Minnesota Pollution Control Agency
Variance Issue Statement
For
Mesabi Nugget Delaware, LLC
NPDES/SDS Permit No. MN0067687

September 2012

Issue Statement

Mesabi Nugget Delaware, LLC (Mesabi Nugget) operates an iron nugget production facility (Large Scale Demonstration Plant – LSDP) located near Hoyt Lakes, Minnesota. This facility was originally permitted in 2005; however, construction was delayed until 2009 because of other permitting, financing issues and a change in ownership. The facility became operational on a limited, commissioning basis in January of 2010. As of August 2012 the facility has not yet reached full-scale production capabilities.

The facility appropriates process makeup water from an inactive, water-filled mine pit (Area 1 Pit) at the former Cliffs Erie/LTV mining site for process temperature control (contact and non-contact cooling) and for process water (e.g. scrubber water supply). The wastewater generated from the contact cooling water and the process water is treated prior to return back to the Area 1 Pit. The wastewater treatment system consists of chemical coagulation, precipitation and clarification, followed by microfiltration and final mercury removal through a proprietary mercury filtration system. The treated wastewater is normally routed back into Area 1 Pit for additional settling prior to reuse as makeup water or discharge to Second Creek through a designated pipe outfall (SD001). If water levels in the Area 1 Pit so dictate, water may be routed to the neighboring Area 2WX Pit for storage prior to discharge through SD001. A second mercury filtration system is available for additional treatment, if needed, before the discharge to Second Creek. The average and maximum rates of flow of the discharge to Second Creek are 1.5 mgd and 5.8 mgd, respectively [(1)]. As necessary, the discharge is proposed to be controlled such that it can be temporarily reduced or eliminated so as not to violate any applicable seasonal water quality standard or to otherwise minimize adverse impact to the receiving water. The Area 1 Pit is considered an inactive mining area undergoing closure and reclamation and is a water body under a NPDES/SDS permit and is not a 'Waters of the State' as defined in Minnesota Rules.

With its application for reissuance of its existing NPDES/SDS permit Mesabi Nugget has submitted an application requesting a variance from water quality-based effluent limitations and the underlying water quality standards for hardness, specific conductance, total dissolved salts (solids or TDS), and bicarbonates [(2)]. The applicable water quality standards are:

- 500 mg/L for hardness for Class 3C waters;
- 1000 μmhos/cm (μS/cm) for specific conductivity for Class 4A waters;

- 700 mg/L for total dissolved salts (solids) for Class 4A waters; and
- 250 mg/L for bicarbonates for Class 4A waters

The concentration of the above parameters in the existing discharge from Area Pit 1 to Second Creek is currently above their respective water quality standards. Because the production facility has only recently commenced operation in a limited capacity, the current concentration in the discharge predominantly reflects pre-operation conditions that have not been materially affected by the limited operation of the nugget plant. Nondegradation is not triggered because loadings are below currently permitted loadings and will remain so for the life of this permit.

The basis for the variance request is the technical infeasibility of construction of additional wastewater treatment systems, such as reverse osmosis, *at this time* to meet the final effluent limitations. It is acknowledged that a treatment technology such as reverse osmosis may at some point in time be capable of achieving applicable effluent limitations, but such treatment cannot be implemented immediately without further evaluation of future wastewater characteristics and undergoing facility-specific engineering design and testing. The request conforms to the requirements for applying for a variance specified in Minnesota Rules, Parts 7050.0190 and 7000.7000.

The existing permit issued in 2005 included a variance, with corresponding interim effluent limitations, for the same parameters as in the current variance request. The currently requested variance is in essence a continuation of the existing variance. For three of the four parameters (bicarbonate, specific conductivity and TDS), however, the magnitude of the current requested variance is less than that granted in the previous variance. In addition, by eliminating the discharge to Second Creek for portions of the year, Mesabi Nugget is proposing to reduce the duration and maximum potential loading of the requested variance as compared to the previous variance. Mesabi Nugget is proposing to eliminate the discharge to Second Creek from April 1st through August 31st due to the potential for impacts to downstream wild rice from sulfate in the discharge. As part of the permit development MPCA staff determined that the downstream waters used for production of wild rice are susceptible to damage from high sulfate levels during the months of April through August [(3)]. In addition, because intermittent seasonal chronic toxicity in the discharge has been observed in the past, the discharge would be restricted during the month of September each year pending demonstration through whole effluent toxicity (WET) testing that chronic toxicity does not exist in the discharge. Thus, the current variance request represents a reduction in both magnitude and duration as compared to the previously granted variance.

This memorandum discusses the basis presented by Mesabi Nugget for requesting a variance from the hardness, specific conductivity, total dissolved salts (solids), and bicarbonate water quality-based effluent limitations, and the Agency staff position for granting the variance.

A. Background

Nugget Plant Description

Mesabi Nugget in January 2010 commenced operation of a 600,000 metric ton/year iron nugget production facility at the Cliffs Erie mining site (formerly LTV Steel Mining Company) located in Hoyt Lakes, Minnesota. The iron nuggets are approximately 96 to 98% iron, and are suitable for direct feed to electric arc furnaces (mini-mills) as well as to foundries and conventional integrated iron and steel manufacturing facilities. Although production has commenced as of early 2010, current production levels remain under rated capacity [(4)].

Mesabi Nugget appropriates process makeup water from an inactive, water-filled taconite mine pit (Area 1 Pit) for contact and non-contact cooling needs and for air pollution control wet scrubber equipment. All process wastewaters generated from the cooling and scrubber systems are treated prior to return back to the Area 1 Pit. This wastewater is treated using a two stage metals removal and softening system utilizing lime, ferric chloride, cationic polymers, caustic (soda ash), and water treatment chemicals to form insoluble metal hydroxides and sulfide precipitates which settle out in a sludge for subsequent disposal. Effluent from the solids contact clarifier is passed through a microfilter, a mercury filter (for additional solids and mercury removal) and then is routed to the Area 1 pit. If water levels in the Area 1 Pit so dictate, water may be routed to the neighboring Area 2WX Pit for storage prior to discharge. Water from the Area 1 Pit will be directed through a second mercury filter, if needed, prior to discharge through outfall SD001 to Second Creek. The treatment is capable of meeting the effluent limitations for the underlying 1.3 ng/L mercury water quality standard applicable to the Lake Superior Basin.

Receiving Water Classification and Applicable Water Quality Standards

Second Creek has been assigned beneficial use classifications under Minnesota Pollution Control Agency (MPCA) Rules Chapter 7050.0430, Unlisted waters; 2B, 3C, 4A, 4B, 5, and 6. Second Creek is part of the Partridge River and St. Louis River watershed that ultimately flows to Lake Superior. The water quality standards for which Mesabi Nugget is seeking a variance from; hardness, specific conductance, total dissolved salts (solids or TDS) and bicarbonates, are standards set to protect the beneficial uses of industrial consumption and irrigation. There are no known existing uses of Second Creek water for industrial purposes or for irrigation. Other industrial uses are either upstream of Second Creek in the Partridge River or much farther downstream in the St. Louis River, well beyond any reaches that may potentially exceed water quality standards as a result of granting the variance.

The following table contains the applicable water quality standards for which Mesabi Nugget is requesting the variance:

POLLUTANT	WATER QUALITY STANDARD	CLASSIFICATION	DESIGNATED USE
Hardness, Ca and Mg as $CaCO_3$	500 mg/L	3C	General industrial purposes
Specific Conductivity	1000 µmhos/cm	4A	Irrigation
Total Dissolved Salts (Solids)*	700 mg/L	4A	Irrigation
Bicarbonates as $CaCO_3$	5 milliequivalents or 250 mg/L	4A	Irrigation

*Total dissolved salts and total dissolved solids are used interchangeably and termed TDS

Current Conditions in the Discharge

The quality of the water in the Area 1 Pit and in the existing discharge from the pit to Second Creek (Outfall SD001) indicates that these four pollutants will exceed applicable water quality standards in Second Creek, assuming little or no dilution is available for the discharge. The current water quality of the Area 1 Pit (2010 - 2011) and of the SD001 discharge (July 2009 - June 2010, the most recent 12 month period of discharge) is listed in the table below [(5)].

