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August 2, 2017

Mr. Joe Maki
Michigan Department of Environmental Quality
Office of Oil, Gas, and Minerals
1504 West Washington Street
Marquette, MI 49855

RE: Request for Amendment to Condition F.4
Eagle Mine LLC. Humboldt Mill Permit MP 012010

Dear Mr. Maki,

Please find attached, a request for amendment to condition F.4 of MP 012010, which limits the subsurface elevation of tailings within the Humboldt Tailings Disposal Facility (HTDF). The recent discovery of Eagle East resulted in an increase in estimated reserves and will result in an increase in associated tailings if approval to mine is received. Please note that this permit amendment request would have been required even without the contribution of Eagle East due to the additional ore reserves identified during delineation work at Eagle since operations have begun.

With the submission of this letter, Eagle is therefore requesting an amendment to condition F.4 to accommodate additional tailings as currently projected under the combined Eagle and Eagle East life of mine plan. Approval of this amendment by the Department would not be construed as an approval to mine Eagle East, rather, the scope would refer only to the placement of tailings from both Eagle and Eagle East (if approved) to a higher elevation within the HTDF.

Should you have any questions concerning this application please contact me at 906-339-7029.

Sincerely,

Jennifer Nutini, P.E.
Environmental Engineer

Request for Amendment to Condition F.4
Eagle Mine LCC. Humboldt Mill Permit MP 012010

02 August 2017

Humboldt Mill, Champion, MI

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Introduction

In 2010, a Part 632 mining permit (Mine Permit) was granted by the Michigan Department of Environmental Quality (Department) so that the historical Humboldt Mill could be revitalized and once again used to process ore. In addition to renovating the existing mill facilities, improvements were made to the nearby existing water-filled former open pit mine to provide for an environmentally-sound tailings management facility, now referred to as the Humboldt Tailings Disposal Facility (HTDF).

Eagle Mine, LLC, has used the HTDF since August 2014 for subaqueous tailings disposal as allowed under Mine Permit Condition F.4. Condition F.4. states that *"…The surface elevation of tailings shall not exceed elevation 1420 feet mean sea level (ft MSL)"*, a condition that was written based on the original resource estimate for the Eagle Mine in 2008-2009. Since the initiation of mining at Eagle, the resource has been defined at a greater, resulting in a corresponding increase in the total volume of tailings required to be placed in the HTDF.

Eagle is therefore requesting an amendment to condition F.4 to accommodate additional tailings as currently projected under the combined Eagle and Eagle East life of mine plan, specifically that tailings be permitted to a level of 1515 ft MSL. A discussion of the details surrounding the environmental considerations for this amendment are presented in the following sections.

Amendment Details

Mine Plan and Metallurgy

Although the life of mine plan has been modified to include Eagle East, the Humboldt Mill facility will not need to be modified to process the additional material. Eagle and Eagle East ore will be blended to achieve an optimal grade for recovery and the facilities will continue to operate similarly to current production rates. The production rate base case of 1,500 tonnes per day, 7 days per week, was revised early in the mine life to 2,000 tonnes per day, 7 days per week. Eagle intends to continue to operate at this production rate based on the current resource size and life of mine plan.

Data collected during the Eagle East drilling program indicates that the deposit is mineralogically similar to Eagle, albeit higher in grade. Copper is found in chalcopyrite, and nickel in pentlandite; gangue mineralogy is composed of pyrrhotite, serpentine, olivine, pyroxene and other mafic and ultramafic mineralization. Eagle and Eagle East drill core composite samples have been tested, compared, and found to have equivalent performance for processing in the mill. Therefore, as stated above, it is not anticipated that process modifications will be necessary.

Tailings Characteristics

Eagle conducts regular bathymetric surveys of the HTDF, in accordance with its Part 632 permit, to assess the deposition and consolidation of tailings in the HTDF as well as to monitor compliance with Condition F.4 of the mine permit. The bathymetric surveys indicate that the beach angles of the tailings are steeper than anticipated in the early feasibility studies. Additional column testing also indicates that consolidation

of the tailings is slightly less than expected and occurs over a longer time period than anticipated. As a result of both the beach angle and compaction factors, the tailings will occupy more vertical space than initially projected.

In order to compensate for the beach angles of the tailings, Eagle is adjusting its subaqueous tailings deposition method to increase the storage efficiency of tailings. Currently, Eagle places tailings using what is referred to as subaqueous conical deposition, which is similar to an underwater cone-shaped mounds. There are three main deposition cones along the centerline of the HTDF, which were anticipated to spread out and fill all of the reaches of the HTDF. Due to the higher beach angles, the tailings are spreading less than anticipated at the bases of the cones. Therefore, to fill areas along east and west sides of the HTDF, additional tailings lines will be placed at closer intervals proximal to the HTDF sidewalls to fill zones on either side of the existing tailings cones. The location and method of tailings placement will be varied throughout the year to maximize the spatial placement of tailings, but will always be done in a subaqueous method consistent with the permit requirements.

