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THE SCIENCE: The Copper/Nickel Mining Threat to the Aquatic Ecosystem of the South Kawishiwi River and to Lakes and Rivers Downstream in the Boundary Waters Canoe Area Wilderness and Voyageurs National Park in Minnesota and in Quetico Provincial Park in Ontario

Tom Myers, PhD, in his December 3, 2013 report entitled "Technical Memorandum: Twin Metals Mining and the Boundary Waters Canoe Area Wilderness, Risk Assessment for Underground Metals Mining," focused on essential facts demonstrating why copper/nickel mining threatens irreparable harm to priceless northern forest ecosystems (NMW's parentheticals explain why facts identified by Dr. Myers are significant):

- Waters that would receive acid mine drainage (AMD) are currently of extremely high quality (therefore, pollution caused by mining would degrade an increasingly rare resource).
- The waters that would receive acid mine drainage contain few base compounds (therefore, natural buffering of AMD will be nearly nonexistent).
- The many streams, wetlands, lakes and aquifers downstream of the mine sites are massively interconnected (therefore, damage from AMD will be widespread and uncontrollable).
- Mine sites lie in close proximity to these water resources (therefore, preventing AMD from entering the waters is impossible).
- The high probability of acid mine drainage coming from the mine sites, waste rock piles, and tailings pond failures (no practical possibility exists of preventing air, rainwater, and snowmelt from reaching the waste rock).
- The difficulty of predicting when and where acid mine drainage may occur because of the nature of faults in the bedrock (therefore, no practical possibility exists of effectively blocking AMD movement through the ground).
- The potential that acid drainage could impact waters far downstream from the mine sites (therefore, major waterways of the Boundary Waters Canoe Area Wilderness, Quetico Provincial Park, and Voyageurs National Park would be threatened).
- The high cost and low probability of remediating acid drainage when it occurs.
- River discharge and aquifer recharge are highly seasonal, with the bulk of it occurring between mid-April and mid-June (therefore, drawdowns of surface water and groundwater by mining activity outside that period of higher flows will deplete water available in the affected ecosystems at times when the flows are already at annual low points).

Lawrence A. Baker, PhD, in his November 24, 2013 report entitled "Potential Ecological Impacts of the Twin Metals Mine," stated the following conclusions, among others:

- "The potential impacts of the mine are high because this is a very large mine located in an ecologically sensitive area."
- Fish in these waters are sensitive to acidification; even small changes in pH caused by acid mine drainage would result in losses of species. If pH were to decline below 5.0 most species would be lost.
- Leaching of heavy metals associated with acid mine drainage impairs fish and other aquatic life.
- Because wild rice is harmed or destroyed by sulfate levels greater than 10 mg/L, and because background sulfate levels in these waters are around 6 mg/L, elevated sulfate levels associated with acid mine drainage would likely impair wild rice production. It may also harm other rooted aquatic plants.
- Sulfates are a factor in the creation of methyl mercury, which is the form of mercury taken up in the food chain. The increased methylation would increase the concentrations of mercury in fish and thus expose human and other consumers of fish to the risks of elevated levels of mercury in their bodies.
- Acid mine drainage input and elevated sulfate levels would affect the natural cycling of phosphorus between sediments and waters. The release of phosphorus to waters would cause increased algal growth, loss of water clarity, and eutrophication.
- Acid mine drainage and associated contamination may affect a large number of shallow, easily contaminated domestic drinking wells in the area.
- Tailings dam failures, because of an extreme weather event, human error, or other reason, pose a serious risk to downstream ecosystems; the downstream distribution of acidic water and heavy- metals contaminated sediments would contaminate the waters for many kilometers. Damage caused by metal-laden sediments would persist for years.

Minneapolis Star Tribune, On-Line, December 6, 2013 (referring to a proposed Minnesota copper/nickel mine, known as PolyMet, that lies in the watershed of Lake Superior; the proposed PolyMet mine is in the same geological formation—the Duluth Complex—with the same dangerous sulfide chemical composition that mining companies are exploring in the watershed of the Boundary Waters Canoe Area Wilderness):

But this type of hard rock mining carries greater risks to water quality and wildlife habitat in one of the most beautiful corners of the state. Copper-nickel mines, also known as hard-rock mines, have a long legacy of destruction in other states, primarily the west, and taxpayers are spending millions of dollars to clean up streams and rivers at other sites across the country.

Unlike the taconite long mined in northeastern Minnesota, these precious metals are found in ore that contain sulfides. When exposed to air and water, the sulfides create acid drainage that leaches heavy metals and mercury from rock, and the acidity destroys aquatic life.