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Ronald Wieland, EAW Project Manager (environmental.rev@dnr.state.mn.us)
Minnesota Department of Natural Resources
Division of Ecological and Water Resources
500 Lafayette Road, St. Paul, Minnesota, 55155-4025

RE: Northshore Mining Expansion Environmental Assessment Worksheet (EAW)
Environmental Impact Statement (EIS) Needed

Dear Mr. Wieland:

The comments below are submitted on behalf of WaterLegacy, a non-profit organization formed to protect Minnesota's water resources and the communities that rely on them. We have approximately 10,000 members and supporters throughout the State of Minnesota.

WaterLegacy requests that the Minnesota Department of Natural Resources (MDNR) prepare an environmental impact statement (EIS) for the proposed 108-acre Northshore Mining expansion into Type II Virginia Formation (VF) rock (expansion project).

WaterLegacy believes that an EIS is required for the Northshore Mining expansion project because the project has the potential for significant environmental effects. Minn. Stat. §116D.04, Subd. 2a; Minn. R. 4410.1700, Subp. 1. In addition, with respect to characterization of rock to be excavated, analysis of pollutant concentrations, and assessment of hydrology, information necessary to a reasoned decision about the potential for, or significance of, possible environmental impacts is lacking, but could be reasonably obtained through EIS analysis. Minn. R. 4410.1700, Subp. 2a.

An EIS is needed since mitigation measures that are specific and can be reasonably expected to mitigate the identified environmental effects of the expansion project have not been considered. Minn. R. 4410.1700, Subp. 7(C). An EIS is also needed since the cumulative potential effects from the Northshore Mine expansion project are significant when viewed in conjunction with other historical, existing and proposed taconite and copper-nickel mining projects contributing to the environmental effects of the project. Minn. R. 4410.1700, Subp. 7(B). Finally, an EIS must be provided for the expansion project because ongoing permits for the Northshore Mine do not provide regulation to prevent or mitigate the adverse environmental effects of the expansion of mining into high-sulfur rock. Minn. R. 4410.1700, Subp. 7(C).

An EIS should be prepared for the Northshore Mining expansion project for the following reasons:

1. The MDNR should order an EIS because acid mine drainage, sulfates, and metal leachates from the expansion project have the potential for significant adverse environmental effects.

2. The MDNR should order an EIS because environmental effects from acid mine drainage, sulfates, metal leachates and other pollutants from the expansion project are inadequately characterized in the EAW.

3. The MDNR should order an EIS because pollutants seeping from the expansion project to groundwater have the potential for significant adverse environmental effects, particularly at mine closure.

4. The MDNR should order an EIS to consider alternatives to prevent, minimize or mitigate the impacts of the expansion project, including alternative excavation locations, methods of disposal for high-sulfur VF rock and systems to collect and treat wastewater and pit water.

5. The MDNR should order an EIS to consider the cumulative impacts of the expansion project, in conjunction with historic, existing and planned operations at the Northshore Mine, other taconite mines, and proposed sulfide mining in both the Lake Superior and Rainy River Basins.

6. Northshore Mining's National Pollutant Discharge Elimination System (NPDES) permit does not control or mitigate impacts of the expansion project on water quality and does not militate against the need for an EIS.

**Project Summary**

Northshore Mining's Peter Mitchell mine pit straddles two major watershed divides. The southwest half of the mine area originally drained to the Lake Superior Basin, and the northeast half drained to the Rainy River Basin. The watershed pillar that historically separated the two watersheds has been removed, and the division between the watersheds is currently maintained by the placement and operations of the pit sumps. (EAW, p. 8) At closure, Northshore Mining proposes that the entire mine will form a single pit lake with an outfall discharging to the Dunka River watershed in the Rainy River Basin. (*Id*., pp. 9, 18).[1]

Northshore Mining plans to expand the Peter Mitchell mine pit by 108 acres south beyond its current permit. (*Id*., p. 4) In this expansion, Northshore Mining will encounter Type II Virginia Formation (VF) rock, which the MDNR has defined as VF rock with a sulfur content of between 0.2% and 1.0% by weight percent. (*Id*., p. 3) This is the first time Northshore Mining would be permitted to excavate Type II Virginia Formation rock with the capacity to generate acid mine drainage (AMD). (*Id.,* p. 3)

[1] It is not clear from the record in what year or under what permit authority this watershed divide was removed. WaterLegacy knows of no environmental review document evaluating the impacts of this change in hydrology at the Northshore Peter Mitchell Mine.

The expansion project will include 94 million long tons of stripping, including overburden, Virginia Formation (VF) and Biwabik Iron Formation (BIF) rock. (*Id.*, p. 4). It is expected that 16,297,000 long tons of Type II VF materials will be mined, including 6,571,000 long tons from VF sills and 9,727,000 long tons from VF metasediments. (*Id*., p. 17, Golder 2013, p. 33)

Northshore Mining will dispose of the Type II VF waste rock on a 153-acre stockpile pile on the north side of the pit at 1,600 feet above mean sea level (amsl), approximately 100 feet above the predicted pit lake level at mine closure. (*EAW*, p. 5) No subaqueous disposal is proposed.

No liner or collection system is proposed for this permanent Type II VF waste rock stockpile. The EAW proposes that a 5-foot layer of other blasted rock, including BIF and Type I VF rock will be placed under the Type II VF rock and on the pile's outer slopes. (*Id.*, p. 6) A final cover, with a membrane-backed geosynthetic clay liner, "will be progressively placed on stockpile areas at the final elevation." (*Id*.)

In addition to the Type II VF waste rock stockpile, the project expansion will permanently expose approximately 10.9 acres of Type II VF rock formations running the length -- approximately 8,600 feet or 1.6 miles -- of the pit's southern high wall. (*Id*., p. 16).

## 1. The MDNR should order an EIS because acid mine drainage, sulfates, and metal leachates from the expansion project have the potential for significant adverse environmental effects.

