Attachments to Dunka Letter

A. MEQB Letter of Paul Eger to Abner Fisch, MPCA (Dec. 14, 1976)

B. USEPA, email response to Bruce Johnson re FOIA Request, #05-FOI-01595-10 (Oct. 25, 2010).

C. MPCA Memo, Jerry Flom to Curt Sparks, "Mine Dump Seeps," Sept. 1, 1988.

D. MPCA Memo, Mark Schmitt to Carri Lohse, "Birch Lake Fish Tissue Data," July 26, 1985.

E. MPCA Memo, Virginia Reiner to Ken Haberman, "Bob Bay Monitoring," Jan. 5, 1984.

F. MPCA Memo, Carri Lohse to Mark Tomasek, "Standards Information Request from Erie Mining Company," Feb. 28, 1985.

G. Schematic of Dunka Mine waste locations, taken from MDNR Case Study.

H. MPCA Memo, Carol Sinden to Richard Clark, "7Q10 Determinations for Unnamed Creek to Bob Bay," Feb. 1, 1991.

I. MDNR Dunka Case Study, Table 5-1.

J. Public Notice of Intent to Reissue NPDES/SDS Permit 0042579, Public Comment Period June 16, 2000 – July 17, 2000.

K. MDNR, *Long Term Wetland Treatment of Mine Drainage at LTV Steel Mining Company's Dunka Mine*, December 2000, p. vi, Executive Summary attached to MDNR letter from Paul Eger to Pat Cary, MPCA (Jan. 10, 2001)

12/22/76 REF - LOOKS K.KM
Like we may
have to give
them a T.E.
Please advise
Pat

Received and Logged
in by JGM of CEQ

STATE OF MINNESOTA

ENVIRONMENTAL QUALITY COUNCIL
Copper-Nickel Project
138 Hennepin Square Building
2021 East Hennepin Avenue
Minneapolis, Minn. 55413

Phone: 612-378-7770

December 14, 1976

Ltr w/ Board Circuit DEC 16 1976

Abner Fisch
Pollution Control Agency
1935 West County Road B2
Roseville, Minnesota 55113

Dear Abner:

As you know, the Regional Copper-Nickel Study has been conducting a series of studies at the Erie Mining Company taconite mine four miles east of Babbitt. In this area, the geological formation known as the Duluth Gabbro Complex overlies part of the eastern edge of the Biwabik iron formation. To mine the taconite in the eastern portion of their pit (Dunka Pit) Erie has had to remove and stockpile the overlying gabbro. The Duluth Gabbro formation contains copper and nickel sulfide minerals of potential economic value. The material stockpiled by Erie is presently not considered to be of ore grade—it does represent material that would be classified as lean ore and waste rock. These stockpiles are representative of the type that more than likely would be produced by full-scale open pit copper-nickel mining. Leaching of heavy metals is presently occurring from these stockpiles and the leachate flows into Unnamed Creek and then to Birch Lake.

In November 1974, the Environmental Quality Council requested the preparation of a regional environmental study on possible impacts from potential copper-nickel mining in northeastern Minnesota. This regional study is presently underway. In general, the study has two goals: 1) to characterize the present environment and socio-economic state of the region; and 2) to predict possible impacts resulting from potential copper-nickel development. Neither of these tasks is easy but the prediction of impacts is particularly difficult. Often the only type of information available is that obtained from literature and this information may not describe the actual situation in Minnesota. In an effort to develop better predictive models, field studies have been initiated in the Unnamed Creek watershed and Birch Lake. The data collected from these areas will provide a basis to compare literature values and predict impacts. Several studies were initiated this summer and some are planned for continuation this winter. Information is being collected on the aquatic biology, water chemistry, the leaching process, the transport of heavy metals, the toxic effect of the leachate and heavy metal accumulation in plants, fish and sediments.

Erie Mining Company has been cooperating with the Regional Study. Some of this cooperation has necessitated the delaying of some of their proposed mitigation techniques. In particular, one of the proposed control measures is to pump-down and intercept ground water before it reaches the stockpiles. One of our studies underway is centered around the stockpile area and it is important that data continue to be collected without imposing additional changes (pumping) in the system. Erie has temporarily ceased pumping from this area and is willing to delay further testing of this procedure. If testing is discontinued, Erie will be delayed in devising a final plan for control of the stockpile run-off. Under Erie's present permit, the run-off from the Gabbro is to be controlled by June 1977. I feel that it is important to collect data from this area during the spring run-off period. This would mean that pumping should not be resumed until the end of June 1977. This would require that Erie be granted an additional time period to comply with the permit conditions. I would suggest that time be extended to Erie in order that we may collect valuable spring run-off data. This does not mean that other mitigation techniques required under their permit should not be pursued. Recent information that we are developing implies that their present proposal will only be partially successful in stopping the seepage from the stockpile area. It is our plan to have the situation better defined within the next few months.

The data collected from this study will be useful not only in the prediction of impacts resulting from copper-nickel mining but also in the reversibility of those impacts. It is our plan to continue to collect data in this area during and after mitigation procedures have been implemented. This will give us a measure of the degree to which adverse impacts can be controlled and/or reversed. If you have any questions or need more information, please contact me.

Sincerely,

Paul Eger

PE:st

cc: Phil Brick
Steve Chapman
Robert Criswell, PCA
Perry Beaton, PCA
Richard Svanda, PCA
Tim Scherkenback, PCA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
WN-16J

OCT 25 2010

Mr. Bruce Johnson
6763 253rd Avenue, NE
Stacy, Minnesota 55079

Re: Freedom of Information (FOI)
(Identification No. 05-FOI-01595-10)

Dear Mr. Johnson:

This is the Water Division's response to your FOI request dated September 29, 2010. You requested from the U.S. Environmental Protection Agency (EPA) a copy of the completed NPDES Permit Rating Worksheet for NPDES Permit MN0042579.

We do not have an NPDES Permit Rating Worksheet for the facility Cliffs Erie LLC-Dunka MN0042579. This facility is a minor facility and EPA does not maintain those records. The facility has been a minor since the original issuance of their permit, which was May 27, 1975.

For information on this facility, you may want to contact the State of Minnesota at:

Agency File Manager
520 Lafayette Road North
St. Paul, Minnesota 55155-4194
Telephone: 651-296-6300/800-657-3864

You may appeal this response to the National Freedom of Information Officer, U.S. EPA, FOIA and Privacy Branch, 1200 Pennsylvania Avenue, N.W. (2822T), Washington, DC 20460 (U.S. Postal Service Only), FAX: (202) 566-2147, E-mail: hq.foia@epa.gov. Only items mailed through the United States Postal Service may be delivered to 1200 Pennsylvania Avenue, NW. If you are submitting your appeal via hand delivery, courier service or overnight delivery, you must address your correspondence to 1301 Constitution Avenue, N.W., Room 6416J, Washington, DC 20004. Your appeal must be made in writing, and it must be submitted no later

than 30 calendar days from the date of this letter. The Agency will not consider appeals received after the 30 calendar day limit. The appeal letter should include the 05-FOI-01595-10 as listed above. For quickest possible handling, the appeal letter and its envelope should be marked "Freedom of Information Act Appeal."