POLLUTANT	WATER QUALITY STANDARD	CURRENT PIT 1	MOST RECENT DISCHARGE (7/09-6/10) (SD001)
Flow, *mgd*	---	---	3.8
Hardness, Ca and Mg as $CaCO_3$, *mg/L*	500	739	740
Specific Conductivity, *µmhos/cm*	1000	1269	1194
Total Dissolved Salts (Solids), *mg/L*	700	872	824
Bicarbonates as $CaCO_3$, *mg/L* or (*milliequivalents*)	250 (5)	329	330

Current Conditions in the Receiving Water (Second Creek)

Monitoring of the flow and water quality in Second Creek upstream and downstream of the discharge is required by the existing permit. For the monitoring period July 2009 to June 2010 prior to cessation of the discharge in July 2010, upstream flow ranged between 0.3 to 2.1 mgd with an average of 0.9 mgd. Downstream flow increased to a range of 4.0 to 12.3 mgd with an average of 6.9 mgd, the increase being due to the existing discharge as well as other contributions from the watershed [(5)]. Concentrations of the variance parameters were often (but not always) at or above applicable water quality standards

both upstream and downstream of the discharge with no clear pattern of increasing or decreasing concentrations in the downstream direction. Monitoring of flow at the headwaters to Second Creek (outfall SD026 of the Cliffs Erie NPDES/SDS Permit MN0042536) indicates flows near zero at certain times of the year [6]. It is expected (and has been documented) that for substantial parts of the year water quality standards will not be met for these four pollutants in Second Creek downstream of the Mesabi Nugget discharge given the minimal upstream flows and the predominance of the Mesabi Nugget discharge [5].

The following table summarizes the results of monitoring in Second Creek (July 2009 - June 2010, the most recent 12 month period of discharge).

POLLUTANT	**WATER QUALITY STANDARD**	**SECOND CREEK UPSTREAM**	**SECOND CREEK DOWNSTREAM**
Flow, Ave., *mgd*	---	0.9	6.9
Flow, Min – Max, *mgd*	---	0.3 – 2.1	4.0 – 12.3
Hardness, Ca and Mg as $CaCO_3$, *mg/L*	500	580	661
Specific Conductivity, *µmhos/cm*	1000	1083	1030
Total Dissolves Salts (Solids), *mg/L*	700	686	751
Bicarbonates as $CaCO_3$, *mg/L* or (*milliequivalents*)	250 (5)	337	294

It should be noted that site and watershed conditions for the receiving water have changed since July 2010, the time that is represented in the table above. First, Mesabi Nugget is currently storing water within on-site mine pits such that there is currently no discharge through SD001 and second, Cliffs Erie has installed a collection and pumpback system at the SD026 headwaters to Second Creek thereby reducing the volume of flow upstream of the SD001 discharge point. The combined effect of these activities has been a marked decrease in upstream and especially downstream flow rates in Second Creek as well as a general overall decrease in pollutant concentrations. Some of the influences are temporary/seasonal (cessation of discharge through SD001) and some are more permanent (SD026 pumpback system) so it is difficult to assess what future conditions will be.

B. Discussion

Variance Request

Mesabi Nugget is requesting the variance from the water quality standards for hardness, specific conductivity, bicarbonates, and total dissolved salts (solids) based on provisions in Minn. R. part 7050.0190, subpart 1, and in conformance with the provisions included

in Minn. R. part 7000.7000, subp. 2 [(2)]. The variance request is directed at the final effluent limitations for hardness derived from the underlying 500 mg/L Class 3C water quality standard in Minn. R. 7050.0223, subp. 3; for specific conductivity from the underlying 1000 µmhos/cm Class 4A water quality standard; for bicarbonates from the underlying 5 milliequivalent (250 mg/L) Class 4A water quality standard; and for total dissolved salts (solids) (TDS) from the underlying 700 mg/L Class 4A water quality standard in Minn. R. 7050.0224, subp. 2.

The Agency, in proceeding to grant a variance, must consider the items listed in Minn. R. 7000.7000. The discharger has provided the necessary information in their application and supplemental submittals for these items, and has provided any additional information that the MPCA has requested.

Comparison of Current Variance Request with Previously Approved Variance
The existing permit issued in 2005 included a variance for the same parameters. The current request is in essence a continuation of the existing variance. As a part of the permit development process, interim effluent limitations were calculated based on current effluent levels for hardness and bicarbonates, and on projected levels in 5 years for specific conductivity and TDS. The interim limits for specific conductivity and TDS are based on projected levels because they may be affected by changes to the facility related to optimization or fully-operational process components [(7)]. The resulting interim effluent limitations are lower than those included in the previous permit for three of the four variance parameters. This is shown in the table below.

POLLUTANT	**PREVIOUS VARIANCE EFFLUENT LIMITS (Mo. Ave./Daily Max.)**	**REQUESTED VARIANCE EFFLUENT LIMITS (Mo. Ave./Daily Max.)**	**PROPOSED VARIANCE EFFLUENT LIMITS (Mo. Ave./Daily Max.)**
Hardness, Ca and Mg as $CaCO_3$, *mg/L*	740 / 831	740 / 831	831 / 863
Specific Conductivity, *µmhos/cm*	2159 / 2425	2000 / 2246	1889 / 1965
Total Dissolved Salts (Solids), *mg/L*	1619 / 1818	1200 / 1348	1160 / 1228
Bicarbonates as $CaCO_3$, *mg/L* or	396 / 445	396 / 445	362 / 378

In addition, by eliminating the discharge to Second Creek for portions of the year, Mesabi Nugget is proposing to reduce the duration and maximum potential loading of the requested variance as compared to the previous variance. Mesabi Nugget is proposing to eliminate the discharge to Second Creek from April 1st through August 31st due to the potential for impacts to downstream wild rice from sulfate in the discharge – this will decrease the duration of impacts from the variance parameters as well - and potentially for the month of September pending demonstration through whole effluent toxicity (WET) testing that chronic toxicity does not exist in the discharge during this time period (which is the period when intermittent chronic toxicity in the discharge has been

observed in the past). As part of the permit development MPCA staff determined that the downstream waters used for the production of wild rice are susceptible to damage from high sulfate levels during the months of April through August [(3)]. The reissued permit will include requirements that avoid a discharge during these times.

It is projected that hardness and bicarbonate concentrations in the discharge will decrease once the facility reaches full operation and the wastewater treatment process can be stabilized and optimized, while specific conductivity and TDS are expected to slowly increase initially. Although specific conductivity and TDS concentrations are expected to increase over the short term, the variance schedule in the draft permit requires actions to be implemented in the short-term (i.e., 18 to 24 months after permit issuance) with the goal of a downward trend for these constituents. Additionally, the discharge will need to comply with the interim effluent limitations in the permit for these two parameters. These interim limits were calculated based on a combination of existing water quality monitoring data and projections of effluent quality from the permit application and subsequent supplements.

Applicability of Variances from Water Quality Standards - Minn. R. 7050.0190, subp.1.
Minn. R. 7050.0190, subp. 1 allows a variance for discharges of hardness, bicarbonates, specific conductivity, and total dissolved salts (solids) in a situation where strict compliance with the standards would cause the discharger undue hardship; and that strict conformity with the standards would be unreasonable, impractical, or not feasible under the circumstances.

Conditions to Grant a Variance
The discharger must conform to the provisions of Minn. R. 7000.7000

Items A through C – Name, address, signature and facility location and description
Mesabi Nugget has provided this information.

