LEDPA Economics and Feasibility

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The department requested that the applicant further detail the Least Environmental Damaging and Practicable Alternatives (LEDPA) by addressing the property directly to the east of the proposed project site. This question was first addressed with the applicant in the January 17, 2017 Correction Request, and again in the March 2, 2018, letter to the applicant to address public comment. Additional requests for information to fully characterize the feasible and prudent alternatives were contained in the March 8 EPA letter of objection and the DEQ March 19 letter for additional information to address the federal objection. The department has specifically asked the applicant to further address potential upland alternatives for non-wetland dependent activities.

From the March 19, 2018 letter:

Additional supporting documentation demonstrating that the preferred-alternative is the least environmentally damaging practicable alternative (LEDPA), e.g. documenting off-site alternatives for waste rock storage including cost analysis. The LEDPA shall demonstrate that the applicant's alternative avoids and minimizes impacts to wetlands and aquatic resources.

- Provide a final site plan. Final site plan should include the location of storm water management facilities, waste management features, collection liners, ditching, and site infrastructure development including proposed power substation and road construction, realignments or widening.
- Address future underground mining.
- Further detail the LEDPA analysis to include the economic considerations and asserted costs.
    - Alternatives should address the specific site(s) and locations that were considered for the analysis.
    - Documentation should support why the alternative is considered not economically feasible, which should include a detailed cost analysis.
- Provide description of what considerations were given to alternative upland areas near the project site, e.g., state land to the east of the site, or other nearby properties.
- Provide further analysis on how the preferred alternative avoids and minimizes impacts to aquatic resources.

Applicant response to public comment:

"The preferred site alternative maximizes use of the upland acreages in the vicinity of the mine pit to the extent possible, as described in some of the responses above. As shown in the LEDPA analysis, several other alternatives were evaluated and were considered economically infeasibly and/or not prudent with respect to wetland impacts (refer to LEDPA Table 4-1).

"Off-site ore processing was evaluated as Alternative Site Plan B in the LEDPA, and was deemed not economically viable due primarily to increased ore transport costs. As described in

comments above, there is a high sensitivity of the Project to material transport costs since ore, waste rock, tailings, and water transport costs make up a significant portion of the Project's operating costs. Any significant expansion of the Project Area (whether in the vicinity of the site or off-site) renders the Project economically unviable simply as a result of the transportation costs combined with the lack of any existing facility to handle any of these mine products or by-products in the region."

The applicant provided further response to the suggestion of the state owned land to the east of the project site:

WRD Comments: There is some upland acreages within the project area that have not been included in the alternatives analysis. These areas are not significant in size, but may be able to support ancillary facility development that will otherwise directly impact wetlands and aquatic resources.

There is no information about offsite ore processing contained in the LEDPA. The project has been compared to the Flambeau mine, in which the ore was transported to Ontario for processing. The project has also compare itself to Polymet, in which the ore will be transported by rail offsite to a refurbished taconite processing facility. There is also the standard that Eagle Mine has demonstrated for offsite ore processing at the Humbolt mill.

The applicant has not sufficiently demonstrated that the project is not capable of alternative logistics, technologies and sites that may minimize impacts to wetlands. The applicant also has not demonstrated the offsite alternatives that were considered for processing ore or the stockpile or disposal of materials. The department has requested that the applicant demonstrate the alternatives by identifies the sites that were considered and provide a detailed cost analysis. The applicant has not provided this information to support their assertion that offsite processing or material storage and disposal is not feasible or prudent.

