
Appendix A
Agency Correspondence

Exhibit 1	Sample Letter of Request for Project-Related Comments Project Area Maps List of Contacted Agencies
Exhibit 2	Response from United States Environmental Protection Agency
Exhibit 3	Response from Federal Emergency Management Agency
Exhibit 4	Response from Itasca County Health and Human Services
Exhibit 5	Response from Minnesota Department of Health
Exhibit 6	Response from Minnesota Historical Society
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Exhibit 9	Response from United States Department of Agriculture-NRCS
Exhibit 10	Response from United States Army Corps of Engineers

Exhibit 1



SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

[Date]

[Name]

[Organization]

[Address]

[City, State, Zip Code]

Re: **Request for Project-Related Comments and Information**

STB Finance Docket No. 34992 – Itasca County Regional Rail Authority,
Construction of railroad line to the new Minnesota Steel Industries plant to be
located at Nashwauk, in Itasca County, Minnesota

Dear [Mr. or Mrs. Name]:

This letter requests information and your comments regarding a rail line construction project being proposed by the Itasca County Regional Rail Authority (ICRRA) that is the subject of an environmental review by the Surface Transportation Board (Board). The Board is an independent agency within the United States Department of Transportation that has jurisdiction over railroad construction and operations.

Pursuant to the National Environmental Policy Act (NEPA) and the Board's rules, the Board's Section of Environmental Analysis (SEA) will prepare an environmental document that evaluates the potential environmental impacts of the proposed rail construction project and the reasonable and feasible alternatives to the proposal. Under NEPA and applicable rules of the Board and the Council on Environmental Quality (CEQ), an Environmental Impact Statement (EIS) will be required if the proposed project would have significant environmental impacts. If the proposed project appears unlikely to have significant environmental impacts, then an Environmental Assessment (EA) may be prepared instead. SEA is beginning the process of gathering information on the project area and project-related issues and concerns. Information collected will assist SEA in the preparation of the appropriate NEPA document for the proposed project.

Description of the Proposed Rail Project

ICRRA is a political subdivision and noncarrier established under Minnesota law for the purpose of owning, constructing, and operating railroads in Itasca County, Minnesota. ICRRA filed a petition with the Board on March 9, 2007, pursuant to 49 U.S.C. 10502, for authority to

construct approximately 9 miles of new railroad line that would connect an existing rail line at Taconite, Minnesota to the site of a new steel mill to be constructed by Minnesota Steel Industries, LLC (Minnesota Steel) at Nashwauk, Minnesota (see Attachments A and B which show the location of the proposed rail line alternatives identified to date). ICRRA will own the lead track and lease operating rights to an existing, experienced short-line railroad to provide common carrier rail service over the proposed rail line to Minnesota Steel.

The proposed rail line would begin at the intersection of an existing mainline track extending from Grand Rapids to Forbes, Minnesota. This line is co-owned by BNSF Railway, Inc., and the Canadian National Railway Company. Both carriers operate over this line, and ICRRA's short-line operator would have access to both railroads. ICRRA is proposing a lead track with an interchange yard near the mainline track and terminating as a single track at the Minnesota Steel site, which will have a small rail yard within its facility. The proposed rail right-of-way will be located on land owned primarily by Minnesota Steel, and there will be no crossings of public highways or other railroads. SEA's environmental document will evaluate the proposed rail line right-of-way, as well as a no-build alternative and any other reasonable alternatives (Attachments A and B).

The proposed rail line would be used to transport shipments of chemicals, steel slabs, and taconite pellets associated with the Minnesota Steel plant. Itasca expects the rail line to handle 30,000 carloads and three million tons annually. This is based on one train making single daily roundtrips or two trains per day, one in each direction, at 70-90 carloads per trip, 7 days per week.

Agency Consultation

At this time, I request your preliminary comments regarding the proposed rail project. Any information you provide relating to the following issues will assist SEA in determining what environmental issues should be addressed in its environmental review:

- Safety
- Local land use
- Existing transportation systems
- Air emissions and ambient air quality
- Energy use
- Water quality and wetlands
- Ambient noise levels
- Historic sites, archaeological sites, or cultural resources
- Socioeconomics (population, employment, growth, and development)
- Wildlife, vegetation, and fisheries
- Soils and geology

Information on additional issues or concerns that you consider appropriate would also be appreciated. Please respond by May 18, 2007, so that we can incorporate your response into the environmental review process, as appropriate, and schedule any meetings, site visits, surveys, and conduct any necessary follow-up activities. Please submit comments and responses to Burns & McDonnell (B&M), SEA's independent third-party contractor in this case, at the following address:

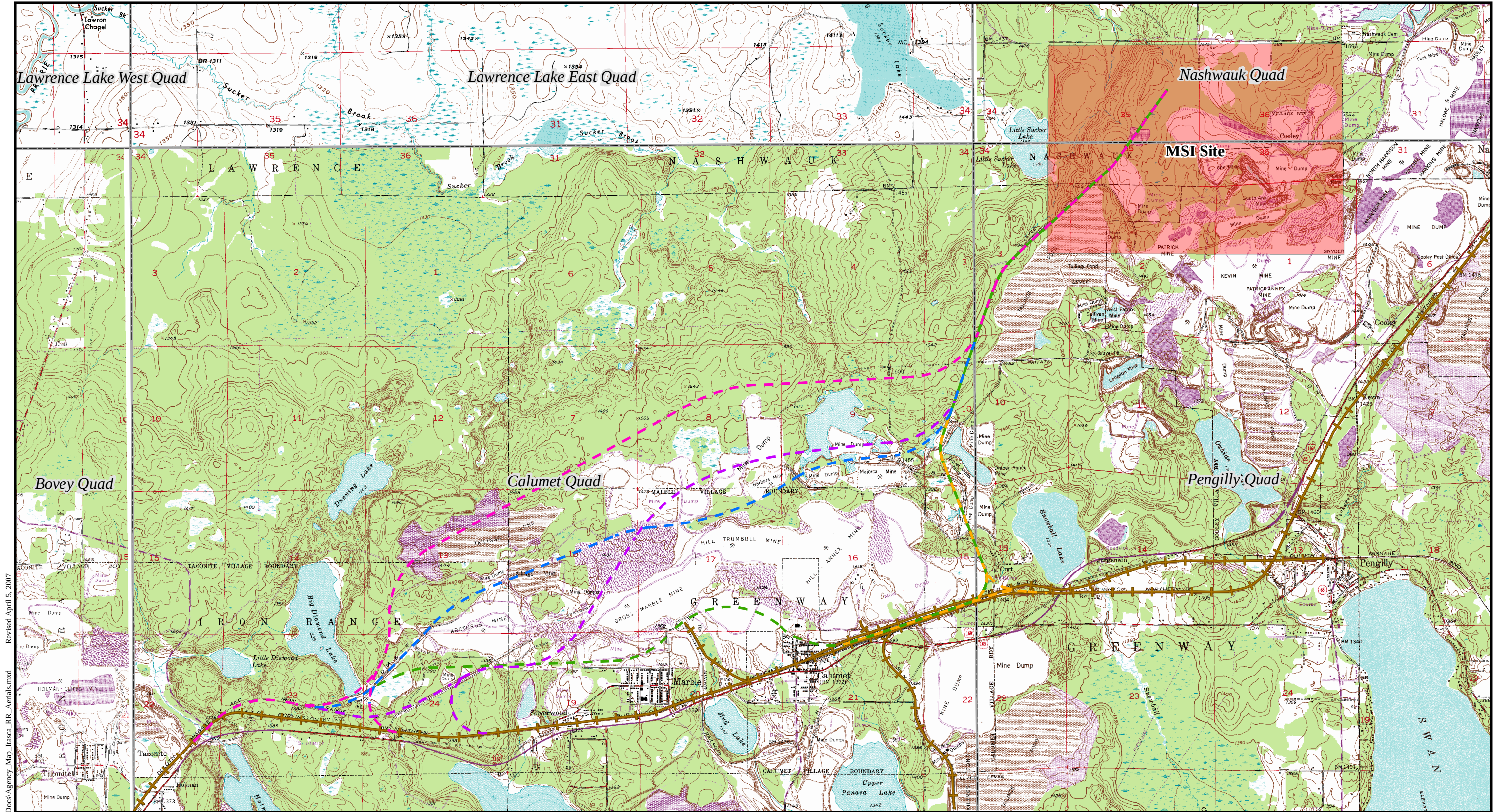
Burns & McDonnell Engineering Company
Attn: Stephen Thornhill
P.O. Box 419173
9400 Ward Parkway
Kansas City, Missouri 64141

I appreciate your assistance on this project. If you have any questions, please do not hesitate to contact Ken Blodgett of my staff at (202) 245-0305 or Steve Thornhill of B&M at (816) 822-3851. Thank you for your assistance.

Sincerely,

A handwritten signature in black ink, appearing to read "Victoria Rutson". The signature is fluid and cursive, with the first name "Victoria" and last name "Rutson" clearly distinguishable.

Victoria Rutson, Chief
Section of Environmental Analysis



R:\Itasca County\44941\GIS\Data\Files\ArcDocs\Agency Map_Itasca RR_Aerials.mxd
Revised April 5, 2007

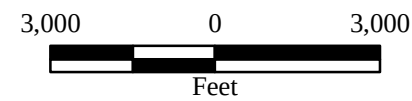
LEGEND

- Minnesota Steel Site Boundary
- Municipality Areas
- USGS Quadrangle
- Existing Railroad

Railroad Alternatives

- Option 1
- Option 2 (Itasca Preferred Alternative)

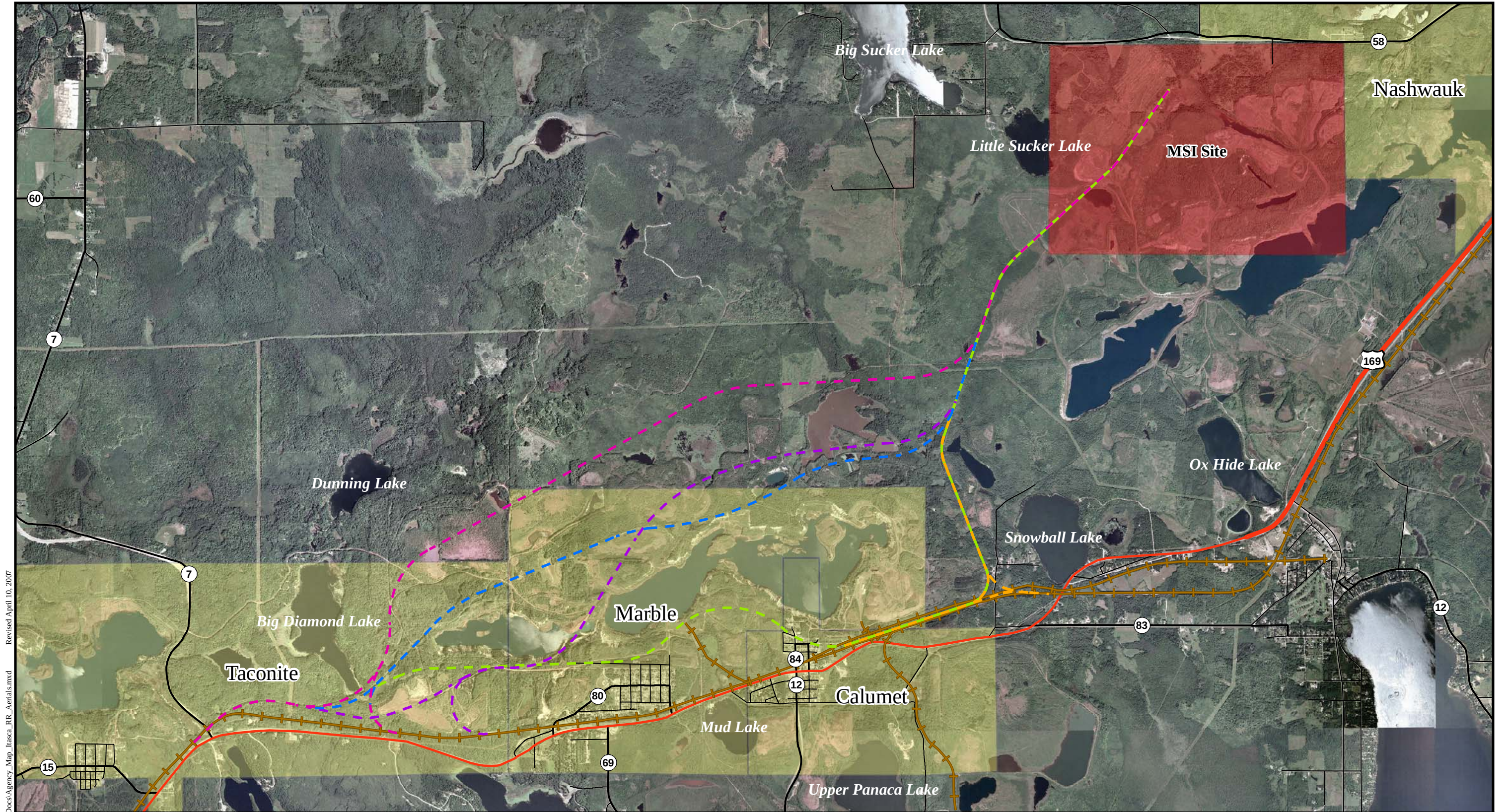
- Option 3
- Option 4
- Option 5



Attachment A

Itasca County
Regional Railroad Authority

USGS Quadrangle Image
Railroad Alignment Alternatives

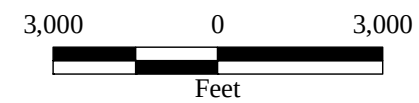


LEGEND

- Minnesota Steel Site Boundary
- Municipality Areas
- Existing Railroad

Railroad Alternatives

- Option 1
- Option 2 (Itasca Preferred Alternative)
- Option 3
- Option 4
- Option 5



Attachment B

Itasca County
Regional Railroad Authority

Aerial Image
Railroad Alignment Alternatives

AGENCY CONTACTS

Itasca County Railroad

Army Corps of Engineers Center
Attn: Tamara Cameron
Regulatory Functions Branch
190 Fifth Street East
St. Paul, MN 55101-1638

U.S. Environmental Protection Agency
Attn: Kenneth Westlake
Environmental Planning & Evaluation Unit
77 West Jackson Boulevard, Mailstop B-19J
Chicago, IL 60604-3590

U.S. Fish & Wildlife Service
Twin Cities Field Office E.S.
4101 East 80th Street
Bloomington, MN 55425-1665

National Park Service
Stewardship Team Manager
111 East Kellogg Boulevard, Suite 105
St. Paul, MN 55101-1288

Bureau of Indian Affairs
Environmental Services
Attn: Mr. Herb Nelson
Whipple Federal Building
One Federal Drive, Room 550
Fort Snelling, MN 55111-4007

U.S. EPA
Region 5
P.O. Box 277
Cass Lake, MN 56601

Loretta B. Sutton
Program Analyst
U.S. Department of the Interior MS-2342
Office of Environmental Policy and
Compliance (PEP)
1849 C Street, Northwest
Washington, DC 20240

Federal Aviation Administration
Great Lakes Regional Office
Air Traffic Division, AGL-520
2300 East Devon Avenue
Des Plaines, IL 60018

U.S. Department of Agriculture
Natural Resources Conservation Service
375 Jackson Street, Suite 600
St. Paul, MN 55101

U.S. Department of the Interior
National Park Service
Midwest Region
Attn: Ernie Quintana
601 Riverfront Drive
Omaha, NE 68102

Federal Emergency Management Agency
Region V
536 South Clark Street, 6th Floor
Chicago, IL 60605

Minnesota Public Utilities Commission
Attn: LeRoy Koppendrayner, Commissioner
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

Department of Agriculture
Attn: Becky Balk
625 North Robert Street
St. Paul, MN 55155

Department of Commerce
Attn: Marya White
85 Seventh Place East, Suite 500
St. Paul, MN 55101-2198

Department of Health
Environmental Health Division
Policy Planning and Analysis Unit
625 North Robert Street
St. Paul, MN 55155

Department of Natural Resources
Attn: Steve Colvin
Environmental Review Unit
500 Lafayette Road, Box 10
St. Paul, MN 55155-4010

Minnesota Pollution Control Agency
Rick Newquist, Supervisor
Environmental Review Unit
520 Lafayette Road
St. Paul, MN 55155

Department of Transportation
Attn: Gerald Larson
MN/DOT Environmental Services
395 John Ireland Boulevard, MS620
St. Paul, MN 55155

Board of Water and Soil Resources
Attn: Jim Haertel
520 Lafayette Road
St. Paul, MN 55155

Minnesota Historical Society
State Historical Preservation Office
345 Kellogg Boulevard West, Level A
St. Paul, MN 55102-1906

Minnesota Indian Affairs Council
3801 Bemidji Avenue
Bemidji, MN 56601

State Geodetic Advisor
Attn: Dave Zenk
Office of Land Management, Geodetic Unit
Transportation Building, MS 641
395 John Ireland Boulevard, Room 618
St. Paul, MN 55155

Minnesota Dept. of Natural Resources
Attn: Chris Kavanaugh
1201 East Highway 2
Grand Rapids, MN 55744

Office of the State Archaeologist
Fort Snelling History Center
St. Paul, MN 55111-4061

Minnesota Homeland Security
& Emergency Management
444 Cedar Street, Suite 223
St. Paul, MN 55101-6223

Office of the Governor
Governor Tim Pawlenty
130 State Capitol
75 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, MN 55155

Minnesota Dept. of Economic
Development
Itasca Resource Center
1215 Southeast 2nd Avenue
Grand Rapids, MN 55744-3982

Minnesota Environmental Quality Board
658 Cedar Street, Suite 300
St. Paul, MN 55101

Itasca County Environmental Services
Attn: Don Dewey
123 Northeast 4th Street
Grand Rapids, MN 55744-2600

Chuck Meyer
Red Lake Band of Chippewa Indians
Red Lake DNR Wetlands Program
15761 High School Drive
Red Lake, MN 56671

Itasca Co. Soil & Water
Conservation District
Attn: Jim Gustafson
1889 East Highway 2
Grand Rapids, MN 55744

Grand Portage Chippewa
Attn: Margaret Watkins
Environmental Department
P.O. Box 428
Grand Portage, MN 55605

Mille Lacs Band of Ojibwe
Attn: Charles Lippert
43408 Oodena Drive
Onamia, MN 56359

Fond du Lac Reservation
Attn: Chris Berini
Division of Resource Management
1720 Big Lake Road
Cloquet, MN 55720

Brad Frazier
Trust Lands & Resources
Grand Portage Reservation
27 Store Road
Grand Portage, MN 55605

Mr. James Zorn
Executive Administrator
Great Lakes Indian Fish & Wildlife
Commission
100 Maple Street
Odanah, WI 54861

Itasca Co. Board of Commissioners
Attn: Amanda Schultz
Itasca Co. Administrative Services
123 Northeast 4th Street
Grand Rapids, MN 55744-2600

City of Nashwauk
Robert Fragnito, Mayor
301 Central Avenue
Nashwauk, MN 55769

Nashwauk Council Chamber
301 Central Avenue
Nashwauk, MN 55769

City of Keewatin
Mayor Tom Sampson
127 3rd Avenue
Keewatin, MN 55753

City of Calumet
City Hall
932 Gary Street
Calumet, MN 55716

City of Marble
302 Alice Avenue
Marble, MN 55764-0038

Nashwauk Area Chamber of Commerce
113 First Street
Nashwauk, MN 55769

Itasca Co. Health and Human Services
Itasca Resource Center
1209 Southeast 2nd Avenue
Grand Rapids, MN 55744

Iron Range Resources
Attn: Sandy Layman, Commissioner
4261 Highway 53 South
Eveleth, MN 55734-0441

Mr. Gordon Adams, Jr.
Bois Forte Band of Chippewa
Bois Forte Reservation Tribal Council
P.O. Box 16
Nett Lake, MN 55772

Gina Papasodora
Leech Lake Band of Ojibwe
6530 US Highway 2, Northwest
Cass Lake, MN 56633

Mr. Thomas McCauley
White Earth Reservation Tribal Council
P.O. Box 418
White Earth, MN 56591

Itasca County Commissioners
Itasca County Courthouse
123 NE 4th Street
Grand Rapids, MN 55744

Exhibit 2



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

MAY 16 2007

REPLY TO THE ATTENTION OF:

B-19J

Ken Blodgett
Section of Environmental Analysis
Surface Transportation Board
395 E Street SW
Washington, DC 20423

RE: Information and Scoping Request on rail construction project to Minnesota Steel Industries plant, Itasca County, Minnesota (STB Finance Docket No. 34992)

Dear Mr. Blodgett:

The United States Environmental Protection Agency (U.S. EPA) received your April 13, 2007 request for information and comments regarding the project proposed by the Itasca County Regional Rail Authority (ICRRA). The proposed project is a rail line to the proposed Minnesota Steel Industries (MSI) mine and processing plant near Nashwauk, Minnesota.

