May 7, 2015

Violet Camsell-Blondin
Chairperson
Wek'èezhii Land and Water Board
#1-4905 48th St,
Yellowknife, NT
NT X1A 3S3

Dear Ms. Camsell-Blondin:

The Environmental Monitoring Advisory Board (EMAB) would like to thank the Wek'èezhii Land and Water Board for the opportunity to submit its intervention regarding the Renewal application for the DIAVIK Water License W2007L2-003 Renewal.

Our Oral presentation before the WLWB at the public hearing will be given by Sean Richardson, Chairman of EMAB with technical support provided by EMAB's consultant, Tim Byers.

We will be pleased to answer any questions on our presentation at the hearing.

Should you have any questions about this intervention, kindly contact Ms Brenda McDonald, Executive Director at 766-3682.

Sincerely,

Sean Richardson
Chair
cc. EMAB Board of Directors
May 6, 2015

The Environmental Monitoring Advisory Board (EMAB) is pleased to submit this intervention to the Wek’eezhii Land and Water Board. This intervention will present proposals for amendments to terms and conditions of Diavik Water License W2007L2-003, as well as pose pertinent questions relating to supporting documents for conditions relating to AEMP. Also open to debate is the proper term limit for this licence.

The following lists EMAB’s subjects of concerns, in order of priority.

1) North Inlet: - regarding hydrocarbon-contaminated sediments and dike stability with implications to Part L Conditions Applying to Closure and Reclamation

2) AEMP: - regarding establishing links to Air Quality monitoring program, and eutrophication indicators, and monitoring of sentinel fish species, with implications for Part K: Conditions Applying to Aquatic Effects Monitoring.

3) Aquatic Response Plan: - regarding suggested improvements to the Plan, especially in biological effects.

4) Closure: - regarding a need for a Sulphate EQC, PKC dam stability assurances, PKC pond water safety for waterfowl, pit lake fish habitat funding for closure, and more progressive reclamation of mine components.

5) Dike Construction: - regarding need for a mitigation strategy within the A21 Construction Environmental Management Plan to address higher-than-expected TSS.


7) Dust Deposition: - regarding possible impacts to fish habitat of dust deposition over Lac de Gras, and elders’ recommendations on siting of dust monitoring gauges.

8) Dike Dewatering: - regarding possibility of collapsing lake ice creating turbulence-induced TSS
1.0 North Inlet

1.1 EMAB is concerned about hydrocarbon inputs into the North Inlet sediments. This continues to be a problem, as the latest SNP report (February) plainly shows. In fact, North Inlet Sediments have been shown to be acutely toxic to Amphipods (*Hyalella azteca*). We also note an Oil & Grease exceedance of Water License EQC in effluent from the treatment plant (1645-18) on Sept 22, 2014. EMAB is looking for greater clarity as to how DDMI is mitigating this problem.

Recommendation:

(a) DDMI should indicate what mitigation measures it has put in place to significantly reduce or eliminate this contamination source.

(b) Also, there are no Effects Benchmarks set for Oil & Grease or TPH in the AEMP. The current condition of sediments in NI now warrants establishing such a Benchmark.

1.2 Since zooplankton within the NI water column have similar-to-higher abundance and biomass than Lac de Gras zooplankton, DDMI believes this indicates that the North Inlet zooplankton community has not been adversely impacted by hydrocarbon sludge. This may very well be true if hydrocarbons are locked in to the benthic sediments. However, the finding that the zooplankton in the inlet has become an almost homogeneous community dominated by only one taxonomic group (cyclopoid copepods) to the almost total exclusion of all others suggests something in the water column is negatively affecting zooplankton — in Lac de Gras, only 8-34% are cyclopoids while 52–84% are rotifers (Golder 2014). **DDMI believes this is caused by an excess of nutrients entering the system, but EMAB doesn’t believe we’ve been presented with enough evidence to support or reject that conclusion.** One important question is whether the hydrocarbons are truly locked into the sediments or whether there is potential for infrequent upwelling turbulence which may mobilize sediments up into the water column. Turbulence could be caused by heavy wind storms or generated by other means. If so, we would need to know the duration of exposure of the sediments in the water before settling back down to the bottom.

