. All four members of the DGRB attended the meeting with Andy Robertson attending the first day of the meeting by teleconference and travel delaying his arrival on site till the morning of the 16th. The primary objectives of the meeting were to inspect and review the following:

- Perform inspections of the A154 and A418 dikes, PKC facility, open pits and underground workings for the mining of the A154 and A418 pipes;
- Review on-going design, construction and operation of the PKC facility, including the monitoring, control and remediation of seepage;
- Review the performance of both the A154 and A418 water retention dikes;
- Review designs and geotechnical performance of underground development, SLR mining and mine/pit wall interaction for the A154 and A418 mines/pits;
- Review the hydrogeology and mine dewatering.

Additionally, a sub-panel of the DGRB, known as the A21 Geotechnical Review Panel, reported to DDMI on the A21 dike design review six times: December 21, 2011; April 24, 2012; September 6, 2012; January 9, 2014; April 25, 2014; and October 18, 2014.

Independence

Independence was a criterion with the original DRB along with technical expertise. Four of the five original DRB members were unquestionably independent while one was a geotechnical specialist from RioTinto (separate from the Diavik operation) so would not meet the independence definition of being free from influence or conflict of interest.

Currently DDMI’s primary interest is the technical expertise of the DGRB. They provide a valued third party view that is separate from the operation. The DGRB as a whole would likely not be considered to be fully “independent” as two of the four members are employed by RioTinto; although they are not part of the Diavik operation. While the DGRB is not currently required to be fully “independent”, it could likely be structured to meet this requirement, if it was necessary for a specific review.
IR#5 DDMI – Emergency Response and Preparedness

Regarding DDMI’s Emergency Response Plan (ERP) and Emergency Preparedness Plan (EPP):

a. Provide the most recent dates that DDMI tested these plans for the dikes and for the Processed Kimberlite Containment (PKC) dams; and,

b. Describe the frequency of testing, and indicate when the next tests will occur.

Response

Diavik has a fully integrated “Business Resilience & Recovery Program” (BRRP) designed to respond and recover from disaster events. The program is designed with overarching processes that are relevant in any disaster scenario (emergency contacts, call-out structure, dedicates roles/responsibilities, incident control room(s)) plus scenario checklists to cover off the major aspects of foreseeable disaster events. For example, separate BRRP checklists exist for Dam and Dike emergencies. The BRRP is further supported with trigger action response plans (TARPs) and evacuation procedures that are specific to each department/area where applicable. The pit and underground both have evacuation procedures that could be triggered by multiple scenarios, some being geotechnical in nature (e.g. instrumentation or other measurements showing the potential for a rock fall or dike failure) and some are not (fire, power outage, etc).

The BRRP is tested on a regular basis with “Full Scale” exercises, “Desktop” exercises, routine drills and actual events. It’s important to note here that “Desktop” exercises are detailed events that are simulated over several hours and involve full deployment of the Business Resilience Team. The term ‘desktop’ simply refers to the fact that actual emergency response on the ground is simulated instead of being staged and deployed. At least 1 desktop or full scale BRRP exercise is held each year. Diavik also participates with other mines in their emergency exercises where applicable. Below is a summary of BRRP testing (full scale and desktop) since 2010. In addition to exercises, actual events that routinely test the BRRP, evacuation/mustering, and emergency response include extreme weather (primarily white outs and lightning storms), power outages, fire alarms and underground reports of fire/smoke. Geotechnical triggers have similarly resulted in temporary evacuation of the pit and parts of the underground; also enabling testing of response procedures.
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<tr>
<th>Date</th>
<th>Scope</th>
<th>Exercise Type</th>
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<tr>
<td>August 2010</td>
<td>Plane Crash w/ Environmental Fuel Spill</td>
<td>Full Scale</td>
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<td>Nov 2011</td>
<td>Underground Fire in the Maintenance Shop</td>
<td>Desktop</td>
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<td>July 2012</td>
<td>PKC Dam Failure</td>
<td>Desktop</td>
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<td>December 2013</td>
<td>Explosion at the PSF</td>
<td>Desktop</td>
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<td>February 2014</td>
<td>UG Fire at E’Kati</td>
<td>Full Scale - Mutual Aid Exercise for ERT (did not include Diavik BRRP)</td>
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<tr>
<td>December 2014</td>
<td>UG Vehicle Collision and Fire</td>
<td>Full Scale</td>
</tr>
<tr>
<td>March 2015</td>
<td>UG Fire at Snap Lake</td>
<td>Full Scale - Mutual Aid Exercise for ERT (did not include Diavik BRRP)</td>
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DDMI's Water Licence requires DDMI to comply with the Canadian Dam Association’s (CDA) Dam Safety Guidelines. The CDA Guidelines (Section 2.3.1) require that dam owners have a dam safety policy.