U.S. EPA reviewed the MSI project's draft environmental impact statement (DEIS) prepared by the U.S. Army Corps of Engineers (Corps) and the Minnesota Department of Natural Resources (MnDNR). In this document, the rail line was mentioned as a related project. In our comments on the DEIS, we determined that the rail extension should be considered a connected action. A connected action is a project that is an interdependent part of a larger action, in this case, the MSI mine and processing operations, and depends on the larger action for its justification (please see the Code of Federal Regulations, 40 CFR 1508.25). We encouraged the Corps and MnDNR to include as much quantitative information as possible about environmental impacts from the new rail line, as well as other connected actions, in the MSI Final EIS.

Because of the ICRRA rail line project's close ties to the MSI project, we are sending you a copy of our comments on the MSI DEIS. U.S. EPA is concerned about wetland loss and mitigation associated with the MSI project. We therefore recommend that environmental documents for the rail extension project include specific and detailed information about wetland type and function, as well as mitigation. Our comments on the MSI project describe our wetland concerns and discuss the kind of information that is necessary for defining impacts and mitigation.

We suggest that you or your contractor contact the following people who are working on the MSI environmental documents. They have information about resources in the area.

Jon K. Ahlness
Regulatory Branch, St. Paul District
U.S. Army Corps of Engineers
190 Fifth Street East, Suite 401
St. Paul, MN 55101-1638
(651) 290-5381

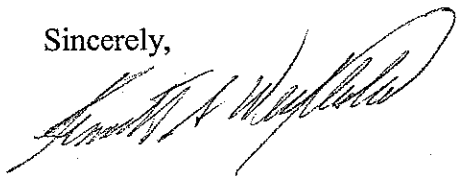
Scott E. Ek
Environmental Policy and Review
Minnesota Department of Natural Resources
Division of Ecological Services
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025
(651) 259-5156

Jess Richards
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4025
(651) 296-7757

You will also find general environmental resource information on two U.S. EPA websites: the Envirofacts Data Warehouse, <http://www.epa.gov/enviro/> and Surf Your Watershed, <http://www.epa.gov/surf>.

We hope this information is helpful, and we trust you will find additional information from other State and federal agencies. We look forward to the next level of environmental documentation, which U.S. EPA will review in accordance with its authority under NEPA and Section 309 of the Clean Air Act. If you need further assistance, please contact Anna Miller of my staff at (312) 886-7060.

Sincerely,



Kenneth A. Westlake
Chief, NEPA Implementation Section

Enclosure

cc: Stephen Thornhill, Burns & McDonnell Engineering Company



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

MAR 30 2007

REPLY TO THE ATTENTION OF:

B-19J

Jon K. Ahlness
Regulatory Branch, St. Paul District
U.S. Army Corps of Engineers
190 Fifth Street East, Suite 401
St. Paul, Minnesota 55101-1638

Scott E. Ek
Principal Planner
Environmental Policy and Review
Minnesota Department of Natural Resources
Division of Ecological Services
500 Lafayette Road, Box 25
St. Paul, Minnesota 55155-4025

RE: Draft Environmental Impact Statement, Minnesota Steel Industries Taconite Mine and Steel Mill Project, CEQ # 20070047

Dear Mr. Ahlness and Mr. Ek:

I am writing to provide the U.S. Environmental Protection Agency's (EPA) comments on the draft Environmental Impact Statement (EIS) for the Minnesota Steel Industries (MSI) taconite mine and steel mill project under the National Environmental Policy Act (NEPA), and Section 309 of the Clean Air Act. The project involves an open pit taconite mine operation, ore processing, and a related steel mill. The project is located in Itasca County, Minnesota, near Nashwauk, at the western end of the Mesabi Iron Range.

Project Background Summary: Project features include: the open pit mine, adjacent stockpile areas, and a new tailings basin on the site of a former tailings basin. The project also includes construction of new facilities for processing ore and producing steel: a crusher, a concentrator, a pellet plant, and a plant for producing direct reduced iron. The steel mill consists of two electric arc furnaces, two ladle furnaces, two thin slab casters, and a hot strip rolling mill. The purpose and need for the project is to mine taconite ore and produce steel on site in order to provide steel product to the domestic and world market. The project is proposed for a 20-year period and is planned to produce about 13 million metric tons of ore per year and 2.5 million metric tons of steel slabs per year.

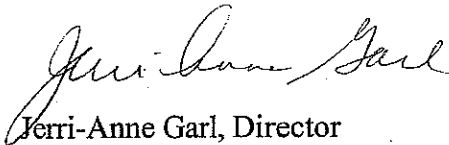
Project Alternatives and Impacts: The MSI DEIS was prepared jointly by the Army Corps of Engineers (Corps), as the lead federal agency, and the Minnesota Department of

Natural Resources (MDNR), under the Minnesota Environmental Policy Act. EPA was involved at the scoping stage of this project and has provided input at several informal and intermediate stages at the request of the Corps. The DEIS presents a preferred alternative that would use the existing Butler tailings facility, rather than a new site, and dispose of sanitary waste at the Nashwauk wastewater treatment plant, rather than building an on-site wastewater treatment system. The project would have direct impacts to approximately 765 acres of wetlands. It will also require de-watering existing mine pits that feed local streams and lakes; MSI proposes to augment water bodies affected by the dewatering. The project is within 200 miles of four Class I air quality areas, designated to protect visibility in national parks and forests.

Project Rating: Based on our review, we have rated the draft EIS for the project “**Environmental Concerns – Insufficient Information (EC-2).**” Enclosed documents contain EPA’s comments and an explanation of the rating system. We have identified areas where additional information is needed to either resolve EPA’s concerns or further evaluate environmental impacts. In summary, we have concerns about the wetlands classification and mitigation, water quality impacts, air quality impacts, tribal resource uses, evaluation of connected actions, and ground water evaluation.

Thank you for the opportunity to review and provide comments on the MSI mining and steel mill DEIS. If you have any questions or would like to discuss our concerns and recommendations, please contact me at 312-353-1441 or Anna Miller of my staff at either miller.anna@epa.gov or (312) 886-7060.

Sincerely yours,



Jerri-Anne Garl, Director
Office of Science Ecosystems and Communities

Enclosures

cc: Ann Foss, Minnesota Pollution Control Agency

**EPA Region 5 Comments for the
Minnesota Steel Industries Mine and Steel Mill Project
Draft Environmental Impact Statement (DEIS)
March 2007**

Alternatives analysis

We appreciate the thorough alternatives analysis prepared for the DEIS. While certain parts of the project, such as the mine pit itself, are fixed, other project features have the potential for different locations. Our review found that the proposed locations of the ore processing facilities, steel mill, stockpiles, and tailings basin considered wetland avoidance and mitigation. Overall, we found the selected alternatives for wastewater treatment, the processing and plant facilities locations, and the tailings basin site acceptable.

Consultation with U.S. Fish and Wildlife Service (USFWS)

Results of USFWS consultation should be summarized in the Final EIS (FEIS).

In-pit stockpiling alternative

In-pit waste rock stockpiling is an alternative dependent on many factors, such as mineral rights, how the mine pit is worked, and mine pit capacity. The DEIS indicates that the feasibility of in-pit stockpiling is not yet known. (See page 3-11); however, the DEIS later discusses in-pit stockpiling as mitigation (page 4-149). Since the alternative's feasibility is not known yet, we recommend the FEIS present it as provisional only, and not definitively factor it into mitigation or minimization.

Connected actions

The DEIS is not clear about whether impacts due to connected actions are included in the overall impact totals. These connected actions include: gas line construction, electrical power lines, public roadway, railroad extensions, and water/sewer lines. Because these infrastructure projects are considered connected activities under NEPA, their impacts should be included and evaluated, even though other agencies or entities will permit or undertake these activities. As noted in the DEIS, 40 CFR 1508.25 states that connected actions are actions that are interdependent parts of a larger action and depend on the larger action for their justification.

For connected actions (listed on page 2-2 in table 2.2 Environmental Review and Permits for Connected Actions), we recommend that the FEIS:

- Include a discussion of the impacts due to connected actions in each of the appropriate media sections in 4.0 Environmental Consequences.
- Quantify acres and community type of wetlands impacted by connected actions, and explain whether the wetlands are previously disturbed or not. We understand, however, that avoidance and mitigation may be better addressed during the permitting phase for these connected actions and, if so, recommend the FEIS state that.

Wetlands

Classification System: Instead of using the Circular 39 system, EPA recommends using the Eggers and Reed system (1997) or the Cowardin Classification System. Both Eggers and Reed and Cowardin provide more specific plant community information that will be useful and necessary to determine adequate mitigation. We recommend their use to identify wetland impacts as well as to describe the wetland communities to be established for mitigation. We also request that the wetland impact summary tables 4.1.9 and 4.1.10 include the total acres of wetland impacted by community type using the Eggers and Reed or Cowardin system.

The use of the Circular 39 classification system to describe the wetlands impacted is problematic because it does not provide sufficient information on the wetland types being impacted. For example, Circular 39 Type 7 (wooded swamp) does not distinguish between hardwood swamps and coniferous swamps, which are two very different types of plant communities. Similarly, Circular 39 Type 2 does not differentiate between sedge meadow and calcareous fen - these are distinctly different wetland community types and each would be assessed differently regarding what constitutes adequate mitigation.

Natural vs. disturbed wetlands: The DEIS refers to wetlands of natural origin and wetlands of artificial origin, without defining the distinction. We suggest defining these terms in the FEIS. In addition, we recommend clearly identifying natural, artificial and disturbed wetlands by acreage rather than by percents for discrete project segments. This will help readers and decision-makers understand impacts.

Mitigation ratios: The DEIS proposes at least a 1:1 mitigation replacement ratio and indicates that the initial wetland mitigation work should be completed within 5 years. Although hydrology may be re-established in this time frame, the site is unlikely to be a fully functional wetland in 5 years. Due to the time lag between the impacts and the full restoration of functioning wetlands, we request a mitigation ratio of at least 1.5:1 for emergent and scrub shrub communities. We also note that the proposed project will impact approximately 32 acres of forested wetland. The DEIS does not indicate if the impacted areas are hardwood or coniferous forested wetlands. In either case, due to the length of time needed for forested systems to be restored, we request that all forested wetland impacts be mitigated in kind at a 2:1 ratio.

Indirect impacts to wetlands: The DEIS states that since the extent of potential indirect wetland impacts are not precisely known, mitigation for indirect impacts is undefined. To define indirect impacts, EPA supports adding the monitoring measures listed on page 4-30 as Clean Water Act (CWA) Section 404 permit conditions. Those measures are: (1) additional monitoring wells near mine pits where indirect impacts due to de-watering could occur, and (2) long-term wetland hydrology monitoring. EPA will discuss these measures further with the Corps during the Section 404 permit phase.

In-kind mitigation: The proposed wetland mitigation includes a 5-year plan and an additional 20-year plan. Although the proposed mitigation is difficult to assess since the mitigation discussion uses the Circular 39 classification system (see comments above), we conclude from our review that the proposed mitigation will not result in in-kind replacement of wetland type. The majority of the proposed restoration appears to be

either shallow or deep marsh or shallow fresh water, which does not reflect the composition of wetland community types to be directly impacted. Specifically, the mitigation at this site would result in more open water wetland systems, while providing very little forested or scrub shrub wetland habitat. EPA expects to continue discussions of in-kind mitigation with the Corps during the Section 404 permit process.

To ensure adequate mitigation, we recommend establishing a timeline indicating the type of wetlands to be impacted in each watershed as the project moves forward. This information can then be used to guide decisions regarding the most appropriate types of wetland communities to be restored in the 5-year and 20-year mitigation plans.

Concerning the Aitkin 229 and 248 sites, the DEIS provides little information on how wetland hydrology will be re-established and maintained on this mitigation site. The DEIS is also unclear how much, if any, management of water levels will be required to maintain the target wetland communities. Since the mitigation plan proposes to let vegetation naturally establish on the mitigation sites, we recommend that the CWA Section 404 permit establish interim performance standards that require seeding and/or planting the mitigation areas if the target wetland communities do not develop within several growing seasons. We also recommend that the mitigation plan include performance standards for the sites, both for vegetation and hydrology. A conservation easement should immediately be established over the mitigation areas. The plan should designate a long-term manager of the mitigation areas.

Approximately 140 acres of wetland restoration is proposed at Aitkin Site 1981 on land originally developed for farming. Initial wetland restoration planning for this site was conducted between 2003 and 2005, but no restoration work has actually been completed. This site appears to have the potential to provide restoration opportunities for forested and/or scrub-shrub communities. We recommend the FEIS include a complete restoration plan that clearly indicates the wetland communities to be established on the site, how the wetland vegetation will be established, and how hydrology will be restored. We also suggest including recent wetland delineations (those completed in the last three years) be available for review.

Mitigation credits: For proposed additional wetland mitigation at several other sites, including the proposed 150 acres of re-established wetlands in the tailings basins, the project may likely receive full mitigation credit. The mitigation plan also appears to rely on full (100 percent) credit for forest road decommissionings (projected to result in 88 acres of re-established wetlands), which we understand to be part of the Chippewa National Forest's long-term management plan. Under the Section 404 process, MSI can receive up to 25 or 50 percent credit for projects that are independent of the MSI mitigation plan, such as the Chippewa National Forest road removals.

Impacts to local hydrogeology and drinking water sources

The FEIS should demonstrate whether mine pits and ground water are or are not interconnected, to support the DEIS statement that de-watering will not have adverse affects. The results of a ground water analysis should be included in the FEIS, along with supporting maps and cross-sections, as well as a map showing public and private well locations. In particular, we recommend explaining the ground water flow regime near the

Hawkins/Halobe/Hadley Pits, which are approximately 200 yards from the Nashwauk City public water supply well #2. These materials will allow reviewers and the general public to understand the potential for impacts to water supplies. The FEIS should also discuss proposed monitoring to detect any impacts to the public or residential wells due to pit de-watering.

We note that Pickerel Creek originates from a spring-fed stream; the FEIS should address whether it will be affected by de-watering.

Underground injection control (UIC)

While we understand that the on-site wastewater treatment system is not the preferred alternative, should this alternative be selected, it will require a permit as a Class V well under the Safe Drinking Water Act UIC program. The FEIS should include the potential for a UIC permit in its discussion of this alternative. In the State of Minnesota, the UIC program is directly implemented by EPA. We would require an inventory to determine if the system would need an individual permit or be authorized by rule.

Water discharges and water quality

We recommend the FEIS discuss whether or not a National Pollutant Discharge Elimination System (NPDES) is necessary for stream and lake augmentation activities. Generally, augmentation would require an NPDES permit, but the DEIS does not identify a permit for this activity. The DEIS states that all waters meet the state water quality standards; however, in the absence of specific information about chemistry and temperature of the individual pit waters, we are concerned that surface water quality of receiving water bodies (Snowball Lake, Oxhide Lake, Swan lakes, and Oxhide Creek) may be affected by the addition of nutrients (i.e. phosphorus) or sulfates or by changes in temperature due to water transfers or augmentation. We recommend the FEIS provide more information about water chemistry of the pits and discuss possible changes due to inflows from dewatering or augmentation.

Information on page 4-56 states that in the area surrounding the processing plant, surface water would be collected and discharged to a wetland southeast of the processing plant, although the DEIS states elsewhere that no surface water discharges will occur from this project. The FEIS should explain whether this discharge requires an NPDES storm water permit or is otherwise regulated.

We recommend including the following information in the FEIS:

- Page 4-47, Section 4.3.2.2: Oxhide Lake: Will proposed increases and decreases in lake levels cause erosion of the banks or other impacts, or are these fluctuations within the natural range for this lake?
- Page 4.47, Section 4.3.2.2: Snowball Creek: the DEIS mentions that in the post-mining period, the level of Snowball Creek may increase to the point where Pit 6 may not continue to discharge into the creek. This appears to mean that creek levels may not return to pre-mine levels, which differs from statements elsewhere in the DEIS. We recommend clarifying in the FEIS whether the creek levels will or will not return to pre-mining levels.

- We note that Page 4-39, at the end of the first paragraph, refers to additional water appropriations that are likely in the future. The FEIS should be clear about this as a future action and discuss sources and possible impacts.

Risk levels and subsistence consumption

Cancer risk levels:

While we acknowledge that the DEIS has used Minnesota's approved cancer risk level of 1 additional cancer in a population of 100,000 people (1×10^{-5}), we suggest that the State regulators consider using the more protective level of 1 additional cancer in a population of 1,000,000 people (1×10^{-6}) to characterize possible impacts to subsistence fish consumers in the area of the project. We suggest considering the (1×10^{-6}) cancer risk level because of the following reasons:

- In 2000, EPA's water quality standards program recommended the use of the more protective (1×10^{-6}) cancer risk level when deriving criteria for several cancer-causing pollutants (see Federal Register, Vol. 65, No. 214); some of these pollutants occur in the project area and are evaluated in the DEIS.
- The Grand Portage Tribe has EPA-approved water quality standards and uses the updated recommended risk level of (1×10^{-6}) and has treaty rights to consume fish in the area of the project.
- If subsistence fish consumers (not only tribal members) will also be consuming produce similar to the subsistence farming levels in the area, then additional exposure to these pollutants and cancer risk could occur. In the DEIS, subsistence fish consumers are expected not to exceed the (1×10^{-5}) cancer risk level for Arsenic, Benzo(a)pyrene, and Dibenzo(a,h)anthracene (the expected rate was 0.8 in 100,000). If they consume produce similar to higher subsistence farming levels in the area, however, instead of the lesser residential levels, as assumed in the DEIS, they could possibly exceed the (1×10^{-5}) rate.

Non-cancer risks: We recommend that the FEIS include a discussion of the potential non-cancer health effects due to mercury, because the DEIS indicates that exposures may potentially pose non-cancer health risks for subsistence fish consumers (page 4-118). Combined mercury exposure figures - existing mercury exposure levels added to potential incremental increases due to the MSI project - appear to indicate that subsistence fish consumers may have a higher potential for non-carcinogenic health risks due to mercury (see Table 4.7.22). We also recommend that the FEIS consider presenting a similar exposure analysis for other pollutants with non-cancer effects to fully describe the project's potential impacts.

Tribal uses and impacts

While the DEIS identifies impacts to nearby resources (including those in tribal ceded territories), it does not identify all relevant tribal uses or assess potential impacts to those uses. In particular, the DEIS does not investigate wetland resources potentially used by the Tribes. Possible uses include harvesting wild rice, medicinal wetland plants, and plants used for basket-making (e.g. reeds, willow, birch), as well as hunting and trapping wildlife such as fishers and beaver. There may be other cultural uses in the area, such as sweat lodge ceremonies, which could be affected particularly by noise from the mining activities. Project-related or cumulative wetlands loss, water quality changes, air quality

changes, or noise could potentially affect resources and uses that are important to the tribes. We recommend the Final EIS better define tribal uses in the project-affected area and explain potential impact to these uses. We suggest coordinating with tribal governments on these issues.