Item D - Nature of the variance sought
Mesabi Nugget has identified the applicable variance provisions and is asking for a variance for the duration of the permit. Permit duration can be no longer than five years. The reasons specified in seeking the variance are described in Item F below.

Item E - Grounds based on economic burden
MPCA's analysis relies predominately on the technical infeasibility of providing additional treatment capable of achieving final effluent limitations at this time (see discussion under Item F below). Also, EPA agrees that the variance is warranted based on substantial and widespread economic and social impacts that are anticipated to occur without this variance (see discussion under Item H.5 below). The company maintains that the selection and design of wastewater treatment alternatives that may be capable of meeting effluent limits is complex, is dependent on fully understanding the current and projected characteristics of the wastewater, and requires a period of evaluation and bench and/or pilot testing to complete the selection and engineering design of treatment components [(4)]. The company further maintains that it is probable that installation and

operation of such advanced technology would be exceptionally expensive and therefore economically infeasible to their one-of-a kind demonstration project, particularly given the current economics of the Nugget plant.

Preliminary costs estimates of a treatment system theoretically capable of meeting effluent limitations for the variance parameters is approximately $29.5 million in capital costs with approximately $1 million in annual operating costs. This translates to an annualized cost of $4.3 million and a net present value of approximately $37.6 million over a 10 year financing period for the hypothetical treatment facility. (These costs estimates are for a treatment system theoretically capable of achieving the final effluent limitations for only the four variance parameters and not for achieving a 10 mg/L sulfate concentration as were the cost estimates previously provided for the Mesabi Mining project [4]).

Item F - Grounds based on technological infeasibility
Mesabi Nugget investigated the technical feasibility of several wastewater treatment technologies that were identified as having a potential of effectively treating the discharge including biological treatment (anaerobic reactors, wetlands), chemical precipitation (lime softening, ettringite precipitation, barium precipitation), ion exchange (Sulf-IX) and membrane treatment (nanofiltration, reverse osmosis). Of those technologies evaluated, the only option considered potentially technically capable of reducing the levels of the variance parameters to water quality standards was reverse osmosis with evaporation and crystallization of the reject water [2, 4, 8].

Even with reverse osmosis (RO), however, some technological uncertainty remains for the Mesabi Nugget discharge particularly with respect to pretreatment requirements, selection of an effective membrane(s) for variable influent quality, likely fouling and scaling of the heat transfer surfaces, disposition of the reject brine and general design/scale-up considerations for a system capable of treating up to 3000 gallons per minute. At minimum, Mesabi Nugget has indicated that to make an informed decision on the potential installation of addition wastewater treatment a reasonable amount of time would be needed to fully characterize future wastewater characteristics (resulting from potential changes or enhancements to the air quality control systems – see discussion below) and to conduct the bench and/or pilot testing necessary for engineering design and detailed economic evaluation. These and other issues related to the technical infeasibility of immediately installing wastewater treatment for the SD001 discharge are further discussed in the paragraphs below.

Agency review of the Mesabi Nugget technology infeasibility assessment determined that a RO system would likely be required to reduce dissolved solids to levels where the effluent limitations for the variance parameters may be met – other technologies would not be likely to meet effluent limitations. RO is a pressure driven process that retains ions on one side of a RO filter while passing water through the filter to the other side. The pressure applied exceeds the osmotic pressure of the solution against a semi-permeable membrane, and thus forces water through the membrane leaving ions behind. RO has been used quite successfully for the removal of hardness and total dissolved

solids, and certain RO systems have been used for removal of specific ions such as chloride and sulfate. RO systems have typically been applied on smaller scales (relatively low flows) using relatively clean sources of water as make up water for production of boiler water or other water uses requiring waters with low levels of hardness or salinity. Large scale or high flow RO systems for removal of salinity have seen limited use and are generally limited to large plants for the desalinization of sea water for drinking water supplies in countries with inadequate freshwater supplies. More recently, as treatment requirements have become more stringent and technology advances have been made, RO technology has been applied to a wider variety of treatment scenarios including some in mining-related facilities.

A conceptual treatment scenario would be to treat approximately 70% of the flow from the Area 1 Pit with the permeate from the RO system (the treated water) being blended with the remaining 30% of the flow. This would result in the discharge mixture meeting final effluent limitations for the variance parameters (but would not result in achieving a 10 mg/L sulfate concentration in the discharge.)

Pretreatment of the influent to the RO system to remove finely suspended solids and incompatible dissolved species such as iron and manganese, beyond that already provided by the chemical precipitation system, would be required to prevent fouling or plugging of the RO membrane. This would likely involve multiple stages of filtration plus the addition of antiscalants and/or bisulfate to control scaling. Selection of the appropriate membrane and pretreatment components is in large part dependent on the specific physical and chemical makeup of the water to be treated and can only be determined through a series of bench and/or pilot testing. Subsequent changes in influent quality or characteristics could have large effects on the performance and efficiency of the selected membrane and pretreatment.

This last consideration has particular relevancy to the Mesabi Nugget discharge. The Mesabi Nugget facility has been issued an Air Quality Permit which required installation of Best Available Control Technology (BACT) for control of criteria pollutants, Maximum Available Control Technology (MACT) for control of hazardous air pollutants, and ambient air modeling to demonstrate attainment of National Ambient Air Quality Standards (NAAQS), increments and Air Quality Related Values (AQRVs) in the nearby Boundary Waters Canoe Area Wilderness and Voyageurs National Park. Because the facility was the first of its kind commercial installation, there was considerable question on how to scale emission factors from testing that had been done on the previous pilot plant and the efficiency of the new air control equipment to be used on the full-scale plant. As a result the Air Quality Permit was issued with requirements for additional testing related to determining optimum scrubber efficiency, to determine whether additional NOx controls were needed, and whether mercury emissions could be reduced.

Mesabi Nugget is in the process of conducting various studies on their air emission control/scrubber systems as required by the facility's Air Emissions Permit which may result in significant changes in the nature of the influent to an RO treatment system [4, 9]. In particular, Mesabi Nugget is required to complete a Wet Scrubber Optimization Study,

a NOx Control Study and a Mercury Reduction Study. Changes in liquid flow rate as a result of the Scrubber Optimization Study could result in the presence of additional dissolved solids and particulate matter in the influent. A requirement to install a selective noncatalytic reduction system (SNCR) or alternate technology for NOx control would result in significant quantities of nitrogen compounds reporting to the wastewater treatment system. These nitrogen compounds can be detrimental to the performance of RO membranes and may require the installation of additional pretreatment [4, 9]. If additional control equipment is required to remove mercury in the air emissions, the most likely candidate would be the injection of activated powdered halogenated carbon. This would likely change the composition of the influent by adding monovalent ions thereby affecting the selection of an effective membrane, as well as the selection of pretreatment technology due to the addition of the very finely divided activated carbon [4].

Given that these air emission control studies are still in progress and the determination of what, if any, air control improvements will be implemented has not yet been made, it would be extremely difficult and risky to design and install the wastewater pretreatment and RO treatment systems at this time. The results of the air emission control studies are expected to be submitted to the MPCA no later than the end of May 2013; therefore, the proposed variance schedule in the draft NPDES/SDS, in part, considers this timeframe.

By its nature, an RO system will have a reject or concentrate stream consisting of approximately 15% of the influent flow in which the removed pollutants are concentrated and which would require subsequent treatment and/or disposal. For the Mesabi Nugget facility, management of this reject (brine) stream would need to be accomplished by total evaporation of the brine and crystallization of the solids for subsequent disposal in a permitted solid waste landfill. The process is very energy intensive in that large amounts of energy are required for the evaporation and crystallization process. To operate a system of adequate scale to treat the Area 1 Pit discharge would require an estimated energy usage on the order of 8 million kilowatt-hours per year. In addition, the crystallized solids would require off-site disposal which translates to additional energy consumption [10].

