11

December 19, 2012

Dear Mayor Simonson, City Councilmembers, and Planning Commission members,

I respectfully ask that the City review and consider new and existing factual evidence in the public record supporting potential of the proposed mine to result in serious impacts to groundwater and groundwater-dependent resources. This evidence provides just cause for the City to deny a permit for a Conditional Use Permit under City ordinance, in that protection of groundwater cannot reasonably be assured through conditions and mitigations. Please see my prepared comments, following. Note references to CMSCWD refer to the Carnelian-Marine-St. Croix Watershed District, within which this mine would be sited, and which has also received a copy of these comments.

Thank you for your consideration,

Laurie Allmann

Updated Potential for Impacts to Groundwater and Groundwater-dependent Resources, Proposed Tiller/Zavoral Mine, with implications for denial of proposed CUP

1. Distance from base of excavation to groundwater: a moving target

In a 11/6/2011 memo to the CMSCWD, Dan Fabian of Emmons & Olivier Resources, Inc., states:

> *"...The sand and gravel found at this site are very porous, providing a direct conduit to the shallow groundwater aquifer."*

It is generally accepted that the porous nature of the substrate increases the risk of two key potential mine-related impacts: 1) contamination by surface pollutants, and 2) increases in temperature of the groundwater, associated with degradation of the nearby brook trout stream, seepage swamp, and other cold-water environments fed by affected seeps and springs.

In the City of Scandia's applicable mining code, it makes clear that it is the City's role and duty to establish the maximum depth of a mining excavation in order to protect groundwater, as follows:

> "5.6 Protection of Groundwater. The maximum depth of excavation shall be established so that groundwater quality and quantity are protected. This depth of excavation shall be established by the City and will be based, in part, upon soil characteristics, depth to groundwater, nature of mining proposed, and local use of the aquifer."

As stated, this maximum depth is to be based, in part, on the depth to groundwater, which can also be understood as the "separation" between the lowest point of the excavation and the uppermost reach of the water table.

Tiller proposes a maximum depth of excavation of 840 feet above mean sea level; a level described in the FEIS as a "worst case scenario." (See p. 2, responses to comments to the DEIS, included in the FEIS). To date, commenting agencies have assessed the risk of potential mine-related impacts based on the assumption of Tiller's "planned" mining to a maximum depth of 840 feet above mean sea level, and a projected separation from the base of the mining excavation to the water table of 25-30 feet. In their comments for the public record, three agencies have directly cited the 25-30 foot separation as their standard for measurement, as follows:

From the Minnesota DNR

"The minimum depth to groundwater during mining is proposed to be 30 feet for this project, and the final reclamation plan leaves a minimum of 50 feet above groundwater. Warming of groundwater at these depths should be less than .3 degrees Celsius, based on research conducted by the St. Anthony Falls Laboratory at the University of MN (Taylor and Steffan 2008)." (Minnesota DNR letter to City of Scandia, May 18, 2012 comments to the Draft EIS, signed by regional director Keith Parker)

From the Washington County

"Given that mining is proposed to be conducted about 25-50 feet above the water table, there should be no impact to groundwater quality directly from the mining operations." (May 8, 2012, Washington County Board of Commissioners letter to City of Scandia, signed by Board Chair, Dennis Hegberg.)

From the Carnelian-Marine-St. Croix Watershed District

"Depths to within 25-30 feet (of the water table) should have no material impact on the downstream resources that are reliant on groundwater. However, if more material is removed and depth to groundwater is less than stated, both flow rates and temperatures to the springs will increase and thereby disturb of the biology of both the springs, seeps, and streams to the east of the site." (May 17, 2012 letter from Carnelian-Marine St. Croix Watershed District to City of Scandia, signed by Jim Shaver, Administrator.) Note: In a recent personal communication, Shaver expressed some doubts about the accuracy of his own statement, above, but has not provided any clarification in the public record.

At a September, 2012 City Council meeting on the adequacy of the Final EIS, City Councilmember Sally Swanson expressed concern about potential impacts to the seeps. These concerns were dismissed by City Planner, Sherri Buss, who referred to agency comments in the public record for the EIS (quote taken directly from meeting video):

"Look at the comments that were received from the DNR, from the watershed district, and from the Washington conservation district. Because they have had

their technical staff look at the water resource analysis and they agreed with the conclusions that were made in the EIS that those things had been studied adequately, that they don't see negative impacts to the seeps, in fact because there will be more infiltration on the site once mining begins, there may be a benefit to those resources that rely on infiltration in the shallow groundwater layers to support their existence."

Missing from the City Planner's statement is the fact that these agency assessments of "no significant impact" were based on a separation of 25 to 30 feet between the excavation and the water table, when the separation may be only 10 feet or even 3 feet.

Consider:

1. On page 10 of the City Planner's November 26 Memorandum, the Planner recommends as a condition of permit approval: "The maximum depth of mining shall be 840 feet above mean sea level. This will guarantee a minimum separation of 10 feet between the bottom of the excavation and the top of the groundwater." (Note that the proposed condition refers to the maximum depth of excavation, not the minimum separation of 10 feet).
2. In the same Memorandum, (p. 6), the Planner makes reference to "the required minimum 3-foot separation from the bottom of the excavation and the groundwater table," a standard that is identified by the Planner as a Rule of the Carnelian-Marine-St. Croix Watershed District.

If the "guaranteed minimum separation" will be 10 feet, as the Planner states, and the "required minimum separation" (presumably the legally enforceable standard) is 3 feet, then why was a separation of 25 to 30 feet used as the basis for a finding of "no significant impact" to groundwater and groundwater-dependant resources? In recommending that the City approve a CUP for the proposed mine, the City Planner cannot rely on analysis that is not based on the facts. If the mining operator could legally excavate to within 3 feet of the water table, then the decision of whether or not to issue a permit must be based on impacts to groundwater that may reasonably arise from this circumstance.

2. New scientific study offers evidence for increased risk of negative impacts

New insights from University of Minnesota Research Scientist and Environmental Health Specialist Scott Alexander raise additional concerns. Alexander is a highly regarded and credentialed environmental scientist with research-based knowledge of the St. Croix Valley. (See credentials, attached). In "A LiDAR Based Review of the Tiller/Zavoral Mining and Reclamation Project (Dec 12, 2012. Full report attached) Alexander identifies and describes a dominant geologic feature called a "paleo-channel" on the proposed mine site, which could have important implications, including: 1) a higher than anticipated water table, and 2) increased vulnerability of the site to a recurrence of the historic "blow-out" of sediment into the St. Croix, exacerbated by the proposed increased infiltration of surface waters directed into the mine site. According to Alexander:

> *"Current plans to limit depth of mining to 840 feet above mean sea level may not meet the proposed 25 to 30 feet separation since they are not based on any well data from the paleo channel. Water levels, particularly during periods of high recharge following rainfall events, will be higher than expected."* (and) *"Increased recharge on the Zavoral site, during mining operations, could reactivate the blow area by raising the local water table, saturating the surficial sediments and weakening their cohesive strength. Highly focused, or point recharge, will raise water levels in a concentrated area following storm events, increasing localized risk. Periods of high rainfall could conceivably raise the water table into the base of the excavation allowing surficial contaminants, like fuel products and bacteria, to reach the water table."*

These "periods of high rainfall" to which Alexander refers may come more frequently than current analysis predicts. Alexander cites work by the Intergovernmental Panel on Climate Change (IPCC) pointing to an increase in frequency of extreme precipitation events. The elevation of the water table can be expected to respond to this variability in storm events: a factor that cannot be controlled but should be considered in a risk assessment.

In its May 17, 2012 letter to the City of Scandia, The Carnelian-Marine-St. Croix Watershed District acknowledges that increased infiltration is not necessarily a benefit to groundwater and groundwater-sensitive resources, stating:

> *"The District agrees that infiltration amounts will increase as a result of the project. However, this could have negative impacts as material is removed from the site."* (J. Shaver, CMSCWD)

The report by Scott Alexander provides further objective evidence for the "down side" of increased infiltration, which was poorly represented in the EIS and has not been fully represented by the City Planner.

Will monitoring and mitigation be sufficient to prevent a catastrophic event such as a repeat of the historic blow-out of sediment into the river? Alexander notes in his recommendations that, *" Improving the distribution of stormwater...should reduce, but will not eliminate the potential for additional blow outs."*

Chris Stein, Superintendent of the National Park Service, has direct experience that has taught him the limits of mitigation efforts, best management practices and monitoring. In a 2009 letter to the City of Scandia related to the proposed Tiller/Zavoral mine he states:

> *"Despite the best intentions for preventing erosion and sedimentation, in practice control measures often fail or are not properly maintained through the life of a project."* (February 2, 2009 letter to the City of Scandia from the United States Department of the Interior, National Park Service, signed by Christopher Stein, Superintendent.)

In its November 30 letter to the City of Scandia, The Carnelian-Marine-St. Croix Watershed District noted some of the changes that the proposed mine would likely bring to the groundwater discharges east of the site, along the St. Croix River bluff:

> *"The manderate cliff ecological communities are a rare, groundwater-dependent natural resource along the bluffs east of the site. The total flow of groundwater probably will not change as a result of mining. However, the frequency, duration and location of groundwater discharges along the bluffs will likely be affected."* (November 11 letter submitted to the City of Scandia by the Carnelian-Marine-St. Croix Watershed District, signed by administrator Jim Shaver).

Now, based on the contents of the City Planner's report recommending approval of the CUP, and Scott Alexander's LiDAR Based Review of the proposed Tiller/Zavoral Mine, it is prudent take into account the new fact-based insights that have emerged regarding the reasonable implications of this mine for groundwater and groundwater-dependant resources.

In summary:
In addition to the likely alterations of the existing hydrology regime at the site, with changes to the frequency, duration and location of groundwater discharges, we must now consider the impacts of a 10 foot, or a 3 foot separation from the excavation to the water table. How might such a narrow buffer impact the temperature of the groundwater and trout stream on a hot summer day? We much also, given Alexander's report, consider the potential for the water table to rise up into the bottom of the mine pit, exposing the groundwater to surface contaminants. We must acknowledge the existence of the paleo-channel and seriously consider its possible implications, knowing how a "blow-out" of sediment could impact the Federally Endangered mussel species documented 2000 feet downstream of the site. Given the inherent vulnerability of the site associated with its unique hydrogeology, together with its history of an intrusion into the National Wild & Scenic Riverway resulting from a sediment "blow-out" concurrent with mining activity, we must recognize the reasonable limits of mitigation and monitoring in preventing incremental degradation and even catastrophic, irreparable alterations of the landscape.