Air emissions

The DEIS uses sulfur dioxide (SO₂) and nitrogen oxides (NO_x) background concentrations from a 1999 permit application (for an unrelated facility) for modeling this project's impact. The FEIS should explain why more recent data wasn't used and how the impacts evaluation accounted for changes in emissions from any additional emission sources since 1999.

The discussion of boilers under Industrial, Commercial and Institutional Boiler Maximum Available Control Technology (MACT) does not identify a control for the vacuum degasser boiler (pg. 4-85). The National Emission Standards for Hazardous Air Pollutants (NESHAP) requires boilers to install a continuous emissions monitoring system (CEMS) to track carbon monoxide (CO) emissions. The DEIS should clarify whether a CEMS is needed or whether the boiler is exempt. Since the Minnesota Pollution Control Agency (MPCA) does not have delegated authority for the Boiler MACT, EPA would need to make any case-by-case determination of its applicability. EPA will work with MPCA if a case-by-case determination is necessary.

Although the DEIS states that the furnace will use 100% direct reduced iron (DRI), it identifies that in-house scrap will likely be added to the furnaces. We recommend the DEIS clearly state whether furnaces will use in-house scrap in addition to DRI and clarify whether the addition of in-house scrap will change emissions.

We recommend the FEIS cumulative impacts assessment describe, at least generally, the fate of the mercury that is not deposited locally, since the DEIS notes that about 93% of project mercury emissions are expected to be elemental mercury, which typically does not deposit locally near the source (see page 4-99).

EPA advises using clean diesel technology and fuels for construction and operational vehicles and equipment at this facility. We recommend any clean diesel commitments be included in the FEIS and the Record of Decision (ROD).

Risk assessment

The DEIS provides a summary of the results of the Human Health Screening-Level Risk Assessment (HHSRA) (May 2006). We reviewed the HHSRA and are providing comments insofar as it affects conclusions in the DEIS.

Certain compounds were eliminated from consideration in the risk assessment due to lack of emission rate data or due to lack of an approved toxicity value (pgs. 35-36; also mentioned in the DEIS, page 4-103); we can provide the relevant values. In particular, the dose/response non-cancer toxicity values for acenaphthylene can be found on the Integrated Risk Information System (IRIS). Toxicity values for ferrochromium and ferromanganese are listed under Chromium Compounds and Manganese Compounds.

We recommend the FEIS identify whether the pellet plant may emit manganese. If manganese emissions are likely, we recommend that the HHSRA and the DEIS discuss the possible effect of manganese and consider it as a chemical of potential interest (COPI) in the section discussing metal bioavailability and bioaccessibility in the risk assessment.

We recommend adding the following information into the risk assessment and FEIS: a discussion of how lead impacts were modeled (in the HHSRA section), soil ingestion rates, model default numbers, and age-dependent categories. In addition, we recommend defining background lead levels in the risk assessment.

Solid and hazardous waste

Since the project may include an on-site construction debris landfill, the FEIS should include information on possible impacts from the facility, as well as regulatory requirements for the facility, such as monitoring.

We recommend including information in the FEIS on whether these waste streams described on page 40-71 to 72 (Table 4.6-2: Description of Solids, Sludges, and Hazardous Wastes) are exempt under the Resource Conservations and Recovery Act. Though, the DEIS assumes wastes associated with steel mill, kiln and DRI refractory operations and slag will be non-hazardous based on results from other mine projects, we suggest that the FEIS and the ROD include a commitment to test wastes in this facility once it is operational to confirm whether these waste streams are non-hazardous.

We request that the FEIS describe the post-closure care of solid waste management facilities.

Cumulative impacts

Regarding foreseeable projects:

- Table 5.3.1: List of Proposed Projects (page 5-19) should include the Mittal Steel and US Steel/Minntac projects, as well as any current facilities in the area.
- Future Reasonably Foreseeable Conditions (page 5-33) should include and consider all of the projects listed in Tables 5.3.1 and 5.4.1.

We note that data in Table 5.4.1: Maximum Potential emissions Page (5-25) is blacked out. We recommend the blacked out data be added in the FEIS.

Note: Page EX-8 refers to a permit by MPCA and EPA. The reference to EPA should be deleted, since MPCA has authority for implementing the Clean Air Act in Minnesota.

SUMMARY OF RATING DEFINITIONS AND FOLLOW UP ACTION*

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impacts. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1-Adequate

The EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collecting is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for the EPA to fully assess the environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of the Federal Actions Impacting the Environment

Standard bcc's: Originator's File Copy
 Official File Copy
 OSEC Reading File Copy
 NEPA Reading File Copy

Other bcc's:

Author: Anna C. Miller
Filename: C:\EPAWork\NEPA work\Mining\MSI connected actions\Rail Extension Itasca
County.doc

CONCURRENCES

<i>Org/Unit:</i>	Author	Plain Lang.	Team Leader	Admin/ Clr.	DD/ OD	ORA (St. Coord)	ORA
<i>Initial/Date:</i>	<i>AMW</i> <i>5/16/07</i>	<i>AMW</i> <i>5/16/07</i>	<i>AMW</i> <i>5/16/07</i>				
<i>Other Concurrences:</i>							

Exhibit 3



FEMA

June 5, 2007

Burns & McDonnell Engineering Company
Attn: Stephen Thornhill
P.O. Box 419173
9400 Ward Parkway
Kansas City, Missouri 64141

RE: Construction of railroad line to the new Minnesota Steel Industries plant to be located in Nashwauk in Itasca County, MN

Dear Mr. Thornhill:

Thank you for sending us a request to review the above referenced project. It appears some of the rail line construction will take place in federally identified Special Flood Hazard Areas (SFHAs) depicted on the Itasca County Flood Insurance Rate Map (FIRM), prepared for participation in the National Flood Insurance Program (NFIP).

Itasca County participates in the NFIP. Therefore, the county floodplain administrator will have to issue a floodplain development permit for the development affecting floodplains, in accordance with the county's floodplain management ordinance. Additionally, a State of Minnesota floodplain permit may be required. Please contact the Minnesota Department of Natural Resource Water Area Hydrologist (Erica Herr 218-327-4232) for further information.

Further, Presidential Executive Order 11988, Floodplain Management, directs federal agencies to avoid *any action*, including permitting, funding, or constructing, in SFHAs, unless the cognizant federal official first makes the requisite finding of no practicable alternative. The Order further directs federal agencies to avoid actions, which encourage further development of floodplains. The Order mandates an eight-step public mitigative process if the floodplain can not be avoided.

Thank you for the opportunity to review and comment. If you have any questions, please call Jennifer Scholl at (312) 408-5205.

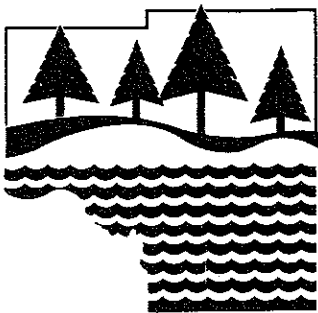
Sincerely,

A handwritten signature in black ink, appearing to read "Terry Reuss Fell", with a stylized flourish at the end.

Terry Reuss Fell, Chief
Hazard Identification & Risk Assessment Branch
Federal Insurance & Mitigation Division

Cc: Region V Environmental Officer
NFIP State Coordinator

Exhibit 4



ITASCA COUNTY HEALTH AND HUMAN SERVICES

ITASCA RESOURCE CENTER

1209 S.E. 2nd Ave., Grand Rapids, Minnesota 55744-3983
Hearing Impaired Number TDD: 218-327-5549
218-327-2941

Visit us at: www.co.itasca.mn.us

May 10, 2007

Burns and McDonnell Engineering Company
Attn: Stephen Thornhill
P. O. Box 419173
9400 Ward Parkway
Kansas City, Missouri 64141

Re: Request for Project-Related Comments
STB Finance Docket No. 34992

Dear Mr. Thornhill:

On behalf of the Itasca County Health and Human Services Department, I would like to take this opportunity to comment on the development of this railroad line, as well as the development of the Minnesota Steel Plant, located in Nashwauk, MN, based on the socio-economic impact for residents of Itasca County. It is of my opinion that the socio-economic impact will be very positive for families with the employment opportunities at the Minnesota Steel industry site. These additional employment opportunities for good paying jobs will assist families and children of Itasca County reach self-sufficiency goals for themselves, thereby, not needing to rely on public assistance that is provided through Itasca County Health and Human Services. We do believe that the development of the railroad line into the MSI site, as well as the development of the MSI site itself will provide many construction jobs and employment opportunities to the residents of Itasca County, as well as future positions, once the MSI site is up and operational.

Because of these additional employment opportunities for families of Itasca County, we believe that it will have a long term positive impact upon the economic development and sustainability for all residents of Itasca County.

If I can be of any further assistance to you, please do not hesitate to contact me at 1-218-327-6152.

Sincerely,



Lester L. Kachinske

Director of Health and Human Services

LLK/plc

c: Health and Human Services Board
ICHHS Division Managers

Exhibit 5



Protecting, maintaining and improving the health of all Minnesotans

April 27, 2007

Mr. Stephen Thornhill
Burns & McDonnell Engineering Company
P.O. Box 419173
Kansas City, Missouri 64141

Dear Mr. Thornhill:

This letter is in response to the request for comments on the rail line being proposed by the Itasca County Regional Rail Authority (Surface Finance Docket No. 34992) near Marble, Minnesota.

The Minnesota Department of Health (MDH) administers the state's Wellhead Protection program. Based on the information that you have provided, it appears that portions of the routes labeled Options 3 and 4 would likely fall within the Wellhead Protection Area (WHPA) and Drinking Water Supply Management Area (DWSMA) for the city of Marble. The WHPA is the surface and subsurface area surrounding a well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field (Minnesota Statutes, Part 103I.005, subdivision 24). The DWSMA is the area delineated using identifiable landmarks that reflect the scientifically-calculated wellhead protection area boundaries as closely as possible (Minnesota Rules 4720.5100, subpart 13). In addition, it appears that a portion of Option 3 would pass near enough to the city of Marble well field so that it would fall within the city's proposed Emergency Response Area. This is a subset of the WHPA through which contaminants are likely to move toward and reach the well or well field within a one-year time period. In addition to the delineation of the ERA, WHPA and DWSMA, Minnesota Rules 4720.5210 and 4720.5550 require an assessment of the vulnerability of the wells and aquifer to contamination. The wells used by the city of Marble are considered highly sensitive to contamination due to a combination of the geologic setting and well construction shortcomings, whereas the Biwabik Iron Formation aquifer used by the Marble city wells is considered to be moderately to highly vulnerable to contamination within the city's DWSMA.

Figures displaying the ERA, WHPA, and DWSMA, and the report in which they appear describing how they were delineated, are enclosed. Please be advised that the report and figures are considered draft at this point. The city of Marble is in the process of reviewing these documents. After completing their review and approval, the city of Marble will formally request approval from the MDH for this portion of their Wellhead Protection plan. Upon approval by the MDH, the report and delineated areas will be considered final. It is expected that final approval will occur within the next three-four months.

Mr. Stephen Thornhill
Page 2
April 27, 2007

Drinking water protection concerns regarding the construction and operation of a railroad within a WHPA include the potential for contaminants leaking or spilling and eventually being captured by the city wells. Of greatest concern would be those portions of Routes 3 and 4 that may be located 1) within the city's ERA or WHPA, and 2) where the aquifer is considered highly vulnerable to contamination (see Figures 1 and 12 of the enclosed report). Contaminant spills or leaks in such areas could enter the aquifer rapidly and be captured by the city wells within a relatively short time period. If either of these rail options is ultimately pursued, it is important that environmental safeguards are in-place within these critical areas, both during the construction and operation of the rail line, to prevent a potential negative impact to the city of Marble public water supply.

Thank you for the opportunity to comment on the proposed development. Please contact me at (651) 201-4654 if you have any questions on this matter.

Sincerely,



James F. Walsh, Hydrogeologist
Division of Environmental Health
P.O. Box 64975
St. Paul, Minnesota 55164-0975

JFW:kmc
Enclosure

cc: Larisa Varishovetsky, MDH Planner, Metro Office
Mike Luhrsen, MDH Engineer, Bemidji District Office
Beth Kluthe, MDH Planner, Bemidji District Office

DRAFT

Wellhead Protection Plan

Part I

**Wellhead Protection Area Delineation
Drinking Water Supply Management Area Delineation
Well and Aquifer Vulnerability Assessment**

For

The City of Marble

April, 2007

James F. Walsh

Minnesota Department of Health

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Glossary of Terms

Capture Zone. The subsurface area surrounding a well or well field that supplies a public water supply system through which water is likely to move toward and reach the well. The capture zone and the surface water contribution area, when needed, comprise the wellhead protection area (WHPA).

Drinking Water Supply Management Area (DWSMA). The area delineated using identifiable land marks, defined in this report, that reflects the scientifically calculated wellhead protection area boundaries as closely as possible (Minnesota Rules 4720.5100, subpart 13).

Source Water Protection Area (SWPA). A source water assessment includes a description of 1) the area to be protected, 2) potential contamination sources that may impact the source of drinking water, and 3) the susceptibility of the public water supply to potential contamination sources. For the purposes of this delineation report, the SWPA and the DWSMA are the same.

Wellhead Protection Area (WHPA). The surface and subsurface area surrounding a well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field (Minnesota Statutes, Part 103I.005, subdivision 24).

Introduction

This report documents the technical information necessary to prepare Part I of a wellhead protection plan that will help ensure an adequate and safe drinking water supply for the city of Marble, public water supply identification number 1310023. It documents the delineation of the wellhead protection area (WHPA), the drinking water supply management area (DWSMA), and the vulnerability assessments for the public water supply wells and DWSMA. An updated source water assessment with a new protection area (SWPA) also is included. Definitions explaining the differences between the terms WHPA, DWSMA, and SWPA are provided in the “Glossary of Terms” at the beginning of this report.

The delineation was performed in accordance with Minnesota Rules 4720.5100-4720.5590 for preparing and implementing wellhead protection plans for public water supply wells. The Minnesota Department of Health (MDH) administers these rules and the results described in this report reflect those of the MDH to 1) identify the capture zones for delineation of the WHPA, and 2) prepare well and DWSMA vulnerability assessments. Also, this report presents the findings of the public water supplier to identify the boundaries of the DWSMA.

The public water supplier operates two wells, termed Well No. 1 (Unique No. 228842) and Well No. 2 (Unique No. 228846). The wells are located in Section 27 of Township 56 North, Range 24 West in Itasca County. Appendix I contains Table 1 that presents some of the key information about these wells that affect their vulnerability assessments.

The WHPA for Wells No. 1 and 2 (228842 and 228846) was determined using a modified volumetric analysis recommended by the MDH for fractured rock aquifers (MDH, 2005). The DWSMA boundaries were determined using U.S. Public Land Survey boundaries, city streets, and roads. Figure 1 shows the boundaries for the WHPA and the DWSMA.

Source Water Assessment

The MDH is required under Section 1453 of the 1996 Amendments to the federal Safe Drinking Water Act to prepare source water assessments for all public water supply systems. Congress intends that assessments should be used to educate public water suppliers and the customers they serve about the source of their drinking water and potential contaminants that may affect people’s health. The following Source Water Assessment for the public water supplier contains the information specified in Minnesota’s source water assessment program description.

Source Water Assessment for The City of Marble

Public Water Supplier ID Number: 1310023

Water Supplier Contact: Mladen Simunovich
Marble Water Superintendent
218-247-7576
P.O. Box 38
Marble, MN 55764

MDH Contact: Beth Kluthe
Minnesota Department of Health
218-308-2115
705 Fifth Street, Suite A
Bemidji, MN 56601
beth.kluthe@health.state.mn.us

Status of the Source Water Protection Plan

The Minnesota Department of Health has approved the 1) delineation of the wellhead protection area, 2) delineation of the drinking water supply management area, and 3) assessments of well and aquifer vulnerability. The public water supplier is proceeding with the development of the remainder of the wellhead protection plan.

Source Water Protection Area - See Figure 1.

Description of the Source Water -The water supply for the city of Marble comes from the Biwabik Iron Formation, a bedrock aquifer that exhibits unconfined hydraulic conditions at the city wells. The aquifer is about 550 feet thick and is covered by approximately 10 feet of overlying bedrock of the Virginia Formation and approximately 130 feet of glacial sediments at the city well field. Generally, groundwater moves in a northeasterly direction in the wellhead protection area, although the flow directions are likely variable and influenced by the water levels within the Arcturus and Hill-Annex Mine Pit lakes.

Table 2
Wells Used by the Public Water Supplier

Well No.	Unique No.	Well Use	Aquifer Type	Well Depth (ft)	Well Sensitivity	Aquifer Sensitivity
1	228842	Primary	Biwabik Iron Formation	500	High	Moderate
2	228846	Primary	Biwabik Iron Formation	503	High	Moderate

Source Water Assessment
City of Marble
Page 2

Aquifer Sensitivity - The sensitivity of the aquifer used by the public water supplier ranges from moderate to high throughout the drinking water supply management area. This rating reflects that the aquifer is generally covered by low permeability bedrock and/or glacial deposits, but young water is present in the aquifer. Tritium samples taken from Wells 1 and 2 (228842 and 228846) on February 10 and June 3, 2004, showed 9.6 tritium units and 9.1 tritium units, indicating that most of the water pumped by the wells entered the ground within the last 50 years.

Well Construction Assessment - Existing construction information for the Marble city wells suggests that grout was not drawn into the annular space of the outer well casings as they were driven, as is currently required by the State Well Code. In addition, the inner well casing for Well 1 (228842) is telescoped – in other words, it does not extend above the ground surface as required by code. Finally, it is unclear whether the annular space between the outer and inner well casings is grouted. These factors could provide pathways for near-surface contamination to enter the source water. As a result, the sensitivity of the wells to contamination is considered to be high.

Susceptibility of the Source Water to Contamination - The source water used by the public water supplier is considered susceptible to potential sources of contamination principally because of the geologic setting, although the construction of the city wells may also provide an avenue for contamination. The land uses within the drinking water supply management area may potentially contribute contaminants that may present a health concern to the users of the public water supply.

Contaminants of Concern - Routine testing of water from the Marble city wells has shown that they have generally been free from contaminants and meet all potability standards of the Safe Drinking Water Act. However, the wells are considered susceptible to contamination from a variety of sources. These include contaminants that may persist in groundwater for long periods of time which are resistant to retardation or removal by movement through fine-grained sediment.

Delineation of the Wellhead Protection Area

Physical Setting

The city of Marble is located in Itasca County near the western end of the Mesabi Iron Range. The town is surrounded by features associated with a nearly 100-year old history of iron mining, which ceased in this area in the early 1980s (David Lotti, personal communication). These features include tailings ponds, waste rock stockpiles, and abandoned mine pits that have filled with water. The nearest mine pit lakes are the Arcturus, Gross-Marble, Hill-Trumbull and Hill-Annex (Figure 2). Each of these was an individual, natural ore mine pit, but the Gross-Marble, Hill-Trumbull and Hill-Annex have become a single water body due to high water levels. They are separated from the Arcturus by a narrow land bridge that is currently overflowing. The pit lakes are variable in depth, with the Arcturus ranging up to approximately 100 feet and the Gross-Marble and Hill-Annex up to 200-250 feet at current water levels (Excelsior Energy, 2006).

Assessment of Data Elements

This section documents how the data elements specified under Minnesota Rules 4720.5400 were used to describe the physical environment.