Theoretically it would be possible to operate a membrane system without an evaporator/crystallizer using multiple stage membrane treatments to reduce the volume of brine so that it could be transported to a larger wastewater treatment facility. However, disposal of the brine presents a significant challenge. Mesabi Nugget looked at a number of brine disposal options that have been employed elsewhere outside of Minnesota including evaporation, underground injection, disposal to a municipal publicly owned treatment system (POTW) and ocean disposal, but each was determined to be not technically feasible for application at Mesabi Nugget [11]. Each of these is discussed briefly below.

The feasibility of evaporation ponds for brine management is fundamentally determined by local climatology, specifically the annual evaporation rate versus the annual precipitation rate. Mean annual precipitation at Hoyt Lakes is approximately 27.4 in/yr

and mean evapotranspiration is estimated at 20.0 in/yr. The excess precipitation precludes the use of evaporation ponds for brine disposal at Mesabi Nugget.

Underground injection involves the injection of the brine into deep, brackish or saline aquifers. In Minnesota there is currently a prohibition on the use of injection wells for waste disposal. Even if a variance from this prohibition was sought, there are no aquifers of suitable capacity, permeability and degree of isolation from aquifers used for drinking water in northeastern Minnesota making this disposal option technically infeasible.

The brine could be trucked to a municipal POTW for disposal. However municipal wastewater treatment systems are not designed to remove the pollutants of concern but would only 'treat' them through dilution. In addition, it does not appear that there is a treatment system within the Lake Superior watershed (including the Western Lake Superior Sanitary District in Duluth) that would have the capacity to accept the volume and strength of the waste brine. Other larger systems such as the Metropolitan Wastewater Plant in St. Paul, being outside the Great Lakes basin, are unacceptable from a regulatory perspective.

Ocean disposal is not a viable option for the obvious reason of geography as well as regulations and treaties governing the diversion of water from the Great Lakes Basin.

RO treatment with evaporation/crystallization has been proposed, and in some cases installed, at other facilities in Minnesota and in other mining-related applications elsewhere. Mesabi Nugget provided a brief discussion of these other facilities and how they may or may not be relevant to their facility [(4)].

US Steel – Minntac had in a previous permit application proposed to construct a membrane treatment system to treat a portion of its process water. After submittal of the application Minntac requested the MPCA to not act upon the application while Minntac investigated refinements to the proposed treatment system. A result of the investigation was that Minntac determined that instead of installing a membrane treatment system to treat process water, it would instead eliminate the substantial source of pollutants entering the process water through installation of dry emission controls to replace the existing wet scrubbers. This is documented in the 2011 Schedule of Compliance between the MPCA and Minntac. As a result, the proposed membrane treatment system was never constructed and there are no requirements in the Minntac permit or Schedule of Compliance to construct a membrane treatment system.

PolyMet has included in its proposed project description an RO treatment system to treat excess wastewater from its plant site tailings basin. Notably, this proposed RO system does not include the evaporation/crystallization component that would be necessary for Mesabi Nugget since PolyMet is proposing to transport the reject/brine stream to its mine site wastewater treatment system for subsequent treatment and disposal. PolyMet is currently in the process of pilot testing RO technology for application at its proposed facility. The PolyMet project, including the proposed RO treatment system, is still

undergoing environmental review and has not yet reached the permitting stage, and thus, of course, a full-scale treatment facility has not yet been constructed.

Essar Steel, in its original project proposal to build a mine, pellet plant and steel mill, included a proposal to install a RO system for pretreatment of process water and a RO system with evaporation/crystallization for treatment of process wastewater from the pellet plant and steel making processes. Essar's revised project proposal currently undergoing permitting has substituted dry air controls in place of the previously proposed wet scrubbers for the pellet plant and has not yet completed the design of the treatment system for the steel making portion of the project. As such, the proposed RO system with evaporation/crystallization has not yet been designed or constructed and depending on the outcome of future evaluations may not even be proposed or permitted.

Multiple Minnesota ethanol facilities use RO, microfiltration, evaporation, and crystallization or some combination of the technologies to treat source water as well as internally generated wastewater streams. These facilities manage their water treatment reject liquids using a variety of permitted methods, including incorporating it in animal feed, sending it to waste management facilities as a solid waste, and trucking it to a permitted POTW. The use of these technologies in coordination is very site-specific and situation-specific which means that there are challenges in making correlations between the use of the technologies in the ethanol production industry and the mining industry. Due to the specific design needs for Nugget it would be inappropriate to assume that the same strategies in use by the ethanol industry would be effective at Nugget, and it is fair to say that the Minnesota ethanol industry does not have a water treatment facility in operation which is similar to what would likely be needed for the Nugget facility.

An RO system with evaporation/crystallization was proposed for treatment of mine water for subsequent reintroduction into the groundwater at the Kennecott Eagle Mine in Marquette County Michigan and was scheduled for start-up and commissioning in winter 2011-2012; however, its actual construction and start-up was delayed. The design capacity of this system at 100-500 gpm is substantially smaller than what would be required for Mesabi Nugget and with little to no operational history, there is little information yet on the success of its operation and whether it will consistently meet treatment objectives.

A wastewater treatment system including RO with evaporation crystallization was included in prefeasibility documents for the proposed Orvana Copperwood project in Gogebic County Michigan. The facility was preliminarily designed at 350 gpm with treated water being used for reuse and/or discharge to a tributary to Lake Superior. As permit applications have only recently been submitted for this project and the economic and environmental evaluation of the project is still in progress, the treatment systems have not yet been fully designed and, of course, not yet constructed or operated.

Treatment systems employing RO have been proposed and approved for treatment of mine water at two Consol Energy coal mines in Appalachia, the Blacksville Mine in West Virginia and the Hutchinson Mine in Virginia. These systems are purportedly sized for

approximately the same flow rate as for Mesabi Nugget, but at this time, it is uncertain whether the application of the technology at these facilities is transferrable to Mesabi Nugget given uncertainties of influent characteristics and treatment objectives, etc. Mesabi Nugget has committed to investigating the treatment systems at these mines for applicability at Mesabi Nugget as part of the proposed variance schedule.

As can be seen by the discussion above, many of the 'known' RO systems with evaporation/crystallization at mining facilities (e.g., Minntac, Essar, PolyMet) are still in the proposal stage and have yet to be constructed and operated. As such, there is little information on the design and/or performance of these systems that is transferable to Mesabi Nugget at this time. In addition, the physical (i.e., flow rate, temperature) and chemical characteristics of the wastewater streams where RO systems have been applied, such as at the nonferrous Eagle Mine or the Consol Energy coal mines, are likely different than at Mesabi Nugget. Thus, it cannot be concluded with certainty at this time that the technology is transferable or feasible for Mesabi Nugget simply because it has been applied elsewhere. In addition, applications of the technology at Minnesota ethanol facilities appear to indicate that the technology is technically complex and very site specific and cannot be directly correlated to scale up to an application at Mesabi Nugget that would have reasonable assurance of meeting their final effluent limitations [(4)].

MPCA staff has reviewed the information submitted by Mesabi Nugget and agrees that of the technologies evaluated, the reverse osmosis with evaporation/crystallization technology has the greatest likelihood of being able to meet effluent limitations. MPCA staff also agree that given the uncertainty at this time over the nature and volume of the wastewater (due to the ongoing air emission control studies and the subsequent need for site-specific bench and/or pilot testing) and the lack of a successful full-scale demonstration at a similar facility, that a reasonable period of time for additional evaluation and testing is needed before an informed decision on the selection and/or design of additional treatment can be made. Without a reasonable level of technical certainty of success, MPCA staff believes it would be unreasonable to require Mesabi Nugget to proceed with installation of an unproven, multi-million dollar treatment system at this time.