a. Submit DDMI’s dam safety policy; and,

b. Discuss how DDMI’s policy covers each of the following requirements in the CDA Guidelines (Section 2.3.1):
   i. Clearly demonstrates the organization's commitment to safety management throughout the dam's life cycle;
   ii. Defines the safety practices and criteria to be used, taking into account any applicable regulations, industry practice (such as the CDA technical bulletins), and due diligence;
   iii. Defines ultimate accountability and authority for ensuring that the policy is implemented;
   iv. Defines the delegation of responsibility and authority for all dam safety activities; and,
   v. Defines the process for making decisions related to dam safety.

Response

For clarity, Water License W2007L2-0003 requires that the dams and dikes be “designed and constructed to engineering standards such that at a minimum they comply with the Canadian Dam Safety Guidelines” (see above Part C Item 1) and that DDMI “operate and maintain the Water Retention Dikes to engineering standards such that at a minimum they comply with the Canadian Dam Safety Guidelines (see above Part G Item 1). The water license requirement for the operation of the processed kimberlite containment facility references that operations “shall be in accordance with the NWT Water Board’s "Guidelines for Tailings Impoundment in the Northwest Territories, February 1987”” but does not reference the Canadian Dam Association Guidelines.

DDMI’s dam safety management system is enabled by the Diavik Health, Safety, Environment and Quality Policy (HSEQ). The policy identifies the business overall commitments to Health, Safety, Environmental Protection and Product Quality which is inclusive of tailings management and all aspects of geotechnical safety including dams and dikes. A copy is included as Attachment #1.

Diavik’s commitment to this policy is reflected in the Operational, Maintenance and Surveillance (OMS) Manuals for the dams and dikes. These manuals define the application of the HSEQ policy when it comes to earthworks. They consider the aspects necessary to effectively operate, maintain and monitor the dams and dikes to ensure the physical integrity of those structures, personnel safety, protection of the environment and production. The elements covered in the OMS Manuals are: instrumentation arrays and monitoring schedules, inspection protocols and schedules, accountabilities, required technical reviews, and unwanted events management.

Diavik recognizes the criticality of the integrity of its earthwork structures to safety. Significant efforts continue to be made towards ensuring the best possible conditions for all of the components of the life of these structures:
- Design: Having reputable, qualified designers;
- Construction: Quality control and assurances processes;
- Commissioning: Close monitoring of the behavior of the structures during that phase and adherence to the designer’s requirements;
- Operating: Working closely with the designers and all reviewers on an on-going basis to honor the expected operational parameters, and making necessary adjustments;
- Reviews: Internal, external, as per industry and corporate guidelines; multi-layered technical, safety and operational review process;
- Monitoring: Rigorous monitoring schedule and instrumentation array as per designer’s requirements, close data review and interpretation;
- Inspections: Regular inspections as per designer’s requirement, by qualified personnel;
- Communication: Transparent communication of the health of the structures and ongoing projects, to internal and required external stakeholders;
- Maintenance: Upgrade and repair work as required, in a pro-active manner and under the designer’s guidance;
- Risk management: Comprehensive Trigger Action Response Plan (TARP) to capture possible emergency scenarios and required responses, accountabilities, training, and awareness; and
- Closure: closure plans going through numerous iterations, respectful of environmental, traditional knowledge and operational parameters.


The Diavik President signs off on the business HSEQ policy, therefore holds the ultimate accountability for implementing the processes that ensure proper tailings management and all aspects of geotechnical safety including dams and dikes.