Tailings peaks are calculated to reach an approximate maximum elevation of 1515 ft MSL, providing a reasonable water cover of approximately 20-25 ft at closure. The HTDF has one distinct basin separated by a bedrock sill between the main basin and the smaller northern basin (**Figure 1** and **Figure 2**). Eagle intends to maintain the northern lobe free of tailings to facilitate potential passive (e.g. ultraviolet, aeration, sedimentation, etc.) treatment and settling of water before intake to the water treatment plant. Although this is not required for any operational purpose, designating the basins in this manner provides flexibility and opportunity for optimization of water treatment. Any passive treatments that may be instituted in the future for added benefit will not be required to meet post-closure water quality requirements.

Treatment and Containment Plan

The primary purpose of the treatment and containment plan for the Humboldt Mill is to ensure that water from the site is contained and receives adequate treatment prior to being released back into the environment. Therefore, in accordance with permit performance requirements, Eagle constructed both a subsurface cut-off wall to restrict groundwater outflow from the HTDF, and operates a water treatment plant (WTP) to ensure the water from the HTDF is safe to discharge back into the environment per the NPDES discharge permit. There are no performance requirements to maintain a certain water quality within the HTDF during operations, provided the treated water quality is acceptable.

Eagle has demonstrated a proactive approach to managing the water quantity in the HTDF. The Humboldt Mill operated under an annual water management plan that ensures adequate freeboard for water storage in the event of an unplanned process upset or an extreme meteorological event. This approach, thus far, has proven reliable to ensure that performance requirements are met.

Eagle has also demonstrated proactive approaches to managing the current water quality from the HTDF by implementing process upgrades and routinely conducting studies to enhance treatment in the WTP.

These studies will also allow for preparation of possible water chemistry changes and treatment adjustments that may be needed in the future.

In addition to ongoing and proactive studies occurring for water management and treatment, Eagle also conducts ongoing monitoring and modelling of the chemistry and limnology of the HTDF. This work offers the ability to forecast potential water quality changes to ensure appropriate mitigation and continued reliability. Using this information, Eagle continually seeks ways to optimize operations and environmental performance via permit management and process modifications to address future water quality conditions if they are anticipated.

Selected water quality parameters of the HTDF are expected to vary within reasonable ranges during operation and active deposition. The primary HTDF water quality parameter that is expected to change is the concentration of total dissolved solids (TDS). Increases in TDS are primarily due to saline inputs from pore water in the ore body, but can also be attributed to minor additions from the mill reagents such as soda ash and lime. Ore at Eagle and Eagle East are located within bedrock of the Canadian Shield (Frape and Fritz, 1987; Dominion, 2014), which has been characterized as having elevated TDS concentrations increasing with depth. Sampling at the mine and at Eagle East has confirmed these naturally-occurring conditions. As a result, elevated sodium and chloride concentrations in pore water originating from the formation will be entrained as moisture in the ore and muck residues, which is expected to enter the tailings water circuit during the crushing, milling, and flotation processes, eventually entering the tailings slurry stream. Therefore, the dissolved solids within the HTDF will also temporarily increase and require removal during operations and for a period of time in closure. Any associated metals will also be treated during the operational period, per Eagle's water management and treatment plan to maintain compliance with the NPDES discharge standards.

Geochemistry and Limnology Update

Sub-aqueous disposal of tailings is commonly used for long-term storage of sulfide bearing tailings as a best management approach. The Global Acid Rock Drainage Guide (Rev 1) by the International Network for Acid Prevention indicates that water covers ranging from 3 to 10 feet are likely sufficient to limit oxygen transport and to prevent tailings fines' resuspension (INAP, 2012) during periods of wave action. This information has been further supported by a site-specific technical review of Eagle's HDTF geochemical and limnological model stating that "anoxia at depth in the lake is a welcome but not required condition for subaqueous tailings disposal, because sulfide minerals oxidize extremely slowly when submerged under oxygen-bearing waters." Eagle proposes to use a 20-foot cover of water over tailings, therefore the tailings should not become re-suspended due to wind or wave and water quality will stabilize.