In a Nov 16, 2011 memo from Dan Fabian of Emmons & Olivier Resources to Jim Shaver, Administrator, CMSCWD, Fabian articulates the District's position:

> *"The project site is located in the subwatershed of Zavoral's Creek which is tributary to the St. Croix River. This area of the Carnelian-Marine-St. Croix Watershed District contains significant, unique, high value resources both within and adjacent to the parcel boundaries as well as nearby. These resources have been documented as part of the EIS process. The District is very concerned about the protection of these resources."*

Six months later, CMSCWD writes in a letter to the City of Scandia, commenting on the Zavoral Mining Draft EIS:

> *"The District's consultants in surface water and ground water have reviewed the draft EIS and have raised several questions and concerns regarding some conclusions in the report but overall, both state that these concerns should not be material to the performance of the project."*

There is no record of the Watershed District providing comment to the Final EIS, and the Watershed District does not appear to have commented during the public hearings on the CUP, although written comments may have been submitted to the City and are not yet posted to the City website. The supposition, based on the most recent comment in the public record, is that District managers do not object to issuance of a conditional use permit for the mine.

Based on this new information, as a resident of the Carnelian-Marine-St. Croix Watershed District, I have respectfully asked the District's Board and now ask the City of Scandia 's elected leaders: 1) to re-examine the likely risks to groundwater and groundwater-dependent resources in the proximity of the proposed mine; 2) to conduct or call for investigation into the expected impacts if the mining would be allowed within 3 feet of the water table, 3) to review and act on the information provided in Alexander's report, 4) to recognize that the assessments of natural resource agencies in the public record of comments to the DEIS and FEIS were limited to the available information at the time, and cannot be assumed to apply to new circumstances without further analysis.

Further, I ask that the City take what action is necessary to protect (in Dan Fabian's words) the "significant, unique, and high value resources both within and adjacent to the parcel boundaries, as well as nearby."

The City Planner's assessment of "no significant impacts" and recommended approval of the CUP are based on insufficient evidence of impacts to groundwater and groundwater-dependent resources. It is prudent for City leaders to make their own determination, based on relevant, current factual evidence.

Scott C. Alexander
Research Scientist and Environmental Health Specialist
Departments of Geology & Geophysics and Environmental Health & Safety
University of Minnesota
Minneapolis, MN 55455

Synergistic Activities

Research Scientist, Dept. of Geology & Geophysics, University of Minnesota. 1991 to present. Current duties include project management for Geothermal / CO_2 Sequestration studies and technical oversight and supervision of Hydrogeochemistry, Fluormetrics and Analog Fluid Hydrology Laboratories. Specific duties include collection of ground water and surface water samples for chemical and isotopic analysis, development of analytical techniques utilizing chemical and fluorescence properties of natural and synthetic materials, and development of tools to measure fluid properties. Additional duties include coordination of Hydrogeology Field Camp.

Environmental Health Specialist, Dept. of Environmental Health & Safety, University of Minnesota. 2004 to present. Duties include management and reporting of NPDES permits to Minnesota Pollution Control Agency, management and oversight of the University's MS4 EPA stormwater permit, and development of official University Policy and Procedures on hydrologic issues relating to groundwater and stormwater on all University of Minnesota campuses.

Both of these positions require scientific and administrative skills while interacting with students, professors, administrators, facilities staff and trades people. Specific tasks include writing and review of grant proposals and research papers, development and management of laboratory analytical and safety procedures, quarterly and annual reporting of results, and oversight of storm water related issues at campus construction projects.

Education

Michigan Technological University
University of Minnesota, B.S. Geophysics 1985

Expertise

Utilizing natural and man-made tracers in hydrogeologic systems including stable isotopes, radio-active isotopes, inorgranic chemical constituents and fluorescent organic dyes to define ground water recharge rates and travel times. Modelling of geochemical processes using computer based aqueous speciation programs. Measurement of fluorescent properties of organic dyes in aqueous solutions. Measurement of chemical, isotopic and physical properties fluids. Measurement of aquifer properties ranging from microscopic lithologic to macroscopic fractures to large scale conduits. Design, evaluation and monitoring of storm water management systems.

Professional Associations

Geochemical Society, American Geophysical Union, Geological Society of America
Past President of the Minnesota Ground Water Association

Awards Institute of Technology Civil Service Outstanding Service Award, 1996

Minnesota Ground Water Association Distinguished Service Award 2010

Current Advisory Boards
Washington County Comprehensive Ground Water Plan Technical Advisory Board
Water Resources Center and Freshwater Society Ground Water Sustainability Planning Group
Capitol Region Watershed District Technical Advisory Committee
Mississippi Watershed Maintenance Organization Technical Advisory Board
Center for Sustainable Building Research – Storm Water Management Committee
University of Minnesota – Storm Water Linkage Committee and Storm Water Taskforce

Recent Consulting Experience:

2007-08	Door County SWCD – Dye tracing around new septic system.
2004	Exponent Inc. – Dye tracing at Askov, MN sewage lagoon.
1999-09	Edwards Aquifer Authority, San Antonio, TX – QA/QC specialist for analytic and field methods.
2002-03	Minnehaha Cr. WD – Dye tracing at Camp Coldwater Spring Hwy 55/62 interchange.
2001-03	Brown and Caldwell – Dye tracing at former industrial complex in Louisville, KY.
2000-01	SafteyKleen, Inc., Rosemount, MN – Identification of leaks in hazardous waste storage cells.
1999-00	Meridian Alliance Group, LLC – Site evaluation of deisel tank truck spill.
1998-04	Cambrian Groundwater Co. – Dye tracing in Teller Co., MT and Woodland Park, CO.

Publications

A. Refereed Scientific Publications (13)

13 Luhmann, Andrew J., Matthew D. Covington, **Scott C. Alexander**, Su Yi Chai, Benjamin F. Schwartz, Joel T. Groten, and E. Calvin Alexander, Jr. (2012) *Comparing Conservative and Non-Conservative Tracers in Karst and Using Them To Estimate Flow Path Geometry*, Journal of Hydrology 448-449:201-211.

12 **Alexander, Scott C.** and Martin O. Saar (2012) *Improved Characterization of Small "u" value for Jacob Pumping Test Analysis Methods*, Ground Water 50(2):255-265.

11 Tipping, Robert G., **Scott C. Alexnader**, and E. Calvin Alexander Jr. (2011) *Groundwater Policy at State and Local Levels: The Science-Policy Linkage, Chapter 8 of Water Policy in Minnesota*, K. William Easter and Jim Perry (editors), RFF Press, New York, NY, pages 122-133.

10 Luhmann, Andrew J., Matthew D. Covington, Andrew J. Peters, **Scott C. Alexander**, Cale T. Anger, Jeffrey A. Green, Anthony C. Runkel and E. Calvin Alexander Jr. (2011) *Classification of Thermal Patterns at Karst Springs and Cave Streams.* Groundwater 49(3):324-335.

9 Borchardt, Mark A., Kenneth R. Bradbury, E. Calvin Alexander Jr., Rhonda J. Kolberg, **Scott C. Alexander**, John R. Archer, Laurel A. Braatz, Brian M. Forest, Jeffrey A. Green, and Susan K. Spencer (2011) *Norovirus Outbreak Caused by a New Septic System in a Dolomite Aquifer*, Ground Water 49(1):85-97.

8 Magner, J.A. and **S.C. Alexander** (2008) *Drainage and Nutrient Attenuation in a Riparian Interception-Wetland: Southern Minnesota, USA*. Environmental Geology 54:1367-1376.

7 Tipping, R.G., A.C. Runkel, E.C. Alexander Jr., **S.C. Alexander** and J.A. Green (2006) *Evidence for Hydraulic Heterogeneity and Anisotropy in the Mostly Carbonate Prairie du Chien Group, Southeastern Minnesota*, USA. Sedimentary Geology, 184(3-4):305-330.

6 Runkel, A.C., R.G. Tipping, E.C. Alexander Jr. and **S.C. Alexander** (2006) *Hydrostratigraphic Characterization of Intergranlular and Secondary Porosity in Part of the Cambrian Sandstone Aquifer System of the Cratonic Interior of North America: Improving Predictability of Hydrogeologic Properties*. Sedimentary Geology, 184(3-4):281-304.

5 Edwards, R.A., B. Rodriguez-Brito, L. Wegley, M. Haynes, M. Breitbart, D.M. Peterson, M.O. Saar, **S.C. Alexander**, E.C. Alexander Jr. and F. Rohwer (2006) *Using Pyrosequencing to Shed Light on Deep Mine Microbial Ecology*, BMC Genomics 7:57.

4 Green, J.A., W.J. Marken, E.C. Alexander Jr. and **S.C. Alexander** (2002) Karst Unit *Mapping using Geographic Information System Technology, Mower County, Minnesota, USA*. Environmental Geology 42:457-461.

3 Magner, J.A. and **S.C. Alexander** (2002) *Geochemical and Isotopic Tracing of Water in Nested Southern Minnesota Corn-belt Watersheds*. Water Science and Technology, 45(9):37-42.

2 **Alexander, S. C.**, and Alexander, E.C., Jr. (1989) *Residence Times of Minnesota Ground Water* (invited paper). J. Minnesota Academy of Science, Vol. 55, no.1, pp. 48-52.

1 Everts, C.J., Kanwar, R.S., Alexander, E.C., Jr. and **Alexander, S.C.** (1989) *Comparison of Tracer Mobilities under Laboratory and Field Conditions*. J. Environmental Quality, Vol. 18, no. 4, pp. 491-498.

B. Unrefereed Publications (28)

28 **Alexander, Scott C.**, Mina Rahimi Kazerooni, Erik Larson, Cody Bomberger, Brittany Greenwaldt, and E. Calvin Alexander Jr., (2013) *Combining LiDAR, Aerial Photography, and Pictometric Tools for Karst Feature Database Management*, 13th Multidisciplinary Conference on Sinkholes and the engineering and Environmental Impacts of Karst, Carlsbad, NM, May 6-10, 2013.

27 **Alexander, Scott C.**, Kent Kirkby, and Rebecca Clotts (2012) *Cycling the Mississippi River Gorge*, Geological Society of America Field Trip 415 Guidebook, 2012 Annual Meeting in Minneapolis, MN.

26 Luhmann, Andrew J., Matthew D. Covington, **Scott C. Alexander**, Su Yi Chai, and E. Calvin Alexander Jr. (2011) *Comparison of Discharge, Conductivity, Temperature, dye Deuterium, and Turbidity Responses from a Multiple Tracer Test in Karst*. Proceeding of the 12th Sinkhole Conference January 2011, St. Louis, Missouri.