1.3 DDMI has laid out 6 different options for dealing with the contaminated sediments of North Inlet for closure. AppdX-5 *Disposal Alternatives for North Inlet Water Treatment Plant Sludge* suggests these options for NI sludge disposal:

(a) Disposal with Type 3 waste rock
(b) Disposal in PKC
(c) Disposal in a new on-land facility
(d) Disposal by mixing with cover soil or hydrocarbon contaminated soil
(e) Disposal within the Underground Mine Backfill Mix
(f) Disposal into the NI Pond followed by Selective Dredging
Another option is to leave the sediments all in the North Inlet and keep the inlet isolated from Lac de Gras.

DDMI should provide a thorough evaluation of all environmental risks, costs and benefits of each option. Without a proper risk assessment of each option, it is difficult for EMAB to offer its support on any one option. EMAB wants to see such a risk assessment done before it can give an opinion, as making the right decision has strong closure implications.

1.4 At Ekati, hydrocarbon-contaminated materials are sent to the landfarm where they are aerated and fertilized to promote bioremediation. (BHP Billiton 2007) DDMI’s own *Hydrocarbon Impacted Materials Management Plan* (Section 4.1) has hydrocarbon-contaminated snow, water, soil, rocks and gravel deposited into a landfarm in the Waste Transfer Area. This Plan goes on to say “*Testing will be completed at a later date to determine if the material is suitable for placement/disposal at the Site.*” However, it is not explained what the disposal procedure will be. In the March 23 Technical Session DDMI said that it currently lacks the amount of contaminated gravel needed to proceed with landfarming. **What is the minimum volume of material necessary to bioremediate?** If bioremediation is the option chosen to deal with the contaminated sediments, then once bioremediation commences, EMAB recommends DDMI report the volumes of material bioremediated. (This is done at EKATI). Once it is deemed to be clean by DDMI, samples of the “cleaned” sludge should be sent to an accredited lab to verify hydrocarbons are no longer present in amounts that could be significant to environmental health.

To what standard should hydrocarbon-contaminated soils and till be remediated to?

EMAB believes DDMI should maintain its current *Agriculture/Parklands Standard* for all bioremediated materials at DIAVIK, and that WLWB should consider whether to make this a condition in the license.

1.5 “*In response to a warming trend identified in the 2008 thermistor data along the North Inlet East Dam, 47 thermosyphons have since been installed in the North Inlet East Dam. These thermosyphons will prevent seepage through the promotion of continuous freezing within the core of the dam.*” (DDMI 2014) “*The foundation in an unfrozen state has a low but finite permeability whereas in a frozen state, the permeability is zero*” (Ferland 2014)

EMAB understands that the current thermosyphons are passive systems, not requiring refrigeration units (Ferland 2014). **If post-closure monitoring determines that water quality in North Inlet is too poor to allow connection of the inlet to Lac de Gras, will these thermosiphons require perpetual care and maintenance to assure directly affected communities and regulators that seepage of degraded water will not enter Lac de Gras? Or will these thermosiphons continue to operate in a passive condition in perpetuity? If a CRP decision is made to leave hydrocarbon-contaminated sediment in a North Inlet that is hydrologically isolated from Lac de Gras (rather than dredging out those sediments), then the**
long-term stability of the East Dike is a crucial consideration, given the minute vertical & horizontal movement measured in that dike (Ferland 2014, p.7)