If you have any questions regarding this response, please contact Ms. Jackson of my staff at 312-886-3717.

Sincerely,

Kevin Pierard, Chief
NPDES Program Branch

STATE OF MINNESOTA
Office Memorandum

DEPARTMENT : **Pollution Control Agency**

PHONE : 296-9207

DATE : September 1, 1988

TO : Curt Sparks, Marvin Hora
Doug Hall, Bruce Johnson

Division of Water Quality

FROM : Jerry Flom
Pollution Control Specialist
Program Development Section
Division of Water Quality

SUBJECT : **Mine dump seeps**

Attached is a brief summation of the toxicity tests Harold and I conducted on mine dump seeps from AMAX and LTV. When metals data are received from MDH we will write a more complete report.

SUMMARY

Forty-eight hour acute static tests using fathead minnows, Ceriodaphnia, and Daphnia magna were conducted on seven mine dump seeps. Five of the seeps were from LTV mine dumps and two seeps were from AMAX mine dumps. Samples were collected August 25, 1988 by Harold Wiegner and the tests were conducted by Harold Wiegner and Jerry Flom at the Minnesota Pollution Control Agency Biomonitoring Laboratory in St. Paul. Water collected from the Dunka River was used as a diluent and as the control water.

DISCUSSION

Ceriodaphnia were the most sensitive organisms tested. All the seeps except LTV W2D showed 100% mortality at the lowest concentration tested, either 3 or 6 percent. The ranking of the seeps from most toxic to least toxic relies on the toxicity shown to all the test species. This may or may not accurately reflect the metals data when they are recieved. There may be discrepencies because the Ceriodaphnia were not tested at low enough concentrations to calculate LC50 values.

RESULTS

The results of the toxicity tests are presented below. An LC50 value shows the concentration of seep water that kills 50 percent of the exposed organisms. Less than values show the lowest concentration tested at which there was 100% mortality. Greater than values indicate no significant acute toxicity. There were no mortalities to any of the control organisms in any of the tests.

MINE DUMP SEEPAGE TOXICITY TEST RESULTS

AMAX B1-IB	LC50
Fathead	>100%
Ceriodaphnia	< 6%
Daphnia magna	70%

AMAX B2-IB	LC50
Fathead	50%
Ceriodaphnia	< 3%
Daphnia magna	5%

LTV EM-8	LC50
Fathead	>100%
Ceriodaphnia	< 6%
Daphnia magna	>100%

LTV S-1	LC50
Fathead	70%
Ceriodaphnia	< 3%
Daphnia magna	16%

LTV S-3	LC50
Fathead	>100%
Ceriodaphnia	< 3%
Daphnia magna	8%

LTV W1D	LC50
Fathead	>100%
Ceriodaphnia	< 6%
Daphnia magna	50%

LTV W2D	LC50
Fathead	>100%
Ceriodaphnia	14%
Daphnia magna	>100%

Most-to-Least toxic ranking

1 AMAX B2-IB
2 LTV S-1
3 LTV S-3
4 LTV W1D
5 AMAX B1-IB
6 LTV EM-8
7 LTV W2D

DEPARTMENT : **Pollution Control Agency**

STATE OF MINNESOTA

Office Memorandum

PHONE : 296-7756

DATE : July 26, 1985

TO : Carri Lohse

FROM : Mark D.C. Schmitt
Pollution Control Specialist
Division of Water Quality

SUBJECT : **Birch Lake Fish Tissue Data**

I have completed my analysis of the Birch Lake fish tissue data. The results are attached. I have included only those analyses which are of interest in the context of the ongoing problems at the Erie Mining Company's Dunka Mine. Many additional analyses were performed. If you are interested in these, I have the master copy of all analyses performed in my desk.

The following are my conclusions:

1) Nickel concentrations in the livers of fish taken from Bob Bay are significantly higher than those in the livers of fish taken from any of the other locations in Birch Lake.

2) Zinc concentrations in the flesh of fish taken from Bob Bay are significantly higher than those in the flesh of fish taken from any of the other locations in Birch Lake.

3) Copper and nickel concentrations in the flesh of fish taken from Bob Bay are significantly higher than those in the flesh of fish taken from all locations in Birch Lake.

4) Nickel concentrations in the livers of northern pike taken from Bob Bay are significantly higher than those in the livers of northern pike taken from any other location in Birch Lake.

5) Nickel and copper concentrations in the flesh of northern pike taken from Bob Bay are significantly higher than those in the flesh of northern pike taken from any other location in Birch Lake.

6) Although the numeric differences in this data set are apparent, an individual with greater experience interpreting fish tissue information needs to evaluate these results to determine the biological significance of these statistically significant results.

There is a considerable volume of information attached to this memo. However, the key results from which I have drawn the above conclusions can be found in three places for each of the individual analyses. On the first page of each analysis, there are two values associated with PR > F headings. The first value, which is associated with the model statement, indicates the probability that the metal concentrations in the organisms

DEPARTMENT : **Pollution Control Agency**

STATE OF MINNESOTA

Office Memorandum

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Division of Water Quality

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VLR

STATE OF MINNESOTA

DEPARTMENT POLLUTION CONTROL AGENCY

Office Memorandum

TO: Ken Haberman
Permits Section
Division of Water Quality

DATE: January 5, 1984

FROM: Virginia Reiner VLR
Monitoring and Analysis Section
Division of Water Quality

PHONE: 6-7363

SUBJECT: BOB BAY MONITORING

I have reviewed the data submitted by Erie Mining Company on their Bob Bay Monitoring Program conducted in 1983 and have the following observations:

1. Copper and cobalt values do not indicate a problem in this sampling.

2. Zinc values occassionally slightly exceed chronic toxicity limits at stations near the junction with Unnamed Creek.

3. Nickel appears to be very mobile, with elevated concentratons being measured throughout the Bay Stations. Concentrations approximately twice the chronic toxicity level were measured as far as station BB-7.

4. Elevated concentrations are limited to samples drawn from near the bottom of the water column. The Unnamed Creek discharge appears to move as a discrete "slug" of water, high in conductivity, metals and sulfate, through the Bay. It is thought probably to be following the old stream channel, with no evidence of mixing with the water near the surface.