25 Gao, Yongli, E.C. Alexander Jr., **Scott C. Alexander,** Darlene M. Anthony, Benjamin Schwartz and Wanfang Zhou (2009) *Field Experience in Karst Short Course – Karst Hydrology*, East Tennessee State University, 22-25 May 2009

24 Walsh, S.D.C., **S.C. Alexander** and M.O. Saar (2008) *Lattice-Boltzmann Simulations of Carbonate Systems*. Proceedings of the 11th Sinkhole Conference September 2008 Tallahassee, Florida. ASCE Geotechnical Special Publication 183, p. 444-453.

23 Green, J.A., A.J. Luhmann, A.J. Peters, A.C. Runkel, E.C. Alexander Jr. & **S.C. Alexander** (2008) *Dye Tracing within the St. Lawrence Confining Unit in Southeastern Minnesota.*

Proceedings of the 11th Sinkhole Conference September 2008 Tallahassee, Florida. ASCE Geotechnical Special Publication 183, p. 477-484.

22 **Alexander, S.C.**, Andrew J. Luhmann, E. Calvin Alexander Jr., Jeffrey A. Green and Andrew J. Peters (2008) *Spring Characterization Methods and Springshed Mapping*. Proceedings of the 11th Sinkhole Conference September 2008 Tallahassee, Florida. ASCE Geotechnical Special Publication 183, p. 4485-494.

21 **Alexander, S.C.**, E. Calvin Alexander Jr., Jeffrey A. Green, William E. Schuster and Brian Forest, (2008) *Dye Trace Study of a New Septic System in Door County, Wisconsin*. Proceedings of the 11th Sinkhole Conference September 2008 Tallahassee, Florida. ASCE Geotechnical Special Publication 183, p. 495-504.

20 **Alexander, Scott C.** (2008) *Microbiology of Minnesota Ground Waters and Beyond*. MGWA Newsletter June 2008, 27(20):16-20.

19 Center for Sustainable Building Research (2006) *Buildings, Benchmarks & Beyond: The State of Minnesota Sustainable Building Guidelines, Version 2.1 Section S-2 Stormwater Management*. www.scbr.umn.edu/B3 115p.

18 Green, J.A., **S.C. Alexander** and E.C. Alexander Jr. (2005) *Springshed Mapping in Support of Watershed Management*. Proceedings of the 10th Sinkhole Conference September 2005 San Antonio, Texas. ASCE Geotechnical Special Publication No. 144, p. 403-409.

17 **Alexander, S.C.** (2005) *Spectral Deconvolution and Quantification of Natural Organic Material and Fluorescent Tracer Dyes*. Proceedings of the 10th Sinkhole Conference September 2005 San Antonio, Texas. ASCE Geotechnical Special Publication No. 144, p. 441-448.

16 Alexander, E.C., Jr., **S.C. Alexander**, J.J. Piegat, K.D. Barr and B. Nordberg. (2005) *Dye Tracing Sewage Lagoon Discharge in a Sandstone Karst, Askov, Minnesota*. Proceedings of the 10th Sinkhole Conference September 2005 San Antonio, Texas. ASCE Geotechnical Special Publication No. 144. p.449-458.

15 Alexander, E. Calvin, Jr., **Scott C. Alexander**, Jeffrey A. Green and Robert G. Tipping (2005) *Karst Mapping in Minnesota*. In: (Greg A. Ludvigson and Bill J. Bunker, ed.) Facets of the Ordovician Geology of the Upper Mississippi Valley Region, Iowa Geological Survey Guidebook Series No. 24, Iowa Department of Natural Resources, p. 72-75.

14 **Alexander, Scott C.,** Karen Sherper Rohs, and E. Calvin Alexander Jr. (2004) *What is the Oldest Measured Groundwater Age in Minnesota?* MGWA Newsletter March 2004, 23(1):6-9.

13 Runkel, A.C., R.G. Tipping, E.C. Alexander Jr., J.A. Green, J.H. Mossler and **S.C. Alexander** (2003) *Hydrogeology of the Paleozoic Bedrock in Southeastern Minnesota*. Minnesota Geological Survey Report of Investigations 61, 105 p., 2 plates.

12 Boerboom, T., A. Knaeble, C. Jennings Patterson, **S.C. Alexander**, J.E. Almendinger, S. Grubb, W.S. Cordua (2003) *Geology and Hydrogeology along the St. Croix River Valley*, AIPG/MGWA Fall Field Trip, September 26-27, 2003.

11 Ekman, Julie and **Scott C. Alexander** (2002) *Water Chemistry and Residence Time, Technical Appendix to Part B, Regional Hydrogeologic Assessment Ottertail Area, West-Central Minnesota*, Regional Hydrogeologic Assessment Series RHA-5, Minnesota DNR.

10 Shade, B.L., **S.C. Alexander** (2002) *Karst Features in Pine County, Minnesota*. In: Minnesota Geological Survey Report of Investigations 60, Chapter 4, p. 55-72.

9 Green, Jeffrey A., William J. Marken, E. Calvin Alexander, Jr., and **Scott C. Alexander** (2001) *Karst Unit Mapping Using Geographic Information System technology, Mower County, Minnesota, USA*. In: (Barry F. Beck and J. Gayle Herring, eds.) Geotechnical and Environmental Applications of Karst Geology and Hydrogeology, Balkema Publishers, Exton, PA, p. 89-94.

8 Alexander, E.C., Jr., **S.C. Alexander**, and K.D. Barr (2001) *Dye Tracing to Camp Coldwater Spring, Minneapolis, MN*, Minnesota Groundwater Association Newsletter, v. 20, 4-6.

7 Konieczki, Alice D., Julia B. Graf, Michael C. Carpenter (principal authors), **S.C. Alexander**, B.E. Cobb, E.D. Cobb, W. Eisenhauer, J. Harding, S. Haines, L. R. Larson, J.K. Lyons, J.L. Manning, E.R.Marzolf, T. McGrath, J.M. Mitchell, R.H. Roeske, O. Rosenberry, R. Seidermann, R. Teeters, M. Thompson and B. Thompson (1997) *Streamflow and sediment data collected to determine the effects of a controlled flood in March and April 1996 on the Colorado River between Lees Ferry and Diamond Creek, Arizona*, USGS Open File Report 97-224.

6 Green, J.A., Mossler, J.H., **Alexander, S.C.**, and Alexander, E.C., Jr. (1997) *Karst Hydrogeology of Le Roy Township, Mower County, Minnesota*. Minnesota Geological Survey Open File Report 97-2, scale 1:24,000, St. Paul, MN, 2 plates.

5 Alexander, E. Calvin, Jr., Jeffrey A. Green, **Scott C. Alexander** and Ronald C. Spong (1995) *Springsheds. Plate 9 in Geological Atlas of Fillmore County, Minnesota*, County Atlas Series, Atlas C-8, Part B, Minnesota Department of Natural Resources, St. Paul, MN.

4 Fay, Steffan R., Ronald C. Spong, **Scott C. Alexander**, and E. Calvin Alexander, Jr. (1995) *Optical Brighteners: Sorption Behavior, Detection, Septic System Tracer Applications*. Proceedings of the International Association of Hydrogeologists XXVI International Congress, Edmonton, Alberta, Canada, June 1995, 9 p.

3 Alexander, E. C., Jr., **Scott C. Alexander**, Barbara J. Huberty and James F. Quinlan (1992) *The Oronoco Landfill Dye Trace III: Results from a Superfund Remedial Investigation in a Glaciated, Diffuse-Flow Karst*. In: (Quinlan, J. and Stanley, A., eds.) Proceedings of 3rd Conference on Hydrogeology, Ecology, Monitoring of Ground Water in Karst Terranes. Nashville, Tennessee, Dec. 4-6, 1991, NGWA, Dublin, Ohio, pp. 417-429.

2 Everts, C.J., Kanwar, R.S., Alexander, E.C., Jr., and **Alexander, S.C.** (1988) *A Comparison of Tracers for Study of Solute Transport in the Vadose Zone* (Paper No. 88-136). Presented at 1988 Mid-Central Region Meeting of American Society of Agricultural Engineers, Columbia, Missouri, April 8-9, 1988, 13 pp.

1 Alexander, E.C., Jr., Davis, M.A., **Alexander, S.C.**, and Lively, R.S. (1988) *Thermal Springs of the Southern Black Hills*. In: (G. Schilberg and D. Springhetti, editors) Caves and Associated Features of the Black Hills, 1988 NSS Convention Guidebook, National Speleological Society, Huntsville, Alabama, pp. 14-26.

C. Short Abstracts and Talks (112)

112 Toner, Brandy, Cody Sheik, Benjamin Bonis, Lindsey Briscoe, **Scott Alexander**, E. Calvin Alexander Jr., Gregory Dick, and Jeffrey Gralnick (2012) *Terrestrial Deep Biosphere Observatory: The Soudan Iron Mine*, American Geophysical Union Annual Meeting, San Francisco, CA.

111 **Alexander, Scott C.** and Andrew J. Luhmann (2012) *Spring Water Thermographs as a Tool for Trout Stream Management*, St. Croix Research Rendezvous, Lee & Rose Warner Nature Center, October 16, 2012 (talk).

110 Wheeler, Betty J., **Alexander, Scott C.**, Green, Jeffrey, A., and Alexander, E. Calvin Jr. (2012) *Ground water tracing information database for Minnesota.* 57th Midwest Ground Water Conference, October 1-3, 2012, Minneapolis, MN (poster).

109 **Alexander, Scott C.** and Martin O. Saar (2012) *Jacob and Goldilocks: How to Define Small "u" for Jacob Pumping Test Analysis*, 57th Midwest Ground Water Conference, October 1-3, 2012, Minneapolis, MN (talk).

108 **Alexander, Scott C.**, Mina Rahimi Kazerooni, Erik Larson, Cody Bomberger, Brittany Greenwaldt and E. Calvin Alexander Jr. (2012) *The Combined Application of LiDAR, Aerial Photography and Pictometic Tools for Sinkhole Delineation*, 57th Midwest Ground Water Conference, October 1-3, 2012, Minneapolis, MN (poster).

107 Tipping, Robert G., **Scott C. Alexander**, and Jeremy Rivord (2012) *What Goes into a Name? Hydrostratigraphic Naming Conventions for CWI*, MGWA Spring Conference "Conduits, Karst, and Contamination" April 19, 2012, St. Paul, Minnesota.