1.6 DDMI has identified PAHs and PHCs in North Inlet sediments that it believes are from heavy machinery lubricants in underground mining. However, EMAB would like to investigate another source. Aircraft de-icing occurs at east end of the airstrip and helicopter refuelling occurs at the helipad halfway between the airstrip and the westernmost end of North Inlet. (DDMI 2014a) Since both the airstrip & the helipad drain towards the North Inlet, this suggests the inlet is intended to receive any spilled hydrocarbons and antifreeze from the airport. The airport is thus a potential source of hydrocarbons and de-icing antifreeze compounds to N Inlet. Yet there is no sampling of hydrocarbons or oil & grease at SNP stations 1645-12 or 1645-13 (N Inlet west and east cells) required in the water license (however, the special study of North Inlet Quarterly Status Report - Q3 [Table 1] showed hydrocarbon content was below detect in water directed into the treatment plant at 1645-13).

**Recommendation:** add PAHs, PHCs and Oil & Grease to list of SOIs to be sampled bi-weekly at 1645-12.

**Recommendation:** A Hydrocarbon Management Plan should be implemented. Much like the Ammonia Management Plan, this would be geared towards identifying inputs of hydrocarbon contaminants into the water system at DIAVIS and minimizing if not entirely eliminating these inputs.

2.0 AEMP

2.1 Links to Air Monitoring

DDMI has stated that incinerator stack testing is not a Water License requirement and not within the WLWB’s mandate (DDMI 2015). A few years ago, Environment Canada established a link between mining impacts on air quality (from incineration) and lakebed sediments at the Ekati mine. The old incinerator was a point source for organochlorines (dioxins and furans) in a lake in close downwind proximity. (Wilson et al. 2011) This fact alone warrants the inclusion of monitoring of potential air quality impacts on aquatic life in the water license conditions applying to AEMP & Closure. EMAB believes that evaluating links between air and aquatic effects monitoring is long overdue.

**Recommendation:** Part K – Conditions Applying to Aquatic Effects Monitoring should require a link be made to results of Air Quality Monitoring Program. Part K(11) mandates “an integration of all information related to assessing aquatic effects.”
2.2 Change in Trophic Levels/Eutrophication:

2.2 a) Eutrophication Indicators - Phytoplankton:
DDMI states (DDMI 2015a): “Chlorophyll a levels continue to be measured at levels that are less than half the effects benchmark even within the zone of nutrient enrichment.” With Total Phosphorus concentrations rising throughout the near- and mid-field zones of Lac de Gras (2013 TP was the highest loading into Lac de Gras since 2002 –Golder 2014a),

EMAB wonders just how representative of total phytoplankton standing crop in Lac de Gras is chlorophyll $a$? EMAB is aware that Chlorophyll $a$ is a simple and cost-effective measure of phytoplankton response to nutrification. But while all algae produce chlorophyll $a$, various taxa have chlorophyll $a$ in differing proportions. Golden algae produce more carotenoids than chlorophyll $a$, while blue-greens produce mostly phycobilins. The 2013 AEMP (Golder 2014b) showed that Chrysophytes (golden algae) and Cyanobacteria (blue-green algae) were the dominant taxa in Lac de Gras by abundance and biomass respectively. These taxa produce chlorophyl $a$ in lesser proportions of their total phytopigments than Chlorophytes (green algae) which appears to be declining in the Lac de Gras phytoplankton community, particularly in Near-Field sites. So if Lac de Gras phytoplankton population were to explode with dominant taxa of chlorophyll $a$-poor species replacing Chlorophyll $a$-rich taxa, would the current eutrophication indicator used in the AEMP (chlorophyll $a$) be able to detect this sign of eutrophication?

The 2013 AEMP Report states that mean chlorophyll $a$ concentrations in the near-field were double those of the far-field and that this increase over reference conditions was measured over 25% of the lake area (Golder 2014c) Given the above question, could increasing phytoplankton population be spreading further into the far-field areas of Lac de Gras than the AEMP has the ability to detect? Perhaps total biomass should also be used as an indicator of possible eutrophication. Total biomass is measured and evaluated in the AEMP Response Plan but not as an indicator of eutrophication.