### A. Acid Mine Drainage

Both the Type II VF waste rock pile and the exposure of 1.6 miles of Type II VF rock running the length of the southern pit wall have the potential to result in acid mine drainage. "Similar to the materials in the stockpile, the pit wall materials may contribute metals and/or low pH as water flows over the face of the exposure or seeps through the pit wall." (Golder 2013, p. 40)

Of the humidity cell tests performed on Northshore Mine VF rock sampled through 2004,[2] 13 tests resulted in acidic conditions, with an effluent pH below 5.5. These humidity cell samples had sulfur content from 0.06% to 0.42%, and only 11 were Type II VF rock, with 0.2% or more average sulfur by weight. Thus, *all* of the expansion project humidity cells containing Type II VF resulted in acidic effluent and at least two samples that were *Type I VF rock* also resulted in acid drainage. (Golder 2013, pp. 31- 32)

The acidity results from the humidity cells are even more striking when reviewed in detail. Above just 0.25% sulfur, all Type VF samples, whether from sills or metasediments, produced highly acidic effluent, with a pH ranging from 3.1 to 3.4. (Golder 2013, Table 3-14).

[2] Inadequacies of humidity cell tests to characterize expansion project rock are explained in Section 2, *infra*.

Although the expansion project is characterized as Type II VF rock, which by definition has an average sulfur content between 0.2% and 1.0% by weight, actual sulfur content in the Virginia Formation metasediments sampled in 2004 ranged as high as 6.10% sulfur. (Northshore 2004, p. 5). Heterogeneous rock with pockets of highly reactive sulfides is likely to seed chemical reactions resulting in acid mine drainage and metals leaching at even higher rates than would be predicted based on the average sulfur concentration test results described above.

## B. Sulfates and Impairment of Wild Rice

Sulfide reactions in the Type II VF waste rock stockpile and in the exposed Type II VF rock on the southern pit wall will also increase concentrations of sulfates and metals at in-pit sumps and discharge points. The Northshore Mining EAW predicts that maximum in-pit sump sulfate concentrations will increase by 5% as a result of the expansion project. Maximum sulfate concentrations at surface discharge SD005, thus, increase to 157 milligrams per liter (mg/L). (EAW, pp. 25-26).

This predicted discharge is more than 15 times the wild rice sulfate standard of 10 mg/L applicable in waters used for the production of wild rice. Minn. R. 7050.0224, Subp. 2. The EAW states, "Because wild rice has not been found to be present during recent wild rice surveys, the surface water quality sulfate standard for wild rice is not applied." (EAW, p. 17)

However, MDNR documents demonstrate that waters downstream of project discharge location SD005 are wild rice waters, and that additional discharge of Northshore Mine wastewater with elevated sulfates from the expansion project has the potential to cause or contribute to an exceedance of the wild rice sulfate standard when the discharge reaches these downstream wild rice waters.

Birch Lake is a water used for the production of wild rice; MDNR has repeatedly reported the presence of wild rice in Birch Lake. (Barr 2013, pp. 2, 4-5) Dunka Bay, where the Dunka River flows into Birch Lake is also a water used for the production of wild rice. (*Id*., pp. 8-9) The Dunka River should also be considered a water used for the production of wild rice, since it has been listed by the 1854 Treaty Authority as a wild rice resource as recently as 2013. (*Id*., p. 5).

Sulfate levels where the Dunka River flows into Birch Lake are already elevated, with recent sampling of 21 mg/L and 23.6 mg/L. (*Id*., p. 14 and Figure 2). Past and present mining activities, including discharge from the Northshore Mine have likely contributed to elevated sulfate levels downstream in these waters. Maximum sulfate discharge of 157 mg/L at SD005 from the expansion project has the potential to cause significant environmental effects on water quality and wild rice where the Dunka River flows into Birch Lake, causing or contributing to the impairment of a beneficial use of these waters.

## C. Metals Leachate and Discharge

Increased metals leaching from the Northshore Mine expansion project has the potential for significant environmental effects.

Even excluding an initial rinsing period of 10 weeks, maximum weekly effluent concentrations from the humidity cell tests done for several metals of concern were far above applicable chronic water quality standards (WQS). Nickel concentrations in the humidity cell tests for the expansion project reached 510 micrograms per liter (µg/L), more than three times the 158 µg/L chronic WQS;[3] copper concentrations reached 54 µg/L, five-and-a-half times the 9.8 µg/L chronic WQS; aluminum concentrations reached 2,500 µg/L, 20 times the chronic WQS of 125 µg/L; and zinc concentrations reached 2,800 µg/L, more than 26 times the 106 µg/L chronic WQS. Manganese also reached 290 µg/L, nearly three times the groundwater health risk limit of 100 µg/L. (Golder 2013, p. 32).

Without identifying whether the outcrops in question were Type I or Type II VF rock, the EAW admits that weathering of several VF outcrops in 2002 and 2003 resulted in exceedances of water quality standards for total aluminum and total copper. The EAW characterizes these exceedances as "isolated, discrete events," but no supporting information is provided to support the suggestion that these exceedances would not be representative if Type II VF rock were exposed to weathering. (EAW, p. 17)

EAW predictions of increased metals discharge from SD005 are based on the Golder 2013 report, after modeling water quality based on various sampling, scale up, infiltration and dilution assumptions. Even if all of these assumptions were reasonable (which cannot be determined by reviewing the EAW), the expansion project will result in significant increases in metal concentrations in effluent discharged to Langley Creek in the Dunka River headwaters. Maximum concentrations in wastewater discharge would increase 80% for copper, 120% for zinc, 194% for cobalt and 314% for nickel. (EAW, pp. -26, Table 11-6).

Increased concentrations of copper, zinc, cobalt and nickel on Unnamed Creek, Langley Creek, and the Dunka River have the potential to degrade water quality and aquatic habitat and the potential for significant adverse environmental effects due to the sheer volume of wastewater that will be discharged containing these contaminants.

For Langley Creek, the majority of existing flow already originates from Northshore Mine pit dewatering. (EAW, p. 29) During operations, mine water from the expansion project would flow into sumps and be discharged at SD004 and SD005 (*Id*., p. 21, Figure 11-2). The increased annual average flow at these sumps would be 200 gallons per minute or more than 105 million gallons per year. (*Id*., p. 22). This 8% increase in pumping rates would be added to the current Northshore Peter Mitchell pit discharge, for a total average annual wastewater discharge to Unnamed Creek of 2,700 gallons per minute, or more than 1.4 billion gallons per year. (*Id*.)