Dissolved oxygen reactions at the sediment-water interface in a natural lake is primarily controlled by biological reactions. Although the future biological productivity of the HTDF is not fully characterized and

the direct impact on dissolved oxygen cannot be fully assessed at this time, Eagle did undertake the study of the reaction of tailings in an oxygenated environment as a worst-case assessment. To assess the short-term and long-term impacts of dissolved oxygen on Eagle's tailings, consultants first produced a geochemical model that assumed a fully oxygenated environment at the tailings-water interface. This model indicated that the tailings surface would oxidize, and once the oxidation was complete, there would be no additional reaction of the tailings surface (Interralogic, Inc., 2013).

Consultants conducted laboratory-scale experiments to validate the long-term behavior of the remaining water column in the presence of tailings and oxygen. Finally, the geochemical model was refined based on both the experimental results and actual measurements taken within the HTDF during operations. Details about the lab experiment are as follows:

- The experiments were conducted on tailings from Eagle which were produced in a pilot plant.
- Static column tests under variable oxygen conditions were conducted for 97 weeks (679 days) to quantify the total mass of chemical species available to be leached from tailings and the time required until no more mass would be released.
- Supernatant from the samples was analyzed for cations, anions, nutrients, and trace elements to determine the cumulative mass leached over time.
- The reaction duration was measured and assumed to be complete when an analyte ceased to increase between two consecutive sample events.

The results of this study indicated and that reaction would be limited in time and total mass. All but two species (chloride and manganese) reached steady-state conditions within 500 days of the start of the experiment. Though chloride and manganese reactions continued following the test end date (as shown in red in Table 1), it is important to note that the tailings are the source of chloride, therefore, the dissolved input will be self-limited by the total tailings volume. Both chloride and manganese would be expected to be limited in time as observed in the other species and tests.

Table 1. Time to achieve chemical steady-state for each species

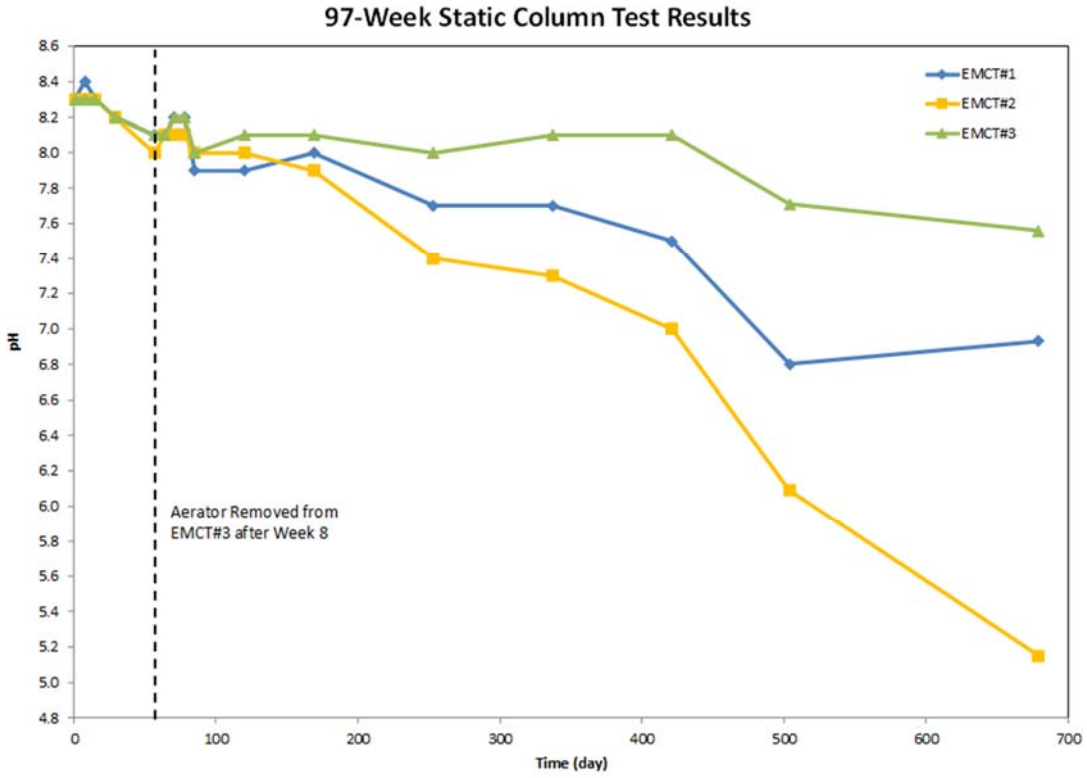
Species	EMCT#1 (days) aerated	EMCT#2 (days) aerated	EMCT#3 (days) not aerated
Na	400	500	500
K	500	500	500
Mg	500	500	500
Ca	500	500	500
Cl	400	400	>680
SO_4	500	500	500
NO_2	100	100	85
P	500	500	500
B	500	500	500
Ba	400	500	200
Co	400	500	120
Cu	500	500	500
Li	400	400	500
Mn	500	>680	400
Hg	15	29	15
Ni	400	500	350
Se	500	500	500
Sr	500	500	500
TDS	500	500	500

Note: EMCT#1 and EMCT#2 had an aquarium bubbler present for 97 weeks. EMCT #3 had the bubbler removed in week 8, so only oxygen that diffused from the ambient air was present in the column thereafter.