106 Briscoe, Lindsey J., E. Calvin Alexander Jr., **Scott C. Alexander**, Thelma D. Berquo, Jeffrey A. Gralnick, F. Marc Michel, Bruce K. Moskowitz, Christine E. Salomon, and Brandy M. Toner (2011) *Iron Mineral Formation in Microbial Mats formed from Shied Brines along an Oxidation–Reduction Gradient*, GSA Annual Meeting, Minneapolis, MN, Abstract 129-3.

105 **Alexander, Scott C.** (2011) *Hydrogeology of the Soudan Mine, Minnesota: Applications to Terrestrial and Extra-terrestrial Research*, Minnesota Minerals Education Workshop, Eveleth, MN, June 21, 2011.

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103 Toner, Brandy M., Lindsey J. Briscoe, F. Marc Michel, **Scott C. Alexander**, E. Calvin Alexander Jr., and Jeffrey A. Gralnick (2010) *Iron Microbial Mat Formation from Deep Continental Brines*, Goldschmidt 2011 Conference, Prague, Czech Republic, Mineralogical Magazine, 75(3): 2022.

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A LiDAR Based Review of the Tiller/Zavoral Mining and Reclamation Project
A Report to TA-COS, 12 December 2012

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The recent release of LiDAR (Light Distance And Ranging) data from the Minnesota Elevation Mapping Project has allowed a renewed analysis of the geology and hydrology of projects across Minnesota. This new data allows a better understanding of the sand and gravel deposits at the Zavoral site, near Scandia, Minnesota and new insights to potential risks. This analysis of the Tiller/Zavoral site was undertaken for the TA-COS citizen group. The high resolution of this data, at 1 meter horizontally and 10 centimeter vertically, allows definition of landscape features and evolution at unprecedented scales. Washington County LiDAR data were published on October 13th, 2012. LiDAR data, and project description, are available at: http://www.mngeo.state.mn.us/committee/elevation/mn_elev_mapping.html.

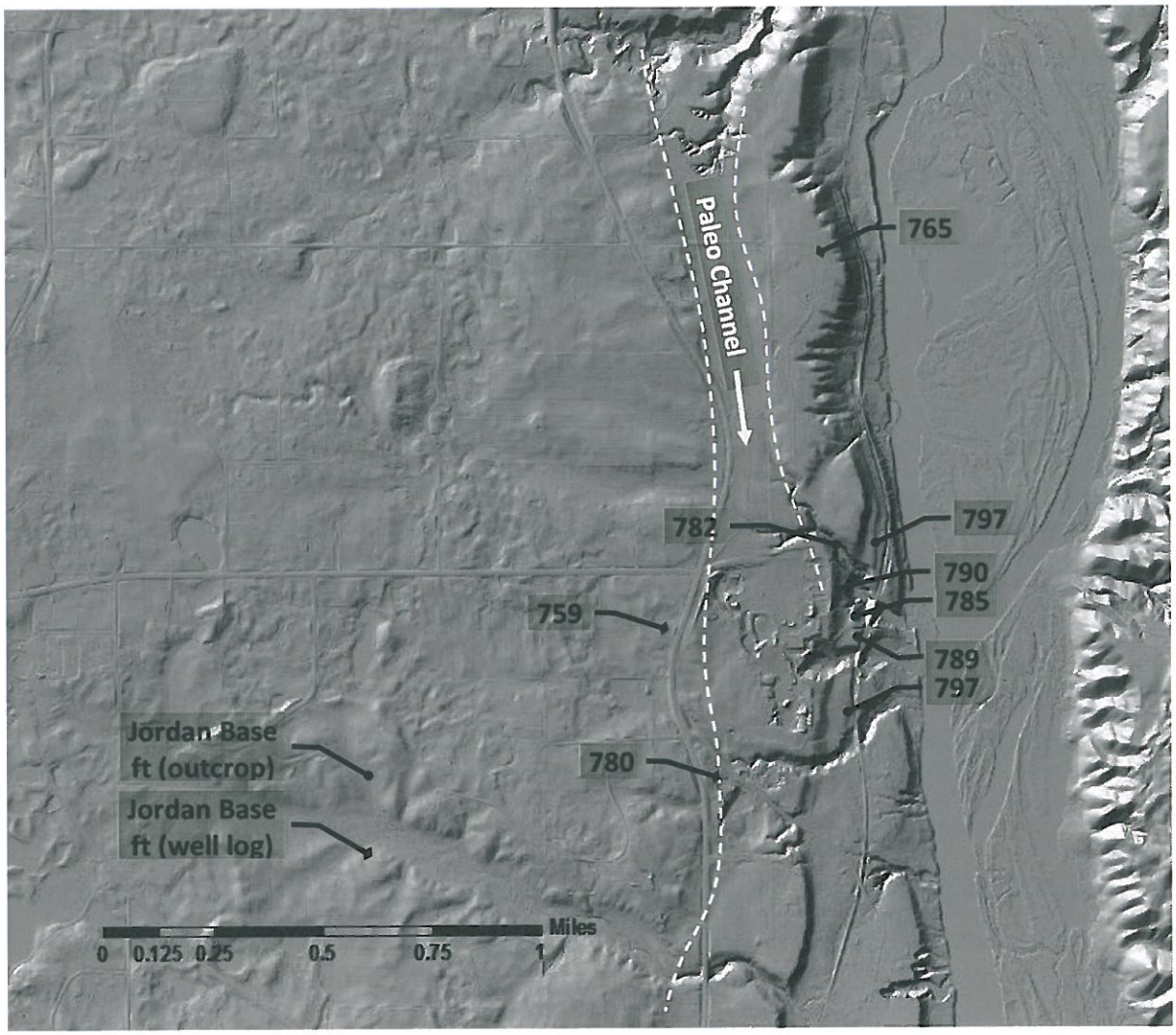


Figure 1. LiDAR image of the Zavoral site and surrounding areas.

The Zavoral property lies along a former channel of the St. Croix River. The stream gravels and sands of this paleo channel were deposited before the St. Croix was cut down into its current deep valley by the retreat of Taylor's Falls. This abandoned, or paleo, channel shows up in Figure 1 as smooth surface running north to south roughly parallel to the current St. Croix River valley. The smooth channel surface is in contrast to the "lumpy" Superior Lobe till terrain covering the western half of Figure 1. This incised channel creates a remnant bedrock ridge running north from the eastern edge of the Zavoral property. The east wall of this incised channel is lost where it meanders eastward intersecting the current St. Croix River valley. There are, however, no wells located in within the boundaries of the paleo channel other than unique well 210498. Well 210498 is the existing water supply at the Zavoral site and has inconsistencies in the surface elevation and sediment depths (the well was drilled in 1969 and the driller's log was based on the ground surface elevation at that time).

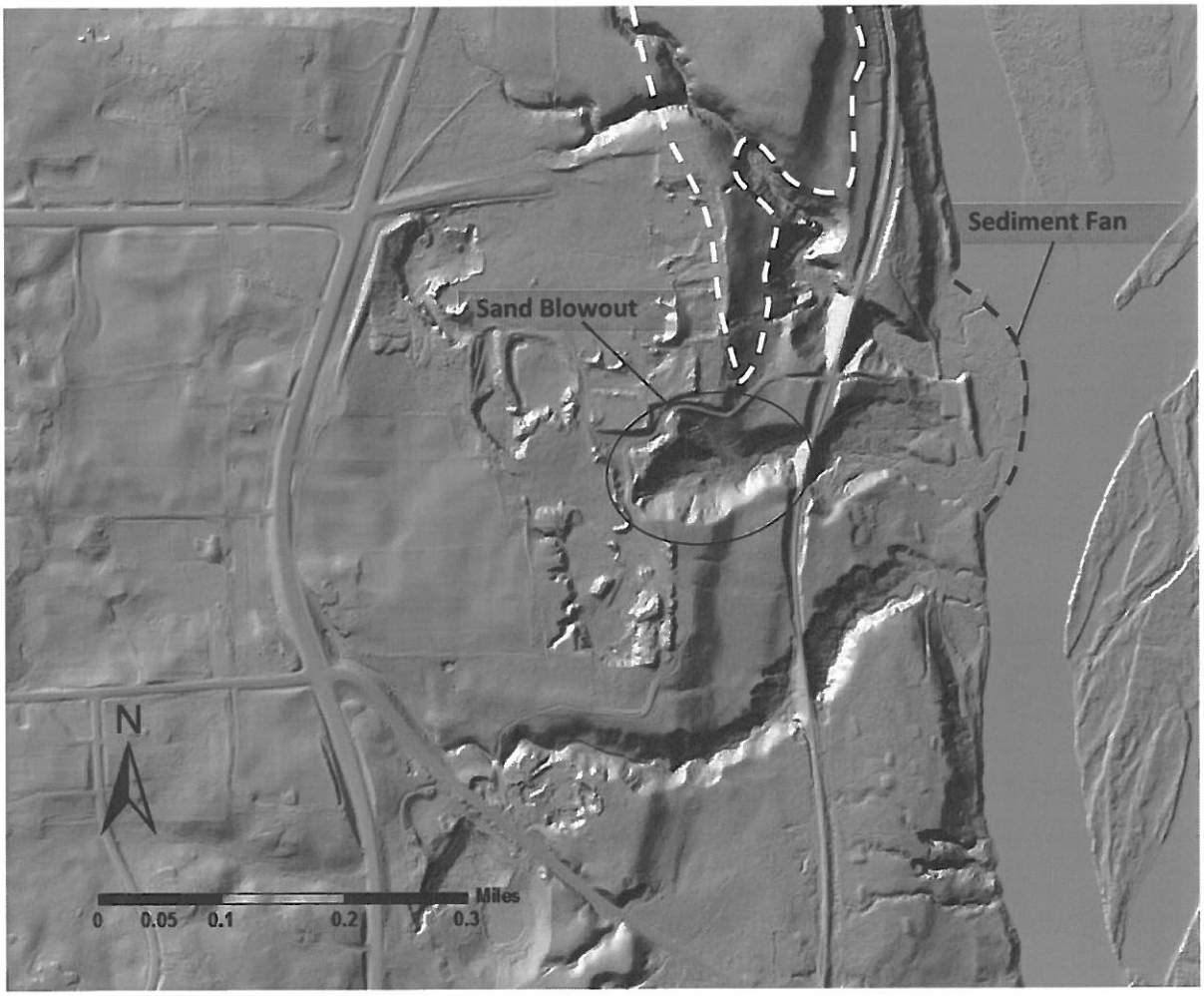


Figure 2. LiDAR image of Zavoral site.