The emphasis of this conclusion is on the technical infeasibility of immediate installation at Mesabi Nugget given the current state of knowledge on the subject. MPCA staff believes that further investigation of RO with evaporation/crystallization technology is warranted and has developed a proposed variance schedule in which Mesabi Nugget would be required to further investigate the feasibility of applying this technology at its facility.

Item G – Other additional data.
No additional data.

Item H.1 – Other relevant data, general description of materials handled or processed…. nature and quantity of materials discharged…. proposed methods to control these materials.

Mesabi Nugget has recently commenced operation of a 600,000 metric ton/year iron nugget production facility which produces iron nuggets capable of being fed directly to electric arc furnaces (mini-mills) as well as to foundries and conventional integrated iron and steel manufacturing facilities. Although production has commenced as of early 2010, current production levels remain well under rated capacity.

The primary sources of the pollutants in the wastewater are the makeup water appropriated from the Area 1 Pit and blowdown from the facility's air pollution control (wet scrubber) equipment. Concentrations of pollutants in the makeup water are primarily from the weathering and leaching of wasterock stockpiles within the Area 1 Pit watershed. These wasterock stockpiles are the result of previous mining at the site by the former LTV Steel Mining Company. Mesabi Nugget will be required to identify and determine the culpability of specific sources and to investigate means to reduce the loading of dissolved solids from these sources to the Area 1 Pit as part of the reclamation and closure of adjacent minelands.

The iron nugget manufacturing process involves the reaction of coal with iron ore concentrate with coal used as a reductant. Current air quality regulations require the use of a wet scrubber system to provide sufficient removal of particulate and acid gases from the nugget process to meet ambient air quality standards and Class I Air Quality Related Values. Mesabi Nugget will be required by the existing NPDES/SDS permit to investigate alternative sources of raw materials (e.g., coal) that would result in reduced influent loadings from the wet scrubber system to the wastewater treatment system. (This requirement was also a condition of the previous permit; however, much of that work was not able to have been completed because the facility has only been operating at a limited production level and for a short period of time (since January 2010)).

Item H.2 – Comprehensive proposed plan to reduce discharges to lowest levels practical...

The draft permit associated with the variance request includes a schedule that will require completion of the necessary studies that will ultimately result in a plan to accomplish reductions in TDS-related parameters over the short term as well as the development of a specific plan of action with schedule for the longer term that will result in reductions in the concentrations of the variance parameters in the discharge such that compliance with final effluent limitations is achieved as soon as possible and no later than August 1, 2021.

This variance schedule will include both short-term and longer term components. The short-term requirements include completion and implementation of a Short Term Water Quality Improvement Study which is intended to focus on improvements that could be made to existing processing and wastewater treatment facilities (WWTF) to accomplish reductions in TDS-related pollutants, including potentially sulfate, in the discharge from the WWTF so as to establish a downward trend in the levels of TDS and specific conductance in the SD001 discharge as soon as possible. These improvements may include actions that would result in pollutant reductions that may not necessarily be sufficient to result in compliance with final effluent limitations. The timeframe for

implementation of the short-term improvements is expected to be within 18 to 24 months of permit reissuance.

The longer term requirements include completion of a series of studies including a Water Balance Study which will identify and quantify water flows into and out of the Area 1 Pit, a Chemical Balance Study which will identify the source and fate of pollutant loadings into the Area 1 Pit including those from operation of the plant as well as those from watershed sources such as from leaching of adjacent stockpiles, and a Pollutant Reduction Study which will include an evaluation of source control strategies, treatment technologies and process optimizations and will propose a detailed plan of action with schedule that will result in compliance with effluent limitations as soon as possible.

The Pollutant Reduction Study is expected to include at least the following elements:

(a) A description of how potential treatment technologies, mitigation alternatives and other actions were considered and evaluated;
(b) An evaluation of the effectiveness (i.e., technical feasibility) of each of the potential treatment technologies, mitigation alternatives and other actions, or combination of actions, in achieving compliance with final effluent limitations as soon as possible. This is expected to include the results of bench scale and/or pilot scale testing of treatment technologies and/or source control strategies;
(c) An evaluation of the cost to implement each of the potential treatment technologies, mitigation alternatives and other actions, or combination of actions;
(d) A detailed description of the plan of action that the company proposes to implement to achieve compliance with final effluent limitations as soon as possible, with rationale for why the particular plan of action is being proposed;
(e) A detailed schedule for implementation with milestone dates indicated; and
(f) A detailed evaluation of the economic impact on the company of implementing the proposed plan of action (i.e., economic feasibility) in the event that the Permittee believes that implementation of the plan of action would result in an unacceptable financial hardship to the company.

The timeframe for submittal of the Pollutant Reduction Study and commencing the implementation of the approved plan of action is expected to be three to three and a half years from the date of permit issuance. Subsequent compliance with final effluent limitations is required as soon as possible thereafter but no later than August 1, 2021.

To provide assurance that requirements of the permit and variance schedule are being completed in a timely manner, progress reports to be submitted every 6 months describing the activities that have been completed and including a general summary of ongoing monitoring data collection and the progression towards attaining compliance with final effluent limitations are required by the variance schedule in the draft permit.

A Source Minimization Plan was required by the original 2005 permit, however, it was not possible to fully complete the plan since construction and operation of the facility was delayed until 2010 (and even as of now is not operating at full scale). Actual operation of the facility is necessary to effectively complete many of the evaluations. The intended

contents of the previous Source Minimization Plan are, in essence, being folded into the series of studies required by this permit, in particular, the Chemical Balance Study and the Pollutant Reduction Study.

MPCA staff believes that the timeline of the variance schedule in the draft permit is appropriate and reasonable for the following reasons. While water and chemical balances have been completed as part of the proposed Mesabi Mining project (currently undergoing environmental review) and do include the Area 1 Pit, these balances are more than 2 years old and need to be updated to reflect actual current and revised projected conditions. Specifically, the surface water model used for the original water balance was requested to be redone by state and federal managers of the Mesabi Mining EIS. The revised model has yet to be formally approved. In addition, the previous model was done using then available 2009 data. The model, once approved, will need to be rerun using more recent data. Lastly, as discussed in detail above, the facility's air emission permit requires a series of air emission control/scrubber studies and evaluations the results of which could significantly affect pollutant loadings and which would need to be factored into the chemical balance. Reports from the air emissions testing are expected no later than the end of May 2013.

Item H.3 - Effect upon air, water, land resources of the state and upon the public and other persons affected.....
Mesabi Nugget concludes that if the proposed variance is approved there will be no impacts on air resources and only a very slight potential for minor impacts to land resources (i.e., soils) should downstream waters be 'unofficially' used as a source of water for private gardens or grasses (such use is not known to exist at this time). There are no endangered species impacts associated with this discharge.

The potential exists for impact on sensitive macroinvertebrates as a result of the discharge. Chronic toxicity testing conducted on the existing discharge and on the Area 1 Pit indicates no effect on fathead minnows but the potential for effect on *ceriodaphnia dubia* [(12)]. Testing results seem to suggest that this potential for impact to *c. dubia* is of greater concern in late summer and is intermittent in nature (i.e., toxicity is not observed in each testing event). Given these observations, the potential for impact within the receiving water itself, if it were to occur at all, would be intermittent and temporary in nature and would be localized to the immediate area of discharge given the larger flows of downstream waters such as the Partridge and St. Louis Rivers relative to the discharge. As a result of these test results, Toxicity Identification and Evaluation (TIE) testing has been initiated and is ongoing. The TIE evaluations will be continued to understand the test results and mitigate the intermittent toxicity as appropriate. In the interim, Mesabi Nugget will be required to control the discharge as necessary to avoid adverse impact on the receiving water. Specifically, discharge from SD001 will not be authorized during September of each year unless Mesabi Nugget can demonstrate through WET testing that toxicity exceeding one toxicity unit is not present.