The pH of the supernatant water was also monitored over the course of the study. The pH decreased during the study, suggesting that oxidation reactions will occur until a certain point in the presence of a continuous supply of oxygen. In two of the three columns, the pH stabilized after about 500 days, and in one the pH continued to drop. There are important differences to note in the sample versus ambient environment of the HTDF which could have influenced the behavior of the lab samples. Oxygen levels in the test samples were much higher than would realistically reach the tailings in the HTDF, even under shallower water cover. In all three experiments sulfate liberation ceased at 500 days, therefore it is reasonable to assume that that the pH would have stabilized in time if the sampling had continued given the depletion of sulfate at the tailings interface. Furthermore, abundant alkalinity in the cover water and watershed will act as a buffer to acid generation during the time period where oxidation occurs. Conditions at other similar tailings facilities that have one to three-meter water covers (ex: Falconbridge Mine, Ontario; Louvicourt, Quebec; Island Copper, British Columbia) show very little sulfide oxidation, which validates the assumption and observations. Based on the study, consultants concluded that the

tailings would release mass into the HTDF, but the reaction would end approximately 2 years beyond the last addition of tailings during which time water will be treated by the WTP.

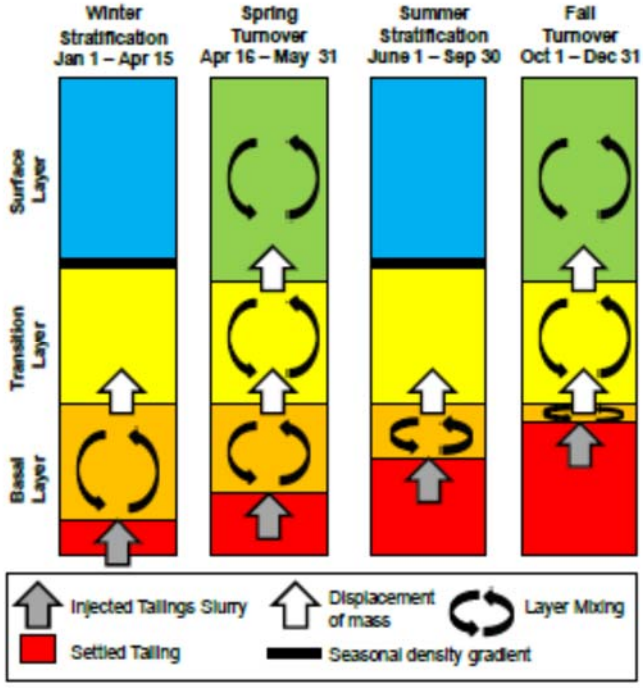
Figure 3. Results of pH monitoring in column experiment



Limnology and geochemistry predictions were also updated based on operational monitoring in the HTDF. The original models prepared for permitting have been continually refined during operations since physiochemical profiles of the HTDF could be collected. Initial physiochemical profiles (specifically, the presence of chloride in surface water and the position of layer boundaries) indicated that there were some differences between predicted and observed conditions, and as a result, revised methodology was used to evaluate the geochemistry and limnology of the HTDF. The conceptual model (Conceptual Model 1) described in permit applications is described as follows:

- A fixed layer volume model with meromictic conditions within the HTDF.
- Water composition of the upper surface layer (WTP influent) would change over time due to gradual dissolution of tailings water into the upper surface water; most chemical constituents would increase over time.
- Turnover of the upper surface layers would occur annual during regional lake turnover cycles in Conceptual Model 1.

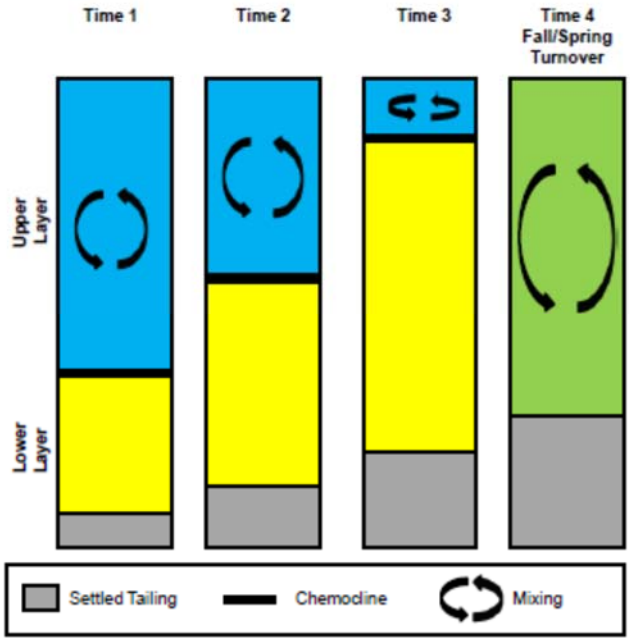
Figure 4. Fixed Layer Volume Model (Conceptual Model 1) Used in Geochemistry Predictions



