



Pangea Environmental, LLC

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Pangea Environmental, LLC was asked to prepare an initial hydrogeological desktop study of Watkins Lake State park and nature preserve by the Irish Hills Concerned Citizens (IHCC). The first phase of the study will focus on the southern portion of the park and preserve because that is potentially threatened by a proposed sand and gravel mining operation.

This current study relied on water well records contained in EGLE WRD Water Well Viewer, topographic maps, Michigan Natural Features Inventory (MNFI), EGLE WRD Wetland viewer, park plan, mine application and air photos.

The area of Watkins Lake State park and Nature preserve is a very rare environment. Prairie fens are present among the other wetlands. Globally, prairie fens are rare and only occur in certain glaciated areas like around Watkins Lake State Park. Fens depend on cold clear water that has high concentration of calcium and magnesium. This water chemistry is responsible for the rare and endangered flora and fauna found in this environment.

Disruption in the hydrogeological system can destroy fens. Mining can be disruptive to the hydrogeology of an area, even if the mine does not mine below the water table.

Based upon water well records, the geology of the area consists of glacial deposits of interbedded sand, clay and gravel to a maximum thickness of approximately 100 to 200 ft. These sediments comprise the glacial aquifer. Beneath the glacial sediment lies the Marshall Sandstone, which is a regional aquifer. The Marshall is also considered the base of fresh groundwater in southern Michigan. In parts of Michigan, large withdrawals of groundwater from the Marshall are bringing up brackish water that is harmful to crops and the fresh water environment. This could be particularly harmful to the fens and associated flora and fauna, if this occurs with the water use at the proposed mine.



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The groundwater in the Marshall aquifer does contain elevated arsenic in parts of the state, in addition to brackish groundwater. Bringing poorer quality groundwater to the surface or near surface can adversely impact the shallow groundwater and surface water quality. Groundwater analysis is recommended prior to industrial scale withdrawals, such as for mineral processing.

The ability of the glacial sediments to produce large quantities of groundwater at the site appears to be limited. In one short term pumping test of 2 hours, the groundwater level in the pumped well dropped approximately 100 ft at a flow rate of 80 gpm. It appears the well “went dry”. Other pumping tests in the glacial sediments were much more optimistic. However, the long term changes in water quality are not known.

There are large capacity (up to 750 gpm) wells in the Marshall bedrock aquifer in the immediate area. One very short term pumping test of 800 gpm conducted at the time of construction by the driller produced a drop in the water level in the well of less than 40 ft after 28 hrs of pumping. The water quality was not determined. It should be noted that surface water resources may be impacted at this flow rate, as indicated by running EGLE WRD Water Withdrawal Assessment Tool (WWAT). Initial screening using this tool is required of all wells that produce 70 gpm or greater. The initial screening results for large capacity well indicated that site-specific evaluation is needed under Part 327 of NREPA.

Water is needed for processing and this water needs to be disposed of. The proposed source of water for the proposed mine is groundwater. The mining application did not indicate how much water will be used and need to be disposed of, a surprising information gap given that it is standard practice to state the quantity of water usage in any mining application. One well installed for Levy has a 750 gpm pump installed. It is not known how a groundwater withdrawal of this magnitude will impact other wells, the wetlands, including the fens and private wells.

Process waste water needs to be disposed of or recycled. This usually involves a pond or series of ponds. This requires additional groundwater to be extracted.



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These are not a closed loop systems as claimed, if the groundwater comes from a deeper aquifer and is discharged where it can infiltrate into the shallow water table aquifer or reach surface water. How will the addition of process waste water impact the hydrogeological system?

As mentioned earlier, groundwater taken from the bedrock in this area may contain elevated concentrations of arsenic and salt water. In other areas of the state excessive withdrawal from the Marshall sandstone has brought up brackish water. How will arsenic and salt water impact the shallow groundwater and environment?

The area has been agricultural for a long time. In other areas we have found elevated nitrates in shallow groundwater. How will large withdrawals of potentially nitrate-containing groundwater and infiltration of waste water impact the shallow groundwater and surface water?

An examination of the topography indicates at least part of the recharge zone for the wetlands, including the fens, is in the proposed mine footprint. The groundwater flow determined by ASTI indicates groundwater flow to the wetlands, so this is a recharge zone for wetlands to the north. Removing material by mining and leaving only 4 ft of soil behind lessens the protection for the groundwater and may cause localized flooding. The soil above the groundwater helps to protect the groundwater. In general, the greater the thickness of soil the greater the protection from surface contaminants reaching the water table. Groundwater levels are not static and changes of several feet are not uncommon.

If the high capacity wells Levy has installed are going to operate at full capacity, we recommend a proper pumping test be conducted to help evaluate the impact of the high volume groundwater withdrawal. This includes monitoring surface water and groundwater quality. The monitoring well should also be sampled for nitrates and arsenic, at a minimum.



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The hydrogeological study conducted for Levy ignored these issues. The GEI review found issues and had questions that could become a very serious consequence under the MZEA, but were ignored in the summary. A proper hydrogeological study has not yet been presented to Norvell Township, in our professional opinion. Geological cross sections that depict the layers of soil and occurrences of groundwater should be prepared. These should attempt to tie into the surface water in the area.

Because of the potential for rare and endangered species to be present a field study should be conducted. This should include the potential mine property and nearby fens.

I have 47 years of professional experience in geology, including industrial sand mining. I have worked for international mining and oil companies, as a regulator for the MDEQ, community college adjunct professor where I taught geology and consulting environmental geologist. I have a BS and MS in geology and post graduate studies in hydrogeology. In the past 6 years I have reviewed over 3 dozen aggregate mine applications in several states and Ontario, Canada. I can be contacted with questions about our opinions expressed in this first phase study. A resume will be provided upon request.

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