Many significant springs found along the St. Croix River in Washington County, Minnesota emerge near the base of the Jordan Sandstone. Crystal Spring, located on the Page property, is typical of these springs emerging from the base of the Jordan Sandstone where it contacts the underlying St. Lawrence Formation. The location of springs often correlates with flexures in the bedrock with the springs

emerging along low points that help focus the flow. Note that this site is about 1 mile south of the Falls Creek Scientific and Natural Area where vertical faults with more than 300 feet of offset have been mapped. Flexures, folds, and faults should be common in this area; in contrast to large portions of southeastern Minnesota where there is limited bedrock topography.

Figure 2 shows an enlargement of the Figure 1 area showing the location of the remnant valley wall (white dashed line) separating the east side of the paleo channel from the current St. Croix River Valley. Where the paleo channel from Figure 1 turns back into the present valley of the St. Croix the bedrock ridge ends. Without the support of the east bedrock wall the unconsolidated sands and gravels in the paleo channel can spill down into the much deeper present day valley forming a sediment fan. Focused recharge due to mining operations can raise the water table in the surficial sands and gravels creating saturated sediments with little strength. The loss of cohesive strength can lead to large scale catastrophic collapse of sediments as exemplified by the sand blowout area and corresponding sediment fan.

Figure 3 applies the colored point data on top of the gray-scale LiDAR hillshade image with contour lines drawn every 3 meters. Crystal Springs emerges on a shallow bench at the base of a vertical cliff just below the 240 meter contour or at 782 feet above mean sea level (msl). This Jordan/St. Lawrence contact often forms a break in the slope of the river bluff due to the higher resistance of the St. Lawrence. Note that a ravine is beginning to form on the side of the current sand mine berm. With the steep slopes in the area this incipient ravine will only get larger.

Additional springs are found below the St. Lawrence Shale where they emerge from the Mazomanie Formation of the Tunnel City Group. In this area, near Scandia, the Jordan springs provide the majority of the spring water feeding trout streams. Additional water emerging in numerous seeps from the Mazomanie creates a two tiered ground water discharge system, feeding additional cool, clear water into the stream channels. This supplemental ground water flow from the Mazomanie is a key component in creating and maintaining high quality trout streams. The addition of cold ground water along the length of the channel helps maintain cool stream temperatures throughout the warm summer months creating long stream reaches with nearly ideal trout habitats. The Mazomanie springs emerge below the 225 meter contour (below 740 feet msl).

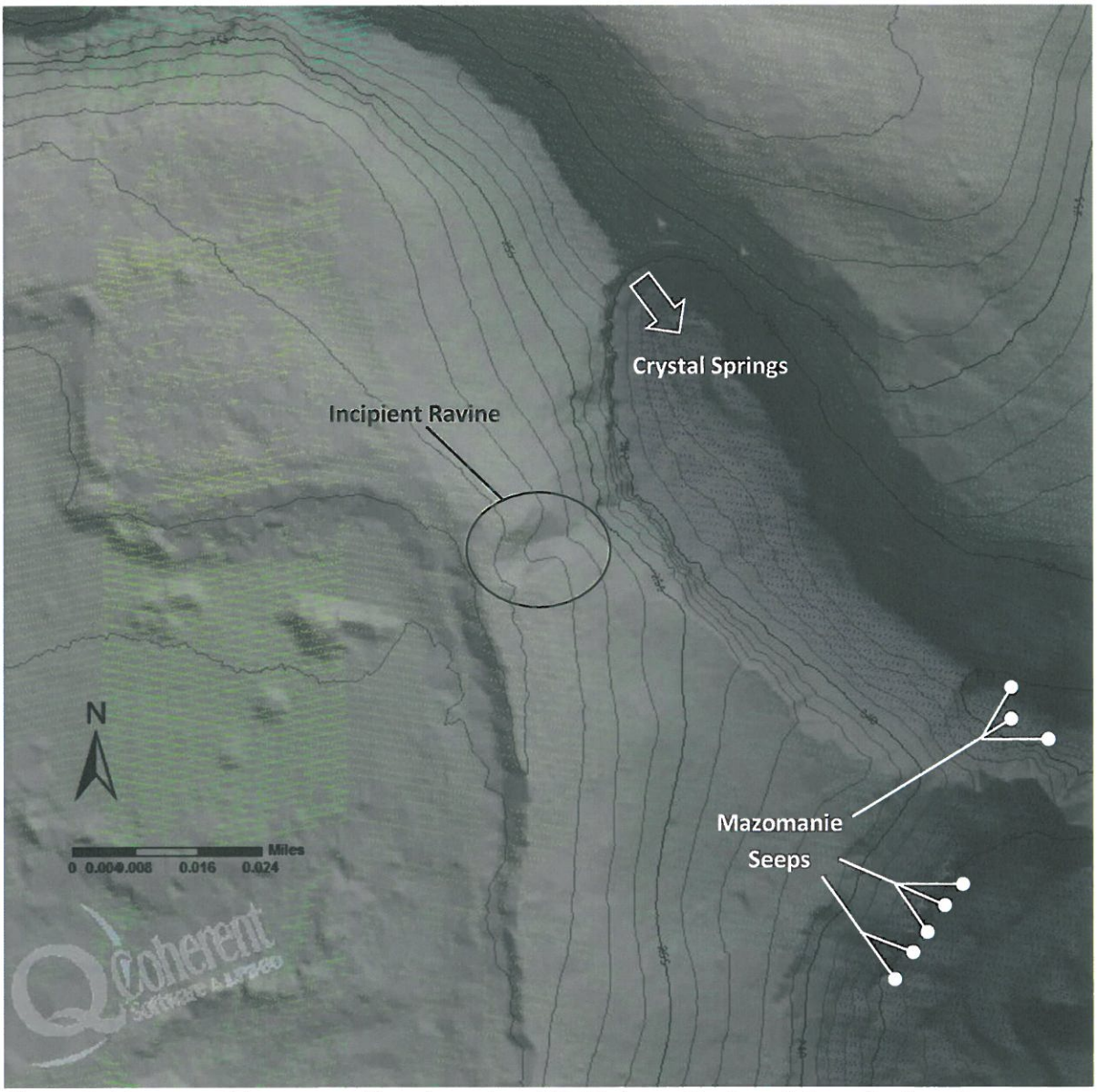


Figure 3. Topographic contour lines based on LiDAR data. Contour interval = 3 meters.

In Figure 4 the land and surface is represented by the continuous array of points with sparse data from the tree canopies forming a haze of points. Crystal Spring occurs at the Jordan/St. Lawrence contact. Crystal Spring has been cutting north and west following the downward dip of the bedrock surfaces. The Zavoral sands and gravels are deposited in an abandoned channel of the paleo St. Croix River as schematically shown in the Figure 3 cross-section.

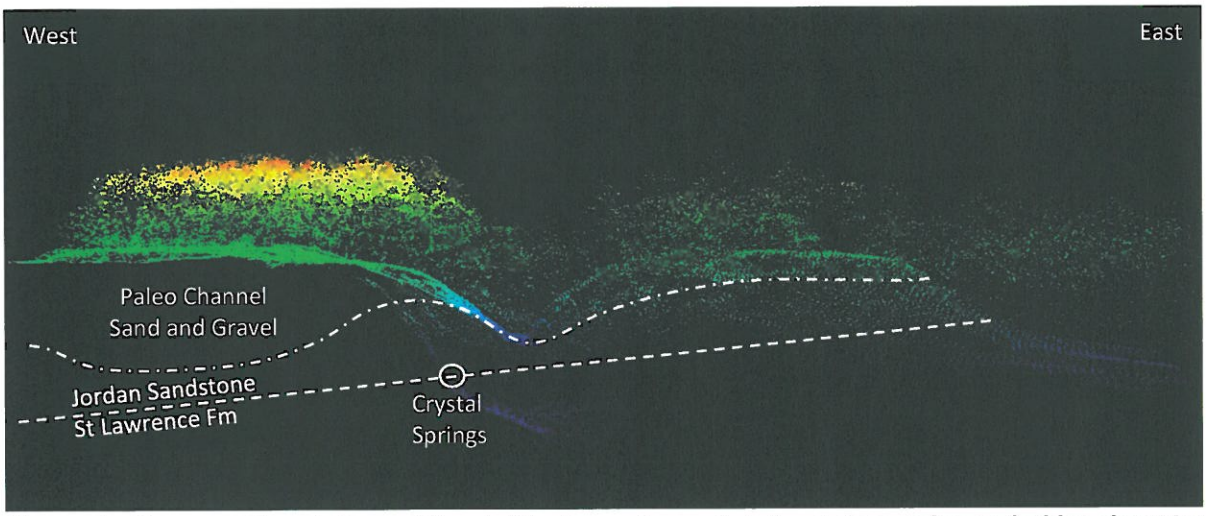


Figure 4. Cross-sectional view of Crystal Spring using point cloud data color coded by elevation.

The water table in the surficial sands and gravels is likely interconnected with the Jordan Sandstone. This water table is very poorly constrained by the current distribution of water wells. Most of the local water wells are completed into the Tunnel City (formerly Franconia Formation) or the deeper Wonewok Formation (formerly Ironton-Galesville Sandstone). These deeper aquifers are not directly connected to the surficial aquifer system.

Figure 5 shows the bare earth LiDAR point data. Areas with no returns are due to loss of signal from vegetatative cover and very steep slopes. Crystal Springs occurs at a low point in the Jordan/St. Lawrence contact, as this surface slopes down to the west. Additional Jordan springs and seeps are found along the base of the Jordan Sandstone. Springs from the Mazomanie Formation emerge lower in the stratigraphic section.