As stated above, Mesabi Nugget is in the process of identifying the mechanism causing the observed intermittent chronic toxicity to *c. dubia* and in that process has conducted

over 30 separate chronic toxicity tests (many of which did not exhibit chronic toxicity). The TIE work to date has followed two main approaches: (1) removing or adding different constituents to identify the parameter(s) possibly responsible for toxicity, and (2) conducting statistical analyses of *c. dubia* young production compared against measured water quality concentrations. In general, removal of constituents (treatment) did not reduce toxicity, but addition of selenium and organic carbon did reduce toxicity. Based on test results to date, it appears that insufficient micronutrient uptake by the *c. dubia* in this water may be the primary cause or a contributing factor to the intermittent toxicity observed. In other words, it appears that the primary cause of observed toxicity is not what is in the water, but instead is the result of what is not in the water.

As stated elsewhere in this document, it is anticipated that TDS and specific conductance may in the short term increase in the discharge if the variance is approved (hardness and bicarbonate are expected to continue to decline). To evaluate the potential that such an increase in TDS and/or specific conductance may have on the chronic toxicity of the discharge, Mesabi Nugget compared specific conductance values taken at the time the toxicity sample was collected against the results of the toxicity test. The results of this evaluation show that while specific conductance varied in a relatively narrow band around the median value across all samples (ranging from 1050 umhos/cm to 1347 umhos/cm around a median of 1232 umhos/cm), the number of *c. dubia* young varied widely from 0 to 25. When specific conductance is plotted against the number of young, the resulting nearly vertical distribution indicates little relationship between the two exists, and indicates that specific conductance is not a predictor of the intermittent toxicity observed in the Area 1 Pit water. A similar demonstration can be made for TDS. This evaluation indicates that an observable increase in the toxicity of discharge would not be expected even if specific conductance and/or TDS were to increase over the short term, and that this existing Class 2B (aquatic life and recreation) use of the water would not be removed or materially degraded with granting of the variance [(13)].

Mesabi Nugget has evaluated the potential for impact on downstream waters should the variance be granted [(14, 15, 16)]. This evaluation includes potential impacts on the concentration of the variance parameters (hardness, TDS, specific conductance and bicarbonate) and sulfate to the immediate receiving water, Second Creek, as well as potential impacts to the downstream waters of the Partridge and St. Louis Rivers. The evaluation included projections for both average stream flow and 'worst-case' 7Q10 low flow conditions and covered the SD001discharge both with and without consideration of the subsurface contribution to the receiving waters from the Area 6 Pit. (The inactive Area 6 Pit is covered under a separate NPDES/SDS permit issued to Mesabi Mining, LLC. It does not have a surface discharge, but is known to impact Second Creek via subsurface contributions.)

In general, under average stream flow conditions the applicable water quality standards for the variance parameters would continue to be exceeded in Second Creek downstream of the SD001 discharge over the short term; however, water quality standards for these parameters would continue to be met in the Partridge and St. Louis Rivers. This is the case whether the subsurface contributions from the Area 6 Pit are included or not. Under

'worst-case' 7Q10 low flow conditions (which by definition would occur only approximately 0.2% of the time), the SD001 discharge when considered alone was projected to result in standards continuing to be exceeded in Second Creek for all four variance parameters and exceedances being extended to Partridge River for TDS and specific conductance. When contributions from the Area 6 Pit were included in the 7Q10 low flow evaluation, exceedance of standards for hardness, TDS and specific conductance could extend into the St. Louis River.

The water quality standards for the variance parameters applicable to these waters are the Class 3C (Industrial Use) standard for hardness and the Class 4A (Irrigation) standards for specific conductance, TDS and bicarbonate. It should be noted that there are no known historic, present or foreseeable actual use of these waters for the Class 3C or 4A use classifications. In addition, the proposed permit includes a provision that prohibits the discharge to Second Creek from April 1st to August 31st of each year, which is generally the same timeframe as any irrigation would potentially occur and for which the Class 4A standards would be most protective of an agricultural designated use. Or in other words, granting of a variance to Mesabi Nugget for the four listed parameters will not result in the removal of an existing actual use of these waters.

It is important to note that the Area 1 Pit would continue to discharge through SD001 whether the Mesabi Nugget plant is in operation or not, albeit without the wastewater treatment of pit waters that the nugget facility is currently providing. Pit 1 watershed hydrology is such that total water inflows exceed water losses to groundwater and evaporation resulting in a long-term overflow or discharge of the pit to Second Creek. Even if the Mesabi Nugget plant was not present or operating, discharges from the Area 1 Pit to Second Creek would continue at levels exceeding water quality standards and, if the permit associated with the requested variance is not approved and issued, the discharge would occur year-round rather than be seasonally controlled thereby potentially adversely affecting downstream wild rice resources.

When evaluating the impact to the environment from an innovative technology such as employed at Mesabi Nugget, it can be informative to compare the *total* release of pollutants of the new technology against the traditional in-place technology. As an example, Mesabi Nugget has provided a comparison of total air emissions resulting from the ITMk3 iron making technology that the nugget process employs and that from traditional blast furnace technologies [(17)]. Emissions of carbon monoxide, NOx, SO2, particulates, carbon monoxide and VOCs are all much less (approximately 50 – 90 percent less, depending on pollutant) from the ITMk3 technology than from blast furnaces. In addition, total emissions of carbon dioxide and mercury are also significantly less for the ITMk3 process. It should be noted these are not comparisons for the immediate local or Hoyt Lakes area but rather represent total emissions for the iron making process wherever the facilities are located (i.e., local to Hoyt Lakes for the ITMk3 process but including the steel and coke manufacturing centers in Gary and Pittsburgh, etc. for the traditional blast furnace processes). What this shows, however, is that overall the innovative technology being used by Mesabi Nugget results in fewer air emissions.

Item H.4 – statement of alternatives…..considered.
Since the Mesabi Nugget Rotary Hearth Furnace is the first and only of its kind commercial scale facility in the world, options for implementing alternatives are necessarily limited. Changing raw materials, particularly the coal and flux used in the process (which are the primary source of pollutants), will require careful testing and gradual introduction to maintain the requisite chemical and metallurgical conditions in the furnace. Mesabi Nugget intends to explore the use of alternative coals to understand its relationship to mercury and other air emissions. Use of alternative coals may result in lower pollutant loadings, but it is not yet clear the extent to which this will occur. Limestone must be used to flux the iron concentrate and create the proper chemistry and metallurgical conditions to produce molten iron. There are no substitute limestone sources which would significantly change the loading of dissolved solids. Alternative sources of iron ore concentrate, already being considered for economic reasons, will also likely not result in significant change in loading of variance parameters to the wastewater treatment system [(4)].

The variance schedule in the draft permit will require Mesabi Nugget to continue evaluating the potential to utilize alternative raw materials and fuels to determine which combination of operations will provide optimum reductions to both air and water media.

Item H.5 – statement of the effect on…..business, commerce, trade, traffic, and other economic factors…
The Mesabi Nugget Large Scale Demonstration Plant is the first and only plant of its kind in the world. The facility started production, on a limited basis, in January 2010 and has yet to achieve a full production level; it is currently operating at about 50% capacity (except as required during air compliance testing when the rate of production is increased). The first two years of operation have been difficult for a number of reasons. First, the scale up of the process from the pilot facility to the full-scale facility has been more difficult and time-consuming that anticipated. Second, the cost of operating the facility is substantially higher than expected. This has been driven by factors across the operation from raw material pricing to energy pricing, process yield and maintenance requirements. And third, there has been an unexpected disconnect between pig iron (final product) sales price and raw materials input costs. The price received for iron nuggets has not kept pace with the historically high prices for the iron concentrate and coal raw materials. Mesabi Nugget has provided a brief evaluation of how the projected cost for immediate installation of treatment (assuming that all the design uncertainties were resolved), could affect the cost of iron nugget production and how that could affect market competitiveness. The company concluded that with the current worldwide competition in iron supply, even a relatively small percentage increase in operating costs would present the company with a significant competitive disadvantage during all economic cycles and particularly so during downturns in iron nugget/pig iron pricing such as occurred in 2009 [(4, 18)].