[3] Chronic WQS above follow the calculations in the EAW for nickel, zinc and copper at a hardness of 100 milligrams per liter. Minn. R. 7050.0220. If the natural background concentrations of receiving waters were applied, as suggested by retired MDNR scientist Bruce Johnson, the applicable WQS for nickel, copper, and zinc would be substantially lower.

The EAW does not discuss what the lowest 7-day average flow expected to occur once every 10 years (7Q10) is for any of these discharge waters. If Unnamed Creek or Langley Creek have a 7Q10 of zero, there is no allowable dilution and impacts to aquatic life must be calculated on the basis that organisms in the aquatic ecosystem will be growing, swimming and reproducing in Northshore Mine effluent.

Non-degradation analysis of the effects of the expansion project is particularly important since downstream of Northshore Mining discharge are waters recently designated in MDNR rulemaking for their special qualities and unique ecological significance. In 2011, the Birch Lake Reservoir, including the lower 300 yards of Dunka River and Dunka Bay, were designated as spawning beds and fish preserves. Minn. R. 6264.0125(H).

**Recommendations**:
An EIS must analyze the potential for significant environmental effects resulting from acid mine drainage from both the Type II VF waste rock stockpile and the 1.6 miles of Type II VF southern pit wall that would be exposed through excavation, considering both the portion of the wall that would be under water and the portion that would permanently remain exposed to weathering. The EIS must also analyze whether the expansion project would cause or contribute to violation of the wild rice sulfate standard in downstream waters, including Dunka Bay where the Dunka River flows into Birch Lake.

The EIS must evaluate the effects of increased copper, zinc, cobalt, nickel and other metal concentrations in discharge from SD004 and SD005, analyzing the potential for degradation of water quality in Langley Creek, the Dunka River and in the Birch Lake Reservoir. This analysis of potential degradation should determine what percentage of each water body's flow will be Northshore Mine discharge during operations and closure and how the concentration of metals in that discharge compares with metal concentrations in regional streams unimpacted by mining.

## 2. The MDNR should order an EIS because environmental effects from acid mine drainage, sulfates, metal leachates and other pollutants from the expansion project are inadequately characterized in the EAW.

The EAW inadequately characterizes the environmental effects of acid mine drainage, sulfates, metal leachates and other pollutants from the expansion project.

### A. Water Quality Predictions

First, the EAW's prediction of changes in water quality as a result of the Northshore Mine expansion project fail to consider impacts from exposed Type II VF rock on the southern pit wall. Although Table 11-6 in the EAW appears to predict water quality at in-pit sump locations "with and without the proposed project," the predictions only consider drainage from the Type II VF waste rock stockpile, and not from 1.6 miles of exposed Type II VF pit wall rock remaining after excavation is completed. (EAW, p. 26, fn to Table 11-6).

The EAW also provides no analysis of the chemical composition of overflow to the Dunka River post-closure as a result of the expansion project. Post-closure, as a result of discharge of untreated pit overflow from the Peter Mitchell Pit lake, average annual flow in the Dunka River would increase by 30 percent as compared to existing conditions. (*Id.*, p. 29). Changes in the chemical composition of nearly one third of the Dunka River flow as a result of expansion into high-sulfur VF rock have the potential for significant environmental effects on Dunka River water quality.

The EAW also provides no predictions of pH in leachate from either the Type II VF waste rock pile or the exposed Type II VF wall. The EAW seems to assume that dilution of acid mine drainage with existing slightly alkaline Northshore Mine wastewater will diminish acidity. (*Id*., p. 5). However, predictions of acid mine drainage from the project expansion must be disclosed to allow evaluation of potential environmental effects if drainage propagates through fractures and to ensure that assumptions in modeling metals leachate are sufficiently conservative.

WaterLegacy is not confident that parameters regarding input pH, groundwater flow dilution and infiltration through the Type II VF waste rock pile used by Northshore Mining's consultants to model concentrations of pollutants in discharge are reasonable. Each of these input parameters have a significant effect on modeled concentrations, particularly cobalt, chromium, copper, nickel and zinc. (Golder 2013, p. 44). In one scenario that utilized conservative input parameters, aluminum was predicted at maximum concentrations (0.14 mg/L) greater than Minnesota's chronic water quality standard (0.125 mg/L). (*Id*., p. 46) An EIS must not only fill the gaps in water quality analysis described above, but also provide predictions based on a transparent analysis including a range of conservative input parameters.

## B. Sampling and Humidity Cell Testing

The EAW's predictions of water quality rely on humidity cell tests that inadequately represent the areas into which the expansion is planned and the scale of the expansion. First, somewhat surprisingly, the humidity cell tests do not represent the entire area into which the Northshore Mine expansion project is planned.

The EAW is imprecise about the sampling used to predict water quality, stating that its numeric water quality predictions are "not directly representative" since the samples were collected "do not precisely match all constituent concentrations from the most recent surface water quality data set." (EAW, p. 24) The actual discrepancies are striking.

All of the samples used in the humidity cell tests upon which the EAW relied were taken in 2003 and 2004. (Golder 2013, pp. 31-32 and Table 3-9). This drill sampling did not extend to the southern and eastern portions of the proposed project's expansion into Type II VF rock. At the time these samples were taken, Northshore Mining explicitly recognized that additional drilling sites were needed to "complete the Virginia Formation characterization." (Northshore 2004, p. 10). The scope of drilling by 2004 and the fact that a significant area of the expansion project was not sampled for humidity testing is shown in Exhibit 1, which reproduces drilling maps from Northshore reports prepared in 2004 and 2008.