Soils: The aquifer used by the city of Marble is buried beneath younger bedrock and glacial deposits, except where exposed at the margins of the nearby mine pits. As a result, soil maps are not useful for delineating its boundaries. However, the Itasca County soils survey (Nyberg, 1987) was useful for assessing the vulnerability of the aquifer.

Precipitation: The method used to delineate the WHPA does not account for aquifer recharge. As a result, precipitation was not considered.

Geology: Figures 2, 3 and 4 show the distribution of the aquifer and its stratigraphic relationships with adjacent geologic materials. They were prepared using existing geologic maps (Jennings and Reynolds, 2005; Jirsa and others, 2005) and well record data that is contained in the County Well Index database. A complete listing of the geological maps and studies that were used to further define local hydrogeologic conditions is provided in the section of this report entitled "Selected References."

The natural landscape of the Marble area was strongly affected by late-Pleistocene glaciation. Although the town of Marble is situated on relatively flat ground, the surrounding area consists of an irregular topography of small hills and depressions (Figure 2). This distribution of landforms is attributed to rapidly shifting depositional environments commonly found near the margins of glacial ice, probably of the Koochiching lobe (Jennings and Reynolds, 2005). Dominant glacial landforms in the Marble area include lake chains that have been attributed to subglacial drainage features known as tunnel valleys (Jennings and Reynolds, 2005). These include the 1) Dunning-Big Diamond-Twin Lakes, and 2) Mud-Upper Panaca-Lower Panaca lake chains. The lake basins within these channels likely formed from late melting of remnant ice blocks. The irregular hills adjacent to these lakes are composed dominantly of coarse-grained sediment, indicative of ice contact deposits (Jennings and Reynolds, 2005).

Although surficial materials in the Marble area are dominated by sediments of the Koochiching lobe, interpretations are complicated by apparent admixture with sediments of the Rainy lobe, probably owing to collapse of both units related to late melting of buried ice (Jennings and Reynolds, 2005). The total thickness of glacial sediments in the Marble area is on the order of 130 feet. Generally, glacial drift thickens to the south and thins to the north, approaching zero along the crest of the Giants Range. The Giants Range is a linear ridge, composed of Archean granitic and metasedimentary rocks, that trends northeast to southwest and is located north of the mine pits (Jones, 2002).

Winter (1971) identified three major morainal till units and associated glaciofluvial outwash deposits in this general area, only two of which appear to occur in Marble. These are the upper surficial and middle boulder till units (Jones, 2002). The surficial till is brown in color; sandy, silty, and calcareous; and is generally less than 30 feet thick in this area (Jones, 2002). The boulder till ranges widely in color from gray to yellow, and consists of sands and silts, with abundant cobbles and boulders, and is generally less than 50 feet thick (Winter, 1971). Glaciofluvial outwash deposits lie stratigraphically between the surficial and boulder tills, and often lie between the boulder till and deeper tills or bedrock (Winter, 1973a). Those that occur between the surficial and boulder tills are the thickest and most continuous outwash deposits in the Marble area, often greater than 50 feet thick and sometimes greater than 100 feet in portions of buried valleys (Winter, 1973a). These outwash deposits consist of fine-grained sands throughout much of the study area, but are highly transmissive, coarse-grained sands, gravels and boulders within buried valleys, and at other locations where the bedrock surface is low (Jones, 2002).

The bedrock geology of the Marble area is shown in Figure 3. The uppermost bedrock beneath the city of Marble consists of the Coleraine Formation, a Cretaceous package of conglomerate, hematite-cemented sandstone and blue-green shale (Jirsa and others, 2005). The thickness and distribution of this unit is poorly known. Morey (1999) indicates that it may be up to 100 feet thick in some areas of the western Mesabi Iron Range. However, the geologic records for the Marble city wells do not indicate the presence of the Coleraine Formation at those locations. The Coleraine Formation is generally not considered to be an aquifer.

The Coleraine Formation lies unconformably on Paleoproterozoic rocks of the Animikie Group, which includes the Virginia Formation, the Biwabik Iron Formation, and the Pokegama Formation. These rocks, in turn, rest unconformably on Archean granitic rocks of the Giants Range Batholith. Rocks of the Animikie Group dip southward around 9-13 degrees and have been diagenetically altered, but not significantly metamorphosed (Jirsa and others, 2005).

The Virginia Formation consists of interbedded carbonaceous shale, mudstone, siltstone, and fine-grained feldspathic greywacke (Jirsa and others, 2005). A cherty siderite layer occurs within the Virginia Formation in this area, which makes it difficult to distinguish from the underlying Biwabik Iron Formation. The Virginia Formation is less than 10 feet thick at the city wells, and thins out to the north so that the uppermost bedrock present within the nearby mine pits is the Biwabik Iron Formation (Jirsa and others, 2005). The Virginia Formation is generally not considered a productive layer.

The Biwabik Iron Formation is the dominant bedrock aquifer along the Mesabi Iron Range because of the combination of fracturing and solution-weathering that have occurred locally in its subcrop area. These same factors have accounted for the development of so-called “natural ores,” portions of the iron formation where magnetite has been oxidized to hematite, thereby enriching the iron content. Natural ore mines dominated production on the Mesabi Range through the 1950s, after which most natural ore inventories were depleted and mining activity focused on the relatively unaltered iron formation or “taconite.” Several natural ore mines existed in the Marble area and were active until the late 1970s or early 1980s. After mining and dewatering ceased, these became the current Arcturus, Gross-Marble, Hill-Trumbull and Hill-Annex pit lakes.

The complete thickness of the Biwabik Iron Formation in the Marble area is probably on the order of 550 feet, although it thins out completely north of the mine pits. It has been subdivided into four members, based largely on mineral content and texture (Figure 4). The Upper and Lower Cherty members consist largely of thick-bedded, granular chert, iron silicates, magnetite and hematite; whereas the Upper and Lower Slaty members are predominantly thin-bedded iron silicates and carbonates, plus magnetite and hematite (Jirsa and others, 2005). A distinct carbonaceous marker horizon, known as the Intermediate Slate or “paint rock,” separates the Lower Slaty and Lower Cherty members. The cherty members of the formation are probably the most hydraulically conductive because of their coarser texture. The city wells are probably open to all four members of the Biwabik Iron Formation (Cotter and others, 1965).

Down-hole chemical logging of Marble Well No. 1 (228842) was conducted on November 17, 2004, using a Hydrolab Minisonde 4a. This tool measures the temperature, specific conductance, pH, dissolved oxygen and oxidation-reduction potential (ORP) of the water column in a well. Changes in these parameters are often related to the presence of preferred flow horizons. The purpose of the logging was to identify specific horizons or fracture zones within the Biwabik Iron Formation that are responsible for controlling groundwater flow to the city wells. This information is useful for fine-tuning the delineation of the city’s wellhead protection area, as well as assessing the vulnerability of the aquifer.

The results of the chemical logging suggest that the dominant productive horizons within the Biwabik Iron Formation at this location are 1) the Upper Cherty Member, and 2) portions of the Lower Cherty Member. The Upper Cherty flow zone extends from approximately 200-275 feet below the top of the well casing and is characterized by a large, positive deflection in specific conductance and dissolved oxygen (Figure 5), with a minor increase in temperature. Increases in these parameters may reflect the influx of relatively shallow, short-residence time water that has been impacted by road de-icing salt.

Two separate flow zones were identified in the Lower Cherty Member. The uppermost of these two zones extends from approximately 360-440 feet below the top of the well casing. Within this zone, the upper 40 feet are characterized by small, negative deflections in specific conductance and dissolved oxygen (Figure 5), with a minor decrease in temperature. The bottom 40 feet of this zone are characterized by large, negative deflections in specific conductance and dissolved oxygen, accompanied by a small decrease in temperature. The lowermost flow zone identified in the Lower Cherty Member was observed from approximately 470-480 feet, which

was the maximum depth that the probe could be deployed. This zone is characterized by moderate, negative deflections in specific conductance and dissolved oxygen, and a moderate increase in temperature. The negative deflections in specific conductance and dissolved oxygen in the Lower Cherty horizons are presumed to reflect the influx of relatively deep-seated and longer residence-time water into the borehole.

In summary, the well profiling results suggest that the majority of the groundwater flow to the Marble city wells comes from a series of productive zones in the cherty members of the Biwabik Iron Formation. The cumulative thickness of these zones is on the order of 165-185 feet, which compares with a total aquifer thickness of approximately 550 feet. Of the productive zones, those within the Lower Cherty member below a depth of approximately 400 feet are likely dominant. This was determined by comparing the specific conductance values determined for the water column with that of a pumped sample collected from Well No. 1 (228842) shortly after the logging session. The specific conductance value for the pumped sample was 432 $\mu\text{mhos/cm}$, which is similar to the average value determined below 400 feet and much lower than that determined for intervals higher in the water column. By comparing the average specific conductance values for these zones, a simple mass balance calculation can be used to estimate their relative importance. Based on this calculation, the productive horizons below 400 feet may account for up to 83% of the flow in Well No. 1 (228842). These interpretations should be viewed with some caution because it was not possible to conduct physical measurements of flow within the borehole coincident with the chemical logging. Flow measurements are considered to be more definitive than other physical or chemical logging methods and should be taken in the future if the opportunity presents itself.

The Biwabik Iron Formation is thought to have little primary porosity, and groundwater flow through this unit is thought to be controlled by faults, joints (both high-angle and bedding-plane), zones of solution-weathering and man-made mining structures such as drifts and shafts. Natural ore bodies were likely formed by interaction between the iron formation and groundwater (meteoric or hydrothermal). As a result, it is useful to analyze the nature of these ore bodies for possible insights into current groundwater flow patterns. Natural ore bodies in the Marble area tend to be flat-lying features that follow specific stratigraphic horizons and are separated by layers of relatively unaltered slaty strata (Morey, 1999). These are often characterized by broad halos of oxidized iron formation (Bleifuss, 1964). Many such ore bodies have fissure or trough-like roots that follow fault or fold axes (Morey, 1999). In the Marble area, major faults trend northeasterly, with strikes ranging from approximately 40 to 65 degrees (Jirsa and others, 2005). Faults are of the normal variety, dip steeply and displacements are poorly known but probably minor. Jirsa and others (2005) identified three dominant jointing orientations in the Lower Cherty Member of the Biwabik Iron Formation from mapping conducted north of the Hill-Annex Mine Pit complex:

- A set that is oriented approximately 20 degrees east of north;
- A set that is oriented approximately 65 degrees east of north; and
- A set that is oriented approximately 40 degrees west of north.

All mapped joints plunge deeply, with dips ranging from 81 to 90 degrees. Some are mineralized with iron oxides.

To summarize, it is likely that groundwater flow through the Biwabik Iron Formation in the Marble area is controlled by features such as 1) bedding plane contacts, which generally dip from 9 to 13 degrees in a southeasterly direction, and 2) high-angle faults and joints that strike approximately 20-65 degrees or 320 degrees. Man-made mining structures such as shafts, drifts and adits may also affect groundwater flow, however it is not known if such features are present in the Marble area.

The Pokegama Formation conformably underlies the Biwabik Iron Formation. It consists of quartzite, quartz-rich siltstone, shale, and localized basal conglomerate. This unit is probably around 80 feet thick in the Marble area, based on the geologic mapping of Jirsa and others (2005). It is generally not considered an aquifer.

Groundwater Quantity and Quality: The Minnesota Department of Natural Resources permits high-capacity wells and documents their pumping volumes in the State Water Use Database (SWUDs). It is important to identify other high-capacity wells in the vicinity of the Marble wells because they may affect the boundary of the capture zone in the WHPA. The only high-capacity wells identified within two miles of the Marble city wells are the municipal wells for Calumet. The Calumet municipal wells are completed in the Virginia Formation and Biwabik Iron Formation. As a result, these wells may constitute a flow boundary to the Marble wells and must be considered as a factor in the WHPA delineation.

Water quality information on the Marble city wells was obtained from MDH records, as well as published data (Cotter and others, 1965). The parameters evaluated were chloride and sulfate, which can be useful indicators of general water quality. Elevated chloride is likely related to road de-icing salt, although fertilizer and wastewater are other possible sources. Elevated sulfate is generally related to naturally-occurring minerals, although wastewater is a possible source. Common mineral sources include gypsum, a soluble calcium sulfate mineral that occurs in minor amounts in some rocks, or the oxidation of sulfide-bearing minerals such as pyrite. Gypsum is not known to occur in the Biwabik Iron Formation or associated Precambrian rocks of the Marble area, although it could be present in minor amounts in glacial drift or Cretaceous sediments. Pyrite is known to occur locally within both the Biwabik Iron Formation and the Virginia Formation and may be present in the Coleraine Formation, which tends to have a greater sulfur content than the Animikie Group rocks (Morey, 1999). It is possible that some of the waste rock stockpiles in the Marble area contain pyrite or other sulfide minerals, and result in localized occurrences of sulfate-rich groundwater.

The historic data from the Marble city wells show that the chloride content of the water has remained relatively constant over time in the range of 2-13 mg/l, with the exception of a single sample from Well No. 2 (228846) taken on October 14, 2004, that yielded 38 mg/l (Figure 6). It is unclear what caused that particular sample to be elevated in chloride. Additional future monitoring should be conducted to establish whether that result was an anomaly or the beginning of a trend. The sulfate data show a similar pattern (Figure 7). Sulfate values have generally fallen in the range of 15-40 mg/l, with the exception of two samples from Well No. 2 (228846) taken on November 27, 1970, and August 23, 1976, that showed values of 140 mg/l and 230 mg/l, respectively. Again, it is unclear what caused these elevated values. Perhaps it can be attributed to changing groundwater flow patterns in the area related to fluctuating water levels at the nearby mine pits. When the Hill-Annex Mine Pit complex was completely dewatered prior

to its closure around 1980, the water level would have been approximately 200 feet lower than currently observed (Figure 8). This would have created a hydraulic gradient much steeper than currently exists in the area. As a result, vertical leakage to the aquifer was likely enhanced and the capture area for the city wells likely extended much further to the south than is currently indicated.

Data on the chloride, sulfate, and oxygen and hydrogen stable isotope content of the Arcturus and Hill-Annex Mine pit lake water was obtained from samples collected at several locations in the summer and fall of 2004. These results were compared with data obtained from the Marble city wells to estimate whether water from the mine pit lakes was being captured by the city wells. The chloride data show that similar values are seen at both the city wells and the pit lake (Figure 6), except for the elevated sample from Well No. 2 (228846). The sulfate data show that water from the pit lakes was somewhat elevated relative to that from the city wells (Figure 7). The stable isotope data show that little, if any, pit lake water was being captured by the city wells as of the latest sampling episode, which was October 14, 2004 (Figure 9). The samples from the Arcturus and Hill-Annex Mine pit lakes showed values that were consistently far removed from the meteoric water line, suggesting that these lakes have undergone a high degree of evaporation. However, each of the well samples plot within the limits of analytical uncertainty of the global meteoric water line. This indicates that these samples consisted primarily of groundwater that has not been exposed to evaporation at the land surface. In light of the stable isotope data, the similarities noted between the chloride and sulfate values for the city wells and the Canisteo Mine pit lake probably reflect that the recharge areas for both have comparable water quality.

In addition to the chemical and isotopic data noted above, the Marble city wells have been sampled for tritium to determine the residence time or “age” of the water. Well No. 1 (228842) was sampled on February 10, 2004, with results of 9.6 tritium units (TU). Well No. 2 (228846) was sampled on June 3, 2004, and that result showed 9.1 TU. These results show that the Biwabik Iron Formation aquifer at this location is dominated by relatively young water that entered the ground since 1954. A water sample was also obtained from the Arcturus Mine pit lake on June 3, 2004, and analyzed for tritium. That result showed 13.3 TU and is probably reflective of the tritium concentration of recent recharge in the Marble area combined with that of inflowing groundwater.

Hydrogeological Setting

In the geographic area that includes the WHPA, the aquifer from which the city wells pump has the following characteristics:

- It is composed of chert and iron minerals and is approximately 550 feet thick;
- It exhibits a porosity that is estimated to be in the range of 1-10%;
- It exhibits a base elevation of approximately 700 feet above sea level at the city wells and rises to the north at approximately 9 to 13 degrees;
- It exhibits a stratigraphic top elevation of approximately 1,250 feet above sea level at the city wells and rises to the north at approximately 9 to 13 degrees;
- It is bounded stratigraphically by relatively impermeable bedrock units in addition to a significant thickness of till.

The aquifer exhibited unconfined hydraulic conditions at the city wells when last measured in 2004. This was determined by comparing the static water level measurements from Well No. 1 (228842) with the stratigraphic top of the Biwabik Iron Formation aquifer (Figure 4). The static water level occurred in the iron formation. However, the aquifer is probably confined a short distance to the south of the city well field (Figures 4 and 10).

The Minnesota Department of Natural Resources (DNR) has developed a procedure for determining geologic sensitivity at well sites (DNR, 1991). The Marble city wells exhibit a geologic sensitivity rating of moderate using the DNR criteria.

The groundwater flow field for the Biwabik Iron Formation is not known with certainty because of the lack of wells with water level data in this area. In addition, the potentiometric surface has probably been strongly altered by mine dewatering. Nothing is known of pre-mining groundwater conditions, but it is certain that mining activities have significantly altered groundwater flow patterns in the area. It is likely that, under pre-mining groundwater conditions, the direction of groundwater flow in both the glacial deposits and the Biwabik Iron Formation was generally to the south or southeast, down-dip from the Giants Range.

Current data suggest that the Hill-Annex Mine Pit complex represents the low point on the local potentiometric surface, and that the dominant groundwater flow direction is northeasterly in the Marble area (Figure 10). This is based on a comparison between 1) static water level measurements for Well No. 1 (228242) taken on November 17, 2004, and 2) current water levels in the Arcturus and Hill-Annex Mine Pit lakes (Excelsior Energy, 2006). Groundwater movement upgradient of the Marble city wells is presumed to be in a northeasterly direction (approximately 22 degrees). The horizontal hydraulic gradient is unknown upgradient of the city wells because no data points exist. However, if it is similar to that observed between the city wells and the Hill-Annex Mine Pit lakes, then it is approximately 0.008. Current data on vertical hydraulic gradients is not available. However, historical data suggest that an upward gradient existed within the Biwabik Iron Formation when Well No. 1 (228842) was reconstructed in 1964. The static water level rose 11 feet after the well was deepened from 385 feet to 500 feet.

Criteria Used to Delineate the Wellhead Protection Area

The criteria for delineating the WHPA, as required in Minnesota Rules 4720.5510, were addressed as follows.

Time of Travel - A time of travel criterion is difficult to apply to an aquifer such as the Biwabik Iron Formation, where flow occurs through well-developed secondary porosity features. As a result, the WHPA is based on a cylinder calculated using a 10-year pumping volume to account for the ambiguity of flow directions caused by secondary porosity. Also, an emergency response area was defined, as specified under Minnesota Rules 4720.5250, using the one-year pumping volume.

Daily Volume of Water Pumped – Information provided by the city of Marble was used to determine the maximum discharge from their wells. The results are presented in the following table. The daily volume of discharge used as an input parameter in the model was calculated by dividing the greatest annual pumping volume by 365 days.

Table 3
Annual Volume of Water Discharged From Marble Water Supply Wells

Well No.	Unique No.	2001	2002	2003	2004	2005	Future Pumping
1	228842	38,592,000	32,861,000	26,844,500	12,800,000	11,400,000	No Increase Expected
2	228846	-----	-----	3,173,500	12,800,000	11,400,000	No Increase Expected

(Expressed as gallons. Bolding indicates greatest annual pumping volume.)

The values shown in Table 3 are the total number of gallons pumped annually by the Marble city wells and reported to the Minnesota Department of Natural Resources under Groundwater Appropriations Permit No. 752176. The city of Marble indicates that it intends to pump approximately the same amounts of water during the next five years. As a result, the maximum amount of annual pumping, shown in bold above, was used to express the daily volume of water pumped from the city wells.