One additional metric for phytoplankton effects that could be considered is percentage of total biomass made up of edible species vs non-edible (this is evaluated for the EKATI mine’s AEMP).

2.2 b) Total Phosphorus in May 2013 was at the highest levels since 2002. In May 2013 TP loads increased over double that of any previous year in May. EMAB would like to know what operational conditions or other factors caused this. Although the 2013 result of 140 kg for May is still well under license limit of 300 kg/month, given the concerns about eutrophication in Lac de Gras it may be instructive to learn what operational factors could create a monthly loading of phosphorus double what is usual.

2.3 Sculpin Monitoring: Slimy sculpin in Lac de Gras cannot be lethally sampled more than once every 3 years “...in order to ensure the viability and successful regeneration of the local population.” Because Slimy Sculpin have a very small home range (thus no adjacent populations from which to recolonize) and it may take two or three years for new cohorts to reach sexual
maturity, “two years between lethal sampling events could harm the population by removing the reproductive fish of the population.”(DDMI 2014c)

Slimy Sculpin is an indicator of benthic conditions in L de Gras and also an early warning of impending contaminant issues for fish higher up the food chain.

EMAB would like DDMI to consider non-lethal sampling in those in-between years. DFO lists 10 different population health metrics that can be measured in live-capture sculpin. If this could be implemented, it would provide a much more complete time series for small-bodied fish data to build a stronger case for temporal trends in sculpin health in Lac de Gras.

3.0 Aquatic Response Plan

3.1 EMAB agrees with ECOMETRIX (WLWB’s consultant) advice to WLWB: Mitigation options are identified at Level 3, but no mitigation implementation level is defined in Biological Effects Action Levels the way they are within the Chemistry and Eutrophication Action Levels. “This is not consistent with the intent of the WLWB (2010) Guidelines. The Guidelines note that a biological response outside the normal range (reference mean +/- 2SD) may require the strongest possible response (if the cause and mitigations can be identified). They note if the biological changes were predicted in the EA, it may be appropriate for a higher Action Level (stronger biological response) to be the mitigation trigger. However, no biological changes consistent with toxicological impairment were predicted in the EA for this project. Therefore, if we start seeing such changes, and they become statistically significant, it would be appropriate to investigate cause, and if mine related mitigations can be identified, to implement them as soon as possible”

Recommendation: Action Levels for mitigation of biological effects should be defined in the Aquatic Response Plan.

3.2 Diavik’s dikes contribute bismuth, lead, and uranium to sediments/substrate at stations nearest the dikes (as does the effluent at sample stations nearest the diffuser). Fortunately, these metals are not yet at levels above CCME or Ontario guidelines, though there are no guidelines for bismuth. In relation to whether these 3 metals show up in elevated levels in fish tissue, DDMI states (DDMI 2015b) “The analysis of the AEMP results for fish determined Action Level I (2013 AEMP Annual Report) which is to increase monitoring frequency to every 3 years. [But] Measured levels did not indicate that an investigation of cause (Action Level 2) was required.” This is correct. However, this may not have been the case if the "normal range" of values they were compared to had been more conservative (i.e. set at mean plus-minus 1 to 1.5 SD instead of 2 SD). The Precautionary Principle would dictate that we take this more conservative approach in examining early warnings of potential impacts to fish health.

Recommendation: It would be of benefit for DDMI to run this analysis again using a range of mean +/- 1.5 SD, and again at +/- 1 SD to see if the result triggers an Action Level 2.