Rather than require humidity cell tests with a representative sample of the entire area where Northshore Mining's expansion was proposed, the EAW relied on 11 humidity cell tests selected through a *post hoc* determination that any of the humidity cells from 2003 and 2004 with Type II VF rock (defined as an average of 0.2% to 1.0% sulfur by weight) could be used to characterize the entire project expansion rock, including areas south and east of the actual 2003 to 2004 sampling. (Golder 2013, p. 32).[4]

Although some effort was made to verify that drilling conducted in 2008 did, in fact, have sulfur content consistent with Type II VF rock (Northshore 2008, Appendix B), there is no data on the composition of metals or salts in the rock south and east of the 2004 drill holes. There is thus, inadequate data to predict levels of metals leaching from this area of high-sulfur VF rock under acidic conditions or that leachates would not violate water quality standards.

In addition to the fact that humidity cell tests fail to represent a significant area of the expansion, WaterLegacy is concerned that the number of samples actually tested is insufficient to characterize more than 16 million long tons of high-sulfur VF rock that Northshore Mining proposes to excavate in the expansion project. In particular, the few samples tested and the averaging of sulfur percentages are likely to understate the impacts of more reactive sulfides on water quality.

The EAW acknowledges that a variety of Virginia Formation rock referred to as "bedded pyrrhotite" has significantly higher sulfur content than other VF rock units. (EAW, p. 14) The EAW then claims, "No occurrences of bedded pyrrhotite have been identified by exploratory drilling in the project area." (*Id*.) Northshore Mining has explained that continuous sulfide layers of bedded pyrrhotite provide a corridor for oxidation of a large portion of the available sulfide (Northshore 2004, p. 8), that bedded pyrrhotite had been identified in three drill holes on the eastern end of the Northshore Mine site (*Id*., p. 3), and that first blast scheduled for the VF rock formation most likely to contain bedded pyrrhotite was planned for 2009. (*Id*., p. 13).

The EAW cites no documentation that drilling and sampling at any time were sufficient to rule out bedded pyrrhotite in the Northshore Mining expansion project area. In addition, sampling for the expansion project has demonstrated that pyrrhotite is "by far the dominant sulfide" and that sulfides may range from less than 1% to more than 15% in discrete samples. (Golder 2012, p. 14). The presence of pyrrhotites and the heterogeneity of sulfides in the expansion project area must be specifically investigated and factored into predictions of leachates and water quality.

## C. Evaluation Needed -- Additional Metals, Dissolved Salts and Specific Conductance

[4] The report seems to admit that the sampling process for humidity cells is not demonstrably representative. The humidity cells are described to contain metasediments or sills "*that are expected to be representative of the Type II VF materials slated for the stockpile based on geologic description and sulfur content*." (Golder 2013, p. 31, emphasis added).

An EIS is needed to analyze drinking water contaminants, salts and specific conductance which were not evaluated in the EAW and which have the potential for significant adverse effects on the environment as a result of the expansion project.

Sampling of rock from the expansion project identified several trace metals occurring at concentrations well above the cut-off of 1 milligram per kilogram that can contaminate drinking water and adversely affect human health. These included barium, chromium, strontium and vanadium. (Golder 2012, p. 13).[5] Minnesota sets Health Risk Limits (HRL) for barium, chromium and vanadium to protect human life and health, pursuant to Minnesota Rule 4717.7500. Although Minnesota does not have an HRL for strontium, the Center for Disease Control has concluded that bone growth may be impaired in children drinking high levels of strontium.[6] An EIS is needed to characterize the concentrations of these and other trace metals in expansion project rock and to assess likely concentrations in seepage and pit lake water that may propagate to groundwater, as discussed in Section 3 below.

Neither the EAW nor underlying humidity cell tests provide data on total dissolved salts or specific conductance, despite the growing body of knowledge in Minnesota as well as other mining regions, that salt mixtures that elevate conductivity impair aquatic life.

After extensive peer-reviewed research, the United States Environmental Protection Agency (EPA) set the chronic aquatic life benchmark value for conductivity at 300 micro Siemens per centimeter (µS/cm) for West Virginia and Kentucky, stating that this standard is also expected to be applicable to ecoregions extending into Ohio, Pennsylvania, Tennessee, Virginia, Alabama, and Maryland. EPA noted that this benchmark is likely to apply whenever dissolved ions are dominated by salts of $Ca^{2+}$, $Mg^{2+}$, $SO4^{2-}$ and $HCO3^{-}$, particularly where natural background levels are lower. EPA explained, "the salt mixture dominated by salts of $SO4^{2-}$ and $HCO3^{-}$ is believed to be an insurmountable physiological challenge for some species."[7]

EPA's web site states that studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 µS/cm. Conductivity outside this range "could indicate that the water is not suitable for certain species of fish or macroinvertebrates."[8]

Recent research in the St. Louis River watershed of the Lake Superior Basin suggests that specific conductance from mine pit discharge is a stressor contributing to impaired streams in Minnesota. In the Embarrass River watershed zone, two impaired streams -- Spring Mine Creek and the Embarrass River -- receive water originating from mine pits. Sampling results from these streams show elevated specific conductance and sulfate concentrations. (Exhibit 2 MPCA, *St. Louis River Stressor Identification Report* (2013), pdf p. 16). In the St. Louis River watershed, streams relatively unaffected by mining, urbanization or agriculture have conductivity values

[5] Sampling from the balance of the expansion project may identify other metals exceeding this cut-off.
[6] ATSDR, Public Health Statement for Strontium, http://www.atsdr.cdc.gov/phs/phs.asp?id=654&tid=120
[7] EPA, *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams*, Final Report, EPA/600/R-10/023F, March 2011, p. xv. Available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=233809#Download
[8] EPA, *What is conductivity and why is it important*? http://water.epa.gov/type/rsl/monitoring/vms59.cfm

from 36 to 380 (µS/cm) and are generally below 230 µS/cm. Streams with conductivity values above 500 µS/cm are limited to areas with mining or urban land-uses. (*Id*., pdf p. 41)

Based on Minnesota sampling and stressor identification research as well as EPA guidance, dissolved salts that elevate conductivity have the potential for significant adverse environmental effects, including degradation of water quality and impairment of beneficial uses of waters for fish and aquatic macroinvertebrates.