The maximum annual volume pumped by Marble Well Nos. 1 and 2 (228842 and 228846) over the 2001-2005 time period was incorporated as a daily volume in the calculations used to designate the capture zone for the wells. For delineation purposes, the pumping rate shown in Table 4 was applied only to Well No. 1 (228842). This allowed for simplification of the fixed radius calculation because the complicating effects of interfering wells could be avoided. This delineation method is appropriate because 1) the wells are closely spaced (approximately 125 feet apart), and 2) Well No. 1 (228842) has been used predominantly in the past. The rate selected is consistent with WHP rule requirements because the maximum volume is used.

Table 4
Pumping Rate Used for WHPA Delineation

Well Number	Equivalent Annual Volume (gallons)	Input Value (cubic meters/day)
1	38,592,000	400.2

Groundwater Flow Field - The groundwater flow field was determined by compiling static water level elevations from 1) wells that are completed in the aquifer used by the city of Marble, and 2) fully-penetrating surface water features such as the Arcturus and Hill-Annex Mine Pit lakes (Figure 10). The ambient flow field in the aquifer upgradient of the city wells is oriented in a northeasterly direction (approximately 22 degrees) with a horizontal gradient of approximately 0.008.

Aquifer Transmissivity - Because of the fractured nature of the Biwabik Iron Formation aquifer, transmissivity was not used to delineate the WHPA, consistent with "Guidance for Delineating Wellhead Protection Areas in Fractured and Solution-Weathered Bedrock in Minnesota" (MDH, 2005).

Flow Boundaries - The following conditions define the extent to which flow boundaries must be considered:

- Geologic boundaries that must be considered include 1) the stratigraphic top and bottom of the Biwabik Iron Formation, and 2) the orientation of dominant geologic structures such as faults and joints.
- Hydrologic boundaries that must be considered include surface water features that at least partially penetrate the aquifer, including the Arcturus and Hill-Annex Mine Pit lakes. In addition, other high-capacity wells that pump from the Biwabik Iron Formation also need to be accounted for in the delineation. The only such wells identified within two miles of the Marble city wells belong to the city of Calumet. Those wells have been accounted for in the Marble WHPA delineation, as described below.

Method Used to Delineate the Wellhead Protection Area - In aquifers influenced by flow through secondary porosity, groundwater may move a much greater distance to supply a pumping well than in porous media aquifers. In addition, flow directions are considerably more variable in aquifer settings influenced by fractures or conduit flow. Therefore, numerical and analytical methods that traditionally are used to designate capture zones for wells completed in porous media aquifers may not apply to fractured and solution-weathered bedrock aquifers. To account for this, MDH has developed the document entitled, "Guidance for Delineating Wellhead Protection Areas in Fractured and Solution-Weathered Bedrock in Minnesota" (MDH, 2005).

According to the guidance, a fracture flow analysis is required when the aquifer exhibits flow through secondary porosity features, as is presumed for the Biwabik Iron Formation. Of the various delineation methods specified in the guidance document, Delineation Technique 2 is most appropriate. This technique is specific to fractured or solution-weathered aquifers that 1) are hydraulically unconfined, or 2) have a horizontal hydraulic gradient of greater than 0.001, and 3) possess a well discharge to discharge vector ratio of less than 3,000 (MDH, 2005).

The formula and values used for calculating the ratio of the well discharge to the discharge vector are presented below:

$$Q/Q_s = \frac{(Q \text{ in } gpm) \left(\frac{1 \text{ ft}^3}{7.48 \text{ gal}} \right) \left(\frac{1440 \text{ min}}{1 \text{ day}} \right) \left(\frac{0.0283 \text{ m}^3}{1 \text{ ft}^3} \right)}{(\text{thickness in ft})(0.3048 \text{ m / ft})(\text{hydraulic conductivity in m / d})(\text{hydraulic gradient})}$$

Q = Well Discharge (L^3/T)

Q_s = Discharge Vector (L^2/T) = $(H)(K)i$

Where: H = aquifer thickness (L)

K = hydraulic conductivity (L/T)

i = hydraulic gradient

For the Marble city wells, 1) the well discharge was determined from the annual water use figures; 2) the aquifer thickness was determined to be 185 feet, which represents the maximum cumulative thickness of likely hydraulically conductive horizons based on down-hole logging; 3) the hydraulic conductivity was estimated to be 5 ft/day, based on specific capacity data for the city wells using the method described in Appendix III; and 4) the hydraulic gradient was estimated to be 0.008. The resulting well discharge to discharge vector ratio is 582.

Delineation Technique 2 uses a calculated fixed radius to represent the volume of aquifer material needed to supply water to the city wells over a 10-year time period. The calculated fixed radius was then modified to account for 1) upgradient groundwater flow, 2) ambiguity of the groundwater flow direction, and 3) the effects of the orientations of secondary porosity features, such as fractures and faults. Details of this approach are presented below.

The calculated fixed radius (CFR) is a simple volumetric calculation for a cylinder that would supply the discharge amount for the well, based on 1) the highest pumping rate in the last five years, 2) the cumulative thickness of the productive aquifer horizons open to the well, and 3) the effective porosity of the aquifer.

$$R = \sqrt{\frac{Q}{nL\pi}}$$

Where: R = radius of the capture area

Q = well discharge = (well pumping rate)(pumping time period)

n = effective porosity

L = cumulative thickness of productive aquifer horizons

π = 3.14159

The CFR calculation for the city of Marble was based on the following:

- 10 years of pumping.
- Q = 385,920,000 gallons, which is the annual pumping rate multiplied by the number of years of pumping. Table 4 lists the maximum annual pumping rate for the city wells. This value represents the combined pumping of both city wells and was applied to Well No. 1 (228842) to represent the cumulative discharge from both city wells. This approach is considered appropriate given that the wells are located within approximately 125 feet of each other.
- n = 0.10. This value represents the upper end of the estimated range shown in the MDH guidance document (2005) for dolomite and limestone. No specific category exists for iron formation, and limestone is considered to be a reasonable equivalent given that both are marine chemical sediments. The high-end value was used because it is being applied to only the hydraulically conductive portions of the aquifer, as determined from borehole logging described earlier in this report.
- L = 185 feet. This is the cumulative thickness of productive aquifer horizons identified using borehole logging techniques. Using this value rather than the entire thickness of the Biwabik Iron Formation (approximately 550 feet) results in a more conservative well capture zone.

Using the values noted above, the CFR for the Marble city wells is 941 feet (Figure 11). In order to account for upgradient groundwater flow, the CFR noted above was projected in the dominant upgradient flow direction for an additional 10-year pumping volume. This projection was then adjusted plus and minus 10 degrees from the dominant flow direction to account for uncertainty in the groundwater flow field (Figure 11). Finally, the CFR was projected an additional 10-year pumping volume upgradient along the dominant trend of linear bedrock structural features, such as faults and joint axes (Figure 11). The resulting WHPA for the city of Marble is a composite of these delineation methods.

In order to estimate whether pumping of the Calumet city wells has any impact on the WHPA for Marble, an updated source water protection area (SWPA) was delineated for the Calumet city wells using the method described above. Contrary to the Marble delineation, the entire open-hole interval was used as the aquifer thickness because no borehole logging data exist for the Calumet wells. As a result, the lowest estimated porosity value (0.01) was used in the CFR calculation in order to make it as conservative as possible. The SWPA was based on a 10-year pumping volume using the maximum pumping value for the previous 5 years, and was extrapolated both upgradient and along geologic structure for an additional 10-year pumping volume (Figure 11). The resulting composite area was terminated along the Hill-Annex fault, a major structural feature that separates the relatively unoxidized iron formation east of the fault from the strongly oxidized iron formation to the west. The Calumet SWPA is separated from the Marble WHPA by approximately 2,600 feet at their closest point, suggesting that the wells are not close enough to constitute hydrologic boundaries at their current pumping rates.

Results of Model Calibration and Sensitivity Analysis - The fracture flow delineation procedure cannot be calibrated because it is a simple calculation of an aquifer volume based on well discharge, aquifer thickness, and effective porosity.

Model Sensitivity - Model sensitivity refers to the amount of change in model results caused by the variation of a particular input parameter. Because of the fractured nature of the Biwabik Iron Formation aquifer, a porous-media groundwater flow model was not used to delineate the WHPA. As a result, no model sensitivity analysis was performed. However, an effort was made to assess the sensitivity of the WHPA to the input parameters used in the CFR calculation and extrapolation.

The CFR calculation is sensitive to the pumping rate of the well, in addition to aquifer thickness and porosity. The well pumping rate used in the CFR calculation is prescribed in the state's wellhead protection rule ((Minnesota Rules 4720.5510, subpart 4) and is a conservative value because it is based on the highest recorded value for the wells. The use of any smaller value in the CFR calculation would result in a reduced CFR and WHPA.

Aquifer thickness and porosity are indirectly proportional to the resulting CFR; larger values result in smaller CFRs and vice-versa. The 185-foot aquifer thickness used in the CFR calculation is based on the cumulative thickness of productive aquifer horizons identified using borehole logging techniques. Using this value rather than the entire thickness of the Biwabik Iron Formation (approximately 550 feet) results in a more conservative well capture zone. The porosity of the Biwabik Iron Formation is unknown. A relatively high value of 0.10 was used in the calculation because it is being applied to only the hydraulically conductive portions of the aquifer based on borehole logging. For comparison, a porosity value of 0.05 would yield a CFR of 1,332 feet.

The extrapolation of the CFR is sensitive to the 1) ambient groundwater flow direction, and 2) orientation of dominant geologic structural features. Uncertainty in the groundwater flow field was accounted for by creating a composite of capture zones from angles of flow that are 10 degrees greater and 10 degrees lesser than the representative angle of ambient flow (Minnesota Rule 4720.5510, subpart 5, B(2)). The orientation of dominant geologic structural features was based on the geologic mapping of Jirsa and others (2005). The variation in the strike of dominant structural features was accounted for by utilizing the range of observed values.

Uncertainty Analysis - As noted above, the WHPA for the city of Marble is sensitive to a variety of input parameters. The least well known of these parameters are aquifer thickness, porosity, and groundwater flow field. The following section describes steps that could be taken to provide a greater degree of certainty in the calculated capture zone.

Recommendations for Future Data Collection

1) Enhancing the understanding of local hydrogeologic conditions.

Aquifer Thickness and Porosity -

- The borehole logging conducted on Well No. 1 (228842) yielded important information regarding likely productive horizons within the Biwabik Iron Formation aquifer. However, the aquifer thickness estimates provided by this logging method should be considered preliminary in the absence of physical measurements of flow within the borehole. Borehole flow measurements are considered to be more definitive than other physical or chemical logging methods and should be taken in the future if the opportunity presents itself. The Minnesota Geological Survey possesses such equipment and may consent to its use at the Marble city wells under appropriate conditions. The minimum conditions required for successful deployment of this equipment include 1) the well(s) must be accessible and open (no pumps or related equipment in the well); and 2) adequate notice must be provided so the equipment can be mobilized. If the city of Marble plans to conduct maintenance or repair on either of their wells, that would involve short-term removal of the well pump(s), they should contact the MDH to arrange for this type of borehole investigation. The results should allow for a more accurate determination of the thickness of the water-producing horizons penetrated by the wells. With that information in hand, the CFR and resulting WHPA could be refined using the appropriate aquifer thickness and porosity.

Groundwater Flow Field -

- The city of Marble should work with the MDH so that every 5 years, the locations of new wells that are constructed within one mile of your well field can be verified and accurate elevations obtained. This information may help address uncertainties related to the distribution of hydraulic head in the Biwabik Iron Formation aquifer.

- The city of Marble should continue to measure the static water level at the city wells on an annual basis. This information can be used in conjunction with water level data from the nearby mine pit lakes to verify the local horizontal hydraulic gradient. If the horizontal hydraulic gradient were to change such that it became 0.001 or less, then a different delineation technique may be indicated for the city's WHPA.
- Hydraulic Conductivity - Although this parameter is not used directly in the calculation of the city of Marble's WHPA, it does factor into determining the appropriate delineation technique because of its impact on the well discharge to discharge vector calculation (MDH, 2005). For this delineation, hydraulic conductivity was estimated using specific capacity data from the city wells, based on records provided by the city. This method of estimating specific capacity is less accurate than an aquifer test conducted for determining aquifer transmissivity. It may be beneficial for the city of Marble to conduct an aquifer test in the future so that hydraulic conductivity of the Biwabik Iron Formation aquifer can be more accurately determined. The MDH can assist the city with planning and conducting such a test.

2) Surface water/groundwater exchange.

Chemical and Isotopic Data -

- Existing isotopic data suggest that the Marble city wells were not capturing an identifiable component of pit lake water as of October, 2004. It is possible that this relationship could change through time, either because of increases in water use by the city, or an increase in water level elevation within the nearby mine pit lakes. In order to track whether such changes may be occurring and verify the accuracy of the currently delineated WHPA, the MDH recommends that one of the city wells be sampled for the stable isotopes of water, chloride, and sulfate on an annual basis. The city will be responsible for most of the sampling, but the MDH will pay for the analyses using funding that it has dedicated for this work. There would be no cost to the city for the analyses and MDH staff time. If it became apparent that the city wells were capturing a significant component of pit lake water, then that feature and its surface watershed area would need to be added to the WHPA for the city of Marble.

3) Water use considerations.

Revisions to the WHPA -

- The following water use factors should be monitored to determine if a revision of the WHPA or DWSMA is required: 1) the installation of any new high-capacity wells within 1.5 miles of the city well field, and 2) increased discharge from the city wells over the values used in this report.

Delineation of the Drinking Water Supply Management Area

Method Used to Designate the Drinking Water Supply Management Area - The Drinking Water Supply Management Area (DWSMA) was determined by overlaying the WHPA on a map of area roads, railroads, and public land survey boundaries and using a geographic information system to select the closest such feature. This area was then reviewed and modified by staff from the city of Marble and the MDH.

Assessment of Well Vulnerability

This part documents the vulnerability of the wells used by the public water supplier and is required under Minnesota Rules 4720.5210. The protocol for determining well vulnerability is defined in the MDH document entitled Methodology for Phasing Wells into Minnesota's Wellhead Protection Program (1993), which was approved by the U.S. Environmental Protection Agency as part of its review of Minnesota's wellhead protection program description. The MDH uses the protocol to maintain a database defining the potential vulnerability of community and noncommunity public water supply wells. A score is calculated for each well using 1) construction criteria defined in the State Well Code, 2) geologic sensitivity, and 3) the results of water quality monitoring conducted by the MDH. A numeric score is assigned to each well based on the results of the three areas of evaluation. A cutoff score is used to define wells that are most likely to be vulnerable based on their construction, geologic setting, and sampling history. The printouts of the vulnerability ratings for each well are presented in Appendix I.

The results of the well vulnerability assessments suggest that the wells used by the city of Marble are vulnerable to contamination. This conclusion is based primarily on the fact that water samples collected from the city wells on February 10 and June 3, 2004, contained tritium at 9.6 and 9.1 tritium units, indicating the predominance of young (post-1954) water in the samples. An additional factor is that the city wells do not meet current standards for construction.

Vulnerability Assessment for the Drinking Water Supply Management Area

The aquifer used by the Marble city well was evaluated for its vulnerability to contamination throughout the extent of the DWSMA on the basis of 1) geologic and soils maps, 2) geologic logs from wells in the area, and 3) the chemical and isotopic data noted above.

The Itasca County Soil Survey includes an assessment of the geologic sensitivity at the water table based on the criteria of the DNR (1991). The geologic sensitivity ratings within the Marble DWSMA range from very high to low. These ratings correlate well with the surficial geologic mapping of Jennings and Reynolds (2005). Geologic sensitivity ratings of very high correspond to areas where bedrock is within 50 feet of the land surface and/or the overlying glacial sediment is relatively coarse. This condition was noted only along the northern margins of the DWSMA near the Arcturus and Gross-Marble mine pits where the Biwabik Iron Formation is exposed or covered by only a thin veneer of glacial sediment (Jennings and Reynolds, 2005). Geologic sensitivity ratings of moderate and low are assigned where the soil has a relatively high clay or loam content, suggesting that till was the parent material. Again, these areas are well correlated with those areas mapped as Koochiching lobe till by Jennings and Reynolds (2005).

The geologic sensitivity ratings described above were compared with that from Marble Well No. 2 (228846), which is the only well with a complete stratigraphic record that is completed in the Biwabik Iron Formation and located within the city's DWSMA. The geologic sensitivity rating for that well is moderate, which is consistent with the rating suggested by surficial geologic mapping (Figure 12). Geologic protection at the city well field consists of clay-rich till

and the Virginia Formation. Although the Virginia Formation thins to a feather-edge a short distance north of the Marble city wells, based on the mapping of Jirsa and others (2005), till cover continues almost to the edge of the Arcturus and Gross-Marble mine pits. At that point, the Biwabik Iron Formation is exposed.

The chemical and isotopic data for the Marble city wells suggest that the Biwabik Iron Formation is characterized by the presence of young water. As a result, the overlying geologic protection provided by the Virginia Formation and till cover is considered to be leaky. This is consistent with a moderate vulnerability rating. Those areas determined to exhibit a geologic sensitivity rating of low, based on surficial geologic mapping, were increased to a vulnerability rating of moderate to reflect the leaky nature of the till. Finally, mapped areas smaller than a few acres in size were incorporated within the surrounding mapped area so as to avoid small slivers of land that would be difficult to identify and manage.

In summary, the vulnerability of the Biwabik Iron Formation aquifer ranges from high to moderate throughout the city of Marble DWSMA. Within areas rated as high, the time required for water moving vertically from the land surface to reach the aquifer is probably on the order of days to months. Within areas rated as moderate, the time required for water moving vertically from the land surface to reach the aquifer is probably on the order of several years to decades.

Selected References

Bleifuss, R.L. (1964), *Mineralogy of oxidized taconites of the western Mesabi and its influence on metallurgical processes*, Society of Mining Engineers Transactions, v. 229, pp. 236-244.

Cotter, R.D., Young, H.L., Petri, L.R., and Prior, C.H. (1965), *Water resources in the vicinity of municipalities on the western Mesabi Iron Range, northeastern Minnesota*, U.S. Geological Survey Water Supply Paper 1759-B.

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Selected References - Continued

Minnesota Department of Health (1996), *Methodology for phasing wells into Minnesota's wellhead protection program*, Minnesota Department of Health, St. Paul, Minn., 18 p.

Minnesota Department of Health (2005), *Guidance for delineating wellhead protection areas in fractured and solution-weathered bedrock in Minnesota*, St. Paul, Minn., 80 p.

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Winter, T.C. (1971), *Sequence of glaciation in the Mesabi-Vermillion Iron Range area, northeastern Minnesota*, U.S. Geological Survey Professional Paper 750-C, p. C82-C88.

Winter, T.C. (1973a), *Hydrogeology of glacial drift, Mesabi Iron Range, northeastern Minnesota*, U.S. Geological Survey Water Supply Paper 2029-A, 23 p.