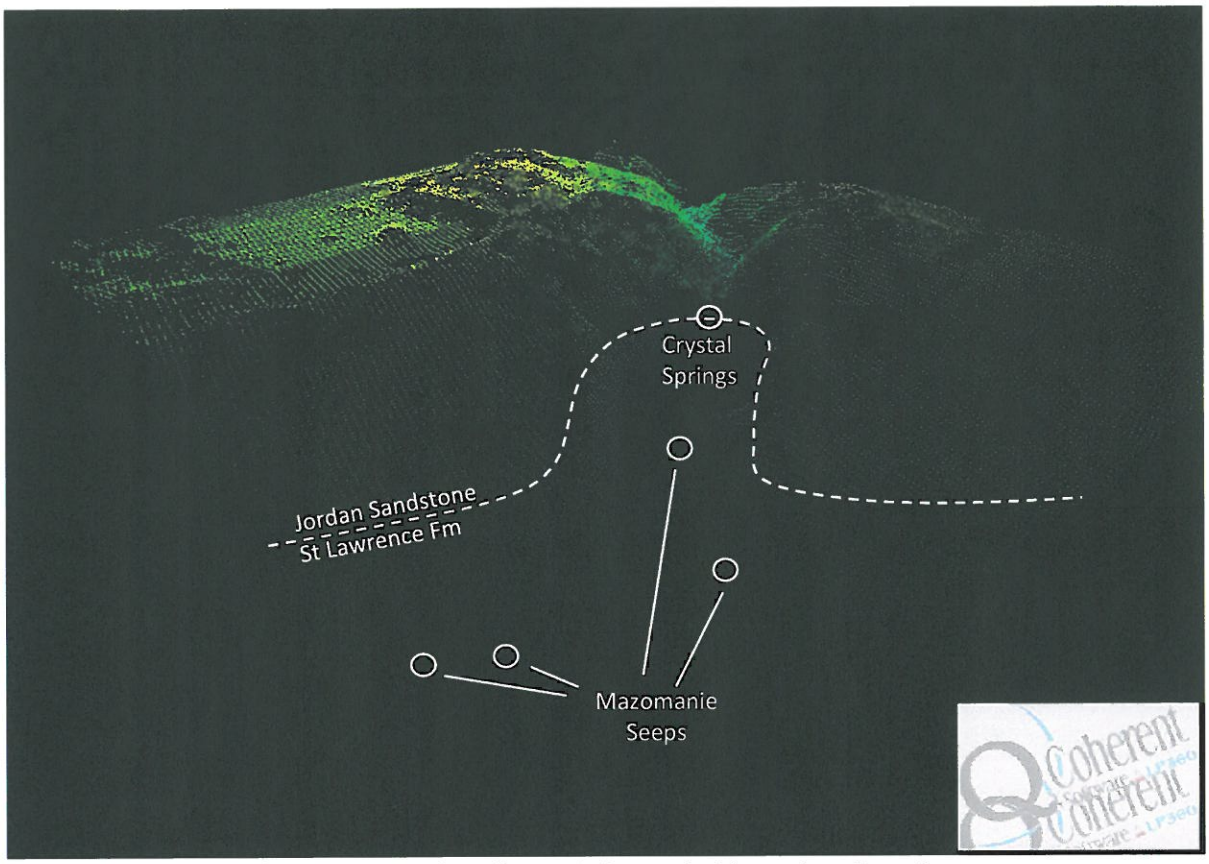


Figure 5. 3D view of LiDAR ground surface. Color coded by point elevation.

Figure 6 is a conventional photograph of Crystal Springs. The contacts of the bedrock units are highlighted showing the control of Crystal Springs by the underlying St. Lawrence formation. The vertical cliffs in Figure 6 show up in the Figure 5 LiDAR image as a lack of data points where there are no returns.

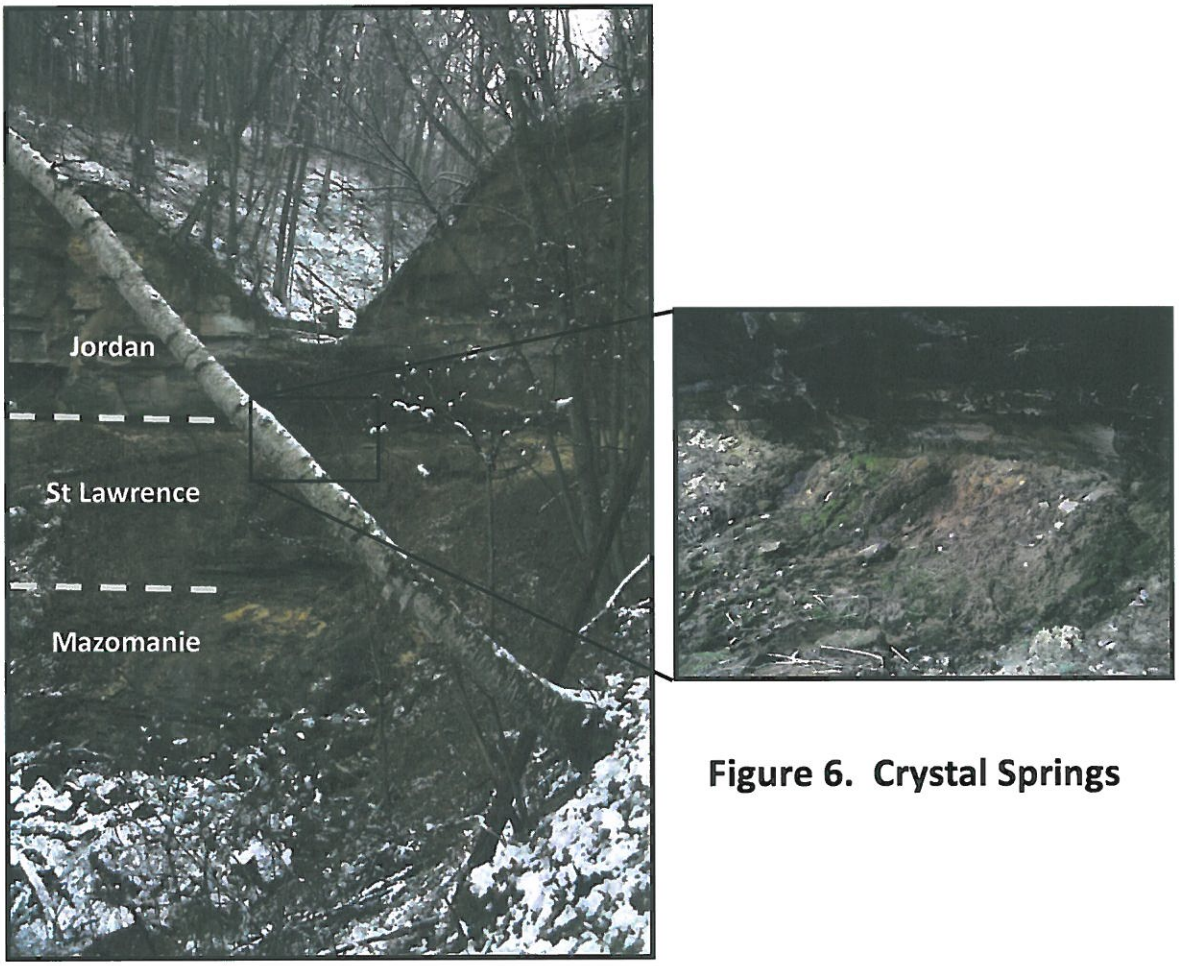


Figure 6. Crystal Springs

Figures 7 and 8 present some of the thermal imaging done by A.W. Research Laboratory as part of a Groundwater Intrusion study for the Marine WMO in April 2002. In early April the spring water shows up as warm compared to the surrounding ground surface. *[Springs in Minnesota provide cool water through the summer months but also provide warm water in the winter preventing freezing in the channel].* The Figure 7 inset in particular shows bright white springs coming from the Jordan Sandstone, as at Crystal Springs. Where there are additional inflows from the lower Mazomanie springs the stream line re-brightens. The thermal imaging insets are overlain on pictometric photos using the "Bird's Eye View" tool from www.bing.com/maps.

Figure 7. Pictometric photo of Crystal Springs gorge with thermal imaging inset.

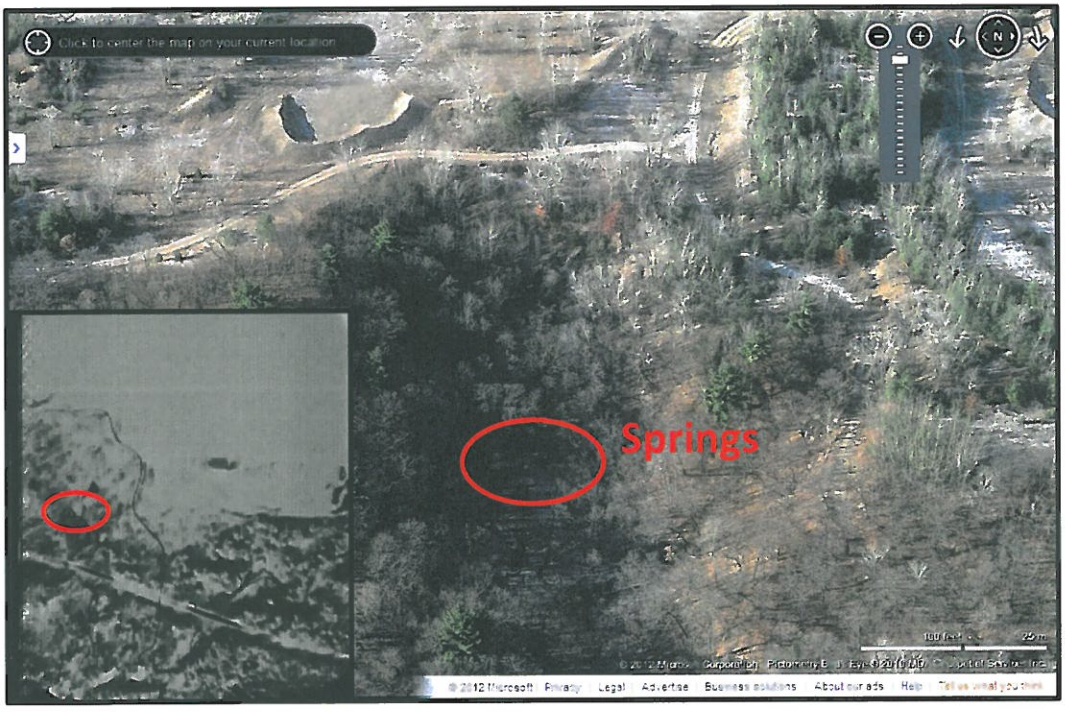


Figure 8. Pictometric photo of sand blow area and associated springs.