**Recommendations:**
An EIS is required to address inadequacies in the EAW's analysis of the potential for the Northshore Mine expansion project to result in significant impacts on surface water, drinking water and aquatic life. The EIS must evaluate the potential for acid mine drainage both at the Type II VF waste rock stockpile and from the exposed Type II VF rock on the southern pit wall. The EIS must require characterization of rock in the southern and eastern portion of the expansion project area that has not yet been analyzed in any humidity cell tests, and must ensure that sampling is sufficient and representative of metals concentrations and areas of highly concentrated sulfides.

The EIS must also evaluate and disclose predicted water quality in the outfall to the Dunka River watershed proposed post-closure, comparing the loading of all contaminants with and without the expansion project. In its predictions of water quality, the EIS must make its assumptions transparent and show the effects of more and less conservative assumptions on water quality.

The EIS must also include data on drinking water contaminants, dissolved salts and specific conductance. The EIA must then evaluate the potential environmental effects of groundwater contamination on drinking water quality and the effects of elevated specific conductance from Northshore Mine discharge on surface water quality and aquatic life.

**3. The MDNR should order an EIS because pollutants seeping from the expansion project to groundwater have the potential for significant adverse environmental effects, particularly at mine closure.**

Seepage to groundwater of Northshore Mine expansion project contaminants has potential for significant adverse effects to drinking water and, also, to surface water, should seepage daylight to wetlands, streams, rivers or lakes.

The Northshore Peter Mitchell mine pit is excavated into the Biwabik Iron Formation (BIF), and the Northshore expansion project would excavate several hundred additional feet into BIF rock. (EAW, Figure 10-1) Maps attached to the EAW and to the Barr 2008 Hydrology Study illustrate the excavation of BIF rock proposed in the expansion project and the significant change in depth of the pit, as compared with both pre-mining bedrock elevation and the current ground surface. (Barr 2008, Map 1, attached as Exhibit 3). Although the PolyMet NorthMet SDEIS highlighted plans to retain a 130-foot separation between its final mine pit and the Biwabik Formation (PolyMet SDEIS, p. 4-43), the Northshore EAW doesn't even discuss potential impacts of the high-sulfur expansion project on this important aquifer.

Although it is likely that pumping during mine operations will create a pressure gradient that minimizes seepage through the surficial aquifer and bedrock fractures, filling of the pit at closure will alter this hydrological profile.

At closure, the pit in the expansion project area of the Northshore Mine will be connected with pit lakes to the west, forming an entire, connected "extensive pit lake" across both the Lake Superior and Rainy River Basins. (Golder 2013, pp. 16-17) The expected final pit lake surface elevation will be 1,500 feet amsl, with a ponded area of approximately 400 acres, a maximum depth of approximately 300 feet, a volume of 60,000 acre-feet, and a total of 19,550,000,000 gallons storage. (Golder 2013, p. 18 and Table 3-7).

The change in water pressure gradient as this extensive pit lake forms has the potential to increase propagation of pollutants through bedrock faults and fractures as well as through surficial groundwater. The expansion project, including the Type II VF waste rock pile and Type II VF exposed pit wall, has the potential to increase pollutants seeping through groundwater from the huge Northshore Mine pit lake to both the Lake Superior and Rainy River Basins.

The EAW recognizes that fractures carry water in the bedrock at the Northshore Mine. (EAW, p. 15). Ground water movement in the BIF is generally through fractures, faults and joints. (Barr 2008, p. 7) The Biwabik Iron Formation is an important drinking water aquifer for Northeastern Minnesota, and more than 55,000 people rely on public water systems drawing their water from the BIF.[9] Numerous public water supply and residential drinking wells are located in the vicinity of the Northshore Mine and the expansion project. (Barr 2008, Map 9, attached as Exhibit 4).

The existing Northshore Mine area and the area of proposed excavation into and storage of high-sulfur VF rock include highly fractured and faulted areas. Exhibit 5, *Faulted Bedrock and Surface Topography Vicinity of Proposed Northshore Mining Expansion Map 1*, provides an overview of fractures and faults at the mine site. Some of these faults extend to the location of surface waters, including Yelp Creek, the Partridge River, Langley Creek, the Dunka River and Birch Lake. Exhibit 6, *Faulted Bedrock and Surface Topography Vicinity of Proposed Northshore Mining Expansion Map 2*, shows faults in a broader context that identifies some of the area waters from Birch Lake to Colby Lake. Both of these maps are derived from Minnesota Geological Survey data.

Groundwater sampling for the PolyMet NorthMet project has demonstrated the propagation of pollutants from the existing Northshore Peter Mitchell pit to groundwater in the Partridge River watershed. As noted in the tribal Cumulative Effects Assessment (PolyMet NorthMet SDEIS, Appx. C, pdf pp. 2072-2073), deep groundwater borehole samples for the PolyMet project found elevated ammonia nitrogen, the most likely source of which was the blasting compound used at the Northshore Mine one mile north of the site. This tribal analysis, as well as WaterLegacy's comments (WaterLegacy 2014, pp. 50-51) cited underlying technical reports indicating that

[9] James F. Walsh, Minnesota Department of Health, *Isotopic and Chemical Characterization of Water From Mine Pits and Wells on the Mesabi Iron Range, Northeastern Minnesota, as a Tool for Drinking Water Protection*, available at http://info.ngwa.org/gwol/pdf/042180533.pdf

tritium, a post-1952 pollutant, was found deep in groundwater on the PolyMet site, confirming a connection between Partridge River watershed groundwater and pollutant sources at the Northshore Mining Peter Mitchell Pit.

Despite the evidence of faults in BIF bedrock and at the Northshore Mine site and the depth of excavation into the BIF bedrock proposed in the expansion project, the EAW considers no potential impacts of the expansion project on the BIF aquifer or public and residential drinking water. The EAW evaluates no potential for contaminated seepage to propagate through surficial groundwater or bedrock faults or fractures either during operations or at mine closure, after formation of the 19.5 trillion gallon Northshore Mine pit lake.

The EAW claims that there will be no post-closure effects to groundwater quality because regional surface features surrounding the pit are all at elevations higher than its 1,500 feet above sea level (amsl). (EAW, p. 29) However, uncollected seepage from the Type II VF waste rock pile would drain from 1,600 amsl, not 1,500 feet amsl. The elevation of faults and fractures is not discussed. Birch Lake is 1,417 feet above sea level and Colby Lake is 1,440 feet amsl.