Unacceptable loadings of nickel are being contributed to Bob Bay by Unnamed Creek. Although the Agency has the option of requiring Erie Mining to conduct further biological monitoring on the Bay under clause C.11.b. of their current permit, I believe such a study would likely agree with the conclusions of the 1976 study prepared by the EQB ("Regional Copper-Nickel Study, Erie Mining Project, Biological Sampling," Mark Johnson and Steve Williams, October, 1978). This study concluded the following:

"In Bob Bay of Birch Lake, no effect on phytoplankton production was evident. However, benthic invertebrate density in Bob Bay was significantly less than in Dunka Bay. This was the result of a single genus, Tanytarsus, a genus sensitive to heavy metals which was abundant in Dunka Bay but not Bob Bay. Clams (Anodonta) from Bob Bay have accumulated significant amounts of copper in their tissue while water lilies (Nuphar variegatum) from Bob Bay have accumulated significant amounts of copper and nickel. Whether the source of these metals is the sediments or the water is unclear at this time." (p.37)

This newest study reaffirms that leaching from the metal rich gabbro continues to be a problem in Bob Bay. In 1976-77 exceedances of the copper criterion in the lower part of the Bay were noted. This study documents exceedences of the zinc criterion in the lower Bay and of the nickel criterion at the sampling stations along the entire length of the Bay. Clearly the problem is persisting and the Agency should emphasize the need for Erie to begin implementation of mitigation techniques.

VLR:jae

Third, other parameters are concentrated in the density current. 1983 median sulfate values in Bob Bay were 480 mg/l in July and 510 mg/l in September. Copper-nickel study area streams had a median sulfate level of 6.6 mg/l. Zinc exceeded the chronic toxicity criterion in some density current samples taken in September. The highest recorded values were 60 ug/l, the criterion is 47 ug/l and the median of copper-nickel area streams was 2 ug/l. Copper also occasionally exceeded its site specific chronic toxicity criterion of 5.4 ug/l.

Fourth, according to the 1983 Bob Bay Study, water quality in the bay has worsened since the 1976-77 study. This may be due to the increased concentration of the stockpile runoff and by the elimination of the Dunka Mine dewatering discharge and the stockpiling of more lean ore in the Bob Bay watershed.

Fifth, the need for effective mitigation techniques is obvious. Both Unnamed Creek and Bob Bay are classified as 2B waters. The concentration of metals and associated stockpile runoff parameters in Unnamed Creek and the density current in Bob Bay should be decreased to be within chronic toxicity criteria and 2B water quality standards. Bob Bay monitoring should continue and Erie should be required to begin effective mitigation as soon as possible.

Conclusions

1. Stockpile runoff to Unnamed Creek forms a density current at the bottom of Bob Bay. This density current runs the entire length of the bay and is characterized by high conductivity and metals.

2. The water quality standard for nickel is being consistently violated in Unnamed Creek and at the bottom of Bob Bay. Zinc and copper occasionally exceed standards.

3. Water quality in Unnamed Creek and Bob Bay has deteriorated since the 1976-77 study.

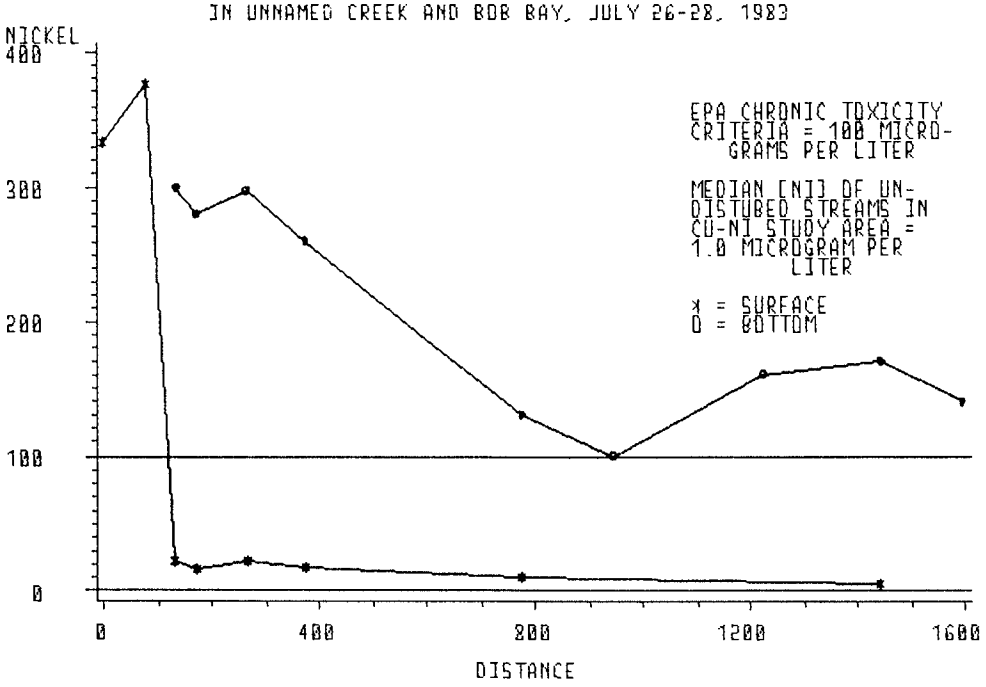
4. Mitigative measures should be initiated to protect the water quality of Unnamed Creek and Bob Bay.

JFM/CL:jae

Attachment

cc: Ken Haberman
Mark Schmitt
Mark Tomasek

FIG. 1 NICKEL CONCENTRATION IN SURFACE AND BOTTOM WATER
IN UNNAMED CREEK AND BOB BAY, JULY 26-28, 1983



µg/l

NICKEL CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER LITER.
DISTANCE IS REPORTED IN METERS FROM EM-1.

STATE OF MINNESOTA

DEPARTMENT POLLUTION CONTROL AGENCY

Office Memorandum

TO: Curtis J. Sparks, P.E.
Chief, Permits Section
Division of Water Quality

DATE: December 6, 1984

THRU: John F. McGuire, P.E., Chief
Monitoring and Analysis Section

FROM: Carri Lohse CLL
Monitoring and Analysis Section
Division of Water Quality

PHONE: 296-7249

SUBJECT: REVIEW OF BOB BAY STUDY, 1983

The Monitoring and Analysis Section has reviewed the Bob Bay Study, 1983, prepared by the Minerals Division of the Minnesota Department of Natural Resources. The section has previously reviewed the 1983 data (see memo from Virginia Reiner to Ken Haberman attached). Those conclusions and recommendations still stand. Based on the review of the Bob Bay Study, some points need to be emphasized.