After the Diavik President, the “area owners” are next in the accountability line. Each area of the mine site has an accountable manager designated. This accountability changes periodically with changes documented and authorized through a change management process. Currently the Manager, A21 Construction has accountability for the water retention dikes and the Manager, Fixed Plant has accountability for the PKC dams. When the individuals in these positions are unavailable, their authorities are delegated to their superintendents.

Decisions relative to safety are made in a collaborative setting. Technical expertise is assembled: designers, technical personnel, area owners, and representatives from operations (dewatering, support services, surface mining operations and underground operations when applicable). The situation is examined from a risk management perspective, either informally or through structured risk assessment tools. The approach is to fully understand the situation at hand, discuss options, weigh them in terms of feasibility and impact on safety, and recommend the appropriate course of action. Risk assessment outcomes are ultimately approved by the Diavik President and retained in a registry.
Attachment #1 – Diavik Health, Safety, Environment and Quality Policy
Diavik Health, Safety, Environment and Quality Policy

At Diavik, we are committed to the health and safety of our workforce, environmental protection and quality in the processing of our diamonds. We are committed to creating excellence in our systems to ensure we meet our core values of Integrity, Respect, Teamwork and Accountability. Supported by these values, we believe that all incidents and injuries are preventable. Our goal is zero harm.

To support our Health, Safety, Environment and Quality (HSEQ) policy, we commit to:

- Identify, eliminate, or otherwise control health, safety, environment and quality risks to our people, product, local communities and the environment in which we operate.
- Provide our workforce with the resources they need to achieve our goal of zero HSEQ incidents, injuries and illnesses.
- Comply with all applicable commitments, standards, laws, regulations and other requirements.
- Foster a culture of involvement.
- Support a measurable commitment to quality processes which meets or exceeds our joint venture partner and customer requirements.
- Ensure that HSEQ expectations are clearly communicated and that their management systems are audited.
- Continually seek to reduce the environmental footprint of our operations and related activities.
- Generate sustainable HSEQ performance through long-term, mutually beneficial relationships with our communities and all other stakeholders.
- Be transparent with our workforce, communities, monitoring boards and regulators about incidents that occur within our workplace.

Our vision of excellence is reflected through our people and the product we mine, process and deliver every day. We commit to applying the principles of this policy to continuously improve The Way We Work.

Marc Cameron
President

Document #: HSEQ-003-0110 R2 Expiry Date: 12 April 2016
Attachment #2 – PKC Engineer of Record
Dear Mr. Gord Macdonald,

This letter has been prepared to support the information request response being prepared by the Diavik Diamond Mines (2012) Inc. (DDMI) in response to the Water License Renewal Technical Session which was held on March 23, 2015.

The PKC Facility is a tailings facility which provides a permanent storage area for by-products from processing kimberlite ore at Diavik mine. During operations, it also provides an equalization reservoir of the excess supernatant water and site runoff water for process plant re-use. DDMI constructs, operates, maintains, and monitors the PKC Facility which has been receiving Processed Kimberlite (PK) materials since November 2002.

Golder Associates Ltd. is the Engineer of Record (EoR) for the PKC Facility represented by John Cunning, P.Eng. who is supported by an engineering team including German Pizarro, P.Eng. (BC) and Gerd Janssens, P.Eng. (BC).

1.0 PKC FACILITY DESCRIPTION

The PKC Facility consists of four joining lined dams with a total perimeter length of 5.5 kilometres enclosing the approximately 1,470,000 m² PK containment area. The PKC Facility is designed, and shall be operated and constructed, to provide for the safe, long-term containment of the Coarse PK (CPK) and Fine PK (FPK) produced through operations. The CPK is truck hauled from the process plant and stacked within the PKC Facility. The FPK is pumped as a low-density slurry from the process plant through insulated and heat traced pipelines and discharged through a series of spigots along the upstream side of the PKC dams.