The EAW assumes that all seepage from Type II VF waste rock will seep to the pit sumps and be discharged through NPDES discharge points during operations (EAW, p. 5); that pit water from the entire Northshore Mine will flow only through an outfall to the Dunka River via Unnamed Creek even after mine closure (*Id*., p. 9); and that the expansion project will have "no impact" on the Partridge River. (*Id*., p. 18). These assumptions are arbitrary, since groundwater seepage potential has not been analyzed.

In addition, it is acknowledged that stratification may occur within the eventual pit lake. (Golder 2103, p. 49). A meromictic pit lake may result in higher concentrations of sulfates and metals seeping into fractures than the concentrations of these parameters at pit lake outfalls.

**Recommendations**:
An EIS is needed to assess the potential significant effects of the Northshore Mine expansion project resulting from groundwater seepage during operations and post-closure. The EIS must evaluate impacts on the BIF aquifer and both public and domestic well drinking water sources, including potential increases in drinking water contaminants, such as manganese, barium, strontium, chromium and vanadium.

The EIS must also evaluate whether contaminated seepage from pit water affected by the expansion project will propagate through surficial groundwater or bedrock fractures and daylight in surface waters in either the Rainy River or Lake Superior Basin. Analysis of the impacts of post-closure groundwater seepage must consider potential pit lake stratification and concentration of toxic metals at various levels of the pit lake as well as the pressure conditions that may contribute to propagation of contaminated pit water.

**4. The MDNR should order an EIS to consider alternatives to prevent, minimize or mitigate the impacts of the expansion project, including alternative excavation**

**locations, methods of disposal for high-sulfur VF rock and systems to collect and treat wastewater and pit water**.

An EIS is needed to consider specific alternatives that can be reasonably expected to minimize the adverse environmental effects from the Northshore Mining expansion into high-sulfur rock.

Alternative locations for mining excavation should be analyzed to minimize contact with high-sulfur rock. Although Northshore Mining has decades of iron ore reserves available for continued mining, (EAW, p. 3), the EAW does not consider any alternative locations for the Northshore Mine expansion project that would require less excavation and permanent exposure of high sulfur Type II VF rock. Since sampling and testing are reported only in terms of sulfur weight averages and the location of pyrrhotite concentrations are not identified, the EAW does not demonstrate that alternative mining locations were considered to identify and avoid these reactive and unstable sulfide formations.

Various methods to contain, collect and treat polluted seepage from the expansion project must be evaluated to minimize the project's environmental impacts. The EAW admits that "direct seepage from the Type II stockpile will not be collected or monitored" (*Id*., p. 27) Placing crushed BIF or Type I VF rock under the Type II VF waste rock stockpile will not prevent seepage of leachates. In addition, Type I Virginia Formation rock itself may generate acid mine drainage. (Golder 2013, p. 32, see discussion in Section 1(A), *supra*). The EAW evaluates no seepage collection system or water quality treatment to reduce pollutant loads from Type II VF waste rock stockpile seepage.

Treatment to reduce concentrations of metals, sulfates and other salts prior to surface water discharge to Unnamed Creek, Langley Creek and the Dunka River watershed during operation and post-closure should be analyzed. Wastewater treatment has the potential to reduce degradation of surface water as well as to prevent violation of water quality standards. As discussed above, the EAW neither discloses the chemical composition of pit water post-closure nor considers the potential that pit water may propagate to aquifers or surface water. Potential treatment of pit water to reduce pollutants that may seep through groundwater as well as to reduce pollutants discharged to Dunka River watershed surface waters should be evaluated.

Alternatives to detect and respond to contamination of surface and groundwater should be considered in an EIS. The EAW proposes no monitoring of groundwater or groundwater flowpaths to surface waters. "Supplemental" monitoring by Northshore Mining to identify potential problems that could impact water quality from Type II VF waste rock pile seepage would be limited to monitoring of water chemistry at SD004 or SD005 planned discharge sites or in sumps that may be affected by the Type II VF waste rock pile. (Golder 2013, p. 13)

The EAW also proposes no strategies to mitigate impacts or address contingencies, merely promising that a mine water management contingency plan "will be developed" at some indefinite future time. (EAW, p. 27) Since the sole purpose of the EAW's undefined contingency plan would be "compliance with the NPDES effluent limits" (*Id.*), and there are no effluent

limits for most pollutants of concern in the Northshore Mine NPDES permit (*Id*., pp. 26-27), this assurance of that a contingency plan will be developed in the future is meaningless.

**Recommendations**:
An EIS for the Northshore Mine expansion into high-sulfur Type II VF rock should consider at least the following specific alternatives to avoid, minimize or mitigate environmental effects:

- Alternative location of overall expansion project to reduce excavation and exposure of Type II VF rock.
- More detailed testing to allow avoidance of pockets of VF rock with localized higher sulfides.
- Liners beneath the permanent Type II VF waste rock stockpile.
- Leachate collection and treatment of seepage from the Type II VF waste rock stockpile.
- Subaqueous in-pit disposal of Type II VF waste rock.
- Water quality treatment to reduce pollutants prior to surface water discharge to Langley Creek, Unnamed Creek and/or Dunka River watershed during operations.
- Water quality treatment to reduce pollutants prior to surface water discharge to Langley Creek, Unnamed Creek and/or Dunka River watershed post-closure.
- Long-term treatment and pump back of pit water to reduce pollutants and mitigate effects of pit water seepage to groundwater post-closure.

**5. The MDNR should order an EIS to consider the cumulative impacts of the expansion project in conjunction with historic, existing and planned operations at the Northshore Mine, other taconite mines, and proposed sulfide mines in both the Lake Superior and Rainy River Basins.**

An EIS is needed because the cumulative potential effects from the Northshore Mine expansion project are significant, particularly when viewed in conjunction with historic, existing and planned taconite and copper-mining projects in the Rainy River and Lake Superior Basins.