Appendix I
Municipal Well Information

Table 1
Municipal Water Supply Well Information
Marble, Minnesota

Local Well Name	Unique Number	Use/ Status¹	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Well Vulnerability	Aquifer
1	228842	P	12	200	500	1926/1964	Vulnerable	PEBI
2	228846	P	20	176	503	1955	Vulnerable	PEBI

Note: 1. Primary (P) or Emergency backup (E) well



MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating



625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

PWSID: 1310023
SYSTEM NAME: Marble
WELL NAME: Well #1

TIER: 3
WHP RANK:
UNIQUE WELL #: 00228842

COUNTY: Itasca TOWNSHIP NUMBER: 56 RANGE: 23 W SECTION: 19 QUARTERS: ACA

CRITERIA	DESCRIPTION	POINTS
Aquifer Name(s)	Biwabik Iron-Formation	
DNR Geologic Sensitivity Rating	Medium	25
L Score	0	
Geologic Data From	Data Inferred From Nearby Wells	
Year Constructed	1926	
Construction Method	Cable Tool/Bored	0
Casing Depth	200	10
Well Depth	500	
Casing grouted into borehole?	Unknown	0
Cement grout between casings?	Unknown	5
All casings extend to land surface?	Yes	0
Gravel - packed casings?	No	0
Wood or masonry casing?	No	0
Holes or cracks in casing?	Unknown	0
Isolation distance violations?		0
Pumping Rate	240	5
Pathogen Detected?		0
Surface Water Characteristics?		0
Maximum nitrate detected	<1 09/01/1975	0
Maximum tritium detected	9.6 02/10/2004	VULNERABLE
Non-THMS VOCs detected?		0
Pesticides detected?		0
Carbon 14 age	Unknown	0
Wellhead Protection Score		45
Wellhead Protection Vulnerability Rating		VULNERABLE

Vulnerability Overridden :

COMMENTS

QWTA-PEBI, DRIFT STRATIGRAPHY INFERRED FROM WELL #2. Well was deepened in 1964 from original depth of 385 to 500 feet. A 12-inch inner casing was installed from top to bottom, with the bottom 300-feet perforated. The original casing depth was 130 feet.



MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating



625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

PWSID: 1310023
SYSTEM NAME: Marble
WELL NAME: Well #2

TIER: 3
WHP RANK:
UNIQUE WELL #: 00228846

COUNTY: Itasca TOWNSHIP NUMBER: 56 RANGE: 23 W SECTION: 19 QUARTERS: ACAA

CRITERIA	DESCRIPTION	POINTS
Aquifer Name(s)	Biwabik Iron-Formation	
DNR Geologic Sensitivity Rating	Medium	25
L Score	0	
Geologic Data From	Well Record	
Year Constructed	1955	
Construction Method	Cable Tool/Bored	0
Casing Depth	176	10
Well Depth	503	
Casing grouted into borehole?	Unknown	0
Cement grout between casings?	Unknown	5
All casings extend to land surface?	Yes	0
Gravel - packed casings?	No	0
Wood or masonry casing?	No	0
Holes or cracks in casing?	Unknown	0
Isolation distance violations?		0
Pumping Rate	510	10
Pathogen Detected?		0
Surface Water Characteristics?		0
Maximum nitrate detected	<1 09/01/1975	0
Maximum tritium detected	9.1 06/03/2004	VULNERABLE
Non-THMS VOCs detected?		0
Pesticides detected?		0
Carbon 14 age	M	0
Wellhead Protection Score		50
Wellhead Protection Vulnerability Rating		VULNERABLE

Vulnerability Overridden :

COMMENTS

Appendix II

Figures Used In This Report

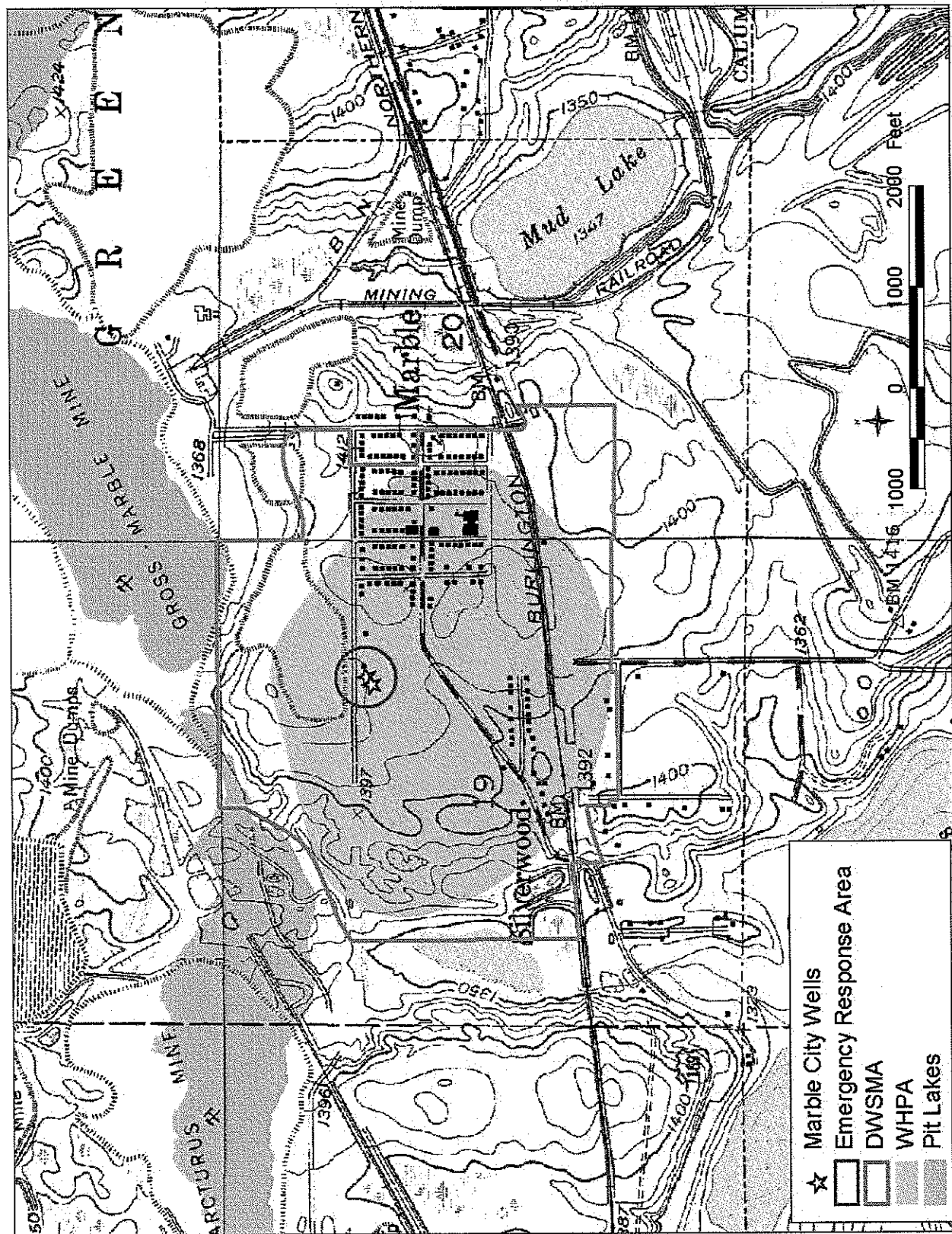
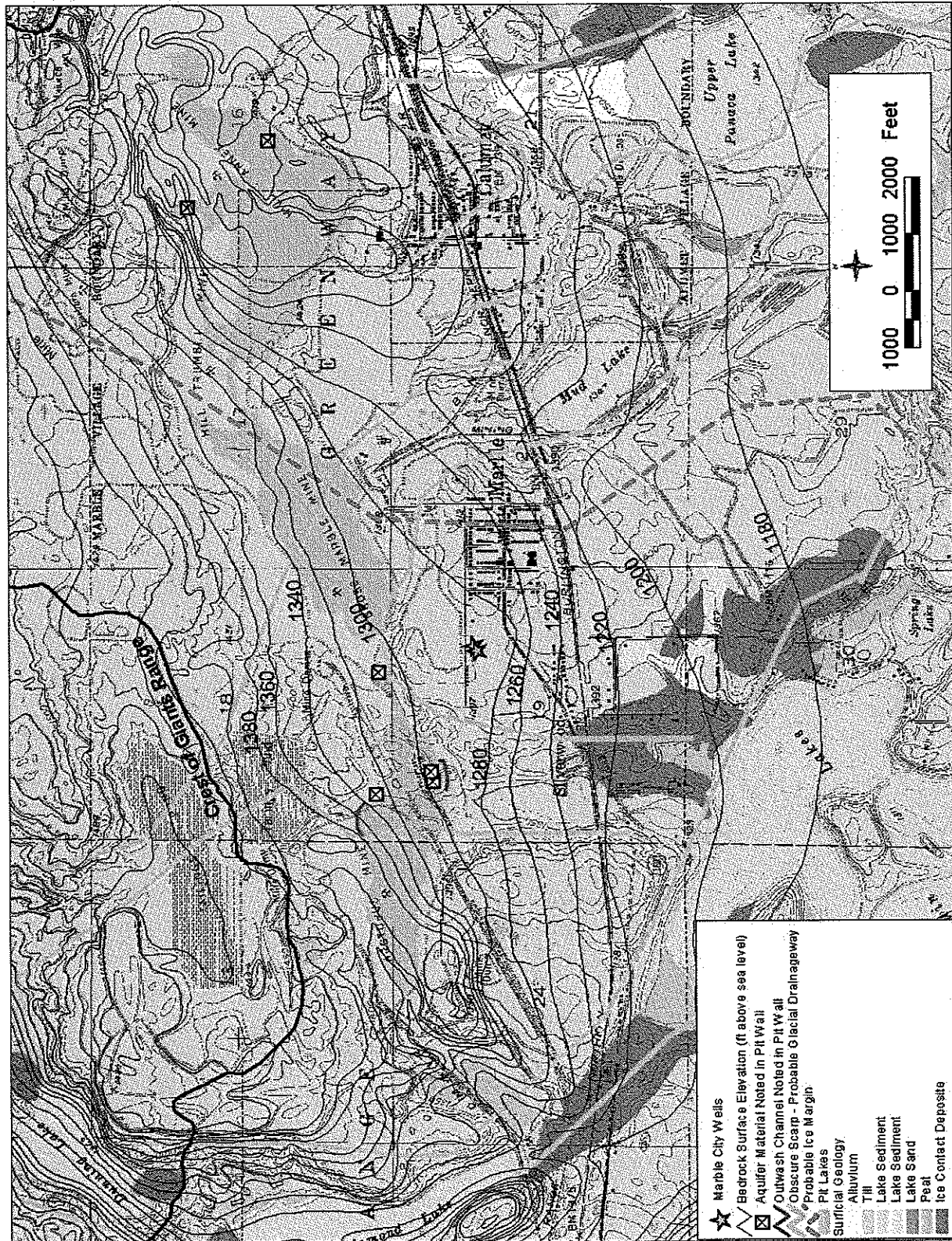


Figure 1. Wellhead protection area (WHPA), drinking water supply management area (DWSMA) and emergency response area (ERA) for the city of Marble.



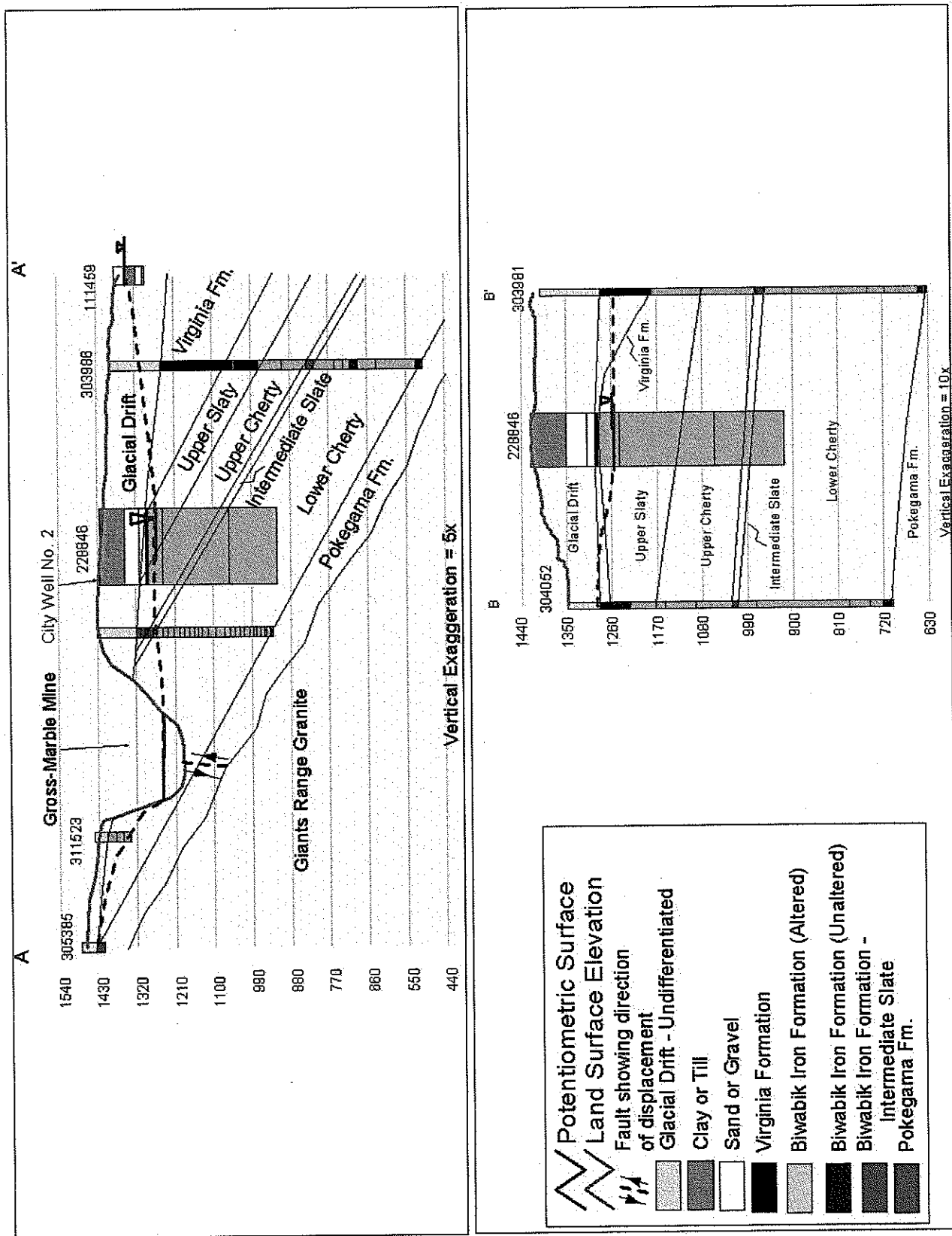


Figure 4. Geologic cross-sections through the Marble area.

Hydrolab Data
 Marble Well No. 1 (228842)
 Well No. 2 On (Pumping Phase)
 11/17/2004

logging down
 logging up

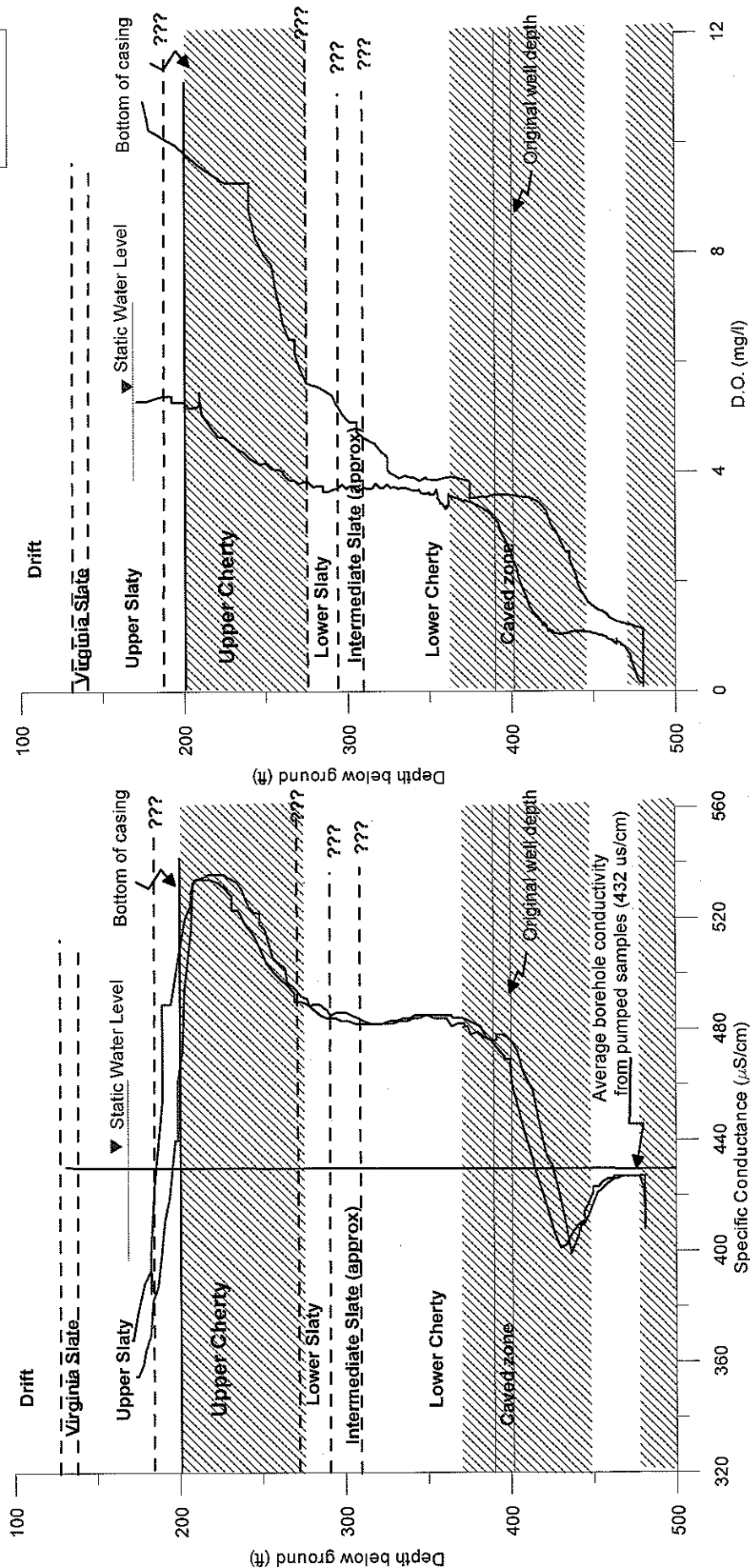


Figure 5. Specific conductance and dissolved oxygen profiles of the water column for Marble Well No. 1 (228842). Hachures indicate possible preferred flow zones.