The PKC dams comprise a downstream rockfill shell and a filter compatible liner bedding system supporting a low hydraulic conductivity element (high density polyethylene (HDPE), bituminous geomembrane or compacted till) on the upstream face. The PKC dams were founded on frozen or bedrock foundations with the liner anchored in a cut-off trench excavated in the foundation.
The PKC dams have been raised in stages. The West and East PKC starter dams were constructed to a crest elevation of 430 m in 2001 and 2002. The dams were raised to crest elevation 435 m in 2003 (Phase 2), to elevation 440 m in 2004 (Phase 3), to elevation 445 m in 2006 (Phase 4), and to elevation 460 m in 2007 through 2010 (Phase 5). Phase 5 included the construction of the South and North dams to crest elevation 460 m to enclose the PKC Facility by the four PKC perimeter dams (South, East, West and North dams). The four PKC dams are currently being raised to crest elevation 465 m (Phase 6).

2.0 ENGINEER OF RECORD ROLE

Engaging EoR services is an industry-recognized best practice for Owners seeking to reduce overall risk, to optimize practices, and to reduce costs associated with mine waste management. As EoR, Golder reports directly to the DDMI and works with DDMI to improve the development and operation of the PKC mine waste management facility. An EoR should be involved in all stages of project development, from initial conceptual design, through detailed design, construction, closure and into post-closure.

Golder, as the EoR for the PKC Facility, working for DDMI performs the tasks listed below for the PKC Facility and site collection ponds:

- Carry out design updates related to raising and/or modification of the PKC Facility and related structures. The most recent design update was completed in March 1, 2013 for the Phase 6 construction (Golder 2013);
- Carry out and/or monitor all field investigations and prepare designs (including drawings, technical specifications and input to operating procedures) to satisfy the operating, and closure requirements of DDMI;
- Monitor and provide quality assurance services of construction and operations to assess quality control testing compliance with the design;
- Provide field engineering, as required, during construction;
- Review and comment on operational planning for dam raise construction, processed kimberlite deposition and water management;
- Provide criteria to DDMI for the preparation of operating plans;
- Review operational, monitoring, and surveillance (OMS) manual updates;
- Review construction quality control data related to the structures;
- Perform regular EoR inspections of the PKC Facility including an annual Dam Safety Inspection (DSI); and
- Review and comment on designs and construction of other structures associated with the PKC Facility that may affect the integrity of the structures of the PKC Facility.
3.0 DESIGN AND CONFORMANCE WITH CURRENT CDA GUIDELINES

The Phase 1, 2 and 3 raises were based on the original PKC Facility design prepared by Nishi-Kohn SNC-Lavalin Ltd. (NKSL 1999, 2001). The Phase 4, 5 and 6 raises were based on designs prepared by Golder (Golder 2006, 2007, 2013).

The design of the PKC Facility made use of the Canadian Dam Association (CDA) Dam Safety Guidelines applicable at the time preparation of the report. The most recent Phase 6 design update (Golder 2013) was prepared following the Dam Safety Guidelines (CDA 2007).

The CDA have released two documents following the design update in 2013:

- Technical Bulletin: Application of Dam Safety Guidelines for Mining Dams, dated 2014 – This technical bulletin is intended to complement the CDA Dam Safety Guidelines (CDA 2013) by providing additional explanation of how the concepts described in CDA (2013) apply to mining dams.

The most recent design update is considered to be in agreement with the Dam Safety Guidelines 2007 (Revised 2013). Application of Dam Safety Guidelines for Mining Dams (CDA 2014) will be considered in the design of the next phase for the PKC Facility and/or during the next scheduled Dam Safety Reviews (DSR).

4.0 CONSEQUENCE CLASSIFICATION

The dam consequence classification is reviewed during each design update and is prepared in consultation with DDMI. The consequence classification is reviewed by an external consultant as part of the periodic DSR.

The current consequence classification is High was as detailed in Golder (2013) following the criteria in Dam Safety Guidelines CDA (2007). The consequence classification will be reviewed as part of the design of the next phase for the PKC Facility and/or during the next scheduled DSR.

5.0 ANNUAL INSPECTION

Annual inspections are conducted by Golder, as the EoR, and as required by Part H of the water licence (W20D7L2-0003, September 2007). The annual inspection allows the EoR to review the facility condition and performance, prepare an annual Dam Safety Inspection report which presents the results of the review including recommendations related to operation, maintenance and surveillance, to identify if the facility is being operated in according with the design intent, and that no conditions which adversely affect safety and stability of the structures exist.