A revised conceptual model (Conceptual Model 2) was developed based on measured conditions in the HTDF and is described as follows:

- A two-layer system that assumes the lower layer and upper layer thicknesses change with time based on the continuous placement of tailings slurry and simultaneous decanting of fresh water from the surface.
- Density gradients between the two layers do not allow constant transport of tailings slurry to the clean surface water, except if complete mixing occurs.
- In the event of complete mixing, water quality conditions would rapidly change.

Figure 5: Conceptual Model 2



Conceptual Model 2 is the model that Eagle is now using as a basis for water treatment and contingency planning.

Long-term water chemistry predictions were updated based on complete mixing of the HTDF under Conceptual Model 2 to estimate the time required for the HTDF to return to steady-state water chemistry when tailings slurry placement ceases. This modeling was done under the worst-case assumption that tailings chemical mass leaches for a period of time (versus rapidly dissolving upon tailings placement). After placement ends, concentrations of constituents in the upper water layers decrease with time based on the total mass load and water treatment rate and technology. Several models could be developed based on available technology for treatment of the water column, therefore, the time to return the water quality is variable. Therefore, as originally stated in the 2008 permit application materials, following the cessation of operations and during the initial years of closure, models indicate that the water quality of the HTDF will stabilize over time until the water quality is adequate to passively discharge back into the environment without treatment.

Closure and Reclamation

During the initial closure/post-closure period, the water column that remains in the HTDF will begin to resemble the water quality inputs of the watershed including precipitation, groundwater, and surface water runoff. Similar lake characteristics are likely to exist which occur in nearby lakes of similar surface area (e.g. Lake Lory, Fish Lake, Perch Lake, Boston Lake), such as seasonal stratification and turnover,

microbial productivity, organic matter deposition, and potentially the development of littoral zone plants and aquatic habitat.

Due to the revised tailings disposal plan, there will be less water remaining in the water column that will require treatment in the post-operational timeframe. Simple mixing models indicate that the abundant natural inputs to the HTDF will efficiently provide complete replacement of the water column approximately every 1.6 years or less. These natural watershed inputs will provide continually stable water quality.

Initial studies are being conceptualized to consider the feasibility and potential end uses of an improved closure habitat for the HTDF, such as the establishment of a littoral zone around the perimeter of the water body to facilitate diverse plant growth and the establishment of more productive biological communities with higher trophic levels. This is a potential improvement compared to the former HTDF constitution where aquatic and fish species could not thrive or reproduce. Since there are no major updates to the reclamation plan needed to facilitate higher tailings placement, the closure and reclamation plans will be updated as needed in the future. Consistent with the existing reclamation plan, Eagle intends to decommission plant equipment and establish a final property use that is consistent with local interests.

Contingency Plan Update

Eagle's contingency plans are routinely assessed as part of the annual mining and reclamation reporting process and will be updated as needed to ensure all potential risks are mitigated. The amendment for additional tailings placement does not require a modification to the existing contingency plan as the options for adjusting the WTP process or amending the HTDF as needed to facilitate stabilization remain applicable. In addition, the mill and HTDF are equipped with the designs needed to prevent any potential uncontrolled releases of ARD during operations and closure, including a WTP that is designed for a broad range of water quality that could be experienced during operations. As expected, the HTDF will meet surface water quality standards and no further treatment will be required upon completion of the closure period.