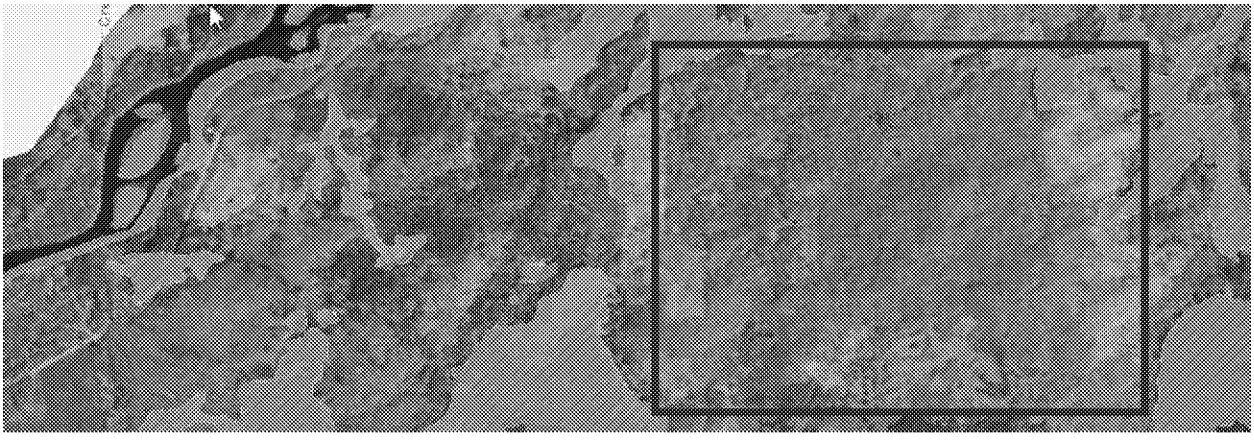
The department further inquired about the opportunity to utilize upland areas that lie to the east of the project site for material storage. The applicant provided the following response (Response from applicant #6.4):

"The State-owned land east of the Project Boundary was considered for siting of Project facilities such as mine waste storage, contact water storage, and ore processing; but was rejected because the longer transport distances for waste rock, ore, and water would render that alternative economically infeasible and not optimal from an environmental and worker health and safety perspective, for the reasons described above. Also, as shown in the NWI wetland map on the MDEQ website, the State-owned land also contains wetland acreage that would need to be avoided in any site plan to use that area and would be subject to the same kind of "indirect impact analysis" that we have evaluated on the existing Project site. While Aquila may have mineral rights in the land to the east, those mineral rights do not give them any control over the surface use.

WRD Comments: This parcel was not included in the LEDPA. No analysis regarding costs and economic viability have been included in the LEDPA. No information about transportation costs were included in the LEDPA.

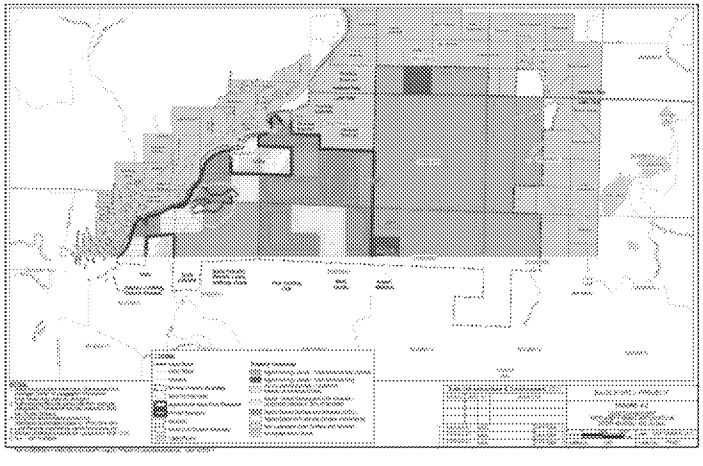
I contacted the Manager of DNR Real Estate Services and asked if Aquila has inquired after the availability to develop this property. DNR responded: "Aquila has never proposed that lands in these Sections be part of the exchange. The only have indicated that there will be likely future easement applications for utilities and roads, but to date, no applications have been submitted."

Wetlands Map Viewer does not show any wetland complexes on the State of Michigan land adjacent to the project area. Using Wetlands Map Viewer, I was able to measure 900 acres of upland adjacent to the project site and proposed development.