The following structures are typically inspected as part of the Annual Dam Safety Inspection:

- PKC Facility – East, West, North and South dams;
- on-land dredged sediment storage facility (Pond 3) – exposed sections of the West Dam; and
- runoff collection ponds – Pond 1, 2, 4, 5, 7, 10, 11, 12 and 13.
The previous Annual Dam Safety Inspection report, the monitoring data, the as-built report for the construction works carried out since the last inspection, the PKC Facility operating information, and the DSR report are all reviewed as part of the annual Inspection process.

A report is issued summarising the findings of the inspection. Any outstanding issues from previous annual inspections are identified and recommendation for maintenance (if required) and future operations provided.

6.0 ROLE IN DAM SAFETY REVIEWS AND DIAVIK GEOTECHNICAL REVIEW BOARD

Dam Safety Reviews (DSR) are conducted by a Geotechnical Engineer independent to the EoR, at a frequency that is defined by DDMI based on the requirements presented in the CDA Dam Safety Guidelines and/or Rio Tinto guidelines.

The most recent DSR was carried out by AMEC with the report issued in December 2010 based on a site visit in 2009. The next DSR is scheduled for 2017.

DDMI maintains a Diavik Geotechnical Review Board (DGRB) which consists of three to four geotechnical engineers whose responsibility it is to carry out an annual review of the geotechnical structures at Diavik, of which the PKC Facility is one. Golder provides input annually to the data required by the DGRB, and was present during the site inspection of the PKC Facility in 2014.

7.0 PREPARATION OF EMERGENCY RESPONSE AND PREPARATION PLANS

Golder prepared an Operation, Maintenance and Surveillance (OMS) Manual in 2010 (Version 1, Golder 2010) as an update to the Processed Kimberlite Containment Facility Operation Plan. This version of the OMS Manual was consistent with Mining Association of Canada (MAC) guidelines and CDA Dam Safety Guidelines. DDMI has since prepared updates to the OMS Manual. It is understood DDMI will issue the next update to the OMS Manual in 2015.

The OMS Manual includes an Emergency Response Plan (ERP) as it relates to the PKC Facility and provides reference to the site wide Emergency Response Documents.

It is the responsibility of DDMI to update and revise the OMS manual, and ERP and EPP, as required and to obtain review input to the updates from the EoR. The OMS Manual should include the Dam Safety Policy, and organizational structure with roles and responsibilities.

These documents are reviewed as part of the DSR.
8.0 Closure

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Gerd Janssens, P.Eng. (BC)
Geotechnical Engineer

ORIGINAL SIGNED AND SEALED

John Cunning, P.Eng.
Principal, Senior Geotechnical Engineer

GJ/JCC/rs/bb
REFERENCES


Attachment #3 – A154/A418 Engineer of Record
April 08, 2015

P.O. Box 2498
Suite 300, 5201 - 50th Avenue
Yellowknife, NT, X1A 2P8
Canada

Attention Mr Gord MacDonald

Subject: Diavik Diamond Mines Water License Renewal
Letter by Engineer of Record for the Water Retention Dikes, A154 and A418

Our Reference: 020132

Throughout the design, construction and first years operation of the Diavik Water Retention Dikes (A154 and A418), the Engineer of Record was Anthony Rattue of SNC-Lavalin, operating in the Northwest Territories (NWT) under the entity Nishi-Khon/SNC-Lavalin. Mr Rattue is a Professional Engineer registered in the Province of Québec and licensed to Practice in the NWT. His career has been spent entirely in the field of earth and rockfill dam design, construction and surveillance. In line with assuring succession, François Ferland also of SNC-Lavalin, participated in the last two annual inspections and annual dike performance evaluation, that of 2013 in the company of Anthony Rattue.

The CDA Dam Safety Guidelines, on first reading, may give the impression that they are intended primarily for the evaluation of existing dams. Indeed, at any point in time, there are more dams in operation and under surveillance than under construction. However, as mentioned in section 1.1 of the 1999 Guidelines, which were those valid at the time of the construction of the above mentioned structures, the Guidelines have the objectives of ensuring consistent and adequate evaluation across Canada of existing dams and that new dams can be designed and constructed to be safe.