Mesabi Nugget has indicated, as documented in financial evaluations submitted as a supplement to the original variance application, that it is currently losing tens of millions

of dollars annually. While short term losses are not entirely unexpected with a first commercial development of a new technology (the ITMk3 iron nugget technology), the current and future projected losses are considerably larger than expected and not sustainable, and will jeopardize the future of this facility, and the ITMk3 technology overall, if costs cannot be controlled in the near future. Mesabi Nugget has determined that the addition of an annualized cost of $4.3 million for the immediate installation of an additional reverse osmosis wastewater treatment system capable of meeting final effluent limitations for the variance parameters would add unsustainable losses for the foreseeable future such that the entire $300 million project would be jeopardized [(4)].

Closure of the existing facility would result in the permanent lay-off of 111 people from the facility itself plus up to an additional 200 contractors and suppliers according to studies on impacts of layoffs to other industries. In addition, closure of the Large Scale Demonstration Plant would likely result in the abandonment of the Mesabi Mining project (iron ore concentrate from the proposed mining project would no longer be needed for the LSDP) resulting in the future loss of an estimated 240 additional jobs [(4)].

The Mesabi Iron Range area has, in general, experienced a long-term loss of jobs and resulting economic decline (especially the case for the East Range as a result of the loss of 1500 jobs with closure of LTV Steel Mining Company mine in 2001). Currently, unemployment in the immediate East Range communities hovers around 10% compared to a statewide average of less than 6% and median household annual income is on the order of $40,000 compared to a statewide average of over $55,000. Given the relatively small population base of the immediate East Range communities, the loss of this many well-paying jobs would result in considerable hardship for area communities [(4)].

The total county and state taxes, royalties and leases paid by Mesabi Nugget was approximately $1.4 million in 2011 and is projected to be approximately $3.1 million in 2012. Closure of the facility would eliminate a significant portion (but not all) of these tax and related payments.

In 2010 and 2011, Mesabi nugget paid over $133 million in wages and benefits to its employees and payments to Minnesota vendors and contractors. Shutdown of the facility would result in the loss of this economic contribution to the local community [(4)].

Being the one and only of its kind large scale demonstration plant for an innovative emerging iron making process, closure of the Mesabi Nugget facility would likely result in the abandonment of the ITMk3 iron making technology as an alternative to the traditional taconite pellet process in Minnesota with the resulting loss of this future economic development on the Mesabi Range. While unable to be quantified, this potential loss of opportunity could be significant as the ITMk3 process is currently the only link of the Mesabi Range iron natural resources to the electric arc steel making sector, which currently comprises over 50% of the steel making capacity in the United States. Current Minnesota taconite facilities produce a product that only can be used in the declining blast furnace steel making process and that is incompatible with electric arc technology.

In summary, the Mesabi Nugget facility is currently significantly stressed financially and a requirement to immediately finance and install additional expensive advanced wastewater treatment would place operation of the facility in severe jeopardy. Closure of the facility would not only result in the likely abandonment of the ITMk3 technology but also result in significant and widespread social and economic hardship to Iron Range communities. EPA agrees that the variance is warranted based on substantial and widespread economic and social impacts that are anticipated to occur without this variance.

Variance application submittal, public notice of preliminary determination, and notice requirements - Minn. R. 7052.0280, subp. 4.
Mesabi Nugget has submitted the required application information in Minn. R. 7000.7000, subp. 2, so that the requirements of Minn. R. 7000.7000 directed at Agency review of the variance application and public notice of the variance can be fulfilled. The proposed variance was included into and was public noticed with the draft reissued permit on January 31, 2012.

Agency final decision; variance requirements – Minn. R. 7050 and Minn. R. 7000.7000
As a condition of granting a variance, the agency includes permit conditions that accompany the variance. Minn. R. part 7050 or 7000.7000 specify provisions necessary for a permit that contains a variance for hardness, bicarbonates, specific conductivity, total dissolved salts (solids). The permit will include:

> *Item A. Interim effluent limitation based on currently achievable treatment* – The interim permit limitations applicable at issuance for each pollutant are projected based on current levels for hardness, bicarbonates, conductivity and TDS provided in the variance application. The daily maximums are calculated from the ratio of daily maximum to monthly average limits (1.03-1.06) in establishing the final WQBELs. It is expected that the permittee will be investigating alternate technologies to improve treatment and/or stockpile mitigation to establish a downward trend towards meeting the water quality standards for TDS, specific conductivity, and bicarbonates. The interim permit limitations applicable at issuance for each pollutant are:

Pollutant / Permit Limitation	Hardness	Bicarbonates (as $CaCO_3$)	Specific Conductivity	Total Dissolved Salts (Solids)
Daily maximum	863 mg/L	378 mg/L	1965 µmhos/cm	1228 mg/L
Monthly average	831 mg/L	362 mg/L	1889 µmhos/cm	1160 mg/L

> *Item B. Special permit requirements* – Mesabi Nugget will be required to complete a number of evaluations and studies during the life of the permit with the purpose of reducing the loading of pollutants to the wastewater treatment

facility and to the Area 1 Pit resulting in, over time, a downward trend in variance pollutant concentration at outfall SD001 and ultimately compliance with the final effluent limitations as soon as possible and no later than August 1, 2021.

The variance schedule in the draft permit will include both short-term and longer term components. The short-term requirements include completion and implementation of a Short Term Water Quality Improvement Study which is intended to focus on improvements that could be made to existing processing and wastewater treatment facilities (WWTF) to accomplish reductions in TDS-related pollutants, including potentially sulfate, in the discharge from the WWTF so as to establish a downward trend in the levels of TDS and specific conductance in the SD001 discharge as soon as possible. These improvements may include actions that would result in pollutant reductions that may not necessarily be sufficient to result in compliance with final effluent limitations. The timeframe for implementation of the short-term improvements is expected to be within 18 to 24 months of permit reissuance.

The longer term requirements include completion of a series of studies including a Water Balance Study which will identify and quantify water flows into and out of the Area 1 Pit, a Chemical Balance Study which will identify the source and fate of pollutant loadings into the Area 1 Pit including those from operation of the plant as well as those from watershed sources such as from leaching of adjacent stockpiles, and a Pollutant Reduction Study which will include an evaluation of source control strategies, treatment technologies and process optimizations to determine technical feasibility as well as a detailed evaluation of the economic impact on the company (economic feasibility) and will propose a detailed plan of action with schedule that will result in compliance with effluent limitations as soon as possible. The Pollutant Reduction Study is expected to include bench scale and/or pilot scale testing of treatment technologies as well as a detailed evaluation of the economic impact on the company of implementing the proposed plan of action in the event that Mesabi Nugget believes that implementation of the plan of action would result in unacceptable financial hardship on the company. The timeframe for submittal of the Pollutant Reduction Study and commencing the implementation of the approved plan of action is expected to be three to three and a half years from the date of permit issuance with subsequent compliance with final effluent limitations as soon as possible thereafter but no later than August 1, 2021.

Chronic toxicity testing is required by the existing permit and will be carried forward into the proposed reissued permit. Chronic toxicity testing is included to assess the impacts that the discharge may have on the aquatic life (Class 2B) designated use of the receiving water.

