Ms. Sarah Elsasser, Regulatory Manager
Wekeezhii Land and Water Board
#1-4905 48TH STREET
YELLOWKNIFE NT X1A 3S3

Dear Ms. Elsasser:

Diavik Diamond Mine Inc. (DDMI)
Water Licence – W2015L2-0001
TSS Moving Average Amendment
GNWT Final Arguments Submission

As requested by the Wek'eezhii Land and Water Board (the Board), Department of Environment and Natural Resources (ENR), Government of the Northwest Territories, is pleased to provide its closing statements in relation to proposed amendments of Water Licence W2015L2-0001 - Diavik Diamond Mines (2012) Inc. (DDMI). ENR has participated in the process to date including; submission of information requests, submission of a technical intervention and participation in the public hearing. ENR provides the following closing comments for the Board's consideration.

Total Suspended Solids (TSS) Limits and Averaging

There was much discussion at the hearing about how ENR's recommended Total Suspended Solids (TSS) Limits would be calculated and applied. In summary, ENR presented three TSS limits for construction of the A21 dike:

<table>
<thead>
<tr>
<th>Duration</th>
<th>TSS Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day (max grab ongoing)</td>
<td>50 mg/L</td>
</tr>
<tr>
<td>7 day (rolling average)</td>
<td>25 mg/L</td>
</tr>
<tr>
<td>30 day (rolling average)</td>
<td>11 mg/L</td>
</tr>
</tbody>
</table>

As identified at the public hearing, ENR is of the opinion that its recommended TSS limits are readily achievable, with the implementation of mitigation measures, and protective of the aquatic environment. Compliance sampling would be conducted continuously over the entire open water construction period, commencing at the onset of dike construction activities, not prior. Compliance with the 50 mg/L (1 day) maximum grab limit would be assessed every day during the construction season. Once sufficient data has been collected (i.e. Seven days after the start of construction), the seven day average would also be evaluated on a daily basis. The seven day average would be calculated as a rolling average. Similarly, once 30 days of data had been collected, the 30 day average would also be evaluated every day. Again, the 30 day average would be calculated as a rolling average.

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The following table provides an outline of how ENR envisions that TSS limits would be derived and used. Note the entire potential open water construction season is expressed as 106 days and the max grab limit, as identified above, would apply each day during that period. A rolling seven day average would begin on day seven, after seven days of operational TSS data is collected by DDMI. The rolling 30 day average would begin on day thirty. These rolling averages along with the maximum grab would be used to assess compliance over the entire open water construction period at each Surveillance Network Program (SNP) Station.

<table>
<thead>
<tr>
<th>Construction</th>
<th>Max Grab</th>
<th>7 Day Average</th>
<th>30 Day Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 2</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 3</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 4</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 5</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 6</td>
<td>X</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 7</td>
<td>X</td>
<td>X</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 8</td>
<td>X</td>
<td>X</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 9-28</td>
<td>X</td>
<td>X</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 29</td>
<td>X</td>
<td>X</td>
<td>n/a</td>
</tr>
<tr>
<td>Day 30</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Day 31</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Day 32-106</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

This approach would not incorporate pre-construction zero values into the average calculation as proposed by DDMI. Note there was a lot of discussion about using zero values in the calculation of an average, both within ENR’s technical intervention and at the hearing, which outlined why this is not a preferred practice. This information will not be reiterated in our closing comments.

At the hearing, ENR was also questioned regarding calculating TSS averages when environmental conditions are not safe for the DDMI team to collect TSS samples on a given day. ENR is of the opinion that a reasonable approach would be to use an average of the TSS values observed on the day prior to and following the day that a sample could not be collected. For example, if a TSS value of 5 mg/L was observed on the day preceding a missed sampling event and a value of 10 mg/L was observed on the day following, a value of 7.5 mg/L would be used as the missing value in the context of determining the rolling average.

SNP Sampling Depths and Station Location

There was much discussion at the hearing about ENR’s recommendations for SNP sampling. ENR would like to clarify that its rationale for the SNP recommendations are located within the Technical Report appended to its written intervention, prepared by MacDonald Environmental Services Limited (MESL).
This Technical Report outlines that there are two likely zones of impact from dike construction at the Diavik Mine: the water column or pelagic zone, and, the near bottom zone or benthic zone (see Section 4, page 11). ENR’s proposed sampling method of collecting near surface, mid-depth and near bottom samples is recommended for determining actual TSS levels at various locations within the water column. This is recommended as TSS concentrations will vary with space and time within the water column.