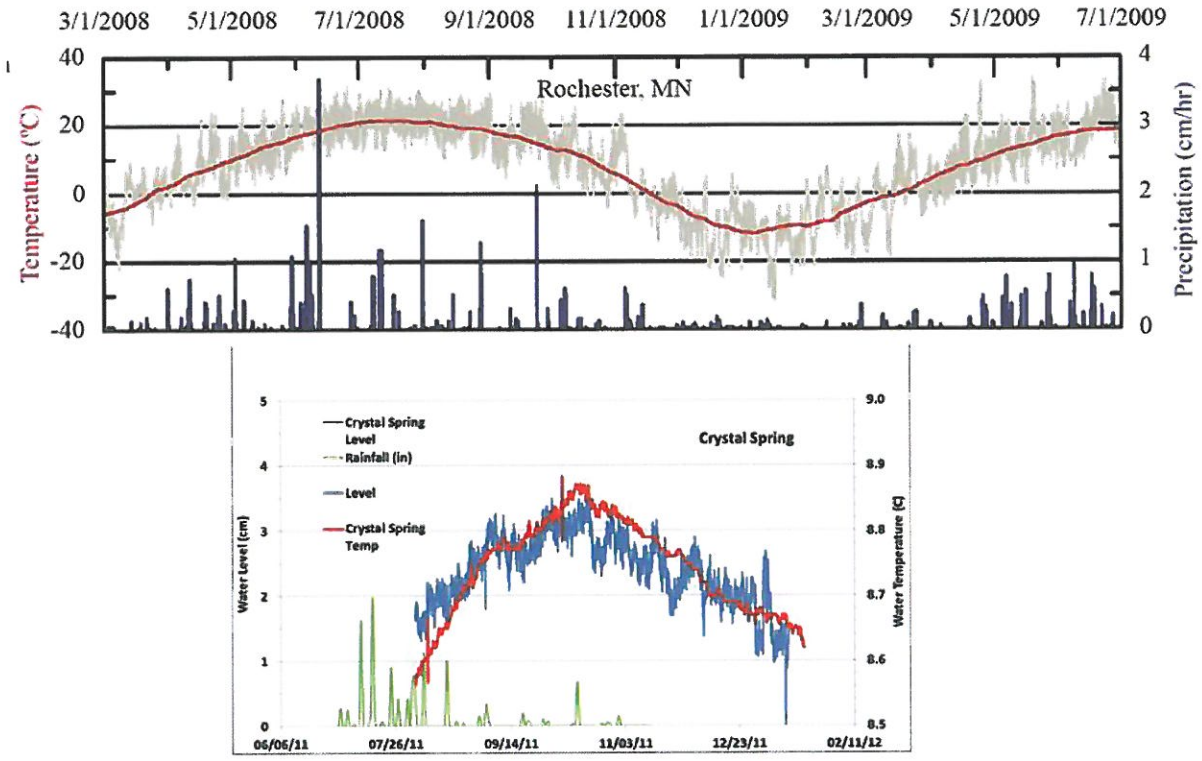


Figure 9. Temperature logger data from Crystal Springs compared to seasonal air temperatures.

The data presented in Figure 9 show a small seasonal fluctuation in temperature at Crystal Springs. The rate of ground water flow and distance from its recharge areas damp out most of the seasonal temperature swings keeping spring temperatures within 0.5 degrees Celsius (about 1 degree Fahrenheit). Given the thick unconsolidated sediments within the paleo channel these temperature variations should not significantly increase with the proposed mining operations. Previous conceptual models of the site assumed ground water flow would dominantly be in the Jordan Sandstone. Within the bedrock units ground water flow can be greatly accelerated along fractures, particularly along deeply incised river valleys. In these previous models removal of surficial sands and gravel almost to the bedrock surfaces would have greatly impacted the seasonal temperature variation at nearby springs.

Recharge of ground water by precipitation events is an important consideration at the Zavoral site. Work by the Intergovernmental Panel on climate Change (IPCC) points to a large increase in the frequency of extreme precipitation events. In Minnesota a 20 year storm event, one that would only occur once every 20 years on average, is about 3.5 inches of rain. This 20 year-on-average is becoming a once in 10 to 12 year event. Large events like the June 14-15, 2012 Goodhue County event with 8.9 inches in 24 hours and the June 19-20, 2012 Duluth event with more than 10 inches of rain in 24 hours

exemplify the near misses. There should be a very real expectation of a 10 inch storm event during period of mining operations at the Zavoral site.

Conclusions

1) The paleo channel extending northward from the Zavoral site is likely a dominant hydrogeologic feature. Ground water flow may be concentrated along the length of this sand and gravel filled channel. However, there is a complete lack of wells in the paleo channel making any suppositions about it difficult. The surface of the paleo channel should also be an important ground water recharge area with sands and gravels extending to the land surface. Current plans for the Zavoral site indicate one new monitoring well in the surficial water table aquifer. Determination of ground water flow direction and gradients are based on two wells located outside of the paleo channel and in more heterogeneous Superior Lobe glacial tills are unreliable.

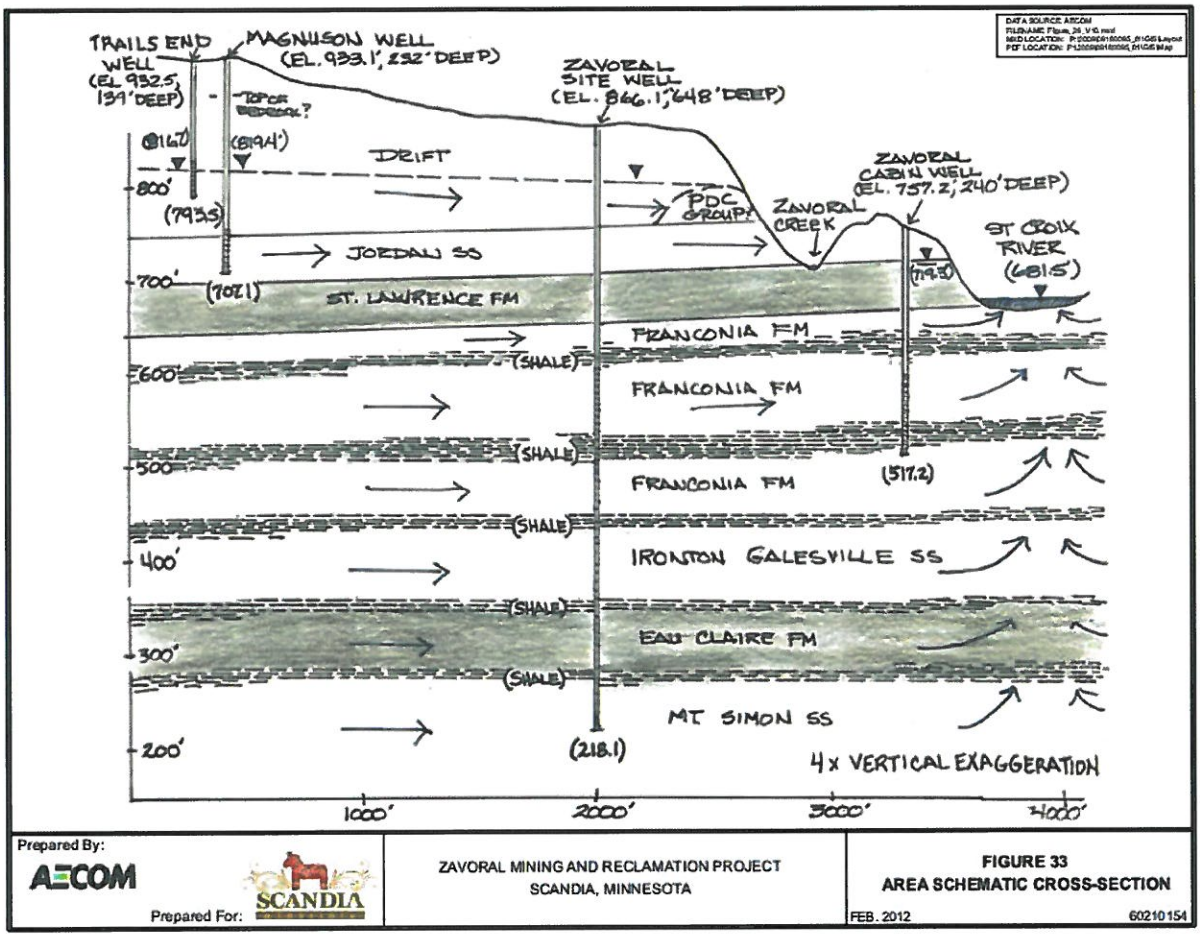
Recommendation 1: To determine the ground water flow directions and gradients there should be a minimum of 3 monitoring wells located within the paleo channel deposits. These monitoring wells should be installed prior to excavation at the site as discussed in Recommendation 2 below.

2) Existing water table measurements may not be representative of flow in the paleo channel. None of the surficial sand or Jordan sandstone wells are located within the paleo channel. The Trail's End and Magnuson wells are located outside the paleo channel. The sands and gravels of the paleo channel extend to the surface creating an area of high recharge. Additionally the limited vegetation presently on the Zavoral site, and during mining operations, should further enhance ground water recharge. This focused recharge is consistent with the observed water levels, from Figure 33, at the Trail's End and Magnuson wells which show a gradient away from the paleo channel. While there are no wells, at present, to confirm this hypothesis this focused recharge should create elevated ground water levels under the site.

Recommendation 2: Mining operations should maintain a minimum separation above the existing water table. Current plans maintain a 25 to 30 foot separation between the water table and maximum excavation depth. Given the highly permeable sands and gravels at the site this thick unsaturated zone helps insure the quality of ground water recharge. Once contaminants reach the water table, and are protected from atmospheric oxygen, they can move laterally with ground water flow to springs with little additional water quality improvement. Current plans to limit depth of mining to 840 foot msl may not meet the proposed 25 to 30 foot separation since they are not based on any well data from the paleo channel. Water levels, particularly during periods of high recharge following rainfall events will be higher than anticipated. ***Once there is actual monitoring well data within the paleo channel the applicants may need to reassess proposed depths of excavation.***

Documents presented in the Draft EIS pertaining to surficial and bedrock geology appear to be based largely on the Washington County Geologic Atlas with some supplemental information from the County Well Index. While the data and mapping techniques used to construct the County Atlas were the best available in 1990 many significant improvements have occurred. Further, the County Atlas

programs maps at a large 1:100,000 scale to show an entire county on one map plate. At the scale of an individual site, like the Zavoral site, the specific geologic and hydrologic details will not be clearly resolved leading to unintentional errors. Figure 33 from the DEIS, reproduced below, highlight some of the issues.



The application of county scale maps to a relatively small site may explain the absence of the paleo channel from the Draft and Final EIS. Without this paleo channel the sloping water table in Figure 33 would be reasonable giving water elevations of 815 down to 800 feet msl. Adding the focused recharge and collected ground water flow within the paleo channel water table elevations may be above 820 feet msl.