First, the runoff from Unnamed Creek flows through Bob Bay in one to three days in a density current along the bottom of the bay. This density current is not greatly diluted as it passes through the bay. For example, a comparison of specific conductivity at different depths in Bob Bay reveals that the highest conductivity is found at the bottom of the water column. The highest recorded specific conductivity in 1983 was 1200 uhmos/cm at 25°C in September at the head end of Bob Bay (BB-0). On the same day, the highest recorded specific conductivity near the mouth of Bob Bay (BB-6.3) was 1000. This relatively small difference indicates that the density current mixes only slightly in the bay.

To put those high values in perspective, consider that the Minnesota Pollution Control Agency's specific conductivity water quality standard for agricultural and wildlife uses is 1000 uhmos/cm. The median conductivity for relatively undisturbed streams in the copper-nickel study area is 55.

Second, dissolved nickel concentrations exceed the U.S. Environmental Protection Agency's chronic toxicity criterion (Figure 1). In surface water in the bay, the nickel concentration (6-23 ug/l) is relatively close to that of copper-nickel area streams (median = 1 ug/l). The criterion is 100 ug/l for the protection of human consumers of fish or lower (depending on hardness) for the protection of aquatic life. Because hardness values are high in the density current, the criterion is fixed at 100 ug/l. However, if the hardness of the natural waters of Birch Lake is taken into account ($\bar{x}$ hardness = 41 mg/l at LBH-2) the criterion is lowered to 49 ug/l. Nickel concentration is quite high in the density current (100-375 ug/l). There is a tendency for the nickel concentration to decrease from Unnamed Creek to the mouth of Bob Bay. However, nickel levels in the density current near the mouth of Bob Bay still exceed the criterion.

To: Mark Tomasek 2/28/85
Enforcement Section
Water Quality Division

From: Carri Lohse Reviewed by Dave Maschwitz also.
Monitoring & Analysis Section
Water Quality Division

Subject: Standards Information Request from Erie Mining Company

Standards

As class 2B, 3B, 4A, 4B, 5 and 6 waters Unnamed Creek and Bob Bay have standards for the following parameters under Minnesota Rule Part 7050.0220: copper, pH, conductivity and hardness. Standards for cobalt, nickel and zinc can be developed according to Minnesota Rule Part 7050.0210 Subpart 14.

The nickel water quality standard ~~for water quality limited waters~~ is ~~can be justified using~~ based on the EPA aquatic life criteria. The criteria for ~~most~~ many trace metals are based on ~~hardness related~~ a hardness-toxicity relationship expressed by a log formula developed by EPA. The MPCA has further refined the formulas by eliminating nonresident species and salmonid species (the standard is for a warm water) (for example, chinook salmon) from the data base used to calculate the criteria this results in formulas with higher intercepts that yield less strict criteria. Minnesota's chronic toxicity criteria for nickel is $e^{(0.76[\ln \text{hardness}] + 1.06)}$ as a 24-hr average. This is the formula used in Virginia Reiner's 830321 memo and my 850116 memo.

The zinc criterion is based on chronic toxicity tests in EPA's zinc criteria manual. Unlike nickel, the chronic toxicity of zinc is not affected

by hardness. The national criterion of 47 µg/l as a 24-hr average protects our freshwater resident species.

Dave Maschwitz developed the cobalt criteria from a summary of cobalt bioassay data compiled by David Lind. When my 850116 memo was written the cobalt values were tentative. Since then Dave Maschwitz has confirmed the values and used them for pretreatment standards as well.

I have two additional comments on the standards. First, final revised EPA criteria are expected within a few months. MPCA will check all the state-wide and site-specific standards developed from EPA criteria for possible changes. This will include the standards for Unnamed Creek and Zoo Bay.

Second, the acute criteria on my 850116 memo are for effluent standards. Those values would be used to develop standards for a discharge from a treatment system in an effluent limited water. The chronic values represent standards for waters of the state and would take dilution and background concentration into account. Because Unnamed Creek should be considered water quality limited the standards derived from chronic criteria would be controlling.

Hardness

The hardness-related log formulas are not designed for very hard water such as the stockpile runoff. 300 mg/l hardness is a general cutoff for using the formulas. Note that the hardness standard for Unnamed Creek and Zoo Bay is 250 µg/l (Minn Rule 7050.0220). I used Birch Lake hardness downstream from the mouth of Zoo Bay for the criteria in my 850116 memo. Further evaluation of a representative

Load Hardness appropriate

Hardness is needed

In new case the high hardness in the receiving runoff is not ~~a~~ factor for the criteria formula. It is the effect of the metals on the softer natural water ~~quality~~ that is of interest

Total vs Active Metals

When the new EPA criteria come out the metals criteria derived by the formulas will be expressed as active metal, rather than as total. Previously, we have used the protective total metal to derive criteria because it is not known how much of the metal in the water is available to organisms. Active metal is measured in samples that have been acidified and then filtered.

It will be to Erie's advantage to measure active metal. However, before they switch completely to active they should run total on the same samples. We want to know what the relationship is between total and active, particularly at the seeps. If there is a consistent significant relationship then we can relate historic total data to new active data.

Note: the copper-nickel study revealed very little difference between dissolved and total metals in copper-nickel area waters.

DUNKA MINE, MINNESOTA

1. SITE INFORMATION

1.1 Contacts

Paul Eger
Minnesota Department of Natural Resources
Telephone: 651-259-5384
E-mail: a.paul.eger@state.mn.us

1.2 Name, Location, and Description

The Dunka Mine is a large, open-pit taconite mine located in northern Minnesota at the eastern end of the Biwabik Iron Formation. The mine covers approximately 160 hectares and has a depth of around 100 m. It sits along the western edge of a small watershed (920 hectares), which is drained by a small stream (Unnamed Creek, Figure 1-1). The watershed is typical for this area of Minnesota and is characterized by a series of upland ridges and low areas containing wetlands. Sulfide-containing waste material from the mine was stockpiled along the eastern edge of the mine and adjacent to these wetlands.