State land to east of project area

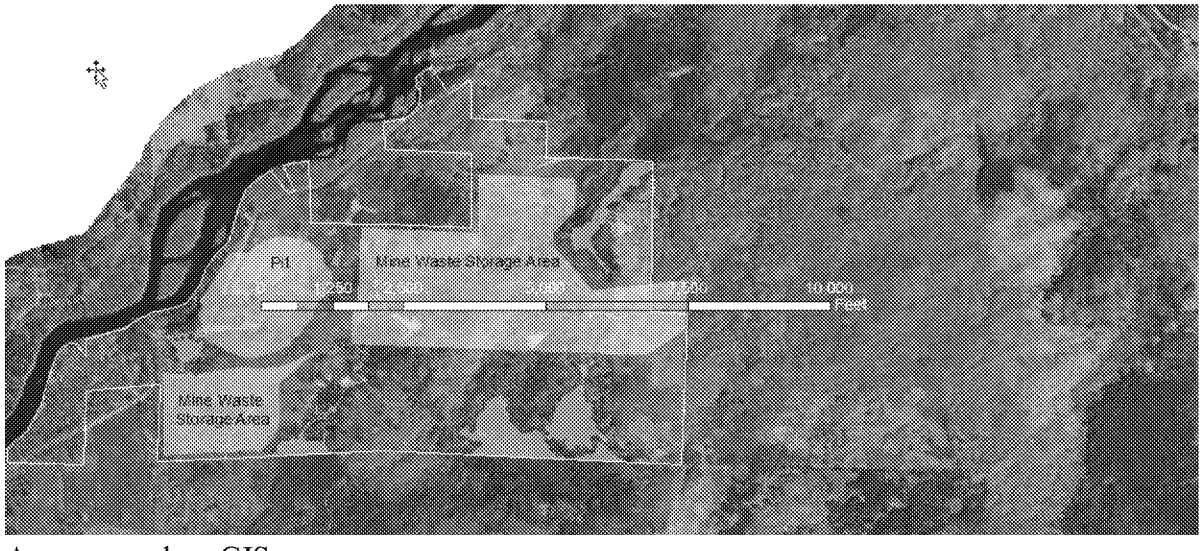
Aquila's application map shows that Aquila has both minerals and surface leases in the area of interest (SOM property).



In response the EPA objection letter, the applicant states: "The straight-line hauling distance from the center of the mine pit to the general vicinity of the proposed process plant and mine waste storage area as currently proposed is approximately 3,000 feet; whereas the straight-line hauling distance to the State-owned land to the east is approximately 10,000 feet. A typical hauling cost for ore and waste rock is assumed to be approximately $0.50 per ton per 1,000 feet…"

For the approximate total quantity of ore and waste rock expected for the Back Forty Project (totaling approximately 60 million tons), the total transport cost as currently proposed will be approximately $90 million. If the mine waste storage area and contact water basin were located on the State-owned land to the east with the resultant hauling distance thereby increased to 10,000 feet, the hauling costs would increase to approximately $300 million. The costs to relocate the waste rock back to the mine pit at closure would be similar, so effectively increasing the total costs for transportation costs on the Project from approximately $180 million to $600 million. And if the contact water basins were also to be located on the State-owned land, pumping costs would also increase significantly.

WRD Comment: This information is not consistent with information in the application. The wetlands application LEDPA states that this distance from the pit to the TWRMF is 3,900 feet. That measurement is made from the center of the pit to the center of the TWRMF. From the center of the pit to the east property line is 7,800 feet.



As measured on GIS:

Approximate center of the mine pit to the proposed processing plant: ~3,800 feet
Processing Plant to center of Mine Waste Storage Area (TWRMF): ~2,600 feet
Processing plant to east property line (direct): ~4,800 feet
Center of pit to east property line: ~7,800 feet

The financial assurance estimate for the 632 application states that it will cost $1.15/ton to relocate waster rock from the TWRMF to the pit, an estimated 3,900 feet. This would mean that it is approximately $0.29/ton per 1,000 feet, not the $0.50/ ton that the applicant provided as an "assumed" transportation cost.

From the 632 Closure Financial Estimate – relocation of material from TWRMF to pit is $1.15/ ton. This information is also based upon the previous site plan in which some portions of the TWRMF are closer and some are further away from the pit.