3) Based on LiDAR elevations Crystal Springs has an elevation of 782 ft msl. The use of the county scale bedrock geologic map has created confusion as to the stratigraphy at Crystal Springs. Crystal Springs clearly emerges at the base of the Jordan Sandstone where the underlying St. Lawrence formation creates a low permeability layer as shown in Figure 6.

This is higher than elevations estimated from USGS topographic maps and is more consistent with water table elevations at the Trail's End and Magnuson wells. The water table may be higher in

between Crystal Springs and the Trail's End and Magnuson wells, as discussed above, with ground water flow outward from the paleo channel.

4) The existing blow out area may be related to the end of the paleo channel where it intersects the St. Croix River valley. The paleo channel gathers recharge water along its length conducting ground water to its southern end on the Zavoral site. ***Increased recharge on the Zavoral site, during mining operations, could reactivate the blow area by raising the local water table, saturating the surficial sediments and weakening their cohesive strength. Highly focused, or point recharge, will raise water levels in a concentrated area following storm events increasing localized risk.*** Periods of high rainfall could conceivably raise the water table into the base of the excavation allowing surficial contaminants, like fuel products and bacteria, to reach the water table.

Recommendation 3: Improve the distribution of storm water, spreading it over as large an area as possible and increasing evapotranspiration by re-vegetation. Avoid concentrated recharge areas. This should reduce, but will not eliminate, the potential for additional blow outs.

A Proposed Resolution for Denial of a Conditional Use Permit in the matter of the proposed Zavoral Mining and Reclamation Project

(Proposed by Laurie Allmann & originally submitted to the Scandia Planning Commission on 12/12/2012, supplemented by spoken testimony offered during the public hearing. Updated with explanatory notes 12/19/2012).

Whereas

The City of Scandia 2020 Comprehensive Plan, to which this application is subject, identifies as a General Community Goal, to *"protect and enhance the natural resources of the area (including rivers and streams) for the enjoyment of present and future generations."*

Whereas

The City of Scandia 2020 Comprehensive Plan, to which this application is subject, states under the heading of "*Community Vision and Values*:"..."*(New) Scandia's natural landscape—the St. Croix River Valley, the woods and wetlands are our most precious assets... Our natural resources must be managed with care."*

Whereas

Under City of Scandia Development Code, "*the evaluation of any proposed conditional use permit is subject to...the following general criteria*," such that a permitted use "*will promote and enhance the public welfare and will not be detrimental to or endanger the public health, safety, morals or comfort,"* and that it "*will not be injurious to the use and enjoyment of other property in the immediate vicinity for the purposes already permitted, nor substantially impair property values or scenic views."*

Whereas

The purposes of the City of Scandia Development code include but are not limited to: "*To conserve and protect natural resources and maintain a high standard of environmental quality, 2) To preserve and protect rural character, the natural landscape, and natural and scenic beauty, 3) To prevent environmental pollution and to protect surface and groundwaters from contamination."*

Whereas

The application presents an unusual and even unprecedented scenario, in that the proposed mine site is part of a complex of documented outstanding natural and cultural resources of local, state, regional, national and even international significance. The 114-acre Zavoral site is designated as part of a Regionally Significant Ecological Area (RSEA); it is immediately adjacent to the lands and waters of the St. Croix National Scenic Riverway; there is a high quality native brook trout stream under consideration for state designation that runs on the Zavoral property and neighboring property; the access road to the mine would be directly off of a Minnesota State Scenic Highway; the Rustrum Wildlife Management Area is on the river immediately below the bluff where the mine would be located; the area is designated as part of the St. Croix Bluffs Important Bird

Area; the neighboring property to the mine has been determined by the DNR to meet the standards for a State Scientific and Natural Area designation, with documented rare features such as old growth forest, significant geologic features and documented occurrence of a Minnesota special concern species (Louisiana waterthrush); and Federally endangered freshwater mussel species are known to occur in the St. Croix within 2000 feet and downriver of the site. These mussels are part of a diverse assemblage of mussel species in the St. Croix that is of international significance.

The City recognizes that *all* of these resources (including the handful of butternut trees on the site) meet the definition of "environmentally sensitive resources" according the Environmental Quality Board Guidelines.

Whereas

It has been established in the EIS and in comments submitted by natural resource agencies that many of these outstanding and remarkable community assets are known to be highly sensitive and vulnerable to impact, with narrowly defined habitat requirements.

Whereas

A higher standard of caution and care is prudent and reasonable when managing community assets such as these that are at the same time valuable, rare, and known to be highly sensitive to irreparable harm.

Whereas

Impacts that can be expected and/or might reasonably occur as a result of the proposed mining operation despite recommended mitigations proposed by the Final EIS would include:

1. Destruction of 9 acres of white pine-hardwood forest, which the DNR describes, in comments for the public record, as "a native plant community rare in the St. Croix Valley" and "a loss of biodiversity value." This loss would occur if a modified scale alternative eliminating the 9-acre woodland were not required as a condition of operation.
2. Increase in mine-related noise audible to recreational users of the St. Croix National Wild & Scenic Riverway, at a level considered by the National Park Service to exceed its standards. Based on the reasonable expectations of the public when visiting this section of the National Scenic Riverway (managed as "quiet waters") this noise would unreasonably diminish the outstandingly remarkable values for which the river was designated.
3. An increase in the potential for severe or fatal accidents at the intersection of TH97 and Scenic Highway 95. As quantified by a credentialed 26-year traffic engineer using Federal and State Access Management Manuals (Vernon Swing, Principal Engineer, RLK Inc.) this risk of severe or fatal accidents will increase by as much as 350%. States Swing, "Even if Tiller (the mine operator) constructs a site access offset from the TH95/TH97 intersection in accordance with MnDOT guidance, the risk of severe or fatal accidents will still increase by 100%."
4. Increased susceptibility of the site to a recurrence of the historic blow-out of sediment into the St. Croix, based on existence of a geologic feature known as a

paleo-channel (Ref. Alexander, "A LIDAR Based Review of the Tiller/Zavoral Mining and Reclamation Project).

5. Separation between the excavation and groundwater may be insufficient to protect groundwater and groundwater-dependent resources. See: a) Alexander, "A LIDAR Based Review of the Tiller/Zavoral Mining and Reclamation Project for discussion regarding implications of potentially higher water table at site relative to exposure of groundwater to surface contaminants, and b) communication from M. Doperalski, Minnesota DNR, estimating an increase of 8.69 degrees Celsius in the waters of the trout stream given a minimum 10 foot separation, wherein a temperature swing of +4 degrees could be detrimental to trout. *
6. Increased risk of potential impacts to downstream water resources, associated with a major erosion/sedimentation event that could occur during the period "immediately after soil stripping and prior to overburden removal" (See ES-7 and ES-19, Environmental Impact Statement), in particular if a storm event should coincide with this period. If this should occur, the risk exists that habitat for trout and listed mussel species may be negatively impacted. (See comment to DEIS, A. Horton, U.S. Fish and Wildlife Service.)
7. Increased exposure of residents and water resources to silica and particulate matter over the life of the mine, as quantified in EIS (4-75-4-97). In particular, detrimental effects on public health due to cumulative impacts of total mitigated emissions on vulnerable populations, including children and adults with documented respiratory illnesses such as asthma and COPD. (Personal communication, neighboring landowner, Dec. 4 public hearing). Potential for incremental increases in particulate matter to trigger greater incidences of air quality alerts.
8. Loss in property value for adjacent landowners, disproportionately impacting low-income homeowners, for whom their property essentially represents their personal estate (Personal communication, neighboring landowner, Dec 4 public hearing)
9. Increase in the number of years of mine-related traffic on highways 95 and 97, based on proposed interruption and subsequent resumption of mine-related traffic from Franconia mine during the operation of the proposed Tiller/Zavoral mine.
10. Direct conflicts with the current comprehensive plan and the ability of citizens and leaders to achieve the vision it embodies.
11. In the larger context of the St. Croix National Wild & Scenic Riverway as a whole, this proposed mine would add to the many currently active mine sites along the river bluff, increasing the proportion of the Riverway compromised by incompatible land use.

Whereas

State statute and Environmental Quality Board Environmental Review guidelines allow for the City's consideration of cumulative impacts. Cumulative Impact is defined in Minnesota Administrative Rules 4410.0200, Subp. 11 as "the impact on the environment that results from incremental effects of the project in addition to other past, present and reasonably foreseeable future projects regardless of what person undertakes the other projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." As such, the City of Scandia

recognizes that, while any given impact may not exceed applied standards following mitigation, the combined impacts of the mining operation as a whole (including those cited above) may be considered to constitute a significant impact.

Whereas

The history of damaging environmental accidents at mining operations in the St. Croix Valley has made clear the reasonable limitations of Best Management Practices, mitigations, establishment of permit conditions and monitoring, both broadly and in the specific case of this site and this mine operator.

Whereas

The City of Scandia concludes that the proposed mine fails to meet the criteria of being "in harmony with the general purposes and intent of the City's Development Code and applicable Comprehensive Plan," in that it presents an unacceptable risk of irreparable harm to the city's "most precious assets."

Therefore

The City of Scandia deems the "No Build" alternative to be the preferred alternative, and denies the application for a conditional use permit to operate the proposed Tiller/Zavoral mining and reclamation project.

** (December 19, 2012. Explanatory Note: This references Allmann's comments made during her presentation at the Dec 12 public hearing with the planning commission, related to potential for a 10-foot separation between the base of the excavation and groundwater, rather than the 25-30 foot separation that had been used by natural resource agencies in their earlier comments to the EIS regarding risk of impacts to groundwater. At the hearing, Allmann quoted directly from M. Doperalski of the DNR, citing her estimate of potential temperature increases if the separation were 10 feet. Impacts to trout would depend on whether the resulting temperature, with the projected increase, exceeded the tolerance standards for trout. Doperalski will be submitting a written comment to the City on behalf of the DNR, which can be used to update this language when available.*

It is reasonable and important to assess impacts based on a 10 foot separation, given this quote from the City Planner's November 26 report:

"The maximum depth of mining shall be 840 feet above mean sea level. This will guarantee a minimum separation of 10 feet between the bottom of excavation and the top of the groundwater."

In her report, the City Planner also cites the Watershed District's standard required 3 foot separation. There is nothing in the Planner's report or Tiller's application that would require Tiller to maintain a 25-30 foot separation. If the water table is actually higher than currently estimated (as Scott Alexander's research indicates may be the case), the proposed conditions of this conditional use permit would not ensure that appropriately cold temperatures needed for trout habitat would be retained. The standard of "no deeper than 840 feet above mean sea level" is not necessarily protective of groundwater, as the City's mining code (5.6) requires.