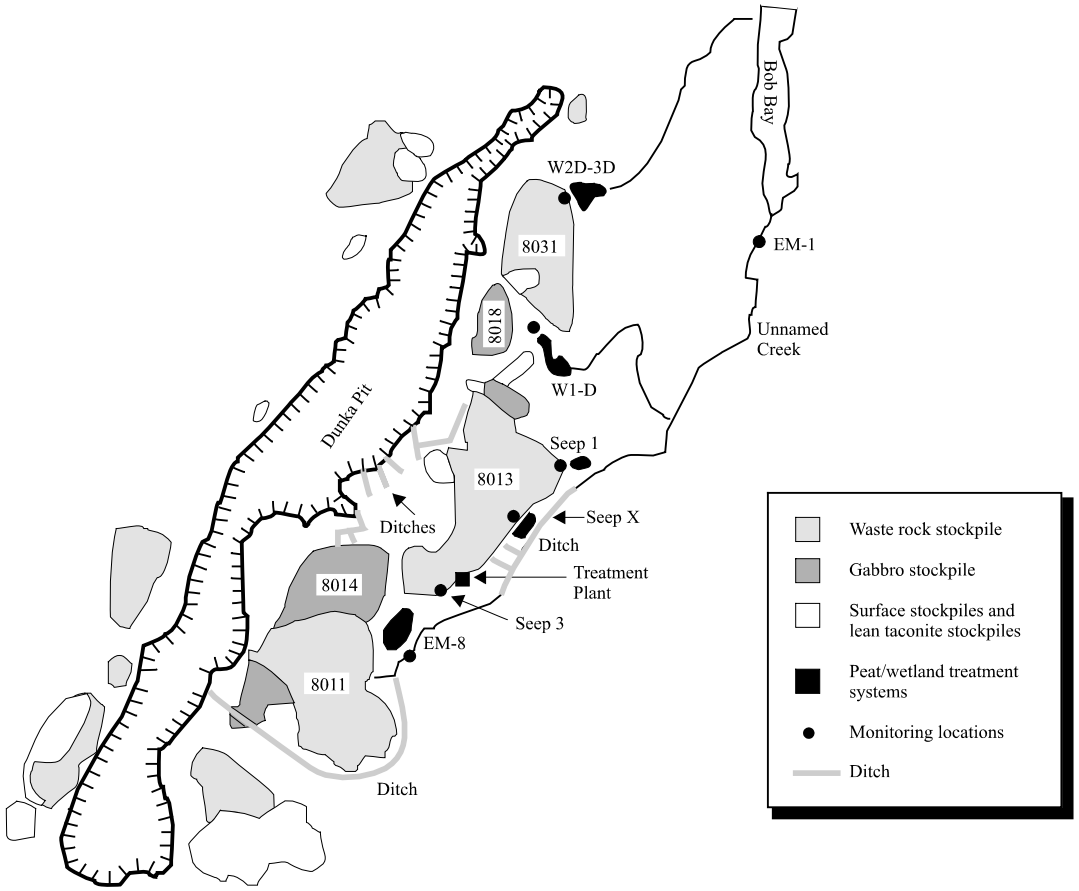


Figure 1-1. Dunka Mine waste location schematic.

SF-00006-04

STATE OF MINNESOTA
Office Memorandum

DEPARTMENT : **Minnesota Pollution Control Agency**

PHONE : 296-8870

DATE : Febraury 1, 1991

TO : Richard Clark
Industrial Section
Water Quality Division

FROM : Carol L. Sinden CLS
Assessment and Planning Section
Water Quality Division

SUBJECT : **7Q10 DETERMINATION FOR UNNAMED CREEK TO BOB BAY**

A low flow determination was made for the unnamed creek to Bob Bay, Birch Lake as outlined below. Attached to this memo is a definition of 7Q10 low flow, a summary of the methods used to calculate a 7Q10, and literature references to these methods.

A 7Q10 identified for the purpose of setting effluent limitations is determined to represent low flow characteristics in the receiving water above the point of discharge. Flow data from station EM-1 could not be used in the analysis because EM-1, as described in Minnesota Department of Natural Resources (MDNR) reports, receives flow from mine dewatering and several seeps, in addition to natural runoff.

Information contained in Agency files indicates that stockpile construction began for the Dunka pit around 1965-1967. The overall impact of stockpile seepage on the watershed has been monitored since 1976 at station EM-1. Flow data for the unnamed creek before mining activities began in the watershed is not available.

USGS records were reviewed and continuous record gaging stations were located on the Dunka River near Babbitt and the Stony River near Isabella. The Dunka River station is located in the northeast quarter of section 9, Township 60, Range 12 West, approximately three miles southwest of Bob Bay. This station has a period of record from 1952 to 1980. The Stony River station is located in the northwest quarter of section 17, Township 60, Range 10 West, approximately eight miles southeast of Bob Bay. The period of record for this station is from 1953 to 1964.

A computer analysis of flows for each station was completed and an annual 7Q10 low flow was calculated for each station following USGS procedures. The 7Q10 low flow for the Dunka River station is 0.081 cfs, for the Stony River station, 7.7 cfs. The Dunka River station was chosen as more representative of flow characteristics for translation to the unnamed creek watershed. Flow was proportioned by drainage area for the Dunka station and this flow per square mile was multiplied by the drainage area of the unnamed creek to obtain the 7Q10 low flow estimate of 0.0 cfs (0.005 cfs). The drainage area of the unnamed creek watershed was determined by USGS at 3.57 square miles.

This flow calculation follows established USGS procedures and is in accordance with Minnesota Rules Chapter 7050.0210 Subp. 7. which states "Where stream flow records are not available, the flow may be estimated on the basis of available information on the watershed characteristics, precipitation, run-off, and other relevant data."

7Q10 Low Flow Definition and Methods of Calculation

7Q10 low flow is defined as the lowest average discharge for seven nsecutive days, having a recurrence interval of ten years. The year that a w flow will occur can't be predicted, but the probability of such flows curing during a long time period may be estimated. For example, a low flow scharge of 3.5 cubic feet per second (cfs) having a recurrence interval of n years indicates that a discharge at least as low as 3.5 cfs will occur as annual minimum about ten times in one hundred years.

derive a 7Q10 low flow, the lowest average flow in a seven consecutive day eriod is identified from daily discharge records at a continuous record gaging tation for each year of record. The climatic year (April 1 - March 31) is sed for analysis because it does not usually separate the low flow season as oes the calendar year or water year. These low flow data are arrayed in rder of magnitude and fit to a probability distribution. The probability istribution estimates the low flows that might recur, on the average, as an nnual minimum. Data retrieval and analysis is done using a computer program vailable in STORET, a computerized database maintained by the Environmental rotection Agency.

here little or no discharge information is available, other techniques are sed to estimate 7Q10 low flows. One technique involves establishing a elation or regression line to transfer low flow characteristics from a ontinuous record gaging station to a nearby station with some flow easurements. Another technique involves calculating a rate of flow per quare mile for a continuous record gaging station and translating this to the ngaged site.

rocedures for calculating low flow values are outlined in the following United tates Geological Survey (USGS) publications:

iggs, H.C. 1972. Low Flow Investigations: Techniques of Water Resources Investigations of the U.S. Geological Survey. Book 4, Chapter B1. 18 p.

indskov, K.L. 1977. Low Flow Characteristics of Minnesota Streams. U.S. Geological Survey Water Resources Investigations Report 77-48. 197 p.

rntson, A.D. and D.L. Lorenz. 1987. Low Flow Frequency Characteristics for Continuous Record Streamflow Stations in Minnesota. U.S. Geological Survey Water Resources Investigations Report 86-4353. 15 p.