3.3 The final level of every framework (Water Chemistry, Chlorophyll a, Biological metrics) has an action of “Significance Threshold “. What action does this entail? Does this suggest a changing of the significance threshold if that level is reached (i.e. moving the goalposts?)
4.0 CLOSURE:

4.1 Waste Rock Piles:

From 2013 Waste Rock Reclamation Research we learn that Chloride, Nitrate & Sulphate produced from the blasting process are main leachates from Waste Rock test piles. Sulphate oxidizes from sulfur in the rock. Type III rock produces more sulphate than Type I due to greater amount of biotite schist. Chloride & Nitrate should dissipate in leachate as time goes by but Sulphate may not since S continues to oxidize within the rock pile. This would suggest that an EQC for Sulphate is warranted for closure to address conditions of the frozen core of the rock pile thawing unexpectedly. Factors possibly countering permafrost aggradation resulting in thawing conditions within the rock pile are:

- impacts of climate change influencing the thermal regime of the rock pile,
- solifluction (slumping of the pile slopes) or other geological processes thinning the granite/till cover resulting in a deepening of the summertime active layer.

To deal with seepage water from rock piles and tailings ponds that is non-compliant with license EQCs, water licenses in NWT currently address this by mandating that all seep water that are non-compliant should be collected and sent to managed reservoirs (sedimentation ponds or tailings ponds). But in the above case, the source of sulphate may not show up until post-closure and so would not be collected. If DDMI is given a 15-year license then EMAB is concerned an EQC for rock pile-generated sulphate may not be enforceable after the mine is closed.

Recommendation: An EQC should be developed for Sulphate. EMAB is unsure of where the Compliance point should be set since the source in this case would be the rock pile sited a distance from Lac de Gras shores rather than the mine effluent going directly into the lake.

4.2 PKC:

4.2 a) DDMI states: “DDMI's PKC Management was designed to meet internal standards that we understand to be equivalent or better than the MAC Tailings Guidelines. Unfortunately, the MAC TSM definitions do not allow for "or equivalent"... MAC TSM specifies a separate Tailings Management Policy. DDMI does not have separate policies for each facility or environmental aspect. DDMI's environmental management systems are ISO 14001 certified. The MAC TSM ranking reflects what DDMI considers to be administrative conformance issues” (DDMI 2015c)

This leaves EMAB with 2 questions.

Does the ISO management oversight system incorporate the recent recommendations on tailings management from Mount Polley? Or does ISO limit itself to administrative aspects of environmental management and compliance?
The Independent Expert Engineering Investigation and Review Panel in BC gave a strong critique of the design flaws in the Mount Polley tailings dam and gave recommendations to improve on Standard Operating Procedures in dam design and approvals.

**How does DDMI’s internal “equivalent-to-MAC TSM” tailings management provide regulators in NWT with assurances DIAVIK’s PKC dams will function as designed post-closure?**

This is not to suggest that EMAB anticipates a Mount Polley-style catastrophe at DIAVIK. However, these are relevant concerns given that the PKC did experience 2 unexpected leaks of contaminated water into Lac de Gras in August of 2008 and 2011. Also, there are large amounts of seepage water sitting within the PKC dam embankment that require monitoring. This was created by a “condition where seepage can continually accumulate within the downstream embankment by a continuously rising ice dam within the zone of downstream rock fill that is permanently frozen” (DDMI 2015d)

**As stated in #1.5 above, these concerns may also be applied to the North Inlet dike at closure.**

**4.2 b)** With the potential for low pH and high concentrations of sulphate & metals in the PKC pond water (AMEC 2013), this new closure plan for the PKC should warrant closure EQCs protective of waterfowl using the pond that could ingest contaminated water in drinking and grooming feathers wetted by the PKC water.

**4.3 Pits:**

Construction of fish nursery and feeding habitat within the diked area of each pit are not costed in the Financial Security for A21 — DDMI says this is still to be determined. This is because, like the first 2 pits, A21 fish habitat shall be built progressively during operation of the pit and is scheduled to be complete in 2022, the same year as the pit will be finished.

**In reference to License Part L (1k): in the event of a premature mine shutdown, how will fish habitat that is being built during a terminated pit operation be costed so to ensure funding is in place to complete the fish habitat work?**

**4.4 Progressive Reclamation:**

**What progressive reclamation has been done to date?** It appears only old infrastructure removal has been done. Are any other mine components or parts thereof scheduled for the next 2 years? The effectiveness of that work needs to be evaluated within a Reclamation Monitoring Program, as per Part L, article 6.