The proposed reissued permit will include requirements that will eliminate the discharge during the period April 1st through August 31st (to avoid potential impacts to downstream wild rice from sulfate in the discharge during the periods

when the wild rice is susceptible to damage from high sulfate levels) and potentially during the month of September pending demonstration through whole effluent toxicity (WET) testing that chronic toxicity does not exist in the discharge during this time period (which is the period when intermittent chronic toxicity in the discharge has been observed in the past).

Item C. Water Quality Based Effluent Limitations (WQBELs) to meet the underlying Water Quality Standard – The final WQBELs for the discharge were derived using the water quality standards set as the waste load allocation, and using procedures in Part 7052.0200, Subp. 5, based on a computed Coefficient of Variation (CV) and a twice per month monitoring frequency. Over the past 5 years the Area 1 pit has been sampled approximately 60 times and the SD001 discharge over 100 times. These monitoring results were used to determine the CV, Standard Deviation and Variance of the data. The final Water Quality Based Effluent Limitations are shown in the table below.

Pollutant / Permit Limitation	**Hardness**	**Bicarbonates (as $CaCO_3$)**	**Specific Conductivity**	**Total Dissolved Salts (Solids)**
Daily maximum	532 mg/L	267 mg/L	1066 µmhos/cm	768 mg/L
Monthly average	512 mg/L	257 mg/L	1025 µmhos/cm	726 mg/L

Item D. Permit re-opener – Specific permit language allowing for permit modification if revisions to water quality standards during the triennial review indicate applicability to this variance exists in the existing permit and will be carried forward into the proposed reissued permit.

Item E. Instream Monitoring – Monitoring of two instream monitoring stations, one immediately upstream of the discharge and one downstream after complete mixing of the receiving water and effluent, is a requirement of the existing permit and will be carried forward into the proposed reissued permit. The purposes of the monitoring are to determine the degree to which either station does not comply with water quality standards for the variance parameters, to determine any seasonality of noncompliance and to help determine the source of any noncompliance with standards.

Mesabi Nugget has provided information and documentation for each part of Minn. R. 7000.7000 that has allowed the Agency to process the application and proceed to make a preliminary determination regarding the variance and any permit conditions that should apply.

C. Conclusion

Mesabi Nugget withdraws water from the Area 1 Pit to utilize as cooling water and for use in its air pollution control scrubber system. The wastewater generated from contact cooling and the scrubber system is treated by lime precipitation and filtration prior to return back to the Area 1 Pit for additional residual treatment. Under normal operations, excess water from the Area 1 Pit is then discharged to Second Creek through outfall SD001 at a rate of up to 5.8 MGD. Because of Area 1 Pit hydrology, the SD001 discharge has historically, and will continue in the future, to discharge whether the Mesabi Nugget facility is in operation or not.

The discharge from the Area 1 Pit has not met final effluent limitations for hardness, TDS, bicarbonate and specific conductance since before the facility was originally permitted in 2005 prior to facility construction. This indicates that the primary source of the current levels of these pollutants is from the Area 1 Pit watershed, primarily the weathering and leaching of historic mining wasterock stockpiles adjacent to the pit. In addition to the watershed sources, the manufacturing process itself contributes additional loading of pollutants to the Area 1 Pit and discharge.

The original permit included a variance for these parameters which expired in 2010. Because the previous variance is expired and because the discharge continues to exceed applicable effluent limitations, Mesabi Nugget has submitted an application for what in essence is a continuation of the previous variance on the basis that immediate installation of wastewater treatment capable of achieving final effluent limitations, such as reverse osmosis, is currently not technically feasible without first providing for a period of evaluation and bench and/or pilot testing to complete the selection and engineering design of treatment components. And even if it could be installed immediately, the company asserts that installation of such treatment at this time would be exceptionally expensive and therefore economically infeasible to their one-of-a kind demonstration project, to the point that continuation of the project would be jeopardized and closure of the facility would be contemplated. Such premature closure of the Nugget plant would result in significant and widespread social and economic hardship to East Range communities.

MPCA staff has concluded that it is not technically feasible or reasonable at this time to require Mesabi Nugget to immediately install additional treatment consisting of reverse osmosis with evaporation/crystallization for the removal of hardness, bicarbonates, specific conductivity, and TDS to meet applicable final effluent limitations based on the underlying Class 3C and Class 4A water quality standards, given the current uncertainties on projected influent quality and treatment system engineering design. MPCA staff have further concluded that this treatment technology, as well as other mitigative opportunities, merit further consideration and investigation and have proposed a variance schedule for inclusion into the associated draft permit specifying a sequence of necessary studies and a process for implementing study results such that compliance with final effluent limitations can be achieved as soon as possible, but no later than August 1, 2021.

MPCA staff is seeking MPCA Board and EPA approval of the requested variance.

D. Recommendations

Agency staff recommends that the Agency Board grant the variance. This recommendation is conditioned upon requirements that the permit include interim and final water quality-based effluent limitations for hardness, bicarbonates, specific conductivity, and total dissolved salts (solids). The permit must also include conditions that require Mesabi Nugget to control or eliminate the discharge during certain times of the year, to conduct periodic chronic toxicity testing of the discharge, and to complete a series of short term and longer term studies resulting in the submittal of detailed plans of action and schedules to reduce the concentration of pollutants in the effluent and to bring the discharge into compliance with final effluent limitations as soon as possible but no later than August 1, 2021.

REFERENCES

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2. Barr Report for Steel Dynamics Inc and Mesabi Nugget Delaware LLC, "*Variance Application, NPDES/SDS Permit Renewal, Permit No. MN0067687, Mesabi Nugget LSDP Facility"*, (Updated Variance Application), June 2010

3. Draft MPCA Staff Recommendation, "*Seasonal Application of the Wild Rice Sulfate Standard – Partridge River*", August 27, 2012

4. Barr Report for Mesabi Nugget Delaware LLC, "*Additional Information Submittal Mesabi Nugget NPDES Permit MN0067687"*, March 2012

5. Mesabi Nugget Delaware LLC and Steel Dynamics Inc, "*Discharge Monitoring Reports*" (NPDES/SDS Permit No. MN0067687 - Monitoring data submitted to MPCA)

6. Cliffs Erie LLC, "Discharge Monitoring Reports" (NPDES/SDS Permit No. MN0042536 – Monitoring data submitted to MPCA)

7. Statement of Basis, Draft NPDES/SDS Permit No. MN0067687, Mesabi Nugget Delaware LLC, September 2012

8. Barr Report for Mesabi Mining LLC, "*Area 1 Pit Water Treatment Evaluation in Support of the Nondegradation Analysis, Mesabi Nugget Phase II Project"*, June 2011

9. Barr Tech Memo, Mike Hansel to Richard Clark, "*Mesabi Nugget – connection between AQ and NPDES permit*", May 31, 2011

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11. Barr Tech Memo, Mike Hansel and Keith Hanson to Richard Clark and Kate Franz, "*Discussion of Alternative Disposal Options for the Area 1 Pit Treatment Scenarios*", July 8, 2011

12. Barr Report for Mesabi Mining LLC, "*Toxicity Identification Evaluation Study for the Mesabi Nugget Pits, Mesabi Nugget Phase II Project"*, June 2011

13. Mesabi Nugget Email (with attachment), Jasmine Scheuring to Richard Clark, "*Mesabi Nugget - Summary of Area 1 Pit WET Testing*", April 13, 2012

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16. Barr Tech Memo, Mike Hansel to Richard Clark, "*Mesabi Nugget Phase I NPDES Permit – downstream impacts under average flow conditions*", June 13, 2011

17. Barr Tech Memo, Mike Hansel to Richard Clark, "*Benefits of Iron Nugget production vs. traditional iron making*", May 31, 2011

18. Barr Tech Memo, Mike Hansel to Richard Clark, "*Economic Consequences of meeting 10 mg/L Sulfate Standard*", May 31, 2011