Cumulative potential effects from historic and existing taconite mine pollution must be considered with respect to surface water discharge of sulfates into the Dunka River watershed from the Northshore Mine expansion project. Sulfate concentrations as high as 150 mg/L in existing Northshore Mine discharge (EAW, p. 26) and the history of sulfate discharge from the Dunka Mine cumulatively effect wild rice. Wild rice surveys that did not confirm the presence of wild rice in the Dunka River or that found “rare” occurrences of wild rice in Birch Lake may reflect cumulative impacts of mining pollution. If historic and existing mine pollution has already impaired wild rice beneficial uses, the additional effects of the expansion project are likely to be more significant and destructive.

Cumulative effects of the expansion project with existing and planned Northshore Mine operations include not only increases in metals and salts, but the effective replacement of the entire flow of 7Q10 water bodies in the Dunka River watershed with mine discharge effluent. Comparison of constituent loading both during operations and post-closure, as compared to a stream unimpacted by mining, is necessary to determine the cumulative effects of high levels of copper, nickel, cobalt, zinc, specific conductance and other parameters on surface waters. Historic, existing and future contributions from the Northshore Mine, Dunka Mine, Twin Metals exploratory drilling and Twin Metals bulk sampling must be considered in this analysis.

Future Northshore Mine expansions must also be considered in conjunction with the current expansion project. The current expansion into Type II VF rock is expected to satisfy the Main Pit mining requirements for only five to ten years. "Part of the long-term plan for the Peter Mitchell Mine is to continue to develop the mine to the south and the west." (EAW, p. 10). The EAW presumes that there will be further pit progressions and that future expansions may also affect high sulfur rock, stating that Northshore Mining "will address separately the presence of any Type II VF materials encountered in any future pit progressions. " (*Id*., p. 11) Additional phased incursions into high-sulfur rock, Type II VF waste rock piles, and Type II VF pit wall exposure would compound the effects of the current Northshore expansion project.

The environmental impacts of the expansion project must also be considered cumulatively with Northshore Mining's destruction of the in-pit dikes separating the Peter Mitchell pit into two drainage basins and Northshore's resulting diversion of water from the Lake Superior Basin to the Rainy River Basin. As a result of the huge pit lake that will be created post-closure after separation between drainage basins is destroyed, pollution from the expansion project has the potential to seep into the St. Louis River watershed as well as the Dunka River watershed.

The EAW acknowledged that the PolyMet project is reasonably foreseeable, but did not assess its cumulative impacts in conjunction with the Northshore expansion project. (EAW, p. 43). An EIS should evaluate potential effects of Northshore mine pit seepage on groundwater and surface water quality in conjunction with discharge from existing taconite mines in the St. Louis River watershed. The EIS should also evaluate Northshore extensive pit seepage in conjunction with polluted discharge and seepage from the proposed PolyMet sulfide mine project.

The EIS should also evaluate effects of post-closure reduction in flow to the Partridge River resulting from the Northshore Mine pit in conjunction with PolyMet sulfide mine project. The Barr hydrology study suggests that the Northshore Mine diversion may reduce flows into the Partridge River immediately downstream of the post-closure watershed boundary "by close to 100 percent relative to current conditions." (Barr 2008, p. 20). Post closure flows as far downstream as Colby Lake may be reduced by as much as 7 percent, representing a decrease of as much as 1,416,000,000 gallons per year (6 cfs) (*Id*.)

Reduction of Partridge River flow resulting from the Northshore Mine expansion project and water diversion has the potential to significantly effect Partridge River water quality in conjunction with the PolyMet sulfide mine project. The PolyMet project would substantially increase levels of a number of metals, including antimony, arsenic, cadmium, cobalt, copper,

lead, nickel, and selenium. (PolyMet SDEIS, p. 5-113; Table 5.2.2-30, p. 5-129; Table 5.2.2-33, p. 5-156). Post-closure, the volume of PolyMet's wastewater discharge would be nearly four times existing Partridge River flow. (PolyMet SDEIS, p. 5-143). The combined effects of Northshore's diversion of groundwater from precipitation away from the Partridge River and the PolyMet project's pollution of the Partridge and Embarrass River watersheds has the potential for significant effects on Partridge River aquatic life and the Colby Lake drinking water further downstream.

Although the Duluth Metals/Twin Metals copper-nickel mine project has not yet been submitted for environmental review, no Minnesota rule requires such a threshold be crossed before a project is deemed reasonably foreseeable. Duluth Metals recently filed a Technical Report on Pre-Feasibility Study (NI 43-101) with SEDAR, the electronic filing system for the disclosure documents of public companies and investment funds across Canada. This 558-page report concludes, "there is sufficient support from the Report results for progression to a feasibility study."[10] As reflected in Exhibit 7 attached, the NI 43-101 Report locates the mine site on Birch Lake, the concentrator site 1-2 miles west of the deposit, but within the Rainy River Basin, and the tailings storage facility in the St. Louis River watershed of the Lake Superior Basin, just north of the Northshore Peter Mitchell mine.[11] At this stage, WaterLegacy believes that MDNR should consider the Duluth Metals mining project reasonably foreseeable and include its cumulative impacts in evaluating the potential for significant environmental effects of the Northshore Mine expansion project.

**Recommendations**

An EIS should consider past, existing and planned taconite mining and copper-nickel mining facilities in evaluating potential environmental effects of the Northshore Mine expansion project. The EIS must consider the cumulative impacts of past and present discharge of sulfates from the Northshore Mine and Dunka Mine on impairment of wild rice in the Dunka River and Birch Lake. The EIS must consider discharge of metals, salts and other pollutants from the Northshore Mine expansion project in conjunction with past, present and planned discharge from the Dunka Mine and Duluth Metals drilling and bulk sampling activities. The EIA must also analyze the potential cumulative effects of additional Northshore Mine planned expansions to the south and the west, including additional potential incursions into high-sulfur VF rock.