**EMAB would like to see work begun on mine components as soon as possible.** If done early enough, the lessons learned in conducting and monitoring the reclamation of mine components such as waste rock piles, tailings ponds, roads and pits can be incorporated into
reclaiming the larger site when its time has come. Lessons learned could also be used by similar mines in the region.

4.5 Financial Security to Cover Post-closure Monitoring:

EMAB is not privy to the discussions between GNWT and DDMI on financial security estimation for the DIAVIK project. EMAB believes areas that should be costed in the Water License Security include:

- **research** and engineering costs in support of proposed reclamation activities;
- **regulatory** costs to obtain necessary permitting and authorizations;
- **consultation** costs to finalize the ICRP,
- any additional **project management** costs should GNWT be required to undertake the remediation.

As well, the Environmental Monitoring Advisory Board, which is mandated to provide advice to both DDMI and the regulators, must continue to be adequately funded during closure reclamation activities and post-closure monitoring.

How is the operation of EMAB costed in setting the EA Financial Security?

The figure is $3M in DIAVIK’s August 2014 RECLAIM estimate (and in Gord MacDonald’s July 25 2012 letter to WLWB). EMAB is skeptical that its mandated responsibilities can be met during the closure monitoring period if it can expect total funding of $3M over a 10-year (or more) period. The main tasks that comprise EMAB role during closure monitoring include:

- Review Monitoring reports (Reclamation, Aquatic Effects, Wildlife, Air)
- Communications to Directly-affected Communities
- Preparation of EMAB Annual Reports
- Review Regulators’ performance in carrying out their mandates for permitting and environmental protection during closure and post-closure at DIAVIK.

**EMAB wishes to be consulted so to be able to provide input** into GNWT & DDMI discussions on both the Water License and EA portions of total Financial Security for the project.

5.0 Construction

5.1 Dikes

Based on experience in building A514 & 418 dikes, DDMI expects that “at least 95% of the sediments put into suspension will settle out of suspension in two hours during dredging”. Dredging will not generate TSS greater than criteria established for protection of fish within 200 m of the dike and dike construction will be “carefully monitored” to assure this. (DDMI 2014e)
However, nothing is mentioned about what mitigation plan is in place to deal with any higher-than-expected TSS generation. EMAB would expect that all dredging activity would cease at that point until the problem could be identified and corrective actions taken before dredging is allowed to resume.

**Recommendation:** please include a high-TSS mitigation strategy in the A21 Construction Environmental Mgmt Plan for Part C of license.

### 6.0 Effluent Treatment and QA/QC Water Quality Testing Problems:

6.1 There have been several instances of lost and contaminated samples over the last few years. WLWB indicated its concern in Review Comment #22. As one example of how this problem can degrade the company’s assessment of environmental changes in Lac de Gras: The 2013 AEMP reports that for 3 years (2011-2013) there were problems in analysis of ammonia in water samples from Lac de Gras whereby even blank samples contained ammonia concentrations higher than Lac de Gras. This resulted in Golder’s conclusion that “the magnitude of mine-related effects reported for ammonia (at an Action Level 2) is made with some scepticism...” (Golder 2014d) This gives EMAB some anxiety about the integrity of the AEMP when doubt arises over the accuracy of its conclusions.

**What is the standard operating procedure for dealing with and mitigating faulty laboratory analytics?**

Also, EMAB questions why, in the past year and a half, noteworthy exceedances of license EQCs (zinc and oil & grease) been measured at one water treatment plant (1645-18) but not the other (1645-18A). The laboratory’s investigation for high Oil & Grease exceedance would suggest it expected the SNP stations at both plants should have similar concentrations (Maxxam Analytics Corporation 2014). Can DDMI assure EMAB that future problems of this nature can be mitigated so that evaluation of water quality changes is not compromised?