Reclamation and Monitoring Cost Estimate

Foth

Client:	Aquila	Scope ID.:	14A012
Project:	Final Reclamation Cost Estimate		
Prepared by:	JPH	Date:	10/14/15
Checked by:	JOS	Date:	10/30/15

Reclamation and Monitoring Cost Estimate		*Life of Mine Estimate*			
				Item	
Item	Units	Unit Cost	Quantity	Total	Comments
Open Pit Restoration					
1) Rock & Tailings Relocation					
Rock relocation to Mine Pit	tonne	$1.15	44,000,000	$50,600,000	Open Pit Data
2) Pit Improvements					
Place and compact soil cover	cu.m	$4.00	1,582,000	$6,328,000	Open Pit Data
Place and grade topsoil	cu.m	$6.00	35,625	$213,750	Open Pit Data
Hydro-Seeding	sq.m	$0.35	237,500	$83,125	Open Pit Data
			Subtotal	$57,224,875	
Buildings and Structures					

ROCK MOVING	SCOPE	RATE	UNIT	DETAILS
TWRMF Rock Relocation	Load/Haul/Dump by Contractor	$1.15	tonne	From TWRMF to Open Pit Using Mine Fleet
TWRMF Tailings Relocation	Load/Haul/Dump by Contractor	$1.25	tonne	From TWRMF to Open Pit Using Mine Fleet
Overburden from Stockpiles	Load/Haul/Dump by Contractor	$4.00	cu.m	From Stockpile to Open Pit Using Mine Fleet
Topsoil from Stockpiles	Load/Haul/Dump by Contractor	$8.00	cu.m	From Stockpile to Open Pit Using Mine Fleet

The applicant further states:

"A typical net present value expected for a mining project similar to the Back Forty Project would be on the order of $250 million. Therefore, the additional operational transport costs for ore, waste rock, and water of over $200 million would certainly result in a negative net present value, and therefore result in an economically infeasible project. It may be correct that the net present value of the project is more highly sensitive to metal prices and ore grades than operating costs, but this would certainly not be the case if average hauling distanced were more than tripled. From an overall "environmental footprint" perspective, to spread out the mine operation (as compared to consolidating it as currently proposed) by building a haul road to a site at least 4,000 feet further east would result in both direct additional landscape impacts as well as secondary or indirect impacts to otherwise relatively undisturbed parcels."

WRD Comment: This response assumes that the DEQ is requesting an alternative of moving the facilities and waste rock storage to only the SOM property to the east of the current project site.

What we have requested is that area be included in the LEDPA for inclusion of a feasible and prudent alternatives analysis.

Moving facilities to the east parcel would impact uplands and potentially result in the avoidance of direct impacts to regulated wetlands within the project site. Reconfiguration of the project may result in the avoidance of direct impacts to WL-6, B1/B2/B1c, 4A, 2c which would minimize the project's overall wetland impacts. The applicant has claimed that these wetland complexes are not connected to groundwater and would not be subject to impacts from groundwater reductions/ pit dewatering. The claims that these wetlands are not connected to or influenced by groundwater is unsubstantiated and these wetlands may be impacted by groundwater reductions even if they are avoided by direct dredge and discharge impacts.

From LEDPA

Economic Viability Criteria

As mentioned, tailings and waste rock storage areas require a liner system as required by 632 R425.409 (a)(i)(A). A liner system is a significant portion of the Project capital cost. As shown in Table 4-1, alternatives F, G, and H have combined tailings/waste rock storage footprints of 17.6, 17.0, and 15.9 million square feet (MSF), respectively, compared to 14.3 MSF for the preferred alternative. Hauling distances (measured in a straight-line) for waste rock are approximately 2,000 feet, 3,000 feet, and 4,100 feet for the three alternatives, respectively, compared to 3,900 feet for the preferred alternatives, as shown in Table 4-1. Also, Alternatives F and G rely on wet slurry tailings which can be costly to cap at closure. All aspects considered, Alternatives F, G, and H were all deemed not economically viable since their capital

Based upon the distance identified in the LEDPA and the costs identified in the Part 632 cost closure analysis ($1.15/ton from TWRMF to backfill pit), the cost to haul one ton of ore 1,000 feet is $0.2948. This may not be a fair comparison to indicate that the transportation costs of hauling an extra 1,000 linear feet is the same as the initial 1,000 feet and it is unclear if the cost includes loading, deposition and placement, which would involve other equipment/ operators.