7Q10 Low Flow Definition and Methods of Calculation

A 7Q10 low flow is defined as the lowest average discharge for seven consecutive days, having a recurrence interval of ten years. The year that a low flow will occur can't be predicted, but the probability of such flows occuring during a long time period may be estimated. For example, a low flow discharge of 3.5 cubic feet per second (cfs) having a recurrence interval of ten years indicates that a discharge at least as low as 3.5 cfs will occur as an annual minimum about ten times in one hundred years.

To derive a 7Q10 low flow, the lowest average flow in a seven consecutive day period is identified from daily discharge records at a continuous record gaging station for each year of record. The climatic year (April 1 - March 31) is used for analysis because it does not usually separate the low flow season as does the calendar year or water year. These low flow data are arrayed in order of magnitude and fit to a probability distribution. The probability distribution estimates the low flows that might recur, on the average, as an annual minimum. Data retrieval and analysis is done using a computer program available in STORET, a computerized database maintained by the Environmental Protection Agency.

Where little or no discharge information is available, other techniques are used to estimate 7Q10 low flows. One technique involves establishing a relation or regression line to transfer low flow characteristics from a continuous record gaging station to a nearby station with some flow measurements. Another technique involves calculating a rate of flow per square mile for a continuous record gaging station and translating this to the ungaged site.

Procedures for calculating low flow values are outlined in the following United States Geological Survey (USGS) publications:

Riggs, H.C. 1972. Low Flow Investigations: Techniques of Water Resources Investigations of the U.S. Geological Survey. Book 4, Chapter B1. 18 p.

Lindskov, K.L. 1977. Low Flow Characteristics of Minnesota Streams. U.S. Geological Survey Water Resources Investigations Report 77-48. 197 p.

Arntson, A.D. and D.L. Lorenz. 1987. Low Flow Frequency Characteristics for Continuous Record Streamflow Stations in Minnesota. U.S. Geological Survey Water Resources Investigations Report 86-4353. 15 p.

Comments on LTV January 4, 1991 letter:

A 7Q10 is established for setting effluent limitations and represents low flow characteristicss in the receiving stream above the point of discharge. Flow data from EM-1 cannot be used to calculate a 7Q10 low flow for the unnamed creek because flow measurements taken at EM-1 include discharge from LTV operations. Flow data before mining operations began in the watershed are not available.

Even if these flow data could be used, the figures identified by LTV in the table on page two of the letter appear to be simple computations of the lowest average discharge for seven consecutive days during the month and year specified in the table. A 7Q10 low flow value is defined as the lowest average discharge for seven consecutive days having a recurrence interval of ten years, and is calculated from an analysis of daily flows from several years of record that are fit to a probability distribution.

cc: Gary Kimball
Bill Lynott
Gene Soderbeck
Dann White

Table 5-1. Minnesota water quality standards

Concentration in µg/L; hardness in mg/L $CaCO_3$.

Trace metal	Standard	Hardness, 50	Hardness, 100	Hardness, 200	Hardness, 400
Copper	CS	6.4	9.8	15	23
	MS	9.2	18	34	63
	FAV	18	35	68	126
Nickel	CS	88	158	283	508
	MS	789	1418	2549	4568
	FAV	1578	2836	5098	9136
Zinc	CS	59	106	191	343
	MS	65	117	211	3784
	FAV	130	234	421	7567
Cobalt*	CS	2.8	2.8	2.8	2.8
	MS	436	436	436	436
	FAV	872	872	872	872

Standards: CS = chronic standard, MS = maximum standard; FAV = final acute value.

CS is defined as "the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity." This is considered the ambient in stream water quality standard, which must be met on an average basis.

MS is defined as "the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by 2." This is considered the ambient in stream concentration that cannot be exceeded on any given day.

FAV is defined as "an estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant." By rule, any wastewater discharge must not exceed these standards at end-of-pipe at any time.

*LTV conducted site-specific testing and demonstrated that cobalt toxicity was a function of hardness. The cobalt chronic value for the Dunka Mine was increased to 50 µg/L.

STATE OF MINNESOTA

Minnesota Pollution Control Agency

NORTH DISTRICT
PUBLIC NOTICE OF INTENT TO REISSUE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) AND
STATE DISPOSAL SYSTEM (SDS) PERMIT MN 0042579

Public Comment Period Begins:	June 16, 2000
Public Comment Period Ends:	July 17, 2000
Current Permit Issued:	July 30, 1991; Modified September 30, 1994
Current Permit Expiration Date:	April 30, 1996

Name and Address of Permittee

LTV Steel Mining Company
P.O. Box 847
Hoyt Lakes, MN 55750

Facility Name and Location

Dunka Mine
Sec. 26, 34 & 35, T61N, R12W and Sec. 2, 3, 10 and 11, T60N, R12W
St. Louis County, MN

Receiving Waters: Unnamed Creek, a tributary to Unnamed Creek ('Billiken Creek'), and a tributary to Birch Lake ('Flamingo Creek')

Description of Permitted Facility

The principal activity at this facility was the open pit mining of taconite. Mining began in 1964 and continued through August 1994 when active mining ceased and the facility entered the closure phase. During the 30 years of mining a considerable amount of surface and rock overburden was removed to expose the taconite ore. This material was segregated and stockpiled by type (surficial, lean taconite, waste rock (low copper-nickel %), and gabbro (higher copper-nickel %)) in stockpiles adjacent to the open pit. During later years of operation, a relatively lesser volume of high sulfur/ low copper-nickel hornfels material was removed from the Dunka Mine site and disposed of in LTV's Hoyt Lakes Tailings Basin. Water quality issues, in the form of stockpile seeps containing elevated concentrations of base metals (primarily copper, nickel, cobalt and zinc) and sulfate, became apparent in the 1970s in the vicinity of stockpiles on the east side of the open pit. Previous issuances of this permit have identified the major seepages, established monitoring requirements and effluent limitations applicable to the seepages, required the installation of treatment systems capable of meeting effluent limitations for the seepages and water quality standards for the receiving waters, and the completion of best management practices such as stockpile capping and diversion ditches to reduce the volume and concentration of the seepages. The result has been the construction of a 2.5 million gallon lined equalization basin, a 350 gallon per minute lime precipitation treatment plant, and constructed wetland treatment systems at each of the stockpile seeps.