Environmental Impact Assessment

The environmental impact assessment (EIA) for Eagle is unaffected by the placement of additional tailings within the existing footprint of the HTDF. Eagle evaluated the current EIA to accompany this amendment request, and the highlights are as follows:

- All current monitoring and inspections will continue and are sufficient to fully evaluate compliance of the HTDF and ensure environmental protection.
- Placing additional tailings at a higher elevation than originally permitted will not impact area topography, drainage, soils, geology, supply wells, wetlands and floodplains, or designated areas.
- Additional tailings will not impact Natural and Wild and Scenic Rivers

- As originally identified in the existing EIA, HTDF design modifications required to accommodate tailings placement would result in a change to both the quantity and quality of surface water and groundwater discharges. The quantity of discharges would be different due to the construction of a cut off wall, and the quality of the discharge water would change to meet discharge limits set in the NPDES permit. This analysis does not change as a result of placing tailings at a higher level.
- The HTDF was previously identified as inadequate to provide suitable conditions for the development of abundant and diverse aquatic macroinvertebrates and fish, with a fish population present that was not self-sustaining. The previous EIA identified that the fish population could be impacted by water quality changes, so placement of additional tailings is consistent with that finding. However, with tailings placed at higher levels, it may be possible to create a more suitable lake habitat (i.e. a littoral zone) for these types of populations to develop following operations.
- The placement of additional tailings in the HTDF does not change the original EIA discussion regarding:
    - Threatened and endangered species, wildlife and terrestrial biota
    - Cultural resources
    - Invasive species
    - Air quality or climatology
    - Aesthetic resources

Conclusion

Eagle Mine is requesting an amendment to Special Condition F.4 of MP012010. Although this change will result in a modification of the permitted elevation of tailings from 1420 to 1515 ft MSL, current modelling indicates that there will be no negative impacts to the environment, either during operation or at closure. This level provides Eagle Mine continuity of operations based on the current life of mine plan; and furthermore, tailings filled to this level provide opportunity for more rapid stabilization of the HTDF water quality, while also creating conditions that would be more suitable for a positive revitalization of the HTDF in closure.

References

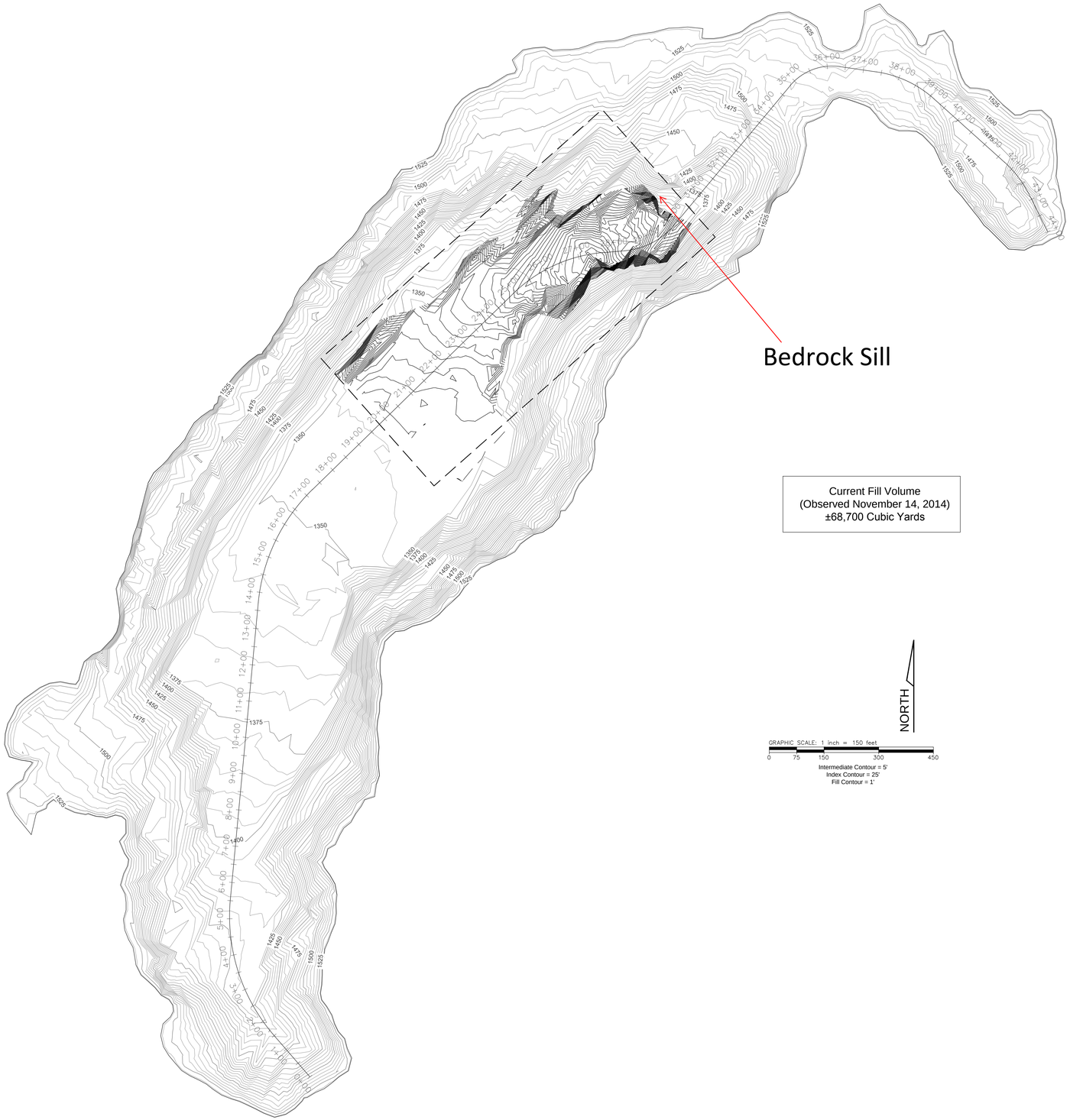
Dominion Diamond Ekati Corporation, 2014. Hydrogeology Baseline Report for the Jay Project