The Guidelines begin essentially with the classification of dams in terms of consequence of failure from which are derived several design criteria. A classification of "Very High" was adopted. Note that the "Extreme" category was added in the 2007 edition but that the design criteria are the same as those adopted for the project in 1999 (date of the design report for the A154 dike).
For earthquake effects, as the site is situated on a stable craton with known active faults only at considerable distance, a deterministic evaluation of seismic hazard was not appropriate. A probabilistic approach was used to establish the 1:10,000 yr design earthquake which is also in line with the “Very High” consequence category. (Extreme consequence category for the 2007 Guidelines.)

The inflow flood to Lac de Gras was selected as that of a 1:10,000 yr return period. The crest elevation for the dikes was established taking into account:
(a) this extreme flood together with wave run-up and set-up for the 1:100 yr wind or
(b) the normal maximum lake level combined with a 1:1000 yr wind.

Note that for a large lake (reservoir) an average wind (1:2 yr) combined with the extreme inflow design flood (1:10,000 yr) would have satisfied the guidelines. In fact, the two analyses, (a) and (b), gave very similar results with the former being only 0.1 m higher. It should be noted that the “Very High” consequence category inflow design flood given in the Guidelines is the “Probable Maximum Flood”, to be derived from a deterministic analysis. However, given the available statistical data, it was deemed appropriate to adopt the probabilistic approach. While the two methods may not give exactly the same result they are widely considered to be equivalent. Indeed the 2013 revision of the Guidelines have adopted the 1:10,000 yr option for the risk informed approach to establish the Natural Hazard.

Significant effort was expended in investigations to characterize the foundations of the dikes to:
Optimize the dike axis location;
Determine dredging requirements prior to embankment placing;
Determine grouting and other foundation treatment requirements.

The Minimum Factors of Safety (FS) for the slope stability analyses were those given in the Guidelines. Note that as soon as dewatering began, any potential sliding surface having a possibility of impacting the central cut-off was required to have a FS of 1.5. As the embankment was constructed by dumping into water, the outer superficial sliding surfaces were close to the angle of repose with a theoretical FS of unity. The slopes were trimmed subsequent to dewatering, and before mining, to increase even these values despite the fact that the hypothetical sliding surfaces had no impact on the cut-off.

The design incorporated a filter blanket over the entire footprint of the downstream shell, together with toe drains to collect seepage and convey it to the pump stations. The embankment material gradations were also selected to meet “State-of-the-art” filter criteria.

Protection of the outer slopes was ensured by the use of appropriately graded rockfill on both the upstream and downstream sides.

Despite the low level of earthquake loading, the design was validated for seismic resistance.

Permafrost is present at the abutments and consideration was given to both aggradation and degradation of the permafrost, and the location of the boundary.

The CDA Guidelines contain no specific requirements for instrumentation. However, given that the initial dewatering was carried out without the ability to inspect the dike toe, and that much of the operation takes place under winter conditions during which little visual observation
is possible, the dikes were intensively instrumented and automated data acquisition systems were included.

As Lac de Gras is a natural lake, the level of which was not affected by the works, no spillway, flow control or other discharge facilities were required. Likewise, no emergency equipment for lake level control is required.

The Engineer of Record was part of the construction supervisory team, and the members of the design team were present and involved throughout to ensure timely response to the site conditions as identified during the construction works.

The EoR coordinated the preparation and presentation of materials for the Diavik Dike Review Board meetings during the design phase, construction, and the first years of operation.

The development of the Emergency Response Plan for initial dewatering was done with the contribution of the EoR.

Annual inspections and performance evaluations are carried out by the EoR, namely Anthony Rattue from 2003 to 2013 and Francois Ferland, also of NKSL, for 2013 and 2014.

As mentioned, the 1999 Guidelines were current at the time of construction of the A154 and A418 dikes, but the 2007 (2013 revision) version does not change the design or dam safety evaluation criteria.

Yours truly,

Anthony Rattue
Engineer
AR/bc