For benthic organisms, only the near-bottom TSS measurements would be used to estimate exposure point concentrations for each sampling station for each sampling date (SNP 1645-82 – 1645-84). ENR is concerned that a depth integrated sample or some variant would not provide discrete information on the TSS concentrations at depth, and therefore would not be sufficient or appropriate to assess protection of benthic organisms outside the construction area (i.e. 200m from the dike centerline). ENR notes that the silt curtain, or turbidity barrier, does not extend all the way to the lake bottom and thus plumes of high TSS water may escape the initial construction zone and travel along the lake bottom. The importance of protecting benthic organisms is that they are low on the food chain and make up a portion of the food that fish eat.

For pelagic organisms, all of the TSS data (i.e., three water depths at SNP 1645-82 – 1645-84) would be used to calculate the exposure concentration for each sampling station for each sampling date.

ENR understands there is some debate about using discrete samples versus a depth integrated sample and that both sample types have been used by DDMI to assess compliance with TSS limits during the construction of other dikes. It is ENR’s view that what was approved in the CEMPs for other dikes is not binding on this amendment application. ENR notes that it is assessing this TSS amendment application on its own merit and, as such, is providing recommendations for assessing compliance with TSS based on Best Practice and protection of the aquatic organisms in Lac de Gras. ENR understands, as described in its written intervention, that the magnitude of any TSS plume that escapes the turbidity barrier will vary over space and time. ENR expects that high TSS may occur near the lake bottom, if the plume flowed under the barrier, in the middle of the water column, in the event of a barrier malfunction, or at the top of the water column depending on currents and as a result of wavy conditions. Thus, ENR’s recommendation is to use discrete sample locations, which would capture the magnitude of TSS at each of these depths, for compliance assessment. ENR’s opinion is that the proposed three depth sampling method is the best method for assessing compliance with the TSS limits based upon the potential behavior of TSS plumes in Lac de Gras.

**200 m from the Centerline of the Dike Footprint**

At the hearing there was some discussion about Part H, Condition 31, of the water licence. This condition requires that compliance sampling during dredging, construction or other in-lake activities should occur at SNP Stations but also "at a 200 metre distance in any direction from the centerline of the dike footprint". ENR is of the view that this specific spatial requirement was included in the original water licence to correspond with the assessment zone described by DDMI in its Environmental Assessment Report.
DDMI's request to move specific details about compliance monitoring from the body of the licence to the SNP was supported by ENR within its intervention. However, ENR clarified during its public hearing presentation that the requirement for compliance assessments 200 metres from the centerline of the dike footprint should remain. In other words, this spatial requirement should remain, but can be located in the SNP versus the body of the licence. It is ENR’s position that any assessment boundary included in the environmental assessment should be maintained within the water licence (e.g. diffuser mixing zone - 60 m, dike construction - 200 m, etc.).

**Legal Sampling**

Questions were raised during the hearing regarding the criteria that must be met for a "legal" sample. As noted at the hearing, there is definitive wording within DDMI’s Water Licence related to its sampling requirements, sample presentation and analysis, as well as requirements related to quality assurance and quality control and environmental laboratory accreditation (W2015L2-0001, Annex 1: SNP, Part C). These protocols must be met for a water sample to be deemed acceptable as a “legal” sample. If DDMI's onsite environmental laboratory meets these requirements, TSS samples analyzed at their laboratory could be used along with any samples collected by DDMI and analyzed at an offsite laboratory, as well as any sampling and analysis conducted by the Inspector.

However, an important distinction should be made with respect to grab samples analyzed in an accredited laboratory versus field measurements. Much of the discussion at the hearing focused on whether real-time turbidity monitoring from a remote buoy (known as a field measurement) could be considered as a “legal” sample. ENR's position is that field measurements cannot be considered a “legal” sample. Further to the discussion at the hearing, ENR is not aware of any other jurisdiction that relies upon field measurements to determine compliance with a water licence or permit. Field measurements are conducted using probes which can have different sensor types, analytical algorithms and varying degrees of error. As such, no standardized or accredited field measurement probe has been certified by an agency responsible for providing quality control or assurance such as the Canadian Association for Laboratory Accreditation. This is likely due to the potential variability that is introduced by the instrument type and method as well as the instrument calibration requirements that are solely the responsibility of the user. An incorrect calibration will result in inaccurate results.