The EIS must consider the cumulative effects of Northshore Mine's elimination of the divide between the Rainy River and Lake Superior Basins along with the effects of the expansion project. As the EIS evaluates potential seepage to groundwater from the Northshore Mine pit post-closure, effects of seepage should be considered in conjunction with water quality impacts of the proposed PolyMet project and other mines the St. Louis River watershed. Effects of the Northshore Mine pit post-closure on reduction of flow from the Partridge River to Colby Lake should be considered in conjunction with impacts of PolyMet discharge and seepage to both the Partridge River and Embarrass River watersheds.

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[10] Duluth Metals, *Twin Metals Minnesota Project, Technical Report on Pre-Feasibility Study* (NI 43-101), filed Oct. 13, 2014, p. 1-37, on SEDAR through http://www.sedar.com/search/search_form_pc_en.htm.
[11] *Id*., p. 1-24.

Finally, given the advanced stage of analysis and potentially critical impacts, the EIS should consider cumulative impacts of the Duluth Metals' proposed copper-nickel mine, concentrator and tailings storage facility on waters of the Rainy River and Lake Superior Basins.

**6. Northshore Mining's National Pollutant Discharge Elimination System (NPDES) permit does not control or mitigate impacts of the expansion project on water quality and does not militate against the need for an EIS**.

The impacts of the Northshore Mine expansion project will not be mitigated by ongoing regulatory authority since the Mine's NPDES permit contains no effluent limits for critical pollutants.

The existing NPDES permit for the Northshore Mining Peter Mitchell Mine (Northshore NPDES) contains no effluent limits for primary pollutants of concern, including pollutants such as nickel and cobalt that are predicted to increase markedly with the expansion project and pollutants, like sulfate, which are already discharged in excess of water quality standards. (EAW pp. 26-27 Table 11-7). In fact, the existing NPDES permit contains no effluent limits for any of the following parameters: aluminum, arsenic, cadmium, cobalt, copper, hardness, lead, mercury, nickel, specific conductance, sulfate or zinc. (Northshore NPDES, pp. 13-28).

The NPDES permit does not consider potential effects of groundwater pollution from the Peter Mitchell mine, even in terms of monitoring. The NPDES permit only monitors surface water at remote locations, not designed to identify potential water quality impacts of mine seepage daylighting to surface water.[12] (*Id*., p. 7) The permit requires no monitoring of groundwater at any location. (*Id*., p. 12) If polluted seepage were to propagate through groundwater to nearby surface water or to contaminate drinking water, no system of monitoring would identify, let alone regulate these effects on water quality.

Despite this lack of effective controls on pollution, the EAW states that the MPCA's current NPDES permit is "sufficient" and that no additional permit issuance or amendment will be required. (EAW, p. 12) Since the applicable Northshore Mine pollution control instrument neither limits surface water effluent nor monitors impacts to groundwater, no regulatory authority can be relied upon to mitigate environmental effects of the Northshore Mine expansion into high-sulfur Virginia Formation rock.

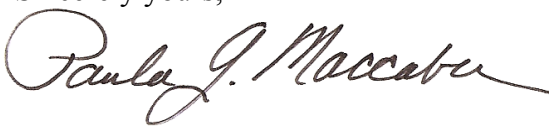
**Conclusion**

For the foregoing reasons, and based on applicable law, documents from MDNR files, and the citations and exhibits supplied with our comments, WaterLegacy believes that an environmental impact statement is needed before a permit to mine amendment can be considered for Northshore Mining's expansion project into high-sulfur Type II Virginia Formation rock.

[12] Surface water is monitored at the untreated municipal water supply for city of Hoyt Lakes, the outlet of Birch Lake at the Highway 1 bridge crossing of the South Kawishiwi River and in the Partridge River at the County Road 666 bridge east of Hoyt Lakes. (Northshore NPDES, p. 12).

We appreciate the opportunity to comment on this matter and would be happy to answer any questions you may have regarding our comments.

Sincerely yours,



Paula Goodman Maccabee
Advocacy Director/Counsel for WaterLegacy

## Attached Exhibits

Exhibit 1 Maps of Northshore Mine Drilling from Northshore 2004 (p.10) and Northshore 2008 (p. 11)

Exhibit 2 MPCA, *St. Louis River Watershed Stressor Identification Report*, October 2013, draft from MPCA files dated December 31, 2013.

Exhibit 3 Map of Current and Post-Closure Northshore Pit Stratigraphy (Barr 2008, Map 13)

Exhibit 4 Map of Wells and Public Water Supply Within 15 Miles of Northshore Mine Site (Barr 2008, Map 9)

Exhibit 5 Faulted Bedrock and Surface Topography Vicinity of Proposed Northshore Mining Expansion, Map 1 (J.D. Lehr)

Exhibit 6 Faulted Bedrock and Surface Topography Vicinity of Proposed Northshore Mining Expansion Map 2 (J.D. Lehr)

Exhibit 7 Duluth Metals Proposed Project Infrastructure Map (NI 43-101 Technical Report on Prefeasibility Study, p. 4-11)

## Primary References from MDNR Files

Barr, *Long-Range Hydrology Study*, November 2008 (Barr 2008)

Barr Technical Memorandum- Louise Segroves and Rachel Walker, *Wild Rice Literature Review and 2013 Field Survey for the Peter Mitchell Mine*, December 11, 2013 (Barr 2013)

Golder Associates, *Northshore Mining Type II Virginia Formation Laboratory Weathering Experiment*, October 2012 (Golder 2012)

Golder Associates, *Type II Virginia Formation Stockpile Plan*, May 2, 2013 (Golder 2013)

MDNR, *Northshore Mining Company Progression of the Ultimate Pit Limit Public Review Environmental Assessment Worksheet*, September 2, 2014. (EAW)

MDNR, *Environmental Assessment Figures, Northshore Mining Company Progression of the Ultimate Pit Limit Project* (EAW Figures)

Northshore Mining Co., *Northshore Mining Virginia Formation Development Plan*, June 15, 2004. (Northshore 2004)

Cliffs Natural Resources Northshore Mining, *Virginia Formation Development Plan 2008 Annual Review*. (Northshore 2008)

Northshore Mining Company – Peter Mitchell Mine, National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit MN0046981, Issuance Date: August 11, 2009; Modification Date August 14, 2013. (Northshore NPDES)