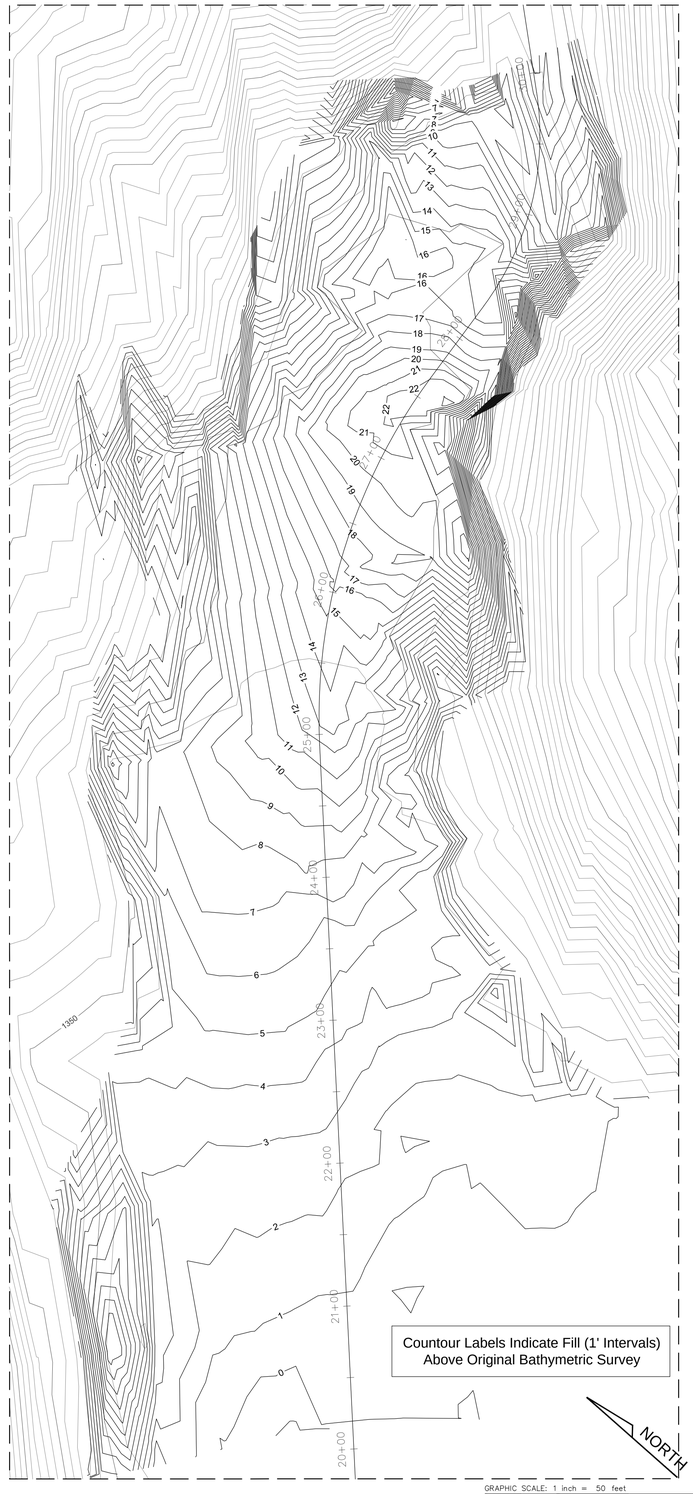
Frape, S.K and P. Fritz, 1987. Geochemical trends for groundwaters from the Canadian Shield in Saline water and gases in crystalline rocks. Geological Association of Canada Special Paper 33, 1987. P. 19-38.