**EMAB cannot support an end-of-mine-life license term when QA/QC issues lead to misgivings about the accuracy of water quality measurements central to any evaluation of license compliance.**

### 7.0 Dust Deposition

7.1 **Question to Department of Fisheries & Oceans:** In its application for renewal, DDMI states that “Dust deposition rates as recorded by dustfall gauges were greater than predicted in the environmental assessment.” (DDMI 2015e) Especially in the early years of pit and road construction, dust has been generated at very high levels. Maximum deposition has been measured at SS1-1 & 1-2 within 115 m north of the airstrip (1,576 & 772 mg/dm2/y respectively) well above BC Ministry of Environment guidelines. (Golder 2014e) These dustfalls were on land near the shoreline of Lac de Gras. Considering there may soon be cumulative contributions of dust to Lac de Gras from Ekati’s Lynx development adding to DIAVIK’s, does
DFO have any concerns with the levels of dust measured at DIAVIK in relation to this material possibly settling over spawning or nursery habitat in Lac de Gras?

7.2 EMAB supports Elders’ recommendation that dust sampling sites should be placed on East Island due west of mine infrastructure. As it is now apparent that the prevailing winds are no longer solely from the north and west, new sample sites west of the mine are warranted.

Recommendation: DDMI should consider placing permanent dust monitoring gauges at sites west of Diavik mine infrastructure.

8.0 Dewatering

8.1 De-watering plan is now to drain pit diked area during Winter to avoid wind-caused wave erosion on shorelines. EMAB would like to know if DDMI has given any consideration as to whether too rapid a lowering of water may result in crash of slumping ice that no longer has water surface to support its weight. The violent action of fallen ice could then create strong turbulence in the water column that potentially increases TSS above license limits from disturbed bottom sediments. This scenario did occur at another mine dewatering in NWT.

9.0 Term of license:

Is a 15-year term that DDMI is asking for appropriate? Can we expect no future exceedances of either EQCs or Response Plan thresholds? Are the current EQCs continuing to protect Lac de Gras to the satisfaction of future land users of the lake?

EMAB is not yet completely comfortable with the evidence to this point for a lack of significant adverse impacts to Lac de Gras biota and water quality. Evidence for possible Eutrophication farther and farther into Lac de Gras, as well as toxic North Inlet sediment would indicate impending adverse impacts that may alter license requirements for EQCs, AEMP methodology and conditions for Closure.

- An argument can be made that current QA/QC problems in identifying water quality trends due to laboratory errors methodology make necessary another review of AEMP conditions in water license before end of mining operations.

- Questions still exist around the Aquatic Response Framework (the early warning system for impending environmental problems) for aquatic life in Lac de Gras.

- EMAB strongly agrees with the WLWB that if an end-of-mine-life license granted, then a final Closure & Reclamation Plan must be prepared rather than the next ICRP version. A final closure option for North Inet must be decided upon sooner than later given the toxic nature of its sediments. EQCs will have to be re-evaluated to accommodate a final CRP that will have to be put into an end-of-mine-life Water License.
Examples of where Water License additions specific to Closure conditions may be needed.

1) Hydrocarbon-contaminated sediments in North Inlet are a new environmental issue. Before this Water License Renewal, ammonia was the only contaminant of concern in the sediments of North Inlet. Depending on whether Hydrocarbon byproducts are not locked into the sediments permanently), then a new water EQC for these hydrocarbon byproducts will be needed in the Water License if the North Inlet is planned to be reconnected to Lac de Gras.

2) As outlined in #4.1 above, if it is determined there is real potential for the frozen core of the Waste Rock Pile to thaw over time, then a Sulphur EQC may be needed in the license.

10.0 References
Dr. David Schindler e-mail message to DFO 2011.

DDMI 2014. 2013 Annual Water License Report, p. 23
DDMI 2014a. Section 3.2.3 Water Management Plan- Version 13
DDMI 2014c. DDMI letter to WLWB Dec 4, 2014
DDMI 2015a. March 13 response to WLWB IR #13
DDMI 2015e. Water License Renewal Questionnaire. P.3.