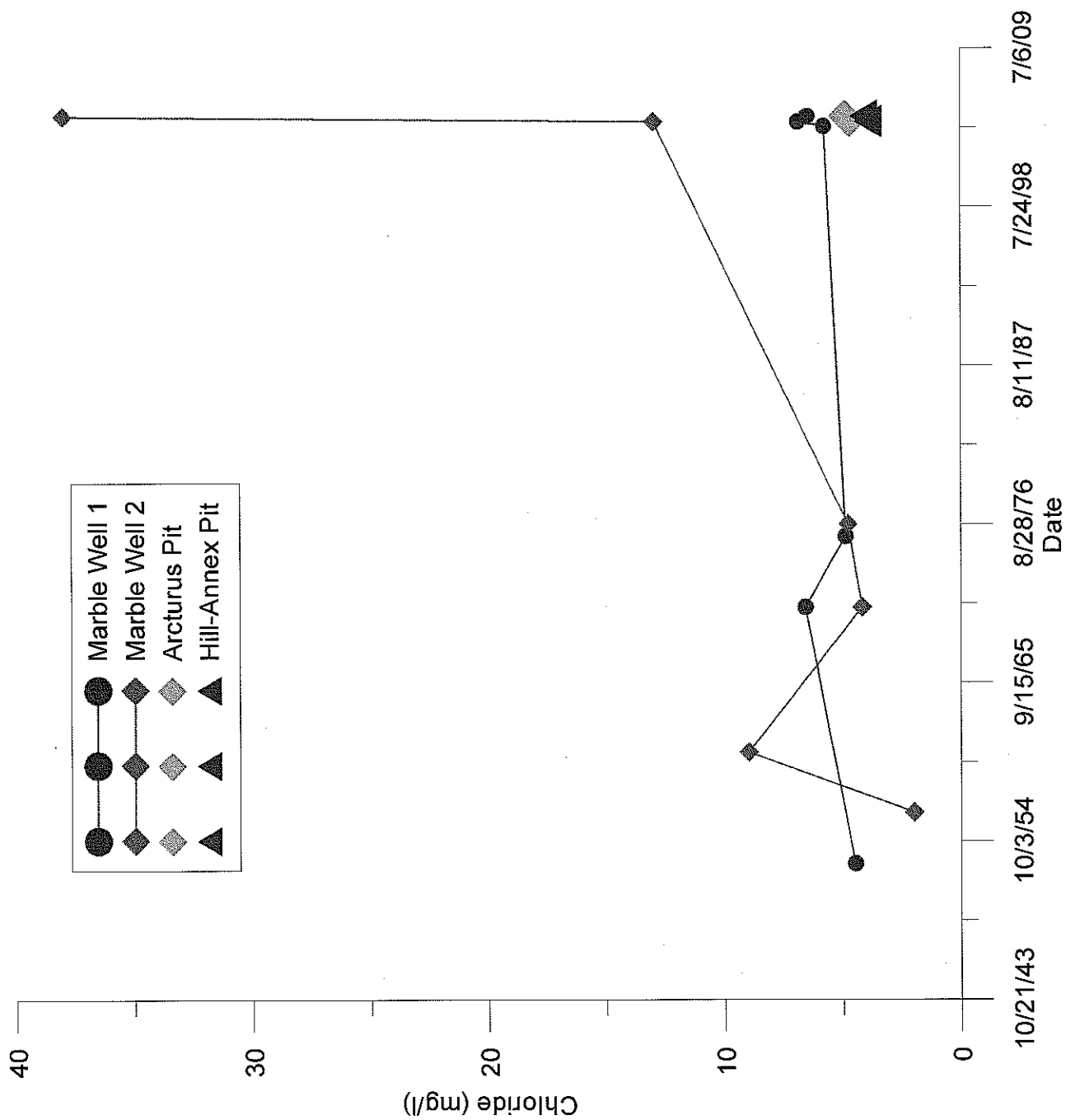


Figure 6. Chloride data through time.

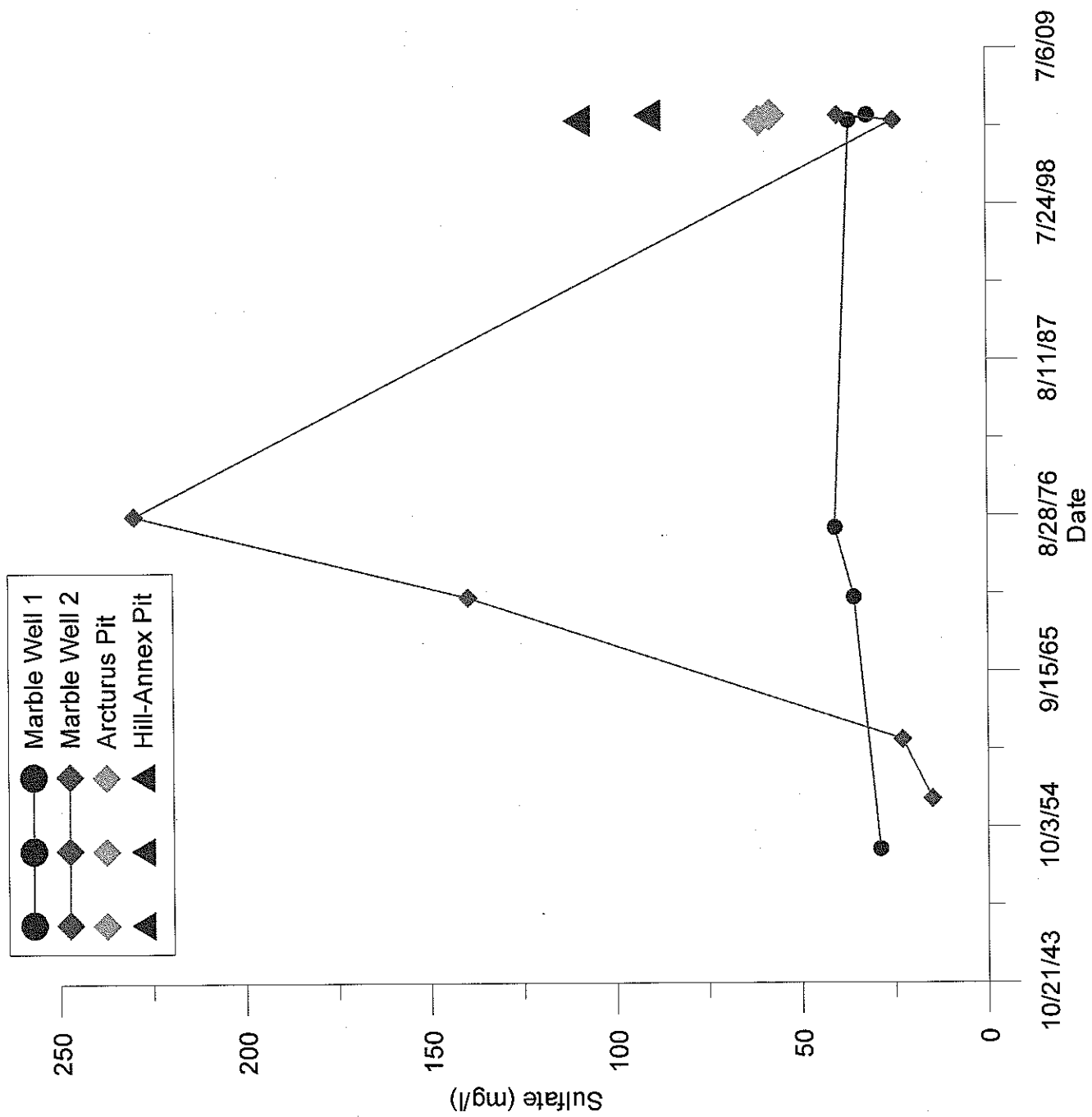


Figure 7. Sulfate data through time.

Historic Water Level Data for Marble Area

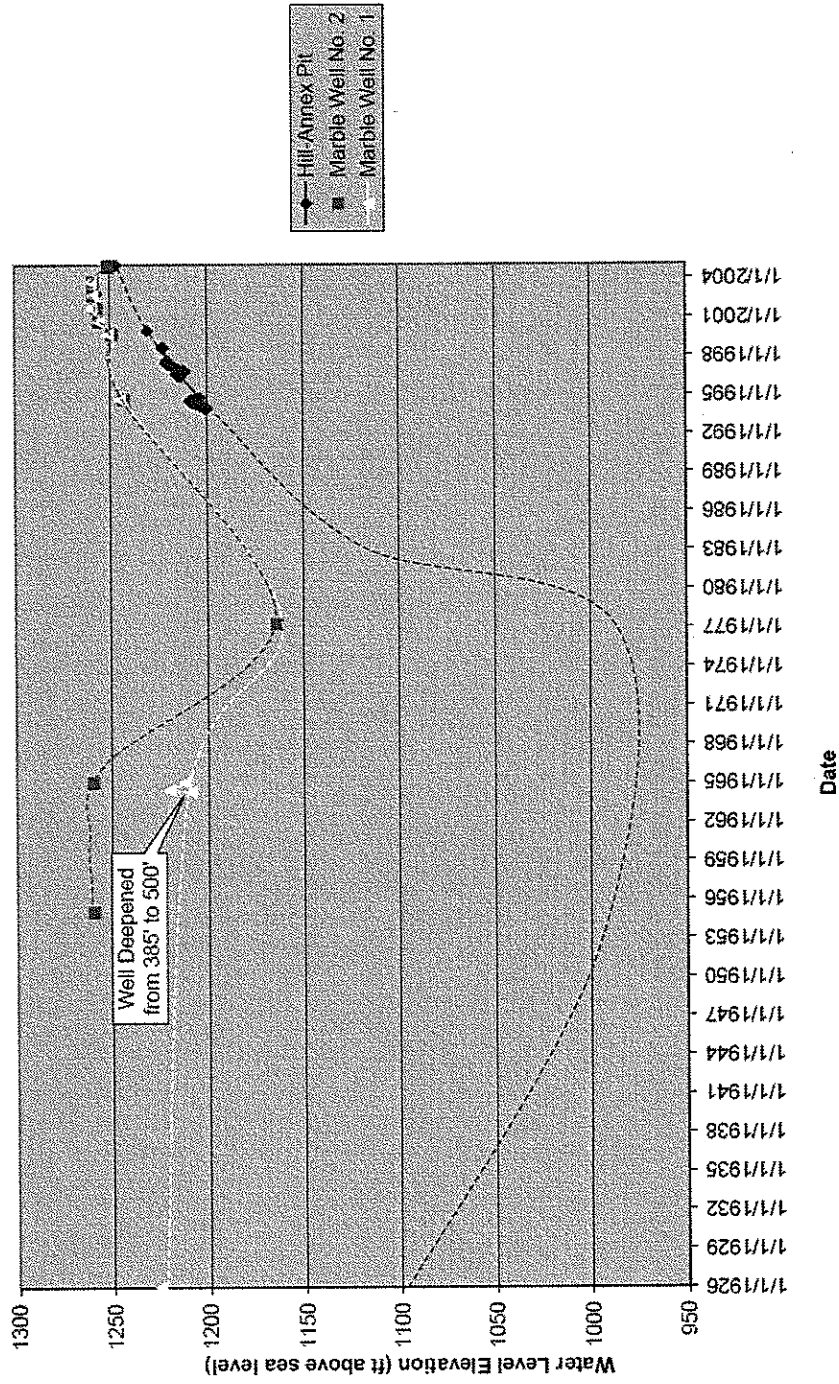


Figure 8. Graph of historic water level data for the Marble area. Historic pit water level data is estimated based on information from the city of Marble and pit bathymetry data. Well water level data is from 1) well construction records, 2) city maintenance records, and 3) Cotter and others (1965). Points represent actual data, whereas dashed lines represent the author's estimates.

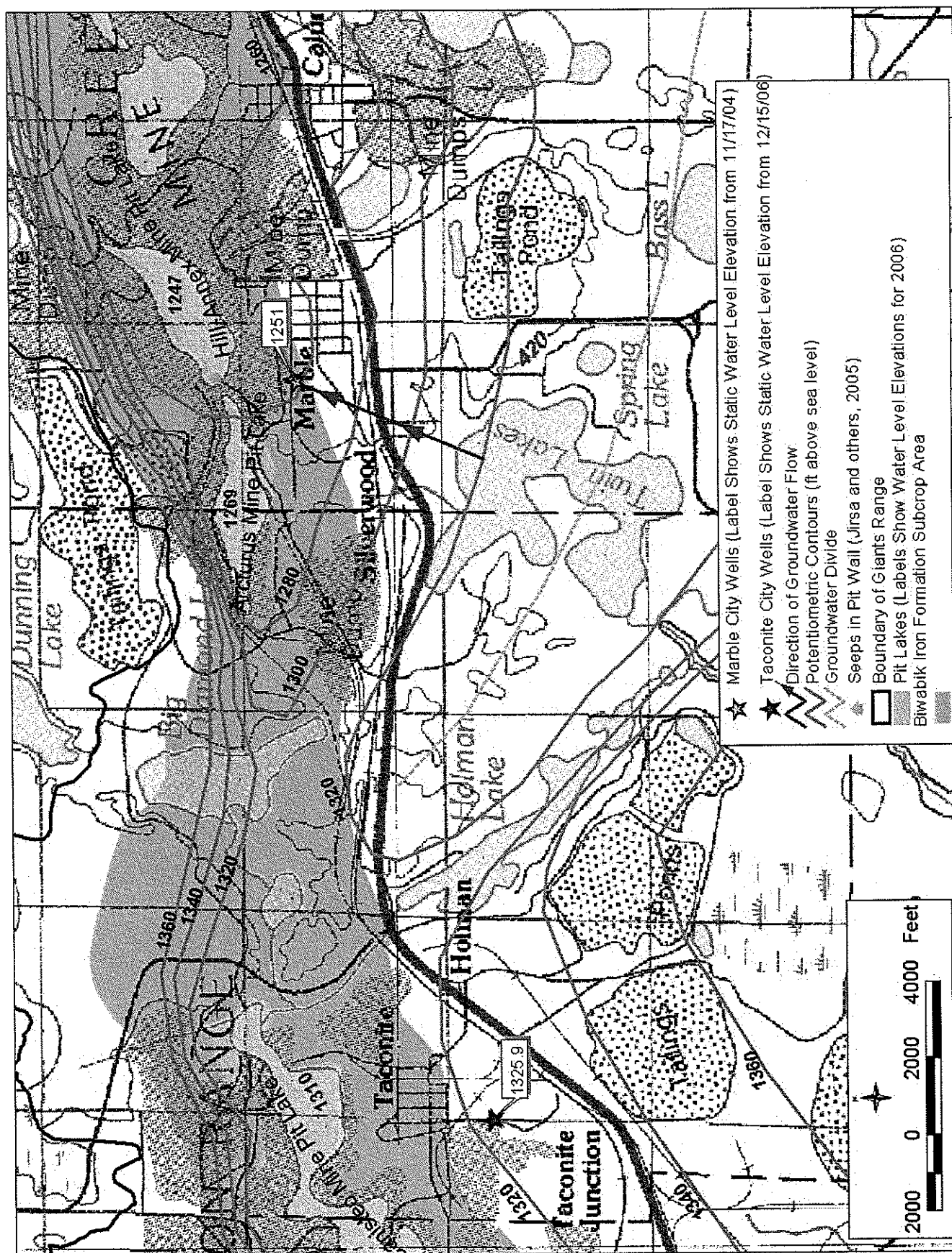


Figure 10. Groundwater flow direction in the Marble area.

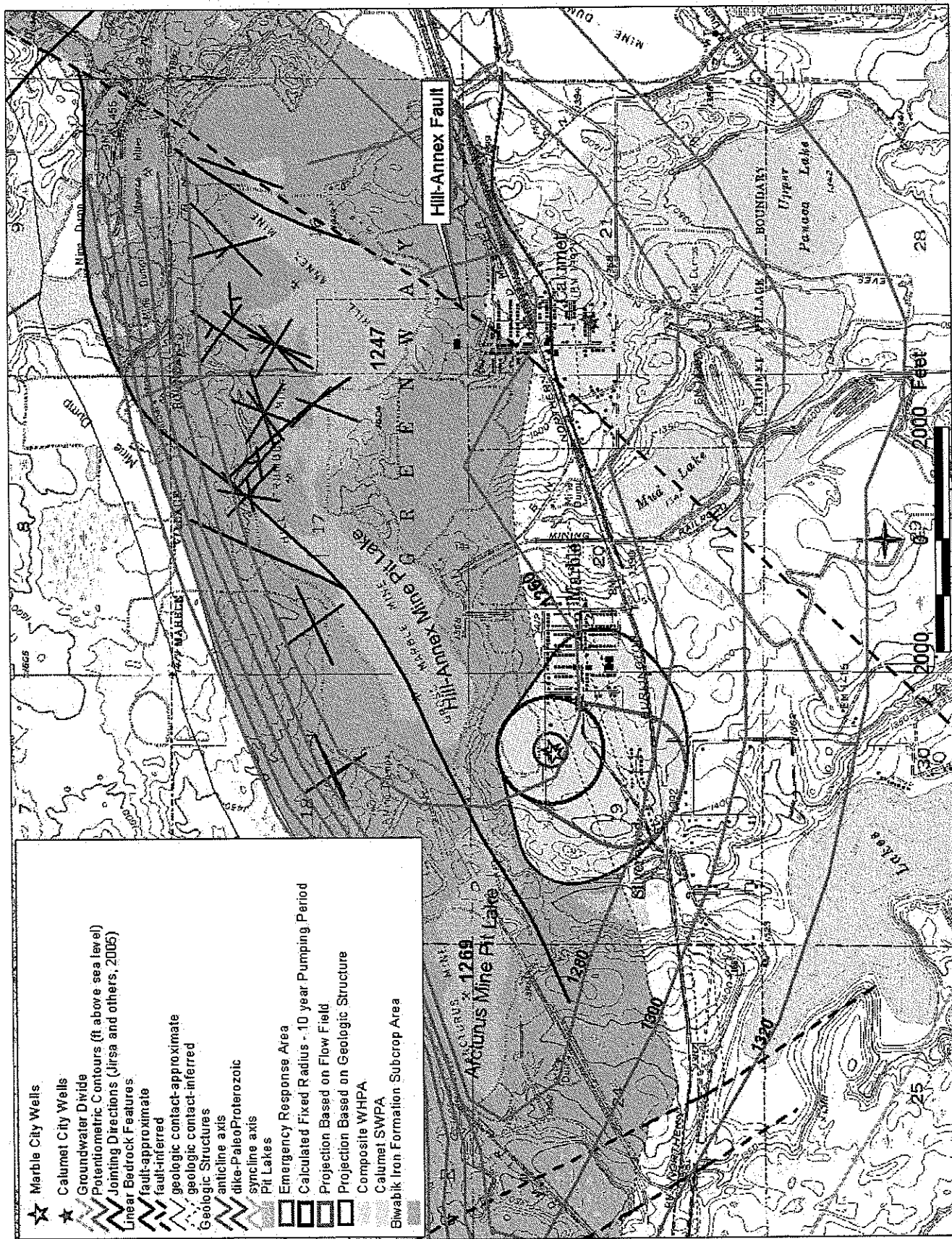


Figure 11. WHPA delineation procedure.

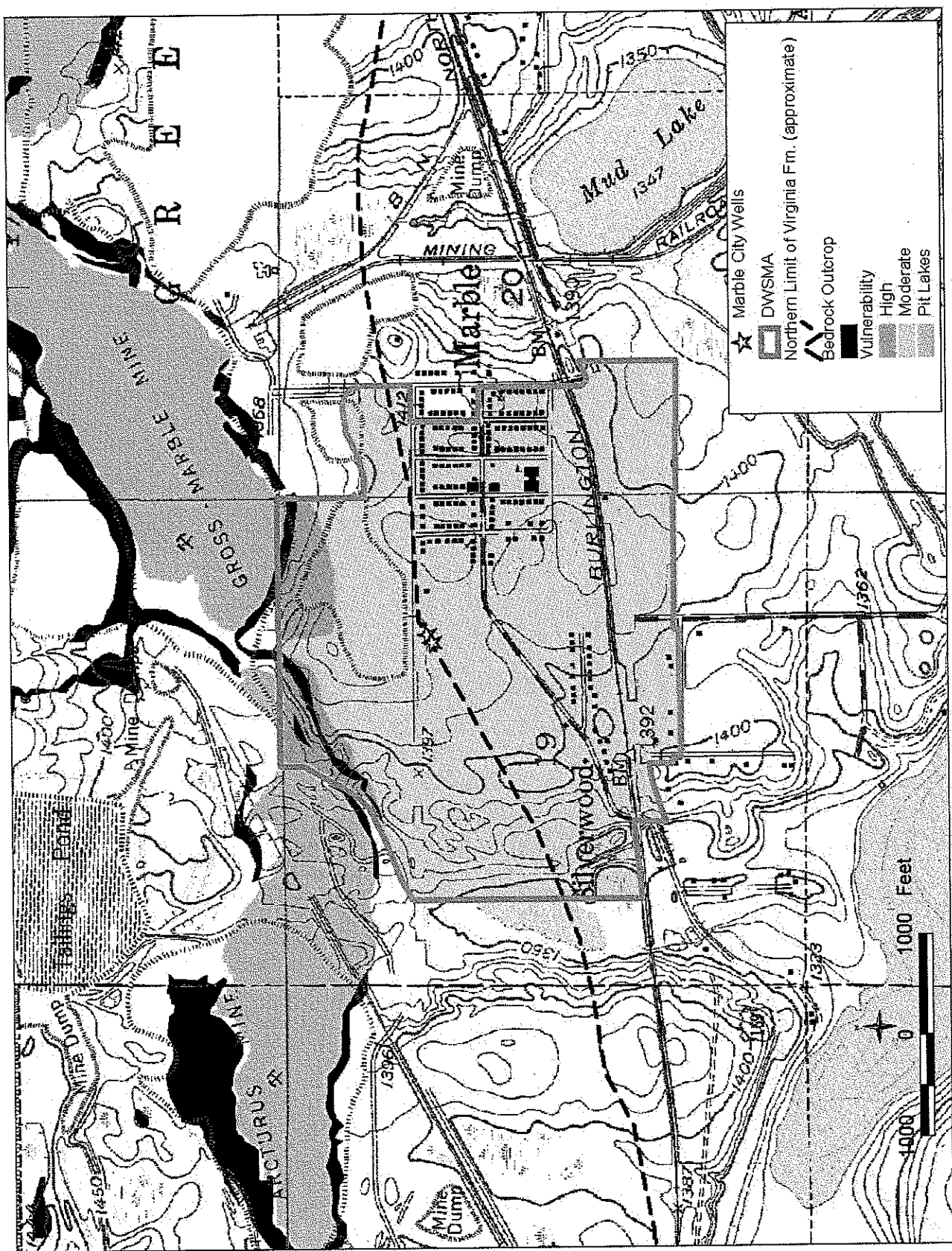


Figure 12. Vulnerability of the aquifer throughout the DWSMA.