Capping of stockpiles 8011, 8012, 8013, 8014, 8018 and 8031 (the 'source' stockpiles) with compacted glacial till or flexible membrane liners, or a combination, also was completed. All of the stockpiles that only required coverage as per Minnesota Department of Natural Resources (MDNR) Mineland Reclamation Rules of 1980 were covered accordingly with (MDNR) approval.

The previous issuance of this permit required the completion and submittal of a Final Closure Plan dealing with water quality issues related to the then impending closure of the mine. The Closure Plan went through several draft submittals and revisions whereby MPCA and MDNR comments were incorporated into the document. The updated Final Closure Plan was submitted on March 15, 1996. This Final Closure Plan has gone through public review and comment in accordance with MDNR Mineland Reclamation Rules. The approved Final Closure Plan describes in more detail activities that have taken place or are proposed since active operations at the mine ceased in 1994. The enhanced stockpile caps and the water diversion structures are considered integral components for the success of the facility's wastewater treatment system. All closure activities contained in the Final Closure Plan, with the exception of the construction of the potential Dunka Lake outlet, have been completed.

Currently, the following approximate wastewater flows are present at each of the seeps:

Seep	97-99 Ave. Flow	97-99 Max. Mo. Flow	Outfall No.
041	0.117 MGD	0.372 MGD	SD007 (070)
043	0.006 MGD	0.032 MGD	SD008 (080)
044	0.058 MGD	0.149 MGD	SD009 (090)
050/051	0.045 MGD	0.144 MGD	SD005 (050)
060/061	0.072 MGD	0.376 MGD	SD006 (060)

Wastewater from seeps 041, 043 and 044 currently does not discharge directly but rather is collected (following wetland treatment) and pumped to the equalization basin during nonfreezing months for subsequent treatment at the lime precipitation plant and discharged through outfall SD004 (040). Under this reissued permit wastewater from these seeps will be discharged directly year-round through new outfalls SD007 (070), SD008 (080) and SD009 (090) respectively. Seep 042, identified in previous issuances of this permit, has been monitored since its discovery at the Dunka Mine. Closure activities that have already been enacted have resulted in improvements to the untreated Seep 042 water quality such that it complies with applicable discharge and water quality standards. Therefore, no further limitations or monitoring of Seep 042 is necessary. Wastewater from seep 051 is treated by wetland treatment and discharged through outfall SD005 (050), however, facilities are in place to collect and pump the wastewater to the equalization basin should the effluent fail to meet discharge limitations. Wastewater from seep 061 is treated by wetland treatment and discharged through outfall SD006 (060) with no ancillary collection or pumping facilities present. Outfalls SD005 (050) and SD006 (060) will remain in place in this permit. The lime precipitation plant and outfall SD004 (040) will remain in place as a backup to the wetland systems, and will be used if the wetland systems fail to achieve effluent limitations or if water quality standards in Unnamed Creek are exceeded. Chronic toxicity testing will be required at Unnamed Creek monitoring station SW001 (701).

Since the mine is now inactive, mine pit dewatering has ceased and the pit is being allowed to fill with water. Dewatering discharge points and monitoring stations 010, 020 and 030 identified in previous issuances of this permit are currently not in use. Discharge outfalls 020 and 030 will be terminated and eliminated from this permit, however, discharge outfall SD001 (010) will be retained in this permit in the unforeseen event that mine pit dewatering may become necessary. Eventually the mine pit may fill to the point where an artificial discharge point may need to be established to prevent inundation of diversion ditches or stockpiles. Such discharge point, if needed, will likely be constructed at the north end of the pit and discharge to Flamingo Creek or Birch Lake. The filling of the mine pit with water and the establishment of the overflow discharge point is projected to take place at some time subsequent to the expiration of this reissued permit. A requirement to evaluate this issue and propose a discharge solution is being added as a condition to this permit. A map of this facility is on the last page of this notice.

The draft permit includes a variance from Minnesota Rules that reads as follows:

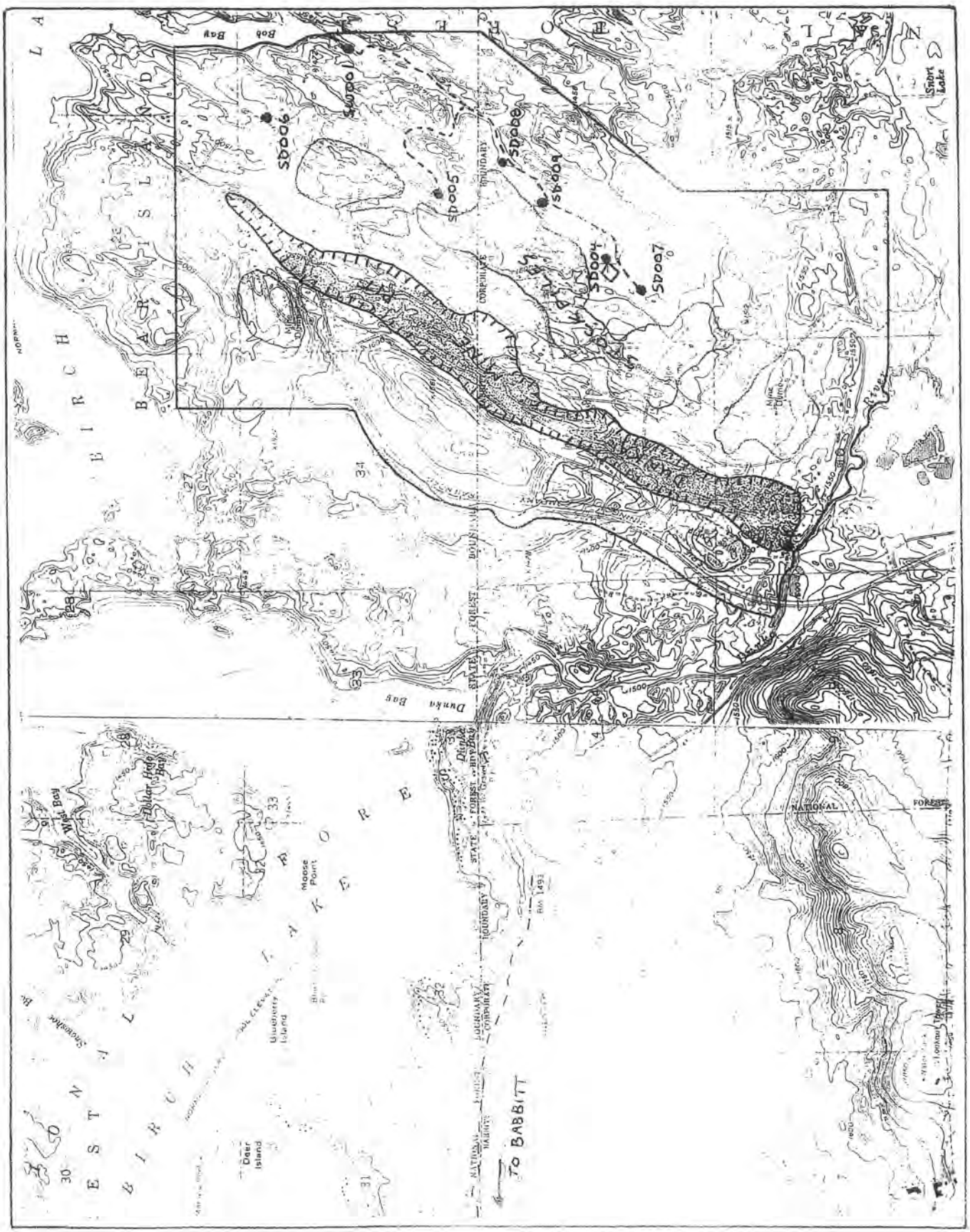
> The Permittee is granted a variance from the provisions in Minn. Rules pts. 7050.0212, subp.6, and 7050.0222, subp. 7.B, that require concentrations of toxic pollutants from a point source to not exceed the Final Acute Value (FAV) at the point of discharge, for outfalls SD008 and SD009, in accordance with Minn. Rules pts. 7000.7000 and 7050.0190. The Permittee shall comply with the additive toxicity effluent limitations for outfalls SD008 and SD009, specified in the Limits and Monitoring Requirements Section and further described in Chapter 1.3.1 of this permit.