Further, turbidity samples taken in the field must ultimately be converted to TSS concentrations, since it is the TSS concentrations that are regulated within the Water Licence. While DDMI does maintain and regularly updates a TSS-turbidity curve, for use as an early warning tool (as described below), it is not apparent that the relationship is sufficiently robust to be used for the assessment of legal compliance. It is uncertain how the validity of the curve would stand up to legal scrutiny, particularly as the relationship between the variables changes depending on the type of construction activity (i.e. dredging versus rock placement) or substrate type that is encountered by the construction activity (i.e. fine sediments versus gravel bottom).
TSS-Turbidity Relationship

Due to the nature and location of in-lake construction activities, the levels of TSS and turbidity in surface waters within Lac de Gras are likely to vary substantially over time and space. As a result, evaluation of exposure of aquatic organisms to these substances necessitates design and implementation of an in-lake construction monitoring program that provides reliable information on the concentrations of TSS and turbidity in the vicinity of the A21 Pit construction activities.

Implementation of an effective response plan requires acquisition and interpretation of reliable monitoring data to support management decisions in a timely manner. For this reason, it is recommended that continuously-collected turbidity data be used to support estimation of TSS levels in Lac de Gras and that those estimates of TSS concentrations be used to support management decisions related to in-lake construction mitigation (i.e., implementation of the response plan). In this case, matching TSS and turbidity data (i.e., data collected at the same sampling station at the same time and at the same water depth) should be used to develop quantitative relationships between turbidity levels (NTU) and TSS concentrations (mg/L).

MESL conducted a review of the TSS-Turbidity relationship developed in 2015 during construction activities which indicated the model is currently too variable to provide an effective TSS prediction. This is likely the result of very few data available for turbidity levels greater than 10 NTU and the single measurement of high turbidity greater than 30 NTU. This single value strongly influenced the slope of the line. It is for this reason that ENR recommends additional turbidity and TSS sampling at the various depths, as described in ENR’s monitoring recommendations. This monitoring will better populate the TSS-Turbidity plot and create a more robust relationship.

Construction Environmental Management Plan

At the hearing, it was apparent that clarity was required regarding ENR’s recommendations related to the Construction Environmental Management Plan (CEMP), which ENR had mistakenly referenced as the Construction Effects Monitoring Plan. ENR would like to clarify that this was simply an incorrect reference within its intervention and that all recommendations provided by the ENR related to the CEMP are still valid. Note, in DDMI’s intervention dated January 27, 2016, there was general agreement that ENR’s recommendations would be considered in an updated CEMP.

At the hearing, DDMI specifically questioned whether ENR’s CEMP recommendations would be better placed within the surveillance network program (SNP). Specifically, the recommendations related to the CEMP were as follows:

ENR recommends that the A21 Construction Effects Monitoring Plan (CEMP) be updated prior to the 2016 construction period. A draft CEMP should be developed for review with a final plan to be approved prior to construction. The CEMP should include action levels which ensure compliance levels approved by the WLWB are not exceeded.
ENR does not believe there is any confusion in this regard and DDMI has agreed to update the CEMP.

ENR recommends that the A21 Construction Effects Monitoring Plan include detailed information related to the utilization of the TSS-Turbidity correlation curve in the establishment of trigger levels.

Schedule 5, Paragraph 3 of the Water Licence outlines the requirements for the A21 Construction Environmental Management Plan and specifically Part (a) outlines requirements for the dredging plan of which, item v), is listed as "final monitoring plan design." ENR's opinion is that the above recommendation conforms to this requirement of the CEMP.

ENR recommends that the A21 Construction Effects Monitoring Plan include mitigative actions for situations when TSS triggers and limits are exceeded.

Schedule 5, Paragraph 3 of the Water Licence outlines the requirements for the A21 Construction Environmental Management Plan and specifically Part (a) outlines requirements for the dredging plan of which, item v), is listed as "final monitoring plan design." ENR's opinion is that the above recommendation conforms to this requirement of the CEMP.

Finally, there was also a discussion at the public hearing related to the urgency of getting a finalized CEMP to ensure it would be in place prior to construction. Based on the current proposed workplan and proposed timing of construction activities, ENR offers that a submission of the CEMP should occur 3 weeks after licence issuance to allow the appropriate time for review and any necessary amendments prior to construction. ENR notes that any future updates to the CEMP must reflect the terms and conditions of the approved water licence.

Closing

The GNWT would like to thank the Board for the opportunity to provide its closing arguments as part of the TSS Moving Average amendment application process. Should you have any questions or concerns, please do not hesitate to contact Mr. Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick.clancy@gov.nt.ca.

Sincerely,

[Signature]

Joel Holder, Director
Conservation, Assessment and Monitoring Division