	60Mt to TWRMF			44Mt from TWRMF to Pit		
Cost per 1000 feet	$0.29/ton	$0.38/ton	$0.50/ ton	$0.29/ ton	$0.38/ton	$0.50/ ton
2000	34800000	45600000	60000000	25520000	33440000	44000000
3000	52200000	68400000	90000000	38280000	50160000	66000000
3800	66120000	86640000	114000000	48488000	63536000	83600000
3900	67860000	88920000	117000000	49764000	65208000	85800000
4000	69600000	91200000	120000000	51040000	66880000	88000000
7800	135720000	177840000	234000000	99528000	130416000	171600000
10000	174000000	228000000	300000000	127600000	167200000	220000000

Total Cost			
	$0.29/ ton	$0.38/ton	$0.50/ ton
2000	60320000	79040000	104000000
3000	90480000	118560000	156000000
3800	114608000	150176000	197600000
3900	117624000	154128000	202800000
4000	120640000	158080000	208000000
7800	235248000	308256000	405600000
10000	301600000	395200000	520000000

Response #6.2

"As mentioned, transport costs for mined materials and water typically drive the economics of mining projects, as is the case with this Project. As noted above, transport distances are also a significant driver of environmental impacts associated with mine projects as well as the health and safety of mine workers. Over the operating life of mine, transport of ore and mine wastes over even modest distances can result in costs substantially greater than similar mines, since the mining industry typically strives to optimize projects by reducing transport distances to the greatest extent possible. Therefore, it is imperative that mine waste storage areas and basins be located immediately adjacent to the mine development for this Project to be economically viable/feasible and optimized environmentally. And, as described in other portions of the permit application documents, since an off-site process plant is not feasible or prudent for this Project, a process plant must also be located on-site. Therefore, in this case, direct impacts to (removal of) portions of wetlands immediately surrounding the mine pit (WL-6, WL-4a, WL-2c, WL-B2, WL-B1, and WL-52) are unavoidable. Since the liner is required beneath the mine waste storage area under Part 632, construction of mine waste storage area liners are also unavoidable."

WRD Comment: I spoke with the production manager of another mining operation in the Upper Peninsula that works with hauling ore. This mining company has a long history of wetland permitting with WRD and is experienced with Michigan's mitigation criteria. I contacted this mining company to discuss transportation and materials cost. This company asked not to be recognized as the source for some of this information as it is proprietary and spoke with some degree of confidentiality.

I asked the production manager about how much it would cost to transport ore an additional 1,000 feet and they said additional distance is "negligible". The manager explained that the costs of transporting ore include equipment (loader and haul truck), labor costs, fuel, and tires (as a separate maintenance cost). They stated that the haul trucks they use consume about 20 gallons of fuel per hour while in operation. Their labor costs (hourly plus benefits) are approximately $50/ hour per operator. For their class of trucks, the cost of tires is about $10/ hour per machine

(8,000 hour service life). Once the haul truck is moving, it travels up to 40 mph. It was explained that the cost of transporting ore is the loading and unloading; once the truck is loaded the only real cost of transportation is the additional operating time.

This company also brought up the costs associated with wetland permitting and mitigation. For their operation, the costs associated with mitigation approximate at $1 per ton; which is twice what the applicant is claiming the extra transportation costs of the east parcel alternative will cost.

Conclusion: The applicant has not provided any substantial information to determine that offsite alternatives are not feasible and prudent. Information would need to include the location of the sites that are included in the alternatives analysis and a detailed cost assessment for each alternative. This assessment should include the costs associated with the entire project and include the cost of the proposed mitigation. If this project is as sensitive to the costs as the application asserts, the applicant should demonstrate that the requirements of a permit can be carried out including mitigation, monitoring and adaptive management.