Appendix III

Method Used to Estimate Transmissivity from Specific Capacity

Method used to Estimate Transmissivity

The method used to estimate transmissivity from specific capacity data is similar to that of Bradbury and Rothschild, 1985, and Mace (2000) but with some differences. The method is described in some detail here.

Starting with a rearrangement of Sternberg's (1973) equation that relates specific capacity (Sc) to transmissivity (T), the duration of pumping (t) the well radius (r_w) and storativity (S) for a partially penetrating well:

$$Sc = \frac{4 \pi T}{\left[\ln \left(\frac{2.25 T t}{r_w^2 S} \right) + 2 s_p \right]} \quad 1$$

Where s_p is the partial penetration factor defined base on the physical properties of the well and aquifer, L is the length of the screen portion of the aquifer and H is the aquifer thickness Brons and Marting (1961):

$$s_p = \frac{1 - (L/H)}{(L/H)} - \left[\ln(H/r_w) - G(L/H) \right] \quad 2$$

Where the function G is approximated by Bradbury and Rothschild (1985) using the following polynomial with 0.992 correlation coefficient:

$$G(L/H) = 2.948 - 7.363(L/H) + 11.447(L/H)^2 - 4.675(L/H)^3 \quad 3$$

Rearranging Equation 1 to solve for transmissivity and substituting for Sc in terms of the discharge of the well (Q) and the observed draw down at time t (s), $Sc=Q/s$:

$$T = \frac{Q}{4\pi s} \left[\ln \left(\frac{2.25 T t}{r_w^2 S} \right) \right] + \frac{Q s_p}{2\pi s} \quad 4$$

The second term in Equation 4 was solved directly from the draw down, discharge, and the well construction and aquifer thickness information. The first term was solved iteratively with assumed values of storativity for confined (0.001) and unconfined (0.075) conditions.

References

- Bradbury, K.R. and Rothschild, E.R. (1985), *A computerized technique for estimating the hydraulic conductivity of aquifers from specific capacity data*, Ground Water, v.23, No. 2, pp. 240-246.
- Brons, F. and Marting, V.E. (1961), *The effect of restricted fluid entry on well productivity*, Journal of Petroleum Technology, v. 13, No. 2, pp. 172-174.
- Sternberg, Y.M. (1973), *Efficiency of partially penetrating wells*, Ground Water, v. 11, No. 3, pp. 5-7.

Exhibit 6



MINNESOTA HISTORICAL SOCIETY
State Historic Preservation Office

May 22, 2007

Ms. Victoria Rutson
Section of Environmental Analysis
Surface Transportation Board
Washington, D.C. 20423

Re: Itasca County Regional Rail Authority to construct a railroad line to the new
Minnesota Steel Industries Plant to be located in Nashwauk
Itasca County
SHPO Number: 2007-1762

Dear Ms. Rutson:

Thank you for the opportunity to review and comment on the above project. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

Our office has been reviewing this project in consultation with the U.S. Army Corps of Engineers. Rather than complete the cultural resource work and assessment of effect in advance, the Corps has proposed a programmatic agreement to outline a process for the survey, evaluation, assessment of effects, and consultation to reduce, avoid, or mitigate effects.

It would seem to us that the STB might want to consult with the Corps and consider being added to the Corps agreement. Otherwise, a second programmatic agreement for the STB undertaking may be needed.

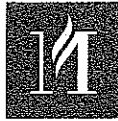
We note that if the cultural resource survey work for this project could be completed early in the planning process, it may be possible to reach a Section 106 review finding that would not require any agreements. We are certainly open to this more simplified approach.

Contact us at 651-259-3456 with questions or concerns.

Sincerely,

Dennis A. Gimmestad
Government Programs & Compliance Officer

cc: Brad Johnson, USACE
John Elmore, Minnesota Steel Industries
Amanda Gronhvd, 10,000 Lakes Archaeology
Stephen Thornhill, Burns & McDonnell
John Wachtler, Barr Engineering



MINNESOTA HISTORICAL SOCIETY
State Historic Preservation Office

May 22, 2007

Mr. Brad Johnson
Regulatory Branch
U.S. Army Corps of Engineers
190 5th Street East
St. Paul, MN 55101-1638

Re: 2005-546-JKA, Minnesota Steel Industries, Butler Taconite Mine Reactivation
Itasca County
SHPO Number: 2005-2320

Dear Mr. Johnson:

Thank you for forwarding a copy of your proposed Section 106 programmatic agreement for the above referenced project.

As you know, our office has recently received notification from the Surface Transportation Board, initiating Section 106 review for the construction of the railroad line to serve this plant. It would seem to us that it would be most efficient if the Corps' agreement could be modified to include the STB. Otherwise, a separate Section 106 review of that action may be needed. Writing separate but related agreements may be unnecessarily complicated and be difficult to implement.

We do note that if the cultural resource survey work for this project could be completed early in the planning process, it may be possible to reach a Section 106 review finding that would not require any agreements. We are certainly open to this more simplified approach.

We look forward to working with you to complete this review. Contact us at 651-259-3456 with questions or concerns.

Sincerely,

Dennis A. Gimmestad
Government Programs & Compliance Officer

cc: Victoria Rutson, STB
Stephen Thornhill, Burns & McDonnell
John Elmore, Minnesota Steel Industries
Amanda Gronhovd, 10,000 Lakes Archaeology
John Wachtler, Barr Engineering

Exhibit 7



National Geodetic Survey

David Zenk PE, PLS
NGS Advisor
395 John Ireland Boulevard, MS641
Saint Paul, MN 55155-1899

Office: 651-366-3523
Fax: 651-366-3444
E-mail: dave.zenk@noaa.gov

Date: May 14, 2007
To: Victoria Rutson
Cc: Gilbert Mitchell
From: David Zenk PE, PLS
Subject: Comments on STB Docket No. 34992

**Comments on STB Finance Docket No. 34992, Itasca County Regional Rail Authority -
Construction and Operation of a Line Of Railroad in Itasca County, MN**

Dear Ms. Rutson:

I have examined the proposed rail corridors in the maps you supplied.

There are no significant negative impacts on the geodetic control in the areas marked on the maps.

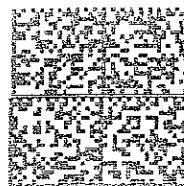
Sincerely,

A handwritten signature in black ink, appearing to read "David A. Zenk". The signature is fluid and cursive, with the first name "David" and last name "Zenk" clearly distinguishable.

David A. Zenk PE, PLS

Exhibit 8

Environmental Coordinator
National Park Service
Midwest Regional Office
601 Riverfront Drive
Omaha, NE 68102



neopost

049J82036859

\$00.260

06/05/2007

Mailed From 68102
US POSTAGE

Burns & McDonnell Engineering Co.
Attn: Stephen Thornhill
P.O. Box 419173
9400 Ward Parkway
Kansas City, Missouri 64141



Re: STB Docket No. 34992 – Itasca County, Minnesota, Regional Rail
Authority Rail Construction

We have received your letter of April 13, 2007 concerning the above
referenced project.

☒ We have no comment on your proposed actions.

These comments have been provided as early technical assistance and do not
necessarily indicate the NPS' or the Department of the Interior's response to
future environmental documents prepared in association with the project.

Thank you,

Regional Environmental Coordinator

Exhibit 9

United States Department of Agriculture



Natural Resources Conservation Service
1889 E Hwy 2
Grand Rapids, MN 55744

Phone: (218) 326-6595
FAX: (218) 326-8938
Email: mike.oja@mn.usda.gov

Date: June 14, 2007

From: Michael D Oja
District Conservationist
Natural Resources Conservation Service
1889 E Hwy 2
Grand Rapids, MN 55744

To: Stephen Thornhill
Burns & McDonnell Engineering Company
PO Box 419173
9400 Ward Parkway
Kansas City, MO 64141

Subject: STB Finance Docket NO. 34992-Itasca County Regional Rail Authority,
Proposed railroad line to Minnesota Steel, Itasca County, MN.

Dear Stephen,

The five alternative routes as identified on the aerial photographs as attachments A and B which supported the April 13, 2007 letter to the USDA/NRCS St. Paul, MN. will be the main subject of these comments. All routes are partially on soils identified as prime or prime if drained as delineated by the USDA Itasca County Soil Survey. These soils are protected by the Farmland Protection Policy Act. If Burns and McConnell Engineering Company require a full assessment of the route impact please fill out the enclosed AD-1006 form and return to me with any new route alignments.

Sincerely,

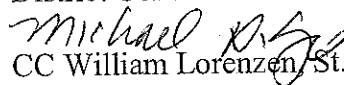
Michael D Oja
District Conservationist

CC William Lorenzen, St. Paul, MN.

Exhibit 10



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST, SUITE 401
ST. PAUL, MINNESOTA 55101-1638

MAY 21 2007

Operations
Regulatory (MVP-2005-546-JKA)

Burns & McDonnell Engineering Company
Attn: Stephen Thornhill
P.O. Box 419173
9400 Ward Parkway
Kansas City, Missouri 64141

Dear Mr. Thornhill:

This letter is in response to the April 13, 2007 letter from the Surface Transportation Board (STB) to the U.S. Army Corps of Engineers St. Paul District Office (Corps) requesting project-related comments and information about STB Finance Docket No. 34992 – Itasca County Regional Rail Authority (ICRRA) for the construction of a railroad line to the proposed Minnesota Steel Industries (Minnesota Steel) plant near Nashwauk, in Itasca County, Minnesota. This proposed railroad line is a connected action to Minnesota Steel's proposed taconite mine, processing plant, and steel mill project. The Corps and the Minnesota Department of Natural Resources (MnDNR) have prepared a joint federal/state Draft Environmental Impact Statement (EIS) for the Minnesota Steel project. The public comment period for the Draft EIS has closed, and the Corps and the MnDNR are currently preparing responses to comments and the Final EIS. The Draft EIS is available electronically at the following web link:

<http://www.dnr.state.mn.us/input/environmentalreview/minnsteel/index.html>

The Draft EIS addresses the environmental effects of connected actions to the Minnesota Steel project (including the railroad line) to a limited degree. The railroad line environmental effects are addressed in the Draft EIS chapter 6.13.2.3 (Railroads) and in Chapter 7.2 (Connected Actions). Table 6.13.1 (enclosed) summarizes the infrastructure impacts. The impacts were based upon the best information available at the time that the Draft EIS was prepared (February 2007). The connected action environmental effects were not fully addressed in the Draft EIS because detailed information regarding the connected actions was not available, and it was recognized that each connected action would also be subject to a separate environmental review and permitting process.

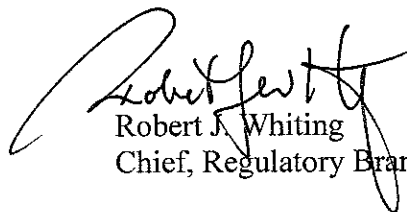
Regarding the National Environmental Policy Act (NEPA) evaluation that the STB is conducting for the railroad line that has been proposed by the ICRRA, the Corps requests to become a cooperating agency because a Clean Water Act Section 404 permit for the discharge of fill material into waters of the U.S. (including jurisdictional wetlands) will likely be required for the project. The Corps recommends that all of the

issues listed on page 2 of the April 13, 2007 STB letter be addressed in the NEPA evaluation. However, the Corps has specific comments for the following issues:

- Water quality and wetlands – The project applicant will need to submit a completed Clean Water Act Section 404 permit application for the proposed railroad line to the Corps and to the Local Government Unit (LGU) for the Wetland Conservation Act (WCA). Alternative routes for the proposed railroad line will need to be evaluated, and information regarding the potential wetland impacts (including wetland acreage and wetland types) along each route will need to be estimated and provided in the permit application. The railroad line route that is selected by the applicant as the proposed project will need to avoid and minimize impacts to wetlands to the greatest degree practicable. Compensatory wetland mitigation will need to be provided for unavoidable wetland impacts if the total wetland impact for the project exceeds 10,000 square feet. The project applicant will need to conduct a wetland delineation of the proposed railroad line route to determine the amount of wetland impacts and the types of wetlands (based upon the Eggers and Reed classification system) that would be impacted. The NEPA wetland analysis will need to include information regarding the type of wetlands to be impacted, the amount of wetlands to be impacted, the functions and values of the impacted wetlands, and any proposed compensatory wetland mitigation.
- Historic sites, archaeological sites, or cultural resources – The NEPA analysis will need to address Section 106 of the National Historic Preservation Act. As the lead federal agency, STB will need to consult with the State Historic Preservation Office (SHPO) regarding Section 106. The project applicant will need to identify any historic properties that may be affected by the proposed railroad line. If historic properties would be impacted, mitigation would likely be required.
- Socioeconomics – Impacts to recreational trails (hiking, biking, ATV, snowmobile, etc.) will need to be included in the socioeconomic evaluation.
- Wildlife, vegetation, and fisheries – The NEPA analysis will need to address Section 7 of the Endangered Species Act. As the lead federal agency, STB will need to consult with the U.S. Fish and Wildlife Service regarding potential impacts to federally-listed threatened and endangered species.
- Soils and geology – Soil erosion and sedimentation impacts will need to be included in the soils and geology evaluation.

If you have any questions, contact Jon K. Ahlness in our St. Paul office at (651) 290-5381. In any correspondence or inquiries, please refer to the Regulatory number shown above.

Sincerely,



Robert J. Whiting
Chief, Regulatory Branch

Enclosure

Copy Furnished:

Scott Ek, MnDNR

Jess Richards, MnPCA

Deb McGovern, Minnesota Steel

TABLE 6.13.1 INFRASTRUCTURE IMPACTS

IMPACTS											
Infrastructure Element (Related DEIS Chapter)	Responsible/Implementing Agency	Environmental Review Process	Cover Types ⁽¹⁾	Wetlands	Residential/Commercial Property Acquisition	Noise	Shoreland Zoning Issues	Surface Water Quality/ Quantity	Wildlife Travel Cumulative Impacts	Cultural Resources	Other Considerations
Roadways ⁽¹⁾ (Chapter 6.13.2.2)	Itasca County	State EAW	Option 1: 5 ac wetlands 45 ac wooded 14 ac brush/ grassland 0.2 ac developed/ transportation/ utility corridor 4 ac mine/land Option 2: 6 ac wetlands 63 ac wooded 19 ac brush/ grassland 0.6 ac developed/ transportation/ utility corridor 4 ac mine/land	Option 1: 5 acres Option 2: 6 acres	Property acquisition may be needed in the vicinity of S. Sucker Lake Road, depending on the final roadway alignment.	Potential for roadway noise impacts to existing residential receptors in the vicinity of Little Sucker Lake and the intersection of the new roadway with existing roadway will be assessed during the Itasca County environmental review process for the proposed roadway.	Yes Conditional Use permit would be required	Increase in impervious surface on new and improved roadways would increase runoff and decrease runoff water quality. Regulations require mitigation, including but not limited to NPDES Construction Stormwater Permit requirements.	Low volume, 2-lane road would not be a substantial impediment to wildlife travel.	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	Approx. 25% of corridor area is within area previously-disturbed by mining Option 2: Southview Road upgrade would cross a creek.
Railroad (Chapter 6.13.2.3)	Itasca County (or possibly private railroad –decision is not final)	Federal environmental review process (Surface Transportation Board)	5 ac wetlands 29 ac wooded 14 ac brush/ grassland	5 acres	No residential or commercial property acquisitions anticipated.	Closest residential receptors are over 0.5 mile from the proposed rail line to the Minnesota Steel plant site. Potential for noise impacts will be assessed in the STB environmental review process for the rail line extension.	Yes Conditional Use permit would be required	Increase in runoff and decrease in runoff water quality. Regulations require mitigation, including but not limited to NPDES Construction Stormwater Permit requirements.	Low volume spur rail line would not be a substantial impediment to wildlife travel.	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	Approx. 35% of corridor is within area previously-disturbed by mining
Gas pipeline (Chapter 6.13.2.4)	City of Nashwanak	Minnesota Public Utilities Commission environmental assessment	25 ac wetlands 44 ac wooded 31 ac brush/ grassland 2 ac cropland	25 acres (Temporary impacts)	No residential or commercial property acquisitions anticipated. The pipeline alignment would be located at least 400 feet away from all existing dwellings.	None	Yes Conditional Use permit would be required	Temporary impact during construction; mitigated by BMPs.	None	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	With the exception of trees that would be cleared from the gas pipeline corridor, ground surfaces including wetlands would be temporarily impacted and ultimately would be restored to pre-construction conditions.
Water/ sanitary sewer lines (Chapter 6.13.2.5)	City of Nashwanak	None required (plan review by MDH and MPCA)	1 ac wetlands 8 ac wooded 4 ac brush/ grassland 1 ac developed/ transportation/ utility corridor	1 acre (Temporary impacts)	None. Construction along existing road right-of-way	None	Yes Conditional Use permit would be required	Temporary impact during construction; mitigated by BMPs.	None	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	Ground surfaces in the utility corridors, including wetlands, would be temporarily impacted and ultimately would be restored to pre-construction conditions.
Electrical transmission line (Chapter 6.13.2.6)	City of Nashwanak or Minnesota Power	Minnesota Public Utilities Commission environmental review	52 ac wetlands 75 ac wooded 114 ac brush/ grassland 4 ac cropland 2 ac residential 32 ac developed/ transportation/ utility corridor	Minimal impacts – support structures only potential impact areas	2 acres of residential property acquisition anticipated	None	Yes Conditional Use permit would be required	Temporary impact during construction; mitigated by BMPs.	None	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	Ground surfaces in the utility corridors, including wetlands, would be temporarily impacted and ultimately would be restored to pre-construction conditions.
TOTAL	NA	NA	89 ac wetlands 219 ac wooded 182 ac brush/ grassland 6 ac cropland 2 ac residential 34 ac developed/ transportation/ utility corridor 4 ac mine/land	89 acres (26 ac of the total would be temporary impacts)	2 acres	NA	NA	NA	NA	Will be addressed as provided for in the Programmatic Agreement (see Chapter 6.10)	NA

⁽¹⁾ No unique cover types were identified. Land cover is typical of the region; second growth forests, shrub/grassland, mine land, wetlands and low density rural residential.⁽²⁾ Does not include impacts associated with construction of turn lanes, assumed to be minimal impacts.