Golder 2014e. DDMI 2013 Dust Monitoring Report. Table 3.1-1 & p. 3-11.

Maxxam Analytics Corporation November 17, 2014 letter to DDMI. 2014 Water Licence Annual Report Appdx A.
Wilson, A. et al. 2011. linking incineration to dioxins and furans in lakebed sediments (or, the case of the missing water license condition). Integr Environ Assess Manag 7, 2011.
Involved in a diversity of environmental research work in the Canadian Arctic for over 30 years. This work has been done mostly as a private contractor, and as sole proprietor of my company, BYERS ENVIRONMENTAL STUDIES. My company is registered in Alberta and Manitoba.

The following is a brief summary of the work I’ve performed for aboriginal and government clients, as well as a complete list of my publication record.

CONSULTING/CONTRACT WORK:

2009-2011 Deparment of Fisheries & Oceans Winnipeg, MB.
Three literature reviews for DFO:
• TK for Ecologically & Biologically Significant Marine Areas in Nunavut
• TK on dolly varden charr
• Deep-sea Beaufort Sea oceanography & biological characteristics

2009-2010; 1999 - 2004 Yellowknives Dene First Nation: Land & Environment Committee Yellowknife, N.W.T.
• Technical assistance with DIAVIK mine closure process
• Technical reviews of 3 diamond mine impact assessments, bringing environmental impact issues to attention of the Committee
• Interventions at public hearings
• Translation of technical/scientific concepts and words into layman’s terms (plain English) for Committee.

August - Sept. 2001 N.W.T. Treaty 8 Tribal Corporation Fort Resolution
• Documenting historical Yellowknives Dene land use patterns in the Slave Geological Province from documents in the Hudson Bay Co. Archives
May 1996 - Aug 2000  **Canadian Wildlife Service**
Edmonton, Alta.
- Study of spring migrant eider ducks as well as their harvest and cripple loss at Holman, N.W.T.

Nov. 1993 - April 1995  **Fisheries Joint Management Committee**
Inuvik, N.W.T.
- Documenting Inuvialuit traditional knowledge on beluga

July 1992 - April 1993  **DFO/FJMC and Aklavik HTC**
Inuvik, N.W.T.
- Training of Inuvialuit seal monitor and fishery technicians.
- Native traditional knowledge study of charr.
- Data collection/biological sampling of beluga.

Nov. 1990 - April 1992  **Dept. Fisheries & Oceans**
Winnipeg, Man.
- Literature review for the ADCAP (Arctic Data Compilation & Appraisal) zoobenthos catalogue of DFO Data Report Series.
- Revision of Beaufort Sea invertebrate taxonomic list into proper systematics.

July 1987 - Jan. 1990  **Dept. Fisheries & Oceans**
Winnipeg, Man.
- Study of feeding, body condition, reproductive success and contaminant burdens in a Beaufort Sea Ringed Seal population.

June 1980 - March 1986  **Canadian Wildlife Service**
Edmonton, Alta.
- **Arctic Polynya Project**
  - Investigation of secondary productivity and fish/seabird use of a polynya in eastern Nunavut.

**Technical Document Reviews**
My review comments incorporated into MVEIRB’s guidance document for developers: *Guidelines for Incorporating Traditional Knowledge into the Environmental Impact Assessment Process*

**PUBLICATIONS/REPORTS:**

**Observations of killer whales (Orcinus orca) in the Canadian Beaufort Sea.**  


**BOARDS and PROFESSIONAL ASSOCIATIONS:**

- **Independent Environmental Monitoring Agency:**
  - a public watchdog for environmental management at the BHPB Ekati Diamond Mine in N.W.T.  
    - [www.monitoringagency.net](http://www.monitoringagency.net)
  - on Board of Directors 2001 to present

- **Arctic Institute of North America**: life member.