MPCA staff is recommending that the MPCA Citizen's Board approve the variance request based on the following factors. Firstly, recent biological monitoring has shown that Unnamed Creek contains an abundance and diversity of aquatic species including sensitive fish and invertebrate species demonstrating the ecological health of the stream. Secondly, the hardness concentrations in the wetland treatment systems' effluent and in Unnamed Creek are at a relatively high level that likely reduces the actual toxicity of the metals in the water. Water Quality Rules, from which the effluent limits are calculated, do not take into account the higher hardness–lower toxicity relationship to the extent that it occurs in the Unnamed Creek watershed. Thirdly, the Permittee has completed extensive remediation and reclamation activities at the mine site to reduce the volume and concentration of seepage discharges, including diversion of surface and ground water and capping of stockpiles much beyond what is required by MDNR Reclamation Rules. Further reductions in flows and metal loads are not practically achievable. And lastly, the cost to upgrade the existing wastewater collection system and mechanical treatment plant, which currently cannot operate during extended freezing conditions, for winter operation is not warranted for the relatively small volume of water that is discharged during the winter. Continued biological monitoring and toxicity testing of Unnamed Creek, and an evaluation to improve existing wetland treatment system performance are requirements of the proposed permit.

Preliminary Determination on the Draft Permit

The MPCA Commissioner has made a preliminary determination to reissue this NPDES/SDS permit for a term of approximately five years.

Facility and Discharge Location



Minnesota Department of Natural Resources

) Lafayette Road
Minnesota 55155-40__45

Pls send it on to the file when you're done. Thx.
Deb

January 10, 2001

Mr. Pat Carey
MN PCA - Duluth
704 Government Service Center
320 W. 2nd Street
Duluth, MN 55802

Dear Pat:

We have recently completed our final report on the long term effectiness of wetland treatment at LTV's Dunka Mine. I have attached the executive summary, and would be happy to send you the complete report if you are interested.

Sincerely,

Paul

Paul Eger
Principal Engineer

cc: Arlo Knoll

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FEB - 2 2001
MN POLLUTION CONTROL AGENCY
DULUTH, MN

Long Term Wetland Treatment of Mine Drainage at LTV Steel Mining Company's Dunka Mine

December 2000

Paul Eger
Jon Wagner
Glenn Melchert
David Antonson
Andrea Johnson

Minnesota Department of Natural Resources
Division of Lands and Minerals
500 Lafayette Road
St. Paul, MN 55155-4045

Executive Summary

A study was conducted at LTV's Dunka Mine in northeastern Minnesota to examine the long term metal removal in two wetland treatment systems that had operated for seven years. One system was an overland flow wetland that had been constructed to treat neutral drainage with an average nickel concentration of around 5 mg/L. The other was a pretreatment system which was installed to treat a drainage with an average pH of 5.4, and which contained 14.7 mg/L of nickel and 0.69 mg/L of copper.

W1D overland flow wetland

The wetland system was constructed in 1992, and the stockpile that contributed the major load to the wetland was capped with a linear low density polyethylene liner in 1995. Over 90% of the metal input to the wetland occurred before the stockpile was capped. After capping, both flow and nickel concentrations decreased. Flow decreased by 55%, while average nickel concentrations decreased by 82%, from 3.98 mg/L to 0.74 mg/L.

The overall nickel removal in the system prior to capping the stockpile averaged 89%. After capping, the input load to the wetland decreased by over 90% and the average percent removal decreased to 61%. Despite lower input concentrations after capping, nickel removal continued throughout the entire study period.

In order to examine treatment lifetime, a portion of the wetland (W1D study cell), which had accounted for 26% of the total nickel removal, was selected for detailed study. Mass balance calculations conducted for the study cell indicated that essentially all the nickel removed from the water could be accounted for by the estimated nickel mass within the substrate. There was no evidence of nickel being removed from the wetland.

Assuming that the post capping load to the wetland remains unchanged, and that new metal removal sites are formed from decaying vegetation in the wetland, there appears to be a balance between the input metal load and the yearly generation of removal sites. If this situation continues, the wetland may be self-sustaining, and treatment may continue indefinitely.

Seep 1 pretreatment system

The pretreatment system is comprised of a pool with two limestone berms, a peat-mixture substrate, and a vertical down-flow section through which the water flows prior to discharge. The system was constructed in 1992, and has generally been successful in increasing pH from an average of 5.40 to 6.95. Copper concentrations have decreased by about 70% and nickel concentrations have decreased by 55%.

The pH increase and much of the copper removal are related to dissolution of the limestone within the pretreatment system. Although it was not possible to calculate a limestone dissolution rate and an expected lifetime, there is no data to suggest that the rate of dissolution has decreased. Nickel removal within the pretreatment system averaged only 15-20%, and occurred primarily in the vertical down-flow section of the system. The major reduction in nickel load appears to be related to capping of the stockpile, and not to removal within the pretreatment system. In 1999, removal in the vertical down-flow section was only 8%, and additional data should be collected to determine if the system has reached saturation.