INAP (2012). The Global Acid Rock Drainage Guide, Rev. 1. International Network for Acid Prevention. Available online at: www.gardguide.com

Interralogic (2013). Final Report: Limnological and Geochemical Assessment of Additional Tailings Deposition into the Humboldt Tailings Disposal Facility. Submitted to Rio Tinto Eagle Mine by Interralogic, Inc, Fort Collins, Colorado, July 10, 2013.

FIGURE 1: HTDF BATHYMETRY





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Eagle Mine - Humboldt Mill
2014 Bathymetric Survey
Champion, MI

	DESCRIPTION	ISSUED
	DATE	

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:

Tailings Basin
Product Fill Map

SHEET NUMBER:

1.0

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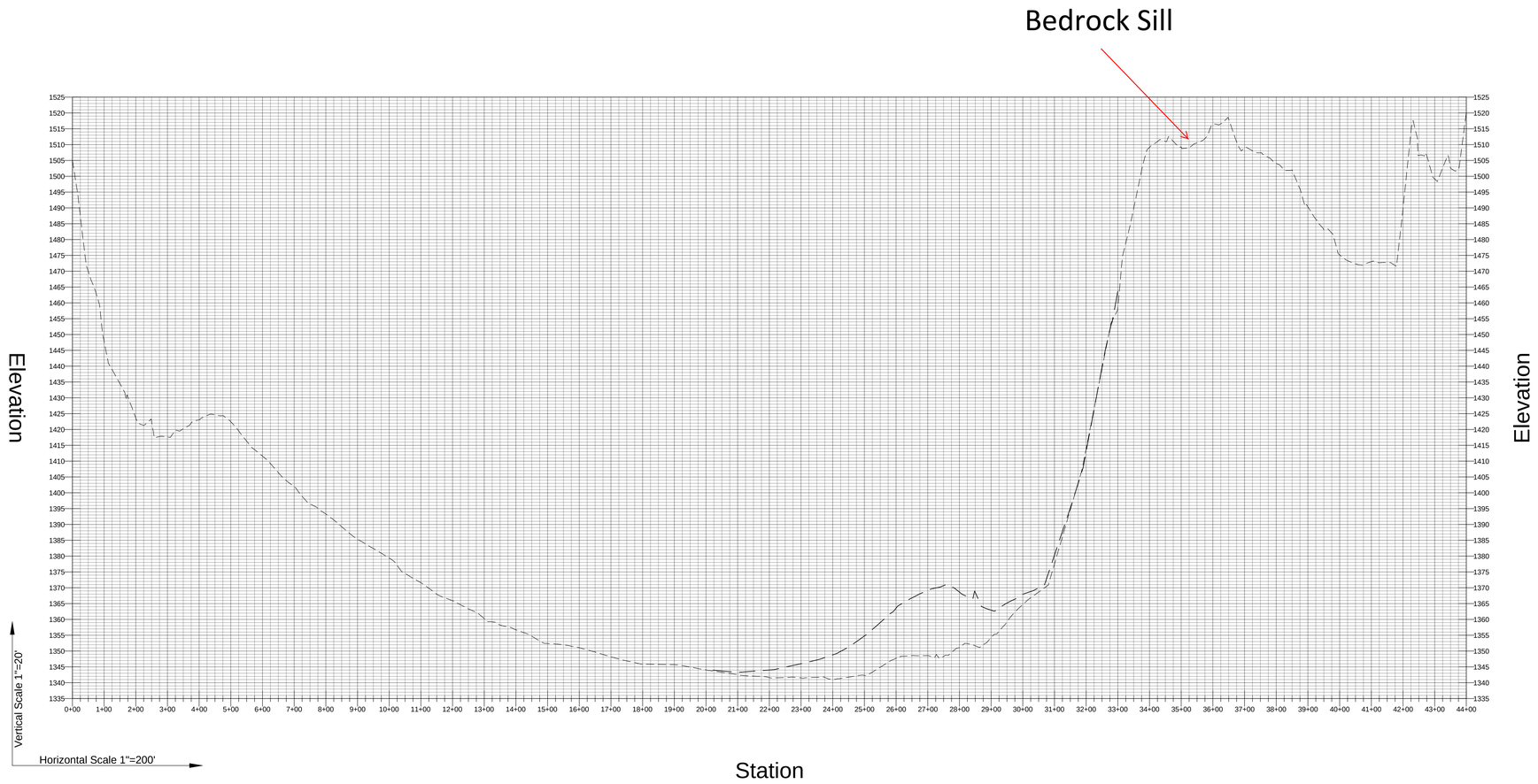
FIGURE 2: PROFILE OF HTDF BATHYMETRY



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Eagle Mine - Humboldt Mill
2014 Bathymetric Survey
Champion, MI

ISSUED	DESCRIPTION	DATE

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
2014 Profile

SHEET